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33

The Blue Cross Book

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For the advancement of the veterinary profession

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From Editor's Desk

MSD-Animal Health and the Editorial Board of the "Blue Cross Book" wish its readers a happy and delightful new year-2016.

Editorial Board is Happy to present the 33rd edition of Blue Cross Book, the 9th uninterrupted volume since its relaunch in 2010. With a view to give a wider look, the Blue Cross Book is now publishing more number of review and research articles, instead of focusing more on articles based on clinical reports and clinical trials. We are sure, this new approach shall help in widening the information and the knowledge base of the Blue Cross Book readers.

Identifying and combating the oxidative stress in livestock, particularly in dairy animals around the peri-parturient period, is a matter of concern recently. Most of the post-parturient problems like metabolic and reproductive disorders have been shown to be related with the oxidative stress. An article on this topic, indicating use of antioxidants in such conditions may prove useful.

Mastitis (clinical or sub-clinical) and infertility at the various stages, are the topics of great concern to practicing Veterinarians. The Blue Cross Book has been publishing very useful information on these topics in each of its volumes. Keeping with this tradition, the present volume also contains articles on mastitis and infertility. Though use of antibiotics in mastitis treatment is in practice since the advent of antibiotic era, the rationality of antibiotic use in a given case is always in doubt. Correct approach for antibacterial therapy and some nutritional alterations to prevent occurrence of mastitis have been discussed.

We are re-introducing a feature "A Pioneer's Profile" from this volume, which will enlighten the present generation about the dedicated efforts of the bygone generation to bring the livestock sector to the status it presently enjoys. We appeal to readers to suggest the names / addresses of such stalwarts who could be brought to the light through this feature.

We are also introducing a new feature "Your Problems------Expert's Solutions" from this issue. The common problems faced by a field Veterinarian in particular disease entity would be appropriately resolved by an expert in that area. We request the readers to inform us about their problems in the treatment of a particular disease, which would be answered by an expert.

We request our readers to give us their feedback about the publication.

Dr. Yash Goyal
Managing Director,
MSD Animal Health

Dear Professional Colleagues,

It gives me an immense pleasure to bring out the 33rd volume of the "Blue Cross Book", a professional publication of MSD Animal Health. I am extremely thankful to the academicians and researchers working in Universities and the National Institutes, so also other Veterinarians who share their experience and expertise through our publication for other stake-holders in the livestock sector, engaged in enhancement of livestock production. With the publication of each volume of the "Blue Cross Book", we have the satisfaction of our active participation in updating the knowledge base of fellow professionals.

MSD Animal Health, with its mission to deliver innovative and valuable Animal Health products, has been working day-in and day-out to bring out new preventives, curatives and biologicals to ensure sustainable quality livestock product, protect public health and help people and pets enjoy their lives together. We have introduced recently few new drugs in our armamentarium to fulfil our vision.

In addition to strengthen the hands of Veterinarians in their endeavor to protect livestock health and enhance their productivity, MSD Animal Health has now ventured into dairy farmers' capacity building program through the informal training at the institutes of repute. Two batches of farmers, one at NDRI, Karnal and one at BAIF, Pune have already undergone such training during the month of November this year.

MSD Animal Health further assures all the stake holders that no stone will remain unturned to reach our mission of providing "Health for All."

A happy and prosperous new year-2016 to all our readers.

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MSD Animal Health

BECAUSE ANIMAL HEALTH IS OUR HEALTH

At Merck Animal Health we've begun a new chapter. It's a chapter being written to meet the demands of a world changing in more ways than we could have imagined.

Every day our customers and partners face challenges that are wider, more complex and developing faster than ever. Not least how animal health is now so tied to our own.

Today, the science of healthier animals is also the science of food safety and supply, of international public health. It's the science of keeping people happy by protecting and caring for their family pets.

Meat and dairy consumption for example, is at the heart of changing lifestyles around the globe. As Asian and Latin-American economies continue to flourish, so does the appetite for protein-rich diets. A 50% increase in demand for animal protein is expected in the next 10 years. So we must keep developing vital vaccines like PORCILIS PCV for swine, and pharmaceuticals like NUFLOR for cattle, to help producers fight diseases that devastate production.

Keeping our protein supplies plentiful also means investing in sustainable business. Programs like our SLICE Sustainability Project which, developed in close partnership with fish farmers, helps control parasites more sustainably and keeps animal health products effective. In turn it improves the efficiency and long-term value of fish production.

We know too that global trade, migrating people and climate change may increase the spread of highly infectious diseases like foot-and-mouth disease, and zoonotic diseases like avian flu. Only a fast, flexible approach to vaccination will stop them. NOBILIS Salenvac T and NOBILIS Influenza are just two of the vaccines helping us control the spread of pathogens into our food supplies and communities Finally, we will strive to protect and prolong our relationships with the pets at the heart of our families. We're investing in medicines for age-related diseases – like us, pets are living longer – as well as in healthier, more effective ways to approach parasites with treatments like AC TIVYL.

Whatever we do to evolve our health platforms in the future, one thing is clear: No business, no government can meet these challenges alone. Today we stand in full knowledge that to succeed we need the joint effort, expertise and insight of all of our stakeholders, customers and partners.

So while our commitment to scientific progress continues, so does our understanding of what that progress means to our customers in the real world. As the people behind the science of healthier animals, we know we must also understand the science of running a business, of feeding

a nation, of maintaining healthier populations. As such, we'll make sure we have the products, technologies, services and insight to tackle our customers' commercial, operational and governmental demands.

We'll put every inch of our experience, resources, and pioneering spirit behind them.

We will be driven by their challenges. Their prosperity will be ours.

Richard R. DeLuca Jr.
President, Merck Animal Health

January 2012

General Articles

*The information on Small Ruminant Sector in India and on PPR has been accessed through Internet and Proceedings of National Conference on PPR Disease. (Nov. 2014)

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Current therapeutic strategies and considerations for Canine Transmissible Venereal Sarcoma (CTVS)

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Abstract

Canine Transmissible Venereal sarcomas (CTVS) or canine transmissible venereal tumor (CTVT) is a naturally occurring tumor that is transmitted between dogs via live tumor cell inoculation and is self-limiting. The tumour is often curable with either vincristine chemotherapy alone, the sole effective treatment or surgery. However, due to resistance to chemotherapy and recurrence after surgery, treatment becomes a challenge. Hence adoption of multi-modal therapeutic strategy by combining chemotherapy with surgery and radiotherapy is inevitable. Immunotherapy also has gained significance due to the altered host immune responses on the behavior of CTVT. Currently, electro-chemotherapy and photodynamic therapy (PDT) has evolved with promising results. However, all these modalities have their own advantages and disadvantages. The different therapeutic options currently available, their effects and advantages, therapeutic consideration, criteria for selection, prognostic overview, cost effectiveness, the constraints and adverse effects are discussed.

Key words: Transmissible venereal sarcoma, canine, CTVS

Introduction

Canine Transmissible Venereal sarcomas (CTVS) or Canine Transmissible Venereal Tumour (CTVT) is benign reticuloendothelial tumor of histiocytic nature that occurs usually in canids and mainly affects the external genitalia, occasionally the internal genitalia and rarely other portions of the body (Das and Das, 2000). CTVS has been identified as having evolved from a wolf or an East Asian breed of dog by somatic cell mutation (Murgia et al., 2006). For the dog and fox, CTVS is strictly host specific (Rust, 1949). The distribution, transmission, etiology, clinic-pathological, histological and cytogenetic features of CTVS has been reviewed by Roshini et al. (2015) in the previous issue (Vol. 32) of the Blue Cross Book. In India, it is the most common tumour of dogs as a result of uncontrolled breeding practices. CTVS affected canids are treated successfully, very often using different medical and surgical techniques. All the related therapeutic strategies are ultimately aimed at providing complete cure. Surgical excision, chemotherapy, radiotherapy, electro-chemotherapy (ECT) and immunotherapy are considered as effective treatment regimens (Das and Das, 2000; Martins et al., 2005; Kumar et al., 2010). However all these modalities have disadvantages like recurrence following surgical management, drug induced toxicity in chemotherapy, adverse side effects, resistance of

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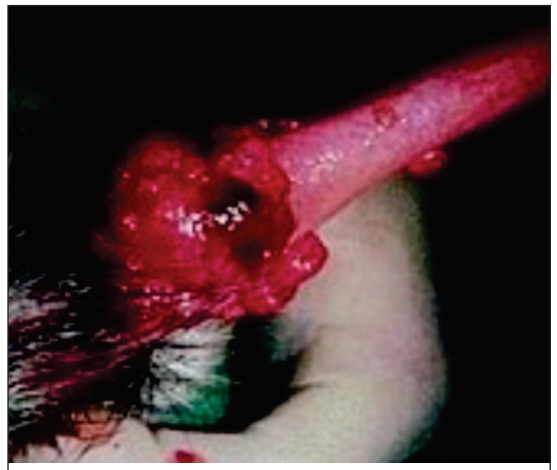

Fig. 1: CTVS in a male dog

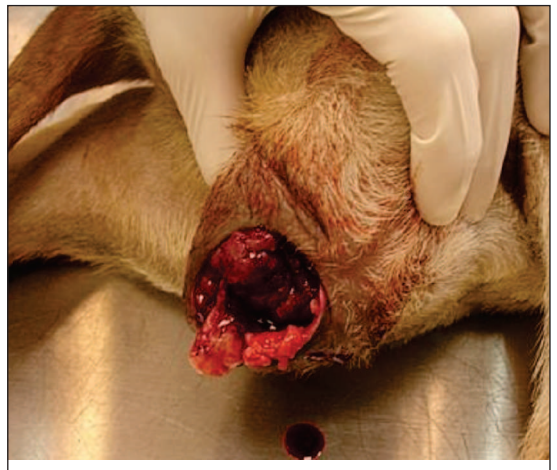

Fig. 2: CTVS in a bitch

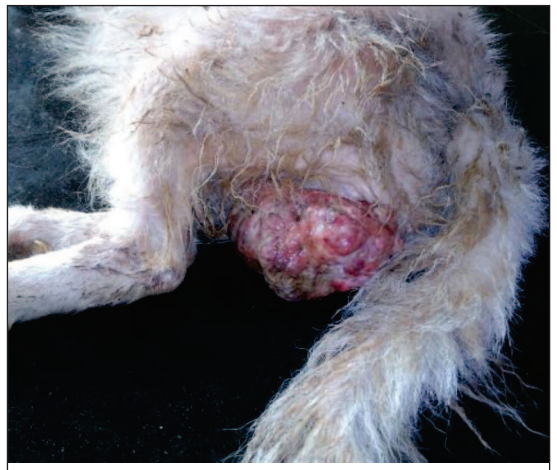

Fig. 3: A huge CTVS diagnosed in a middle aged dog that underwent surgical excision

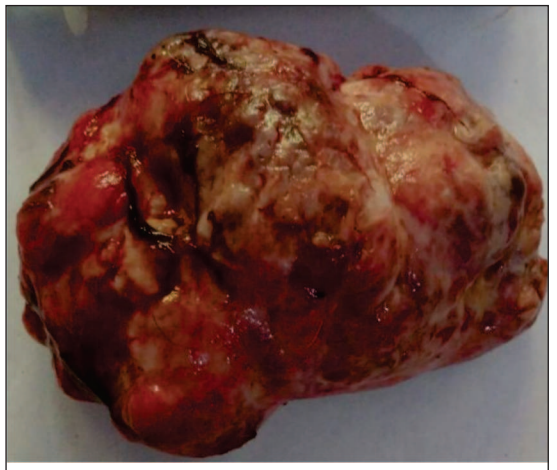

Fig. 4: The excised mass from the dog depicted in Fig. 1

tumour to some drugs and the high cost (Amber et al., 1990; Thrall, 1982; Idowu, 1985; Rogers, 1997). The different therapeutic options, its effects and advantages, prognostic overview, cost effectiveness, the constraints and adverse effects are discussed in detail.

Therapeutic Considerations

The CTVS is at times a challenge for the practicing veterinarians. The tumour is often curable with several therapies including surgery, biotherapy, radiotherapy, ECT, immunotherapy and chemotherapy (Spugnini et al., 2008; Kumar et al., 2010). Currently, photodynamic therapy (PDT) has evolved with promising results. The ultimate aim of all the therapeutic strategies is the complete remission of the growth with minimum adverse effects. The decision for the selection of therapeutic strategy is of great importance. It depends on the clinician's experience, geographical considerations, occurrence rate, cost effectiveness, skilled paramedical staff, infrastructure and the availability of the drug and equipment (Stockmann et al., 2011). Interestingly, even the climatic conditions interfere with the expression of results to the various chemotherapeutic protocols evaluated for CTVS (Aprea et al., 1994). When the tumour becomes chemotherapy-resistant, treatment becomes an ut-most challenge (Spugnini et al., 2008). A complete remission of the growth may be achieved by either alone or by a combination of following therapies.

Surgical excision

Surgical excision can be adopted extensively for the treatment of localized CTVSs. Submucosal resection technique (SRT) is the standard technique employed for the debulking of the CTVS and is often done under general anesthesia. In cases of large invasive localized CTVS, the recurrence rate is as high as 68% (Idowu, 1985; Rogers, 1997; Das and Das, 2000). A similar increased recurrence rate of 25% to 50% has been reported by Martins et al. (2005), when surgery alone was used as the sole method of treatment. The seeding of encapsulated tumour cells from the operated site may also act as a possible source of recurrence (Boscos and Ververidis, 2004). Additionally, for generalized CTVS, the SRT is less practicable. All the affected sites may not be accessible for a surgical intervention in addition to the possible metastasis that account for the recurrence of CTVS. According to Weir et al. (1987), excision was more effective and successful in dogs with small and circumscribed lesion without local invasion or metastases. But, he also observed an increased rate of recurrence. A reduced rate of recurrence was observed when surgical intervention was combined with castration, ovariohysterectomy, autogenous vaccination and chemotherapy (Pandey et al., 1977). Cauterization, electrosurgical or cryosurgical excision should be considered if recurrence is observed subsequent to surgical excision or chemotherapy (Idowu, 1985; Vermooten, 1987; Rao et al., 1993; Rogers, 1997). These excision methods reduce the chance for seeding and transplantation of tumour cells on to surgical wounds that may occur with conventional surgery.

Cryosurgery involves application of extreme cold by using a cryogenic agent administered by a cryogenic unit to destroy abnormal tissue. According to Idowu (1985), cryosurgery definitely yields positive results. But the attainment of complete recovery may be prolonged in chronic cases owing to the large size of the mass (Boscos and Ververidis, 2004). Also, it would be difficult to selectively freeze the tumour mass in addition to the resistance it would hold towards the penetration of the cryogenic agent used, particularly, if fibrosis has set in. Electrosurgical excision offers an added advantage of improved haemostasis. It decreases perioperative and postoperative bleeding and hence reduces the need for ligating the bleeding vessels. However, the electrosurgical excision inflicts additional thermal injury and postoperative pain.

Radiotherapy

Application of radiation has been reported to yield appreciable results in case of tumours that fail to resolve with chemotherapy. Such tumours are often referred as chemotherapy resistant tumours (Boscos and Ververidis, 2004). CTVS are moderately radiosensitive and both brachytherapy and teletherapy have shown to give good results (Vermooten, 1987; Rogers, 1997). A Dose of 10-15 gy (1000-1500 rads) for 2 to 5 days of 1-3 treatments is adequate for

complete regression of the mass (Thrall, 1982). This therapeutic modality can be considered highly effective, if adequate exposure could be achieved. Also, the recurrence rate are comparatively less and takes shorter duration for remission of tumour (Das and Das, 2000). But it requires expensive equipment and skilled operator. Radiation hazards are also less uncommon. Most of the times, the veterinary patients need to be anaesthetized for the smooth conduct of therapy. Hence it could not be considered for a routine therapeutic modality in clinical cases (Thrall, 1982; Boscos and Ververidis, 2004).

Chemotherapy

Chemotherapy has already proved to be the most effective, affordable and practical therapy for the management of Canine Transmissible Venereal Sarcoma (CTVS).

Vincristine sulphate

Intravenous vincristine sulfate is the most frequently used chemotherapeutic agent for CTVS. The drug has been documented to be successful over the past many years with decreased incidence of recurrence and less adverse effects (Rogers, 1997; Varughese et al., 2012). A remission rate of 100% has been reported in cases where the tumour was in the initial stages of progression and less than one year duration, regardless of the presence or absence of metastases (Boscos and Ververidis, 2004; Martins et al., 2005; Nak et al., 2005; Varughese et al., 2012). However, Amber et al. (1990) observed recurrence six months after complete remission by vincristine therapy.

Vincristine sulfate administration arrests cell division in the metaphase stage by binding to tubulin dimer that is necessary for mitosis of spindle fibers resulting in decreased tumor cell proliferation and apoptosis (Gonzalez et al., 2000). Also, it reduces the tumour cell population and the immune suppressing substances produced by these cells. However, the involution of the mass is gradual, although it is significantly noticeable at the beginning of the treatment. The dose of vincristine is approximately estimated to be 0.5 to 0.7 mg/m^2 body surface area or roughly 0.025 mg/kg body weight administered for about four to eight weeks at an interval of one week (Das and Das, 2000; Boscos and Ververidis, 2004). A clinical remission of the lesion usually requires 2 to 8 injections with an average being five (Calvert et al., 1982; Daleck et al., 1995; Nak et al., 2005; Scarpelli et al. 2010). Rarely, 16 administrations have also been reported to achieve full clinical remission (Scarpelli et al. 2010).

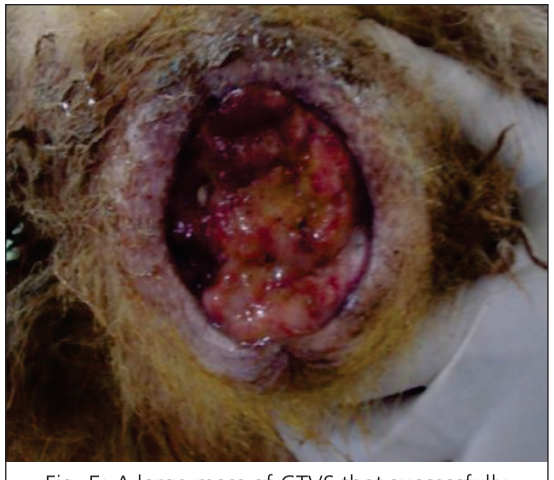

Fig. 5: A large mass of CTVS that successfully responded to vincristine therapy

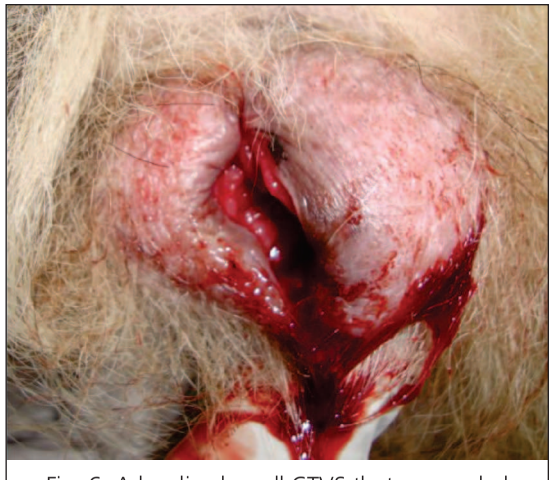

Fig. 6: A localized small CTVS that responded to vincristine therapy

The adverse effects of vincristine sulphate may be attributed to the cytotoxicity due to the non-selective nature of this drug. Often, it predisposes to myelosuppression and gastrointestinal alterations resulting in vomiting. Decrease in appetite, frequent diarrhea, constipation, claudication, diffuse alopecia, desquamation and hypersensitivity reaction has also been noted (Nak et al., 2005; Said et al., 2009). Transient leukopenia with relative neutropenia and lymphocytosis, thrombocytopenia and anaemia were common findings and hence a haematological evaluation is usually recommended prior to each administration (Nak et al., 2005). A total leukocyte count of less than 4,000 mm^3 always warrants delaying further administration for 3 to 4 days and reducing the dose of vincristine sulphate to 25% (Martins et al., 2005). The adverse clinical signs and haematological alterations progressively improve, if the treatment is temporarily discontinued. The most frequent complication associated with vincristine therapy is the development of local tissue lesions, cellulitis and subsequent necrosis that arises as a result of extravasation of the drug during faulty intravenous administration (Rogers, 1997; Nak et al., 2005). Paresis has also been reported in some dogs due to peripheral neuropathy (Calvert et al., 1982).

In male dogs, the adverse effects of vincristine administration mainly affect breeding animals. Even though libido and testicular size appears unchanged, temporary or permanent alteration of spermatogenesis, mid-piece and tail abnormalities of sperm (teratozoospermia), decrease or total absence of sperm motility (asthenozoospermia) and decrease in sperm concentration has been observed subsequent to onset of treatment (Daleck et al., 1995; Martins et al., 2005). The altered spermatogenesis may return to normal after a few spermatic cycles following discontinuation of treatment. However, this seems to vary among individuals as contradictory reports against normal restoration of semen quality are also present in vincristine treated dogs (Gobello and Corrada, 2002).

According to Scarpelli et al. (2010), a delayed response to vincristine therapy in dogs may be noticed with increase in tumor volume, old age and treatment during hot and rainy season. The need for immune surveillance of the affected patient during vincristine therapy was suggested by Gonzalez et al. (2000). The emphasis was on the reduced tumour clearance during chemotherapy because of the diminished immunological reaction of the patient. This may be associated to the age related delay in tumor regression due to decline of cellular and humoral defense mechanisms in older animals.

Doxorubicin

This is another chemotherapeutic agent that has been found to be effective for CTVS. But it is not an alternative agent to vincristine as the enormous side effects of doxorubicin in comparison to vincristine are well-established and is more toxic (Nak et al., 2005). Hence doxorubicin is always a second choice. But, Gandhimathi et al. (2011) observed less adverse effects with doxorubicin treatment compared to vincristine therapy. However, doxorubicin can be considered in those cases that are found resistant to vincristine (Nak et al., 2005; Said et al., 2009). The approximate dose is 30 mg/m^2 body surface area, IV, every 21 days. Usually it requires 2 or 3 cycles of administration (Richardson, 1981; Calvert et al., 1982; Souza et al., 1998; Gandhimathi et al., 2011). A breed specific side

effect of doxorubicin is the cardiotoxicity noticed in Doberman Pinscher (Phillips et al., 1998).

Other chemotherapeutic drugs

Other drugs that may be considered include vinblastine @ 0.1 mg/kg body weight, IV, for 4 to 6 weeks, cyclophosphamide @ 5 mg/kg body weight, PO, for 10 days administered either alone or in combination with prednisolone @ 3 mg/kg body weight, for 5 days, methotrexate @ 0.1 mg/kg body weight, PO, every other day and bleomycin (Hernandez-Jauregui, 1974; Calvert et al., 1982; Das et al., 1991; Singh et al., 1996; Rogers, 1997). Satisfactory degrees of remission without recurrence and side effects have been observed with a combination of cyclophosphamide, methotrexate and vincristine (Das et al., 1991). However, there is no apparent advantage in using a combination of chemotherapeutic agents over using vincristine alone (Vermooten, 1987). Also, the combination therapy is economically less feasible and in prolonged duration of therapy, it may lead to adverse side effects. The administration of vincristine prior to bleomycin is found to sensitize tumor cells, thereby, increasing the cytotoxicity and reducing the effectiveness of this antibiotic. Another antineoplastic employed is the enzyme L-asparaginase. It hydrolyses asparagine to aspartic acid and reduces serum asparagine concentration. This mechanism causes depletion of asparagine that is necessary for protein synthesis leading to tumor regression. Also, L-asparaginase is not affected by multi drug resistance (MDR). A clinically developed MDR or chemotherapy resistant CTVT was successfully treated with a combined modality therapy using L-asparaginase, prednisolone and surgery (Da Silva et al., 2014).

Electro-chemotherapy

ECT has been employed for the treatment of CTVT and was found to be safe and effective. This employs biphasic pulses that are delivered by means of modified caliper or paired needle electrode. Spugnini et al. (2008) employed trains of 8 biphasic electric pulses lasting 50 + 50 µs each with 1 ms interpulse intervals, applied 5 minutes after chemotherapy, using bleomycin at the concentration of 1.5 mg/ml injected locally at a level of 0.5 cm along the margin of tumour. Two sessions of ECT was done at an interval of one week. Complete remission was achieved by about 28 to 48 months. The advantage of ECT included reduced toxic and side effects, local tumour control and absence of bleeding. Mild swelling and erythema may develop that subsides subsequently by about 3 to 4 days after treatment.

Biotherapy or Immunotherapy

The immunotherapy is a promising alternative to chemotherapy and works by modulating the patient's immune system. The CTVT has the inherent capability of spontaneous regression after a prolonged phase of progression due to the formation of natural IgG antibodies (Yang, 1988). A failure in the host immune response to produce sufficient amount of antibody is assumed to inhibit this self-regression mechanism and cause metastasis. Several biotherapy and immunotherapy studies have been tried and are considered as useful adjuncts for managing CTVS over the past few years (Yang, 1987; Otter et al., 1999). Reports on application of autogenous vaccines, intratumoral application of bacillus *Calmette-Guérin* (BCG) or Freundus adjuvant or the autogenous lymphokine activated killers (LAK), and immunotherapy using *Staphylococcus* protein A or a vaccine made from tumoral cells are available, but, with sporadic success (Mukaratirwa et al., 2009). However, higher rate of recurrences have been noticed with these modes of therapies (Vermooten, 1987; Amber et al., 1990; Johnston, 1991; Rogers, 1997). Efforts to treat CTVS with various bacterial toxins like killed suspensions of *Chromobacterium prodigiosum* alone or in combination with other organisms have also been made (Beebe and Tracy, 1907). Autogenous vaccines supplemented with immunomodulatory agents like levamisol may be used following surgical removal to prevent recurrence (Pandey et al., 1977).

Chou et al. (2009) has demonstrated the combined use of IL-6 plasmid and IL-15 plasmid (pIL-6/pIL-15) immunotherapy for the treatment of CTVT in Beagles. The immunosuppressive effect of TGF- on the host immune responses that facilitate tumour progression was antagonized by the administration of pIL-6/pIL-15. Here, pIL-6 antagonized the TGF- activity and pIL-15 enhanced NK- and CTVT- specific cytotoxicity with marked increase in tumour specific IFN- - producing cells that enabled tumour regression. The significance of interleukin-2 in the immunotherapy of CTVT was also reported by Otter et al. (1999).

The dendritic cells/tumor cell fusion hybrids have shown to be effective against tumors. The hybridomas present a set of tumor-associated antigens in addition to its co-stimulatory capability to elicit immunity against tumor cells (Bird et al., 2008). Administration of three injections subcutaneously near the bilateral auxiliary and inguinal lymph nodes at two-week intervals, successfully inhibited tumor growth and accelerated rate of regression by enhanced adaptive and innate immunities and NK cytotoxicity (Pai et al., 2011). In general, paraimmunity activators are administered prophylactically or therapeutically to enhance the non-specific immunity of the host.

Photodynamic Therapy

Much of the preliminary investigation on Photodynamic Therapy (PDT) in CTVT was done by Hage et al. (2003). The basis of PDT is the synergistic photochemical reaction between tumor cells containing accumulated photo-sensitizer and laser light and the subsequent irradiation of photo-sensitized tissue with non-ionizing radiation resulting in tissue damage. The main advantage lies on the selectiveness compared to other therapies as the photo-sensitizer accumulates 3 to 9 times more in malignant cells than in normal cells. The common photo-sensitizers drugs employed include 5-amino-levulinic acid (5-ALA) and hematoporphyrin derivative, phthalocyanine. The 5-ALA is a rate-limiting precursor in haeme biosynthesis and the so generated endogenous substance, protoporphyrin IX (PPIX) has high affinity to tumoral cells. The drug is administered either orally, IV or topically and has the added advantage of its fast clearance. A 2% 5-ALA applied topically in the tumour area accumulates the generated PPIX. The maximum intensity of accumulated PPIX occurs between 60 to 105 minutes, the time at which the fluorescein excitation has to be done. Usually it is done by a pulsed laser light, particularly an excimer laser-pumped dye laser, followed by irradiation of photosensitized tissue with non-ionizing radiation (Schisterman, 2002). According to Hage et al. (2003), PDT may evolve in future as a promising therapeutic method as these techniques have improved precision, selectiveness and fewer side effects compared to conventional therapies. Immobilization of the patient is imperative for PDT.

Combination Therapy

Although considerable side effects have been reported, it is inevitable to adopt a combination of treatment modalities for managing CTVS if there is a recurrence or in cases where the tumour does not respond to chemotherapy using vincristine alone (Das and Das, 2000; Boscos and Ververidis, 2004). The most effective treatment

so far reported to hasten recovery in such cases is the combined surgical excision along with vincristine administration. The potential risk associated with prolonged chemotherapy can also be minimized. Combined BCG and vincristine therapy has been found to be more effective than chemotherapy alone with vincristine. A significantly shorter regression time has been noticed with this combination therapy (Mukaratirwa et al., 2009). Other combinations of modalities that can be adopted for treatment of CTVS are described elsewhere in the text.

Conclusion

CTVS has a high incidence in India. It is most effectively diagnosed via cytological examination. Surgical excision combined with the administration of vincristine sulphate has been identified to be the most suitable and practical method in managing this condition. In field situations where surgical facilities do not exist, chemotherapy alone is promising than surgical intervention. Vincristine has proved to be effective therapeutic drug for smaller lesion and may be combined with cryosurgery in larger lesions. Due to the adverse effect of vincristine on spermatogenesis, the potential benefits of using vincristine must be balanced by clinicians, and owners with interest in using the animal for breeding purpose. In chemo resistant tumours, radiotherapy may be the sole treatment strategy advisable particularly if adequate exposure can be achieved, necessary infrastructure is available and the cost is affordable. Photodynamic therapy is selective, improves precision and reduces side effects caused by conventional therapies. Currently, immunotherapy is useful only as an adjunct therapy for all tumours. Also, the immunotherapy needs to progress via further research from an adjunct therapy to a reliable modality. Further infrastructure development, research and dissemination of information are hence required.

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Small Ruminants Sector in India

Population Dynamics (1951-2012)

Figures in millions

	Census Years									
	1951	1961	1972	1982	1992	2003	2007	2012	CAGR %	% change in 2012 over 2007
Sheep	39	40	40	49	50	61	72	65	1	-9.7
Goats	47	61	67	95	115	124	141	135	3	-4.2

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Oxidative stress and hemato-biochemical changes in dairy animals around parturition

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Abstract :

Oxidative stress due to imbalance between the formation and disposal of reactive oxygen molecules (ROM) or free radicals initiates many pathological situations like disturbances in metabolism and cellular damage. The stress during post-partum stages is a serious condition, if associated with peri-parturient problems like dystokia and retention of fetal membranes. The hematological and blood biochemical changes associated with pre/peri/post parturient periods in buffaloes and role of vit. E and Selenium as effective antioxidants is discussed.

Keywords : Oxidative stress, Buffaloes, Vit. E, Selenium

Introduction :

Dystocia in animals is highly stressful and is associated with significant rise in stress hormones like cortisol, adrenaline and noradrenaline. Stress, if not taken care of at an appropriate time, can be fatal and/or lead to declined production. Therefore, attempts have to be made to reduce the stress and its effects in parturating animals. The imbalance between the production of free radicals and their safe disposal is called as oxidative stress. Therefore, balance between formation and disposal of oxidant molecules is essential for tissue homeostasis. Oxidative stress is widely recognized as a factor in many degenerative diseases, as either a cause or effect.

Oxidative Stress

Reactive oxygen metabolites (ROM) :

In the cells, free radicals or ROM are formed both in physiological and pathological conditions and are extremely reactive and unstable chemicals which react with proteins, lipids, carbohydrates and nucleic acids in the body (Solomons and Fryhle, 2002). Increased rate of free radical production and decreased rate of removal lead to accumulation of free radical, deregulation of metabolic pathways and cellular damage (Berry and Kohen, 1999). Lipid peroxidation (LPO) due to ROM results in production of more free radicals and hydroperoxides that damage the intracellular structures causing loss of cellular functions. The inadequacy of dietary antioxidants increases the LPO level in blood and tissues. Further, a significantly increased LPO level with increased incidence of retention of fetal membranes (RFM) has been reported in periparturient cows (Brzezinska-slebodzinzkaet al.,1994).

Role of antioxidants :

Activated form of oxygen is important in the biosynthesis of complex organic molecules,

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detoxification of xenobiotic chemicals and in defense against pathogens. Under normal conditions, free radicals are neutralized by efficient antioxidant systems which are capable of breaking the oxidative chain reactions, thereby reducing the oxidative stress (Nockels, 1996).

Vitamin-E, a lipid soluble vitamin, is the most effective chain breaking antioxidant and the biologically active form is dl--tocopherol. It is essential for growth, reproduction, prevention of various diseases and integrity of tissues. It interacts directly with lipid peroxides in plasma lipoproteins and cell membranes to neutralize ROM. It is stored by all body tissues but predominantly by the liver. However, these stores are rapidly depleted by the dietary deficiency (Fettman, 2001a).

Selenium (Se), a co-factor of enzyme glutathione peroxidase (GSH-Px), acts synergistically with vitamin-E to protect the body against the free radicals (Kim et al., 1997). As an integral part of the enzyme GSH-Px, Se functions to prevent oxidative damage to body tissues.

Vitamin-E and selenium deficiency in animals results in generation of free radicals and LPO indicating the onset of oxidative stress. Dairy cows fed diets deficient in vitamin-E and selenium had increased incidence of diseases associated with reproduction like retained fetal membranes (RFM), metritis and cystic ovarian disease. Supplementation of vitamin-E and selenium reduced such diseases in dairy animals (LeBlanc et al., 2004). Administration of vitamin-E 21 days prior to the estimated date of calving maintained adequate activities of glutathione peroxidase in whole blood and selenium in plasma (Hidiroglou et al., 1987). However, Brzezinska-slebodzinzka et al. (1994) observed that LPO levels were negatively correlated ($P < 0.01$) with plasma total antioxidants ($r = -0.57$) and -tocopherol ($r = -0.27$). Supplementation of vitamin-E and Se may be beneficial in reducing oxidative stress in dystocia affected buffaloes in the immediate postpartum period (Sathyaet al., 2007).

Oxidative and anti-oxidant status

Malondialdehyde (MDA) :

The products of LPO following reaction of lipids in cell membrane with ROM leads to extensive membrane, cellular and organellar damage (Coltranet al., 1999), the extent of which are related quantitatively to the amount of LPO level in the blood (Yagi, 1987). MDA is one of the end products of LPO and extent of LPO is measured by estimating MDA levels (Lataet al., 2004). The metabolites of LPO were elevated in cases of RFM as compared to the control animals (Kankofer, 2001). A significant increase ($P<0.001$) in LPO levels (2.46 ± 0.07 nmol MDA/mgHbvs 3.67 ± 0.16 nmol MDA/mgHb) from three weeks pre-partum till the day of calving were noticed in cows which experienced RFM (Gupta et al., 2004). Singh et al. (2011) observed significantly high levels of MDA in buffaloes suffering from dystocia than in their normal counterparts. Similarly, MDA production was significantly higher both in the blood plasma and uterine fluid of dystocia affected animals than in normally calved buffaloes (Bansalet al., 2011).

Superoxide Dismutase (SOD) :

The SOD catalyzes the dismutation of toxic superoxide radicals to the lesser reactive compound viz. hydrogen peroxide (H_2O_2), thus protecting the organism against deleterious effects of the free radicals. The increase in the production of ROM impairs the RBC membrane integrity and leads to alterations in erythrocyte antioxidant systems reflected by higher SOD concentrations. The cattle fed diets deficient in vitamin-E and selenium can upregulate the effects of some antioxidant enzymes, including SOD, to mitigate the effects of oxidative damage (Walsh et al., 1992). Similarly, Sathyaet al. (2007) observed decline in plasma SOD activity in the group of dystocia affected buffaloes supplemented with vitamin-E and Se.

Glutathione Peroxidase (GSH-Px) :

GSH-Px is located in the cytosol and utilizes the reducing potential of glutathione to reduce H_2O_2 and other organic peroxides to water. There is a direct correlation between the erythrocytic GSH-Px activity and selenium owing to high concentration of selenium in the former (Fettman, 2001b). It functions in cellular oxidation-reduction reactions to protect the cell membrane from oxidative damage caused by free radicals. During excessive exposure to stimulators of ROM production, there is a relative deficiency of GSH-Px leading to development of oxidative stress. A lowered GSH-Px activity has been recorded during second half of gestation and parturition in cattle (Mihailovicet al., 2000). Blood GSH-Px activity in cows increased with vitamin-E and Se injection and was significantly higher in the treatment group as compared to the control group (Osama et al.,1992).

Blood biochemistry: Metabolic parameters

Blood glucose :

Marked decrease in the levels of blood glucose had been recorded with the advancement of pregnancy (Shrikhande et al., 1999). The levels decreased from 4.87 ± 0.25mmol/L at 4 months to 2.82 ± 0.15 mmol/L at 6 months of pregnancy. The type and duration of parturition in cattle determined the intensity of rise in blood glucose concentration around peripartum period. Blood glucose concentration in cattle was higher on the day of parturition (70.8 mg/dl) as compared to the prepartum period (Athanasiou and Phillips, 1978). The average blood glucose levels in buffaloes 2 days before parturition (2.36 ± 0.2 mmol/L) increased gradually to be significantly higher ($P<0.01$) on the day of calving (3.45 ± 0.35 mmol/L). The levels declined to be significantly lower ($P<0.01$) by day 3 postpartum (2.97 ± 0.23 mmol/L). The levels further increased during fetotomy, detorsion of uterus and caesarean section (Atwal, 1993; Prabhakaret al., 2000).Higher blood glucose concentrations in buffaloes suffering from dystocia as compared to normal calving buffaloes have been reported (Sathyaet al., 2006). The obstetrical procedures lead to enhanced release of catecholamines(Breazile, 1987). The primary effect of increased corticoids on carbohydrate metabolism is gluconeogenesis from non-carbohydrate sources such as proteins and fat. Cortisol also exerts a permissive effect for the release of glucose from liver glycogen by epinephrine and glucagon (Dickson, 1993). Stress of dystocia, resulting in hypercortisolaemia, might induce hyperglycemia. The decline in blood glucose levels on subsequent days following treatment of dystocia (Prabhakaret al., 2000), might be due to withdrawal of stress and/or due to prolonged starvation after maneuvering, leading to exhaustion of glucose pools and glucogenic amino acids.

Total plasma proteins :

A general physiologic effect of glucocorticoid is to increase the rate of protein catabolism including immunoglobulins. Prabhakaret al. (1999b) recorded a gradual decline in total plasma proteins in buffaloes from day 2 prepartum, through the day of parturition, to day 3 postpartum. The protein levels on day 7 after parturition remained significantly lower than those observed before parturition in sheep (Kaushish and Arora, 1977). Total plasma protein level in dystociac buffaloes was marginally lower than that in normal calving controls (Prabhakaret al., 2000). Lower levels of plasma proteins may be due to stress of dystocia and maneuvering, leading to decreased liver function, increased utilization of proteins due to

starvation and inflammation, causing increased movement of fluid and proteins into the tissues (Kaneko, 1989). Buffaloes which died following various obstetrical maneuvers had lower total plasma proteins (6.85 ± 0.3 g/dl), which showed a severely deranged metabolic function (Prabhakaret al., 1999b). Bugalia et al. (1996), however, had recorded non-significant variations in circulatory total plasma protein levels between dystociac and normal calving buffaloes, suggesting insignificant effect of stress and toxemia on protein metabolism. Varshney et al. (1992) observed a fall in serum total proteins in cows after caesarean section up to 5-7 post-operative days which was attributed to the negative balance produced by increased catabolism.

Non-esterified fatty acids (NEFA) :

The levels of NEFA in blood are an index of general stress and the elevated plasma NEFA levels are due to mobilization of lipid reserves for higher energy demands. NEFA is the commonest form in which fat is transported through the plasma compartment. Further, the high levels of NEFA in stress are mainly related to increased nor-adrenaline release and other endocrine-sympathetic alterations (Bhatia and Kanojia, 2003). NEFA levels increased as parturition approached, attaining peak values on the day of parturition in buffaloes (Setiaet al., 1992). The high levels were maintained for a period of 2 weeks postpartum, but mean NEFA levels observed during early lactation were significantly ($P < 0.05$) lower than those recorded at parturition.

Hematology

Hemoglobin (Hb) :

In normal lactating Murrah buffaloes, Hb concentration ranges from 9.0 to 13.5 g/dl (Vegad, 2000).However, low Hb content was observed during advanced pregnancy in cows and buffaloes which returned to normal within 2 weeks postpartum (Kumar et al., 2001). Hemoglobin content was observed to be lower in the uterine torsion affected buffaloes when compared to the normal calvers (Kaur and Singh, 1993). Agrawal (1987) observed no significant change in Hb content after detorsion of uterus and/or caesarean section in buffaloes. The initial Hb level in dystocia affected buffaloes did not vary from controls. However, Hb levels were significantly higher in buffaloes that died after obstetrical interventions than the survivors (Prabhakaret al., 1999a).

Total Leukocyte Count (TLC) :

TLC varies under different physiological status from day to day in an individual animal. The normal range of TLC in a lactating Murrah buffalo is 6250 to 13050 per μl (Vegad, 2000). As a rule, the TLC does not increase beyond 20,000 cells per μl. TLC did not change over the time of gestation; however, it increased ($P < 0.002$) and peaked 2 weeks before parturition (Hoedemakeret al., 1992). This increase was caused by the combined increase in the number of circulating neutrophils before calving ($P < 0.0001$) and circulating mononuclear cells from -6 to-2 weeks before parturition ($P < 0.02$; Kehrliet al., 1989). Taylor (2000) observed a gradual increase in TLC as parturition approached, peaking at approximately 13,000 per μl by 9th day pre-calving, with a return to normal values on day 3 postpartum. However, Mehereet al. (2002) found no specific trend in TLC during the peripartum period. TLC was significantly higher in buffaloes affected with uterine torsion and dystocia as compared to that in normal buffaloes at term (Singh, 1991). The leucopenia during the early postpartum period may be associated with significant increase in susceptibility to bacterial infections (Weiss, 2000).

Differential Leukocyte Count (DLC) :

The lymphocyte-dominated leucogram in cattle is shifted to a more neutrophil-dominated one in the last 1 or 2 weeks before parturition with an increase in the total number of neutrophils (Hoedemaker et al., 1992). Increased glucocorticoid concentration at parturition induced significant down-regulation of adhesion molecule CD62L expression on neutrophils resulting in neutrophilia (Andreasen and Roth, 2000). The neutrophilia caused by glucocorticoids is not only due to reduced margination but also due to increased input of neutrophils from the bone marrow storage pool (Kaneko, 1989). Glucocorticoid induced leukocyte changes include a mature neutrophilia without a left-shift, lymphopenia, eosinopenia and monocytosis (Taylor, 2000). The increased number of bacteria and their endotoxins together with the remnants of placental tissues in the uterine fluid attract the polymorphonuclear leukocyte (PMNL) into uterine lumen (Hussain and Daniel, 1992). Sathya et al. (2010) observed derangement in PMNL functions during periparturient period in buffaloes. Neutrophils were the most mobile of all blood leukocytes and were, thus the first cells to arrive at the inflamed tissue. Chemotactic responses of neutrophils to cotyledon and uterine wall tissues might imply a role of neutrophils in separation of placental membranes and the prevention of postpartum uterine infections, respectively (Hoedemakeret al., 1992). If tissue demand for neutrophils intensified, the bone marrow storage pool of mature segmenter cells become depleted; progressively less mature forms appeared in the circulation constituting a left-shift (Smith, 2000). Reduction in circulating neutrophils resulted from movement to the uterus with "shift to left" in cases of RFM and metritis (Caiet al., 1994). Leukopoenia, left shift to metamyelocytes and monocytosis between 2 and 5 days postpartum with decreased bone marrow granulocyte reserve were seen in cows with retention of placenta (Jain, 1993). Histamine, kinins, eicosanoids, cytokines and fibrinogen breakdown products were some of the vasoactive molecules of inflammation possessing neutrophil chemotactic property (Tizard, 1998). The mean neutrophil and lymphocyte counts dropped sharply after calving and then increased gradually from day 2 following induced parturition and elective caesarean section (Hussain and Daniel, 1992). The eosinophils and monocytes decreased from 275 days of gestation to parturition by 2 percent and 50 percent respectively (Hoedemaker et al., 1992) while these cell counts fluctuated non-significantly during the early postpartum period (Hussain and Daniel, 1992). Varshney et al. (1992) reported an acute fall in eosinophils and rise in basophils and monocytes before and after caesarean section. However, the counts returned to near normal limits by 7th to 11th post-operative day. The neutrophil counts were significantly lower in dystocia affected buffaloes than in normally calved buffaloes during the immediate postpartum period (Sathyaet al., 2010).

Packed Cell Volume (PCV) :

The PCV percentage of normal lactating Murrah buffaloes ranges from 26-34 percent (31.0 ± 2.0%;Vegad, 2000). In anemic cattle, the value falls below 25 percent while in pronounced dehydration or hemo-concentration, it may rise above 45 percent. Kumar et al.(2001) observed decline in PCV values with approaching parturition while Mehereet al. (2002) observed higher PCV values in the prepartum period and on the day of parturition. Further, the values decreased significantly ($P<0.01$) during the early postpartum period (Mehereet al., 2002). The PCV was variable in dystocia affected buffaloes subjected to different obstetrical maneuvers. Agrawal (1987) observed no significant change

in PCV after detorsion and/or caesarean section, whereas Singh (1991) observed a decline in PCV following detorsion, fetotomy or caesarean section. Prabhakaret al. (1999a) observed significantly higher PCV in buffaloes that died after obstetrical interventions than the survivors.

Erythrocyte Sedimentation Rate (ESR) :

It is of prognostic value in certain diseases and may be accelerated in several destructive and inflammatory conditions. Bacterial invasion and tissue damage increased the levels of acute phase proteins like fibrinogen in the blood which reduced the surface charge in RBCs so that the cells aggregate and sink rapidly than usual. Thus, ESR is a convenient and simple measure of inflammatory processes. In cattle, ESR is extremely slow, being less than 2mm in 24 hours. The normal ESR for lactating Murrah buffaloes ranged between 17 and 69 (53.0 ± 12.3) mm per hour (Vegad, 2000). The ESR in normally calving buffaloes did not reveal any significant change except a slight fall on day1 postpartum (Agrawal, 1987).

Conclusions

From the foregoing discussion, it appears that oxidative stress is a major problem posing serious risk to the life of the animal during parturition. Oxidative stress can lead to production of reactive oxygen metabolites and lipid peroxidation of erythrocytic membranes. Blood biochemical estimations can give better understanding of the underlying oxidative stress. Good managemental practices viz. close watch on animal at the time of parturition, symptoms approaching parturition, proper guideline to deliver the fetus along with supplementation of antioxidants help in reducing the impact of oxidative stress on reproductive performance in animals. It is, therefore, recommended to monitor stress in conjunction with the hemato-biochemical parameters as a matter of intensive and critical care.

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Lactoferrin: A Multifunctional Natural Inbuilt Bioactive Protein

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Abstract

Lactoferrin (Lf) is a non-heme iron binding glycoprotein and is the major protein of all exocrine secretions including saliva, tears, semen, vaginal fluids, gastrointestinal fluids, nasal mucosa and bronchial mucosa of human being. Lactoferrin is also a second most bioactive protein after casein found in milk of bovine, caprine, camel and human. Lf functions as anti-bacterial, antifungal, antiviral, antimicrobial, anti-oxidant, anti-inflammatory, anti-parasitic, anti-allergic and most importantly anti-cancerous properties. In the present scenario, the development of drug-resistant cancer imposed a question mark on the use of chemotherapeutic agents. This limitation raises the need of a natural substitute that has generalized acceptance and can possibly eradicate the primary tumor, thus eliminating the risk of recurrence. The role of this natural molecule as anti-inflammatory agent needs further research. It stands as a biomarker for inflammatory conditions and its potential role as a therapeutic molecule needs to be taken forward. The advantage of this natural molecule has proven its potential as a natural therapeutic agent that can be used in various fields of research including cancer.

Keywords : Lactoferrin, Antimicrobial property, Immunity

Introduction

Milk is the primary source of nutrients for young mammalians. It is recognized as being nutritionally balanced and has therefore attracted a lot of scientific interest over the years. Various properties of intact milk proteins have been reported including satiating, antimicrobial, mineral binding, antilipidaemic and anticancer properties (Anderson and Moore, 2004; Chatterton et al., 2006; Clare and Swaisgood, 2000; Cross et al., 2007; Nakamura et al., 2013). Identification of large number of peptides in milk protein hydrolysate makes the milk proteins as one of the most important source of bioactive peptide. Several studies have suggested that milk protein-derived BAPs (Bio Active Peptides) may be used as preventative/prophylactic agents to alleviate symptoms of various diseases in humans. Side-effects of various drugs used to cure/slow down the progress of specific diseases in humans may sometimes outweigh their benefits (Li-Chan, 2015; Saadi et al., 2015). Further, increasing awareness regarding potential benefits of milk protein derived bioactive peptide among the people, laid path of growing milk neutraceutical market (Nagpal et al., 2011). Lactoferrin (Lf) is a non-heme iron binding glycoprotein with molecular weight of

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78 kDa that contains around 690 amino acid residues. It belongs to the transferrin (Tf) family. It is one of the major proteins of all exocrine secretions including saliva, tears, semen, vaginal fluids, gastrointestinal fluids, nasal mucosa and bronchial mucosa of human being (Iigo et al., 2009; Birgens et al., 1985). Lactoferrin is also found in milk of bovine, caprine, camel and human (Baker and Baker, 2005). Lf is also known for its anti-bacterial, antifungal, antiviral, antimicrobial, anti-oxidant, anti-inflammatory, anti-parasitic, anti-allergic and most importantly anti-cancerous properties (Iigo et al., 2009; Parhi et al., 2012). Lf is the second most abundant milk protein after casein and its highest concentration is found in human colostrum and then human milk followed by cow milk (Sanchez et al., 1992). Development of drug-resistant cancers imposed question mark on the use of chemotherapeutic agents. This limitation raise the need of a natural substitute that has generalized acceptance and can possibly completely eradicate the primary tumor, thus eliminating the risk of recurrence. In this context Lf has got the potential to be used as anti-cancer bio-molecule. This review represents the properties and structure of Lf along with the function and therapeutic importance.

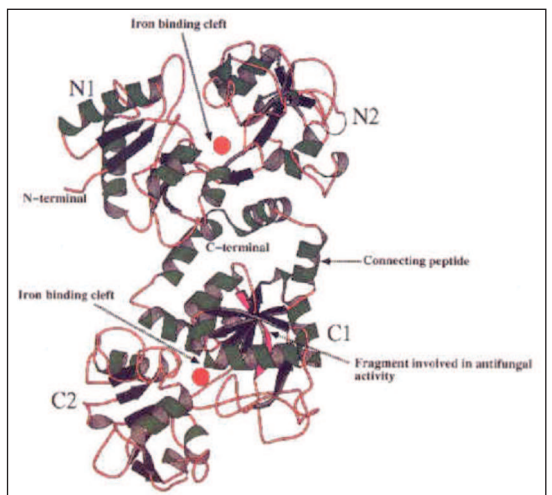

Fig. 1: Three dimensional folding of buffalo lactoferrin [Sources: Karthikeyan et al. (1999)]

Lactoferrin: Structure and Functions

The structure of Lf consists of a single polypeptide chain which is folded into two lobes (N and C lobes) with 33–41% homology (González-Chávez et al., 2009). Both lobes are linked by an -helical residue, making Lf a flexible molecule (Fig. 1). The two lobes of Lf are made of -helix and -sheet, and each lobe can bind either Fe+2 or Fe+3 ions in synergy with the carbonate ion ($CO3^{--}$) (Iafiscoet al., 2011). Amongst transferrin family, the lactoferrin has highest iron binding affinity.

Lactoferrin is the major iron transporter protein in blood plasma (Iafisco et al., 2011). In its natural form, lactoferrin is partially saturated with iron and hence can be fully saturated with iron from the external environment (Kanwar et al., 2008; Tsuda et al., 2004). Lactoferrin acts as a signaling molecule in various pathways to exert their cytotoxic effects. Human Lf (hLf) and bovine Lf (bLf) cause cell cycle arrest and leads to apoptosis (programmed cell death) in cancer cells while bovine lactoferriin (bLf) inhibits cell growth by triggering mitochondrial related apoptosis (intrinsic apoptotic pathway) and disrupting the cell membrane.

Sources of Lactoferrin

Lf is an important part of the innate immune system (Wakabayashi et al., 2006). Lf is continuously synthesized in body and is released into the exocrine fluids like saliva (Reitamoet al.,1980), tears (McClellan, 1997) and vaginal fluids (Valoreet al.,2002), or only at well-defined stages of cell differentiation such as granules of neutrophils (Breton-Goriuset al., 1980). Glandular epithelial cells secrete Lf in milk source. Various concentrations of Lf is found in the milk obtained from different sources (Masson et al., 1969). During an infection or an inflammatory condition, the levels of Lf are raised in the body (Caccavo et al., 2003) making Lf a biomarker for inflammatory conditions.

Lactoferrin: A multifunctional protein with antimicrobial properties

Risk of development of resistance to antibiotics raises the need for alternatives antimicrobials and lactoferrin is one of the promising antimicrobial molecule that have potential to fill the gap (Li et al., 1995).The antibacterial activity of lactoferrin is mediated through its iron sequestering ability by virtue of which iron become inaccessible to bacteria and hamper their growth and division (Bullen et al., 1972). Lf and Lf derived peptide has bacteriostatic activity against both Gram positive and Gram negative bacteria (Ellison et al., 1988). *Staphylococcus epidermidis* is one of the most predominant infectious agents in individual implemented with intraocular lenses leading to a characteristic biofilm formation on the soft contact lenses. It is observed that Lf increases the sensitivity of this bacterium by binding to the anionic cell wall preferentially to vancomycin thereby allowing its entry into the bacteria (Leitch and Willcox, 1999). Lf facilitates the penetration of lysozyme as it binds to teichoic acid and compensates the charges on cell wall (Leitch and Willcox, 1999). Lf causes depolarization of the bacterial membrane leading to membrane penetration and eventually metabolic injury. Lf is also used to treat periodontal diseases by acting against plaque forming oral microorganisms like *Streptococcus mitis*, *Streptococcus gordoni*, *Streptococcus salivarius* and *Streptococcus mutans*.

Lactoferrin also prevents the colonization of *Giardia lambia*, a most common protozoal infection of human intestine by acting on *Giardia trophozoites, plasmalemma*, *endomembrane* and *cytoskeleton* (Ochoa et al., 2008). In another study, antibacterial activity of bLf hydrolysate by using different enzymes including, rennet and pepsin were assessed against *Escherichia coli* and *Bacillus subtilis*. The study revealed that Lf-cin B was the most potent antibacterial peptide and was isolated from both rennet and pepsin LFH (Elbarbary et al., 2010). It was demonstrated that pepsin hydrolysate derivatives of bLf had stronger bifidogenic activity than natural against *Bifidobacterium breve* and *Bifidobacterium longum* species (Oda et al., 2013). Several modifications have been attempted in bLf in order to use it as a food preservative. It was found that Glycosylated lactoferrin (gLf) showed substantial Fe-binding capacity and excellent emulsifying properties and also revealed its ability to inhibit the growth of *E. coli* at 50°C completely (Nakamura, 2002). Hence, these findings offer new possibilities for Lf as a food preservative. In another study, it was observed that nano-formulated Fe-bLf was more effective in the treatment of Salmonella-infected mice than the standard therapy using ciprofloxacin (Gupta et al., 2014). Lactoferrin has ability to damage fungal cell membrane that alters its permeability and also its iron chelating properties attributed to antifungal activity (Wakabayashi et al., 2000). Lf also exhibits antiprotozoal activity but the mechanism varies from its antibacterial and antifungal aspects. Studies proved that although Lf had no role in inhibiting the entry of these parasites into the system but did not allow the growth of these protozoans in the host (Cintra et al., 1986).

Use of lactoferrin as antiviral compound is one of the most recent properties. Although the research regarding antiviral activity of Lf is in early phase, however, there are only a very few cases in which Lf failed to benefit as an antiviral activity. Lf exhibited antiviral activity against a number of viruses including herpes simplex virus, cytomegalovirus, hepatitis B and C virus (HBV and HCV) and human immunodeficiency virus (HIV) (Hara et al., 2002; Ikeda et al., 1998;

Harmsen et al., 1995; Roy et al., 2012). A new perspective in the studies of antimicrobial activity of Lf is due to its potent prophylactic and therapeutic ability in a broad spectrum. Unlike to all these antimicrobial effects, in some protozoans like Trichomonas, Lf helps in effective binding, and successful internalization in these parasites (Tachezy et al., 1998).

Lactoferrin and Immunity

Beside diverse function of Lf in various body fluids, iron free form of Lf is the integral component of cytoplasmic secondary granules of neutrophils thus have role in first line defense (Fig. 2). During inflammation, Lf is released and the concentration of Lf at the site of inflammation is increased from 0.4–2.0 µg/ mL to 200 µg/ mL, playing a major role in the feedback mechanism of inflammatory response (Farnaud and Evans, 2003). In the kidney, Lf is synthesized locally where, it sequestrate free iron from urine and makes it available for metabolic functions (Abrink et al., 2000).

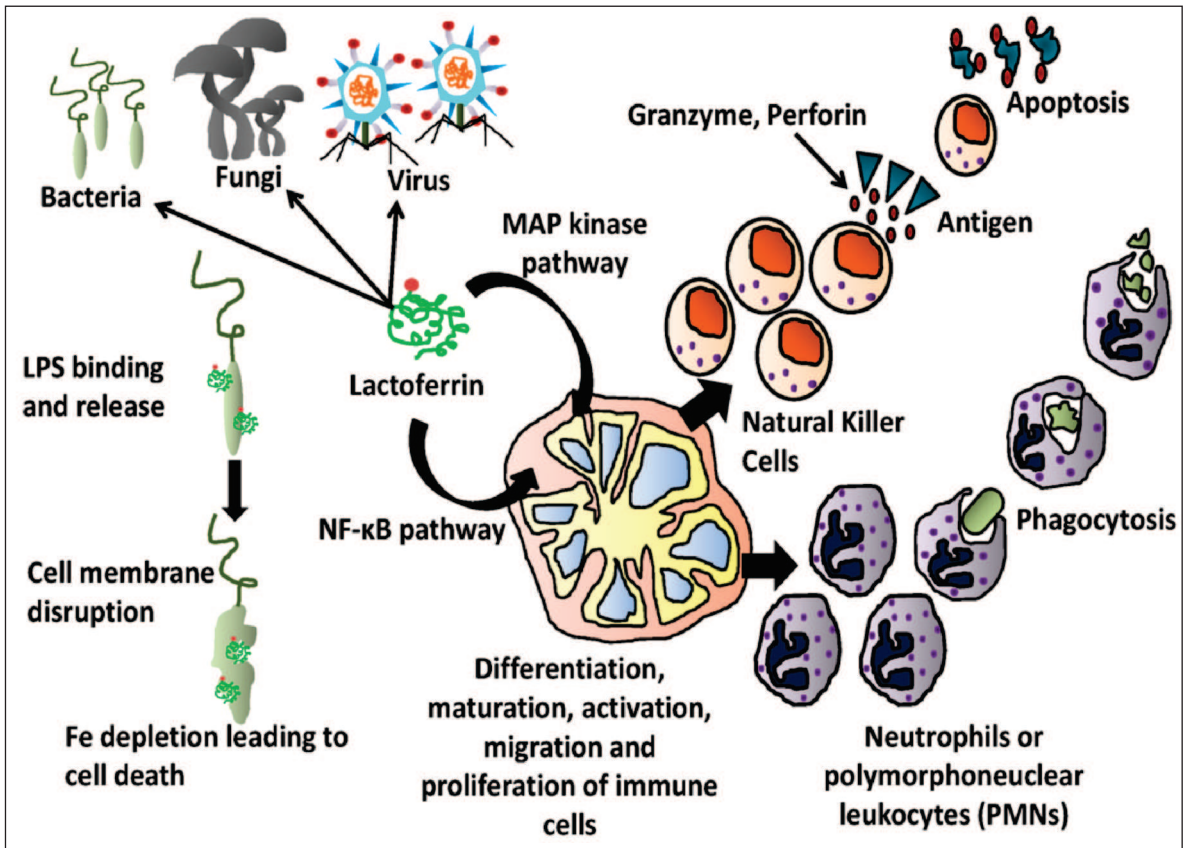

Fig. 2: Role of Lf in the activation of immune cells [Sources: Kanwar et al. (2015)]

Lf acts as immune modulator by interacting with specific cell receptors of epithelial and immune cells and as a lipopolysaccharide to pro-inflammatory bacterial elements (Na et al., 2004; Elass-Rochard et al., 1995; Legrand et al., 2008). At cellular level Lf significantly affects the differentiation, maturation, activation, migration, proliferation and functions of immune cells by using, nuclear factor-kappa B (NF-κB) and MAP kinase signaling pathway (Gahr et al., 1991). Lf from bovine milk showed proteinase inhibitory activity against *Porphyromonas gingivalis*, a bacterial pathogen, by inhibiting Arg and Lys-specific proteolytic activities (Manzoni et al., 2012). The bovine Lf at molecular level influences maturation of lymphocyte and release of cytokines in bone marrow micro-environment (Touyz et al., 2000). Anti-inflammatory action of Lf alleviates stress by preventing the excess inflammatory response (Ye et al., 2014). It was demonstrated that Lf knockout mice shown high susceptibility to inflammation-induced colorectal dysplasia, mainly due to NF-κB and AKT/mTOR signaling, regulation of cell apoptosis and proliferation. On the basis of above study, it can be inferred that anti-carcinogenic property of Lf is attributable to its anti-inflammatory function (Gutteridge et al., 1979).

Free form of iron plays a pivotal role in generation of reactive oxygen species (ROS) and leads to lipid peroxidation of cell membranes using iron-dependent Haber-Weiss reaction. Inefficiency of certain vital enzymes like, catalase, glutathione peroxidase and superoxide dismutase leads to over production of hydroxyl radicals further increases the oxidative stress (Raetz et al., 1991). It is hypothesized that iron sequestration by Lf from the microenvironment limits the oxidative damage to bio-membranes by hampering lipid peroxidation. Lf also regulate the systemic inflammatory response in controlled manner so that there is minimum damage to surrounding tissues (Gahr et al., 1991; Pajkrt et al., 1996). Antioxidant mechanism is one of the attributes by virtue of which oral administration of Lf shown to support improved immune response (Mulder et al., 2008).

Lf is considered as important component in first line host defense, as it plays vital role in innate as well as adaptive immune response (Legrand et al., 2008 and Kruzel et al., 2002). It was revealed that Lf potentiates the phagocytic activity of neutrophils (Wakabayashi et al., 2003), increased activity of NK cells and also involved in macrophages activation by increased production of cytokines and nitric oxide (NO) that, reduces the proliferation of intracellular pathogens (Kawai et al., 2007). Production of pro-inflammatory cytokines such as, TNF-α, IL-6 and IL-1β by Lf according to the requirement helps to confer its immune modulatory activity. Lf regulate the production of antigen presenting cells (APCs) like, macrophages, dendritic cells and B cells which presents the processed antigen to CD4+ T cells via major histocompatibility complex II (MHC II) (Puddu et al., 2009), thereby it plays active role in specific immune response against pathogens. Lf is found to reduce the production of cytokines, TNF-α, IL-6 and IL-1β that were induced by BacilleCalmette-Guerin strain of *Mycobacterium bovis*.

It is reported that all T cell subsets including δγ T cells have been expressed Lf receptors (Mincheva-Nilsson et al., 1997). Lf has shown to-up-regulate the leukocyte function associated antigen (LFA-1) which is an adhesion molecule present on CD4+ and CD8+ T cells, in human peripheral blood mononuclear cells when cultured in presence of human Lf (Zimeckiet al., 1999). Expression of human T cell ζ–chain, T cell receptor complex involved in receptor signaling were enhanced by hLf (Sfeiret al., 2004) observed that when concanavalin A (ConA) activated murine splenocytes were cultured in the presence of bovine or human Lf resulted in reduced production of IFN-γ and IL-2. There are various studies those have proven the immune modulatory function of Lf such as oral delivery of Lf to the mice bearing tumor cells showed an

increase in lymphoid and intestinal CD4+ and CD8+ T cells (Wang et al., 2000); increased population of circulating leukocytes CD3+CD4+, CD3+ TCRγδ+, and granulocyte were seen in mice with orally administered Lf (Wakabayashi et al., 2006). Recently presence of lactoferrin in feces has been introduced as a biomarker for the diagnosis and monitoring of inflammatory bowel disease (IBD). It could also be used as tool to investigate and quantify the effect of granulocyte and monocyte adsorptive apheresis (GMA) in ulcerative colitis (UC) (Hashiguchi et al., 2015). Hence, lactoferrin has diverse role, it ranges from immunodiagnostic tool to immunotherapeutic agent.

Conclusions

The advantages of this natural molecule prove its potential as a natural therapeutic agent that can be used in various fields of research including cancer. The role of Lf as anti-bacterial and anti-fungal agent had been beneficial in its use as a bactericidal and fungicidal agent in lotions and creams. Its use can be extended to topical applications as well. An interesting aspect of using Lf as an anti-cancer agent by delivering it to the body in the form of ice-creams, tablets and oral supplements in the form of NPs have been researched upon. With its role in being able to combat deadly viruses like HCV and HBV also poses a need for its use as an anti-viral agent for human immunodeficiency virus (HIV) and other potent viruses that cause health risks. The role of this natural molecule as anti-inflammatory agent needs further research. It stands as a biomarker for inflammatory conditions and its potential role as a therapeutic molecule needs to be taken forward.

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Small Ruminants Sector in India

Characteristics

- Out of total livestock available in India, 13.52% are sheep and 26.55% are goats, thus small ruminant sector in total constitutes almost 34% of the total livestock population in India.
- Population wise, goats are almost twice the number of sheep as observed in the population dynamics throughout the previous census.
- In India, small ruminants suite the needs of small land holders or landless under the village system due to no investment, ease of rearing and high conversion efficiency.
- Small ruminants are well adapted to harsh climate, long migration, resistant against tropical diseases, poor nutrition, so also shortage and unreliable quality of drinking water.
- This sector is endowed with wonderful bio-diversity as there are well defined 40 breeds of sheep and 20 breeds of goats, well adapted to specific agroclimatic regions of India.

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In Vitro Production of Bovine Embryos

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Abstract

In vitro production of bovine embryo has considerable potential value in disseminating genetic improvement and shortening the generation interval as compared to programme based on progeny testing. Embryos of high genetic quality can be obtained from oocytes collected from slaughtered house ovaries or from donors of high genetic quality by ultrasound guided follicular aspiration. *In vitro* maturation (IVM), *in vitro* fertilization (IVF) and *in vitro* culture (IVC) of bovine oocytes are valuable tools that can be easily applied for both research and breeding purposes. Because of low efficiency of super ovulation and high cost of FSH, in vitro embryo production (IVEP) technology has been researched in the last decade as an efficient alternate to in vivo system. It also offers new dimension to research and development for further application in the genetic improvement of farm animals. The efficiency of IVF in buffalo is much lower than that in cattle. Despite technological progress in the last two decades, the practical application of *in vitro* fertilization IVM technology (IVF) is still less than anticipated because of low efficiency and high cost.

Keywords : Bovine embryo, IVM, IVF, IVC

Introduction

In vitro embryo production (IVEP) is a reproductive biotechnology that has great potential for speeding up genetic improvement in cattle. The *in vitro* production and storage of gametes and embryos with high competence to development is the key of success for several technologies including transgenesis and assisted reproduction. The IVEP is preferred over in-vivo generation due to availability of large number of embryos and convenience (Madan *et al*., 1991). Due to limitation of repeated induction of super ovulation, the OPU (Ovum Pick Up) at frequent intervals in combination with IVF-IVC is providing a more efficient method of producing embryos from selected donors (Devaraj, 2006).

Some commercial applications of *in vitro* fertilization technology have included efforts (1) to upgrade the productive and genetic performance of animals; (2) to overcome infertility of valuable high yielding animals; (3) to produce transgenic and cloned animals; (4) to provide a source of sexed embryos; (5) for twin production in beef cattle; and (6) at the molecular level, the technique is used to elucidate events related to maturation, fertilization of oocytes and development of embryos.

In Vitro Production of Bovine Embryo:

Major steps involved in *In vitro* production of Bovine Embryo are oocyte recovery, *In vitro* maturation of oocyte, *In vitro* capacitation of spermatozoa, *In vitro* fertilization and *In vitro* embyo culture.

1. Oocyte Recovery:

Various methods of retrieval of oocytes from slaughter house specimens like aspiration of oocyte from surface of follicle, collection of oocyte after isolation of individual follicle and slicing of ovary have been developed (Chauangsoongneon and Kamonpatana, 1991). Higher numbers of oocytes were recovered per ovary by slicing method (Dutta and Goswami, 1998). Laproscopy, endoscopy and transvaginal ultrasound guided follicle aspiration (TUGA) technique can also be used to recover oocytes from live animals (Pieterse *et al*.,1988). TUGA is less dependants on the reproductive status of the donor, with use of TUGA oocytes can be harvested from juvenile animals and pregnant animals in the first 3 months of pregnancy, but the success in term of available follicles and quality of oocytes was low (Munjunatha and Devaraj, 2006).

2. *In Vitro* Maturation of Oocyte:

Oocytes with compact multilayered cumulus cells and evenly granulated cytoplasm are selected for *in vitro* maturation (Albertini *et al*., 2001). Prolonging bovine sperm-Oocyte incubation in modified medium-199 improves embryo development rate and the viability of vitrified blastocyst (Nedambale *et al*., 2006). Most widely used complex media for *In vitro* maturation is Tissue Culture Medium- 199 (TCM-199) with Earle's salt, L-glutamine and 25 mM HEPES supplemented with 10-20% heat inactivated serum. Ham's F-10, Ham's F-12, CR1aa, MEM- Minimal Essential Medium, Synthetic Bovine Oviductal Fluid medium are also used as complex media for IVM. Medias are also supplemented with fetal calf serum (FCS), estrus cow serum (ECS), new born calf serum (NBCS) (Gandhi *et al*., 2000), super ovulated cow serum (SCS), anoestrus cow serum (ACS) or bovine serum albumin (BSA) like ingredients as well as hormones like pituitary FSH and/or LH (gonadotrophins) with estradiol-17â either alone or in combination or with extra gonadotropin hormones like human chorionic gonadotrophin (hCG) or equine chorionic gonadotropin (eCG) are also used. Some laboratories also prefer to add growth factors like epidermal growth factor (EGF) (Nedambale *et al*., 2006), EGF plus fibroblast growth factor (FGF), insulin like growth factor (IGF), insulin, transferrin sodium selenite (ITS) (Galli et al., 2001) etc. for improvement of maturation in vitro. An *In vitro* maturation rate of 85% has been reported in TCM-199 with steer serum 10% and PMSG-40 IU/ml (Ravindranath *et al*., 2003).

3. *In Vitro* Capacitation of Spermatozoa:

Sperms used for fertilization should pass through process of capacitation. Capacitation leads to an acrosomal reaction which causes a release of acrosomal enzymes needed for penetration of different layers of ovum during fertilization. For capacitation, frozen semen is used and Percoll based separation system is the most common method for isolating the motile sperm fraction after thawing (Galli *et al*., 2003). Although other systems can also be used like swim-up, simple centrifugation, but separation through a Percoll gradient offers the consistency, flexibility and reliability as well as it reduces the polyspermy – major cause of IVF failure (Mermillod *et al*., 1990). Sperm can be artificially capicited by High ionic strength media (Brackett *et al*., 1982), High pH, Glycosamine glycan such as Heparin (Numbe *et al*., 2001), Bovine follicular fluid, Calcium ionopore, Caffeine and pentoxyphylline (Numbe *et al*., 2001), Caffeine and Theophylline (Chauhan *et al*., 1998), Mixture of penicillamine, hypotaurine and epinephrine (PHE) as well as by Bovine Serum Albumin.

4. *In Vitro* Fertilization:

Buffalo oocytes matured *in vitro* are generally fertilized with frozen-thawed *in vitro* capacitated spermatozoa in Tyrode's Albumin Lactate Pyruvate (TALP) medium or a SOF (Synthetic bovine Oviductal Fluid) based medium both without glucose and with varying concentration of heparin (Galli *et al*., 2003). Fert-CDM medium with non-essential amino acids (Lu and Seidel, 2002) is also used for incubation medium. An in-vitro fertilization rate of 60-80% has been reported in both BO medium and HEPES- TALP medium (Misra, 2005). Suthar (2008) used m-TALP and m-SOF medium for in vitro fertilization and found 64% fertilization rate in eight HF x Sahiwal crossbred cows.

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5. *In Vitro* Embryo Culture:

Several protocols have been developed and applied for embryo culture. They include various co culture and cell-free systems and also the in vivo culture procedure in the surrogate sheep and rabbit oviduct. In IVC, the TCM-199 is supplemented with serum and oviductal cells of Ovine or Bovine origin is used. The evaluation and selection of embryos for transfer or freezing is conducted on Day 7. By this time, normally developing embryos should have reached at least the early blastocyst stage (Galli *et al.,* 2003). Much research is still needed in domestic animal on mechanisms controlling embryo development and on development of totally *in vitro* system for embryo culture.

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BRD (Bovine Respiratory Disease) through the ages - A retrospect

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Abstract:

The historical aspect of the disease, emphasizing the importance of bacterial involvement is discussed.

Keywords: BRD

The movement, assembly, and mixing of cattle has long been known to contribute to an increase in the incidence of infectious respiratory disease. The great nomadic pastoralists of Africa, the Maasai, have known since biblical times that the kraaling of the cattle each night to protect against predators (two and four legged) caused an increase in infectious pneumonia. Contagious bovine pleuropneumonia (CBPP) was common in their herds and they accepted that herding their cattle together at night for protection promoted the spread of the infectious agent (*Mycoplasma mucoides*) among their animals. In fact, they were so aware of it that they initiated some of the earliest recorded autogenous vaccination schemes by dosing their cattle with an homogenate of diseased lungs from affected cattle in a bid to protect healthy in-contacts. In 18th century Britain, a massive increase in bovine tuberculosis was attributed to the confinement of cattle in zero-grazed town dairies which were established to provide milk for the burgeoning urban populations on the back of the industrial revolution and the huge demographic shift of people to the cities. Intensively reared, grain-fed cattle around the world; the movement, assembly and mixing of cattle is known to be a major contributing factor to the development of the bovine respiratory disease (BRD) complex in today's feedlots.

Hereford heifer in severe respiratory distress due to BRD - extended neck, drooling abducted elbows due to thoracic pain

Previously known under a number of different synonyms, one of the first clinical records of BRD appeared in the Journal of the American Veterinary Medical Association in 1912 when Kinsley described the "pectoral form of haemorrhagic septicaemia" in young cattle that had recently passed through public stockyards.

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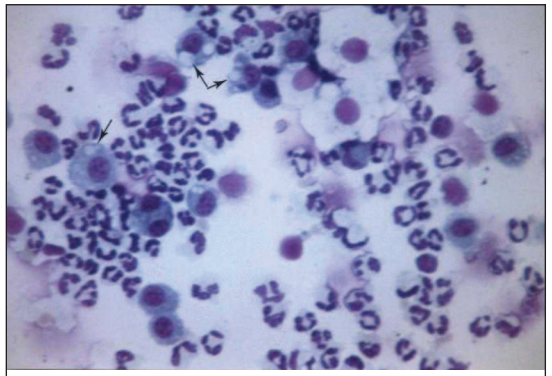
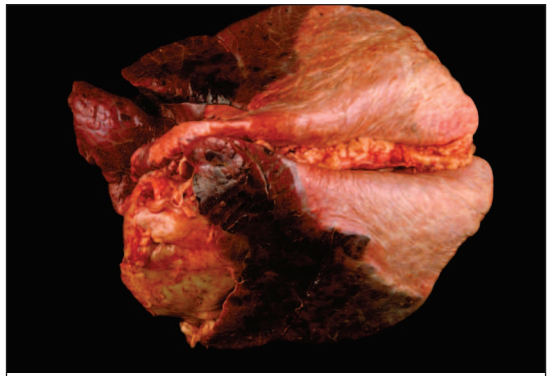


Photomicrograph of acute BRD lung, showing very high presence of reactive neutroplils

Kinsley consistently isolated *Bacillus bovisepticus* from diseased lungs and named the bacterial pneumonia "stockyards fever". In 1925, Hepburn, a large animal practitioner from Aberdeen, Scotland submitted a paper to The Veterinary Record in which he provided an eloquent clinical description of a respiratory disease syndrome in fattening cattle which had been shipped by boat from Ireland via Orkney to Aberdeen. Principally seen in the northern winter, his clinical findings included "high fever, 108°F and over, pulse much accelerated and of the running down type, the respirations quickened and of a laboured, painful character, the animal moaning and salivating at the mouth". In addition, he observed that the farmer would not notice animals to be sick until around ten days after arrival, and importantly, as parasitic bronchitis was very common in cattle that had originated from Ireland, he noted that "coughing was seldom in evidence". Hepburn termed the disease "Transit Fever" and again isolated *B. bovisepticus* in almost pure culture from the lungs of fatal cases which presented with "hepatisation of the apical lung lobes and serofibrinous pleurisy" at post-mortem.

Over the following decades, the clinical, epidemiological and pathological features of the



Postmortem appearance of BRD lungs, dorsal view showing heavy consolidation and finding on anterior lobes

condition became well established. *Pasteurella spp* (as *Bacillus bovisepticus* became know until recently re-classified *Mannheimia spp*) had been regularly isolated from cases, but the bacterium was known to exist in the upper respiratory tract of healthy cattle, and so it was often relegated to the position of secondary or end stage invader. The fact that researchers had been unable to produce a reliable experimental model for the disease using *Pasteurella isolates* seemed to further diminish the role of the bacterium in the disease. In the 1950's, improvements in laboratory techniques led to the isolation of a series of important cattle respiratory pathogens such as IBR virus and PI-3 virus and they seemed to offer the missing link in the series of events that led to feedlot pneumonia. However an important voice cautioned the researchers about over-emphasising the role of viruses and diminishing the role of bacteria: **Jubb & Kennedy, the bible of veterinary pathologists, reminded workers that BRD ultimately remained an acute exudative fibrinous pneumonia in which bacteria were likely to play a central**.

Some important developments in the 1980's in relation to the bacteria itself (it was found to produce a leucotoxin that was lethal to bovine white blood cells), and the ability to study local pulmonary immune events, led to new hypothesises on the pathogenesis of BRD being postulated (an area in which Melbourne University's Professor Ron Slocombe made a significant contribution during his work with North American colleagues at this time).

The current thinking on the aetio-pathogenesis of BRD, and therefore the foundation for control strategies, is based on the continuing evolution on these ideas. The events leading up to the induction of cattle into feedlots are critical. Weaning, transport, mixing, climatic and diet changes, dust, pen competition, etc., all contribute to stress the animal, reduce the efficiency of its immune defenses and promote the exchange of dangerous respiratory pathogens which further compound the animal's compromised defenses. Ultimately some or all of the above conspire to allow *Mannheimia haemolytica* to establish and rapidly multiply in the lung and produce leucotoxin which quickly overcomes the local lung defenses and ultimately gives rise to BRD.

Many sound managemental practices have been established to minimise the impact of stress for feedlot destined cattle such as backgrounding, yard weaning, training of pen riders to spot early cases of BRD, etc; vaccines are already available against some of the viral components thought to contribute to BRD; and effective and aggressive hospital protocols using various antibiotics and NSAIDs have been set up to treat affected cases. **However, the introduction of Bovilis® MH by Intervet represents the first time a vaccine has been made available in Australia against *Mannheimia haemolytica*, the major bacterial cause of BRD. Bovilis® MH critically includes two local strains of *Mannheimia haemolytica*, one of which is a high leucotoxin producing strain**.

Small Ruminants Sector in India

Characteristics.....contd.

- The growth rate, particularly in goat sector is between 3-3.5% during the inter census periods, which is higher than the India's total livestock population growth.
- The decrease in sheep / goat population during 2012 census over 2007 census may be due to indiscriminate slaughter subsequent to increased demand for mutton / chevon and corresponding decline in breedable male / female stock.
- The small ruminant sector contributes 8.5% to total livestock GDP in India.

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Prevalence of ketosis in cattle and its therapeutic management in and around Bikaner

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Abstract

Urine samples of 294 post-parturient cows belonging to the college dairy farm and outdoor patients brought for treatment at the Clinic of College of Veterinary and Animal Science, Bikaner and individual animals in and around Bikaner were examined for prevalence of ketosis. The prevalence of ketosis in cows was 10.20 per cent among the suspected clinical cases. Based on anamnesis, the milk yield abruptly decreased by 46.32 per cent in untreated cows. Maximum cases of ketosis were recorded during 1-2 months post-partum,8-9 years of age and at fourth lactation. The wasting form of ketosis was observed and no case of nervous form of ketosis was observed. Modified Rothera's test was used successfully to detect ketonuria. 90 per cent efficacy in the treatment was recorded when 50 per cent dextrose given intravenously. 10 per cent cases (3/30) which did not response to given treatment were possibly insulin dependent. These three cases of ketosis were treated with insulin @ 80 IU (2 ml) subcutaneously per day till recovery.

Key words: cattle, ketosis, prevalence, Rothera's test

Introduction:

The production or metabolic diseases cause tremendous loss to dairy owners owing to high morbidity and low milk yield. Sometimes mortality leads to heavy financial losses due to lack of timely effective therapeutic measurement. Ketosis is one of the metabolic diseases and is a multifactorial disorder of energy metabolism. Clinically, the disease is characterized by moderate decrease in appetite and milk yield and biochemically by ketonuria, ketonaemia or elevated ketone in milk, hypoglycaemia and low level of hepatic glycogen (Radostits et al., 2000). The present investigation was undertaken to determine prevalence of ketosis in cows around Bikaner and their effective therapeutic management.

Material and methods:

Urine samples of 294 post-parturient cows belonging to the college dairy farm, outdoor patients brought for treatment at Medicine clinic of College of Veterinary and Animal Science, Bikaner and animals reported individually by the owners at their holdings in and around Bikaner were examined for prevalence of ketosis, Rothera's test was conducted before and after treatment. Prevalence of the disease was determined across different months of the year, stages of lactation, age groups and parities.

Collection of urine sample

Fresh urine samples were collected directly in sterilized vials after massaging the perineal region for qualitative determination of ketone bodies by modified Rothera's test and quantitative estimation of ketone bodies by method described by Henry et al. (1969).

Table 1. Prevalence of ketosis in cows based on age, parity, stage of lactation and month of the year (n=294)

S.No.	Occurrence of ketosis	Number of Ketotic cows	Per cent Prevalence
1.	**Age of cows (years)**		
	< 6	3	10.00
	6-7	7	23.33
	7-8	8	26.67
	8-9	10	33.33
	> 9	2	6.67
2.	**Parity of cows (number)**		
	First	2	6.67
	Second	3	10.00
	Third	8	26.67
	Fourth	11	36.66
	Fifth	5	16.67
	Sixth	1	3.33
3.	**Stage of lactation (months)**		
	First (0-1)	10	33.33
	Second (1-2)	14	46.67
	Third (2-3)	3	10.00
	Fourth (3-4)	2	6.67
	Fifth (4-5)	1	3.33
4.	**Month of the Year**		
	September	2	6.67
	October	4	13.33
	November	9	30.00
	December	7	23.33
	January	5	16.67
	February	3	10.00

Results and Discussions:

The prevalence of clinical ketosis in cows with respect to age, lactation number, stage of lactation and month of year is presented in Table 1. A total of 294 cows which were anorectic were screened for urine ketone bodies. Thirty cows(10.20%) were found positive for clinical ketosis. The present study is an agreement with Singh (1994), Gupta (1999) and Bihani (2001) who have reported 11.26, 12.5 and 9.90 per cent prevalence in and around Bikaner, respectively. Age-wise prevalence of ketosis in cows was highest at the age of 8-9 years (33.33%), followed by 7-8 years (26.67%), 6-7years (23.33%), < 6years (10.00%) and > 9years (6.67%) years of age. Similar findings were presented by Bhuin et al. (1993), Singh (1994), Gupta (1999) and Bihani (2001) who have also reported highest prevalence during 8-9 years of age. However, Ziauddin et al. (1995) recorded maximum cases in 5-7 years of age in

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cows. Ketosis was recorded highest in 4th lactation (36.66%), followed by 3rd (26.67%), 5th (16.67%), 2nd (10.00%), 1st (6.67%) and 6th (3.33%) lactation. The present study is in agreement with Henricson (1977). However, Bhuin et al. (1993) reported higher cases of ketosis in 3rd lactation. Maximum number of clinical cases were reported in 1-2 months post-partum (46.67%), followed by 0-1 (33.33%), 2-3 (10.00%), 3-4 (6.67%) and 4-5 (3.33%) months post-partum.The prevalence of ketosis was maximum in the month of November (30.00%) followed by December (23.33%), January (16.67%), October (13.33%), February (10.00%) and September (6.67%) months. Present study is in agreement with Emery et al. (1968), Littledike et al. (1981) and Mir and Malik (2002). Although some other workers like Shaw et al. (1952), Ford and Boyd (1960) and Fox (1971), have reported maximum cases of ketosis within the first month post-partum.

Conclusions:

The prevalence of ketosis in cows was 10.20 per cent among the suspected clinical cases. Based on anamnesis, the milk yield abruptly decreased by 46.32 per cent in untreated cows. Maximum cases of ketosis were recorded at 8-9 years of age, fourth lactation and 1-2 months post-partum. The wasting form of ketosis was observed and no case of nervous form of ketosis observed. Modified Rothera's test was found fully successful to detect ketonuria. 90 per cent efficacy was recorded when 50 per cent dextrose was given intravenously. 10 per cent cases (3/30) did not response to given treatment, they were possibly insulin dependent cases. These three cases were also treated with insulin @ 80 IU (2 ml) subcutaneously per day till recovery.

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Rope truss in management of prolapse in Bovines

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Abstract

Prolapse of genitalia is considered as one of the major reproductive disorders causing great economic losses to dairy industry. Chronic irritation to uterine tract along with excessive abdominal pressure causes increased tendency in relapse of prolapse. Various techniques and appliances have been mentioned to prevent relapse of prolapse. Application of rope truss was used in prevention of relapse of prolapse. The technique was cheap, non traumatic, easy to prepare and apply, does not require specialized techniques, skills or instruments. It facilitated easy urination, defecation and expulsion of placenta / lochia. The technique can be applied under farm condition even by the animal owner himself.

Keywords: Rope truss, prolapse

Introduction

Prolapse of the reproductive tract is an important maternal abnormality in bovines and occurs most often immediately after parturition (Roberts, 1971). Whatever may be the cause, emergency treatment is the most important task for veterinarians to concentrate for better results. Any delay in the treatment may lead to oedema, ischemia, laceration, haemorrhages, shock and death (Pande and Pande., 2002). Early detection and prompt treatment may be imperative to control recurrence of prolapse in bovines. Various types of mechanical aids, appliances and suturing techniques have been suggested to deal with the stated condition, with varying degrees of success and endorsement. The most commonly used techniques include application of various patterns of suturing (Tyagi and Singh, 2004). However, vulval sutures being invasive in nature, cause injury to the site of sutures and myiasis. Straining continues for more duration after application of sutures and was completely in-effective in preventing prolapse (Lakde et al., 2011). Each technique has its own advantages and disadvantages, however, whatever the technique used, it should provide an overall structural adaptation and should be simple, practical, easy to apply and remove, comfortable to the animal and be safe, sound and conformable to the contours of the animal's anatomy in the region of the tail, caudal folds, anal, vulva and perineal regions. Rope truss was found effective, safe, non invasive and easy

Fig. 1 : Genital Prolapse in a buffalo

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method for retention of prolapse and it did not cause any injury to the external genitalia. The duration of straining after application of rope truss was less than vulval suturing (Lakde et al., 2011). The article discusses the preparation and application of the rope truss for management of recurrence of prolapse in bovines.

Material and Methods

34 bovines presented to Veterinary Dispensary, Yamakanmardi, Dist Belgaum, Karnataka for treatment of various degree of prolapse from a 2006 to 2011 formed the material of the study. Of the animals presented, 12 were cattle and 22 were buffaloes. 16 animals were presented with a complaint of pre-partum prolapse and 18 animals were presented for post-partum prolapse. All the animals were managed with the standard protocol for treatment of prolapse of various degree which comprised of reduction and repositioning of the prolapsed organ under epidural anesthesia to its normal position, a course of broad spectrum antibiotics and anti-inflammatory drugs as per the standard dose and administration of supportive fluid therapy. All the animals were administered inj progesterone @ 500 mg i/m, for managing deficiency of progesterone or countering the effects of estrogen. Irrespective of the degree of prolapse, stage of pregnancy or lactation and size of the animal, rope truss was prepared and applied to all the animals in order to prevent relapses. The rope truss was kept in position as long upto five days depending on the severity of the cases. The animals were generally not needed to be kept in forward inclined position, unless in cases of uterine prolapse.

Preparation and Application of the Rope Truss

The rope truss was prepared using a cloth of around five to six meters in length made up of a soft material such as a saree or a dhoti. The cloth was folded length wise about four to five times to make it a broad tape like structure of about three inches in width and was then twisted along its axis to make it like a thick rope of about one inch diameter. Then it was coiled around the palm of the hand and the elbow to form an oval shaped ring of around nine to ten inches diameter, proportional to the length of the vulval lips of the animal to be applied. Strands of 5mm rope were encircled through the cloth ring in a running pattern to secure it and make it a thick bundle. A long piece of half inch thick cotton rope, twice the length of the animal was taken and folded at the centre to make two equal halves. The centre part of the rope was knotted at the dorsal commissure of the cloth ring at 12 o' clock position. Another piece of rope was taken and tied similarly at ventral commissure of the ring at 6 o'clock position. The cloth ring was placed under the tail of the animal and applied with its concavity forward so as to conform to the contours of the anatomy of vulval lips, and snugly fit around the vulval lips, so that in this manner the uterus or vagina could not be forced through the lips of the vulva as the ring formed by the rope truss will not spread or yield to permit passage (Fig 1). The rope truss was then retained in place by passing the two strands of ropes tied at the ventral commissure of the rope truss

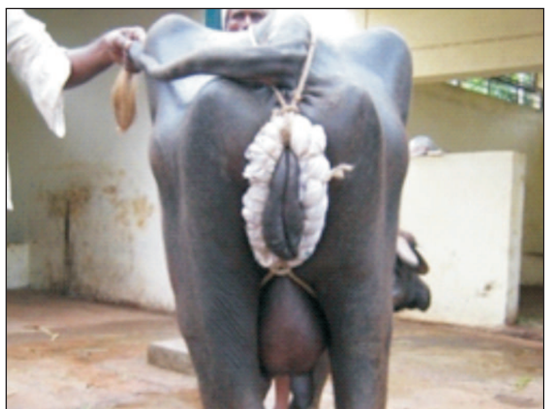

Fig 2:- Snugly contouring rope truss around the vulval lips.

Fig 3:- Application of the ropes around the body and neck.

through the inside of the thigh parallel to the lateral aspect of the udder running cranially through the forelimbs and passing over the lateral aspects of the neck and then snugly tied on the dorsal aspect of the neck. Similarly the two strands of rope on the dorsal commissure of the rope truss were passed along the sides of the tail, passing forward and parallel to the backbone, and then passed through the respective side vertical strands of the previously tied ropes on the neck and looped back and tied to securely and snugly fit the rope truss around the vulval lips (Fig 2). The rope truss was retained in place for a few days until straining ceased or

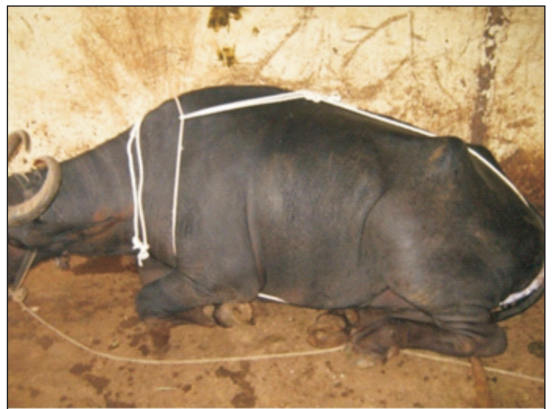

Fig 4:- Retention of the rope truss even after animal sits.

danger of eversion or prolapse was ceased. The rope truss when soiled was not left for more than two days and was replaced at the earliest to avoid being attracted by flies. Movement of the animal during its routine activities caused slight loosening of the ropes which should be tightened around the neck once in two hours to maintain the tension in the vulval region. In animals with more bony prominences on the back or tension around large udders, thick pieces of cloth were kept in between the rope and the body part in order to prevent any trauma or injury due to friction with rope.

Results and Conclusion

Prolapsed mass was retained successfully and effectively with the help of rope truss and no recurrence was recorded. Similar observations were reported by Kumbar et al., (2009) and Lakde et al., (2011). The rope truss exerted sufficient pressure upon the sides of the vulva and kept it closed without interfering with the normal urination, defecation or expulsion of the placenta or lochia as was reported by Craig et al., (2000) and Dharani et al., (2010). The average time needed to keep the rope truss applied was three days. In post-partum uterine prolapse, the rope truss was maintained upto five days. It did not unduly irritate the animal as it was made of locally available, soft, replaceable material making it a cheap option for management of prolapse. It was a non traumatic technique and hence there was no inflammation or infection. In pre-partum cases, it possessed an advantage as there was no disturbance in process of parturition as the rope truss could be easily removed. No recurrence was noticed in both pre-partum and post-partum prolapse. Similar reports were made by Dharani et al., (2010) and Lakde et al., (2011). In case of post-partum prolapse, the soiled truss could be easily re prepared and replaced. The rope truss was maintained in place even in sitting position and

provided adequate tension on the vulval lips to prevent recurrence of prolapse (Fig 4).

It can be conclude that the tendency of prolapse can be curtailed by application of rope truss and it is effective, safe, cheap and easy method for retention of prolapse in both pre-partum and post-partum cervico-vaginal and uterine prolapse. No special skills were needed for preparation of rope truss and even the animal owner could be taught about preparation and application of the rope truss.

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Small Ruminants Sector in India

Issues of concern

- The wool/mohair production has become less important. More importance is being given to meat production from sheep ans goats.
- Poor exploitation of genetic potential of the native stock.
- Shrinking and degradation of natural range lands, decline in quality and quantity of feed and water.
- Uncontrolled and indiscriminate breeding, lack of AI facilities.
- In adequate availability of high merit breeding rams / bucks.
- Un-organized marketing of meat, wool and skins.
- Poor credit support.
- Low awareness about husbandry practices due to lower socio-economic and educational status of those engaged in small ruminants keeping.
- Migratory practices of flocks.
- Presence of large number of endemic diseases and inadequate health coverage.

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Antimicrobial susceptibility of *Campylobacter* isolated from livestock foods

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Abstract:

25 isolates of *Campylobacter,* obtained from chicken meat, mutton, pork, fish and chicken, cattle and human excreta were tested for the sensitivity/ resistance against 11 selected antibiotics. *Campylobacter* was highly sensitive to Amikacin (92%) followed by Gentamicin (84%), Chloramphenicol, Tetracycline, Erythromycin and Ampicillin (80%), Nalidixic acid (76%), Streptomycin (72%), Enrofloxacin (68%), Clindamycin (64%) and Ciprofloxacin (52%). The resistance was high to ciprofloxacin (44%) followed by Enrofloxacin (24), Nalidixic acid and Clindamycin (20%), streptomycin, Erythromycin and Tetracycline (16%), Gentamicin (12%) and Amikacin, Ampicillin and Chloramphenicol (8%).

Key words: *Campylobacter*, Amikacin, Erythromycin

Introduction:

The genus *Campylobacter* spp. belongs to the family campylobacteriaceae, are curved Gram-negative, fastidious, microaerophilic, spiral shaped and motile. It is commonly associated with poultry and naturally colonizes the digestive tract of many birds species. It is also common in cattle and although it is normally harmless commensal of the gastro intestinal tract of these animals, in calves it can cause Campylobacteriosis (Colles et al, 2009). Campylobacteriosis is considered a zoonotic disease, transmitted through under cooked or raw poultry meat, which is considered as an important source of infection (Blaser, 1997). Contaminated milk, water, pork, beef, lamb and seafood are also considered as sources of infection to humans (Jacobs-Reitsma, W. 2000).

Campylobacter spp. infection is one of the most common causes of bacterial gastroenteritis in humans worldwide and mostly the two important species of the genus campylobacter i.e. *Campylobacter jejuni* and *C. coli* are associated (Taylor and Blaser, 1991). *Campylobacter jejuni* var *jejuni* (*C. jejuni*) is a major human enteropathogen, while *Campylobacter coli* causes 5–10% of infections (Nachamkin 1995). *Campylobacter* produces clinically mild, and self-limiting infection, so do not require antimicrobial treatment(Karmali and Fleming, 1979). However, severe and prolonged cases of enteritis, bacteraemia, septic arthritis and other extra- intestinal infections have also been reported (Skirrow and Blaser, 2000). *C. jejuni* has been identified as the predominant cause of antecedent infection in Guillain–Barré syndrome (GBS) and Miller Fisher syndrome, two

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frequent forms of acute inflammatory polyneuropathy (Endtz et al, 2000). But antimicrobial therapy needed for patients with systemic infections, patients with severe or chronic cases of enteritis and for immunosuppressed patients.

WHO estimate that around 1% of the Western Europe population will be affected with *Campylobacter* each year and in many western countries incidence is higher than Salmonella. The risk of GBS increased to around 1 in 200 patients with *C. jejuni*, penner type HS: 90 (Nachamkin, 2002)

The *Campylobacter spp*. may also emerge as antimicrobial resistance species due to the fact that use of antimicrobial agents in husbandry is a matter of concern (WHO, 1997). The choice of antibiotic should be based on sensitivity of *Campylobacter*. To monitor the prevalence of antimicrobial resistance of *Campylobacter* isolates, there is a need for standardized methods (Aarestrup and Engberg, 2001). Generally, National Committee on Clinical Laboratory Standards (NCCLS, 2000) provided guidelines are the most widely used, but no internationally accepted criteria for testing the susceptibility of *Campylobacter spp*. are available and breakpoints do not exist. Consequently, a number of different diffusion and dilution methods have been used in clinical, veterinary and food microbiology laboratories. Hence, the present study was conducted to know the antimicrobial sensitivity/ resistance of this organism isolated from different food products.

Material And Methods:

Isolation and Identification:

About 10 g of each of livestock foods and other samples (chicken meat, mutton, pork, fish and chicken, cattle and human excreta) were inoculated into 90 ml glycerine peptone water in individual sterile polythene bags, homogenized thoroughly in a stomacher for 3-5 min and incubated at 42^{0}C for 48 hours. 1 ml of pre-enrichment inoculum was transferred to 10 ml of Bolton broth for selective enrichment and incubated at 42^{0}C for 48 hours. The enriched inoculum from the broths was streaked onto mCCDA (modified Charcoal Cefoperazone Deoxycholate agar) selective media agar plates and incubated at 42^{0}C for 48hr in CO_2 incubator. The presumptive colonies of *Campylobacter jejuni* were picked up and subjected to biochemical tests. The positive isolates by cultural methods were confirmed by PCR assay using boiling and snap chilling method for DNA extraction targeting 16S rRNA at Genus level and fla- A gene at species level *(C. jejuni)*. Antimicrobial susceptibility of 25 isolates was established by the disc diffusion assay with Muller-Hinton (MH) agar in accordance with French national antibiogram committee guidelines. The antibiotic sensitivity of *Campylobacter jejuni* was tested for antibiotics like Nalidixic acid (30µg), Ciprofloxacin (5 µg), Enrofloxacin (10 µg), Amikacin (30 µg), Gentamicin (10 µg), Ampicillin (30 µg), Streptomycin (10 µg), Erythromycin (15 µg), Tetracycline (30 µg), Doxycycline (30 µg), Chloramphenicol (30 µg) and Clindamycin (2 µg).

MH broth was inoculated with five colonies from the sample and tubes were incubated at 37^{0}C for 2-8hr until achieving a turbidity equivalent to 0.5 on the Mac Farland scale. After turbidity adjustment, a sterile swab was introduced, pressed against the tube wall in order to remove any excess liquid, and then seeded on the surface of a petridish containing MH agar, rotating at least twice. After the liquid was placed, the disc was left at rest for five minutes to absorb any excessive humidity. Using sterile forceps, seven discs (sensifar) impregnated with antimicrobials were placed at equal distances from each other on the surface of each dish. Subsequently the plates were inverted and incubated at 42^{0}C for 48hr under microaerophilic conditions. Dish readings were performed 18hr after incubation and the diameter of inhibition halos was measured with the aid of a ruler. The interpretation was made as per the zone size interpretation chart provided by manufacturer of discs.

Results and Discussion:

Table 1 : Antimicrobial sensitivity and resistance of *Campylobacter spp.* to different antibiotics

S.No.	ANTIBIOTIC (µg)	Sensitive (No.)	Intermediate (No.)	Resistant (No.)
1	Nalidixic acid (30µg)	19 (76%)	1 (4%)	5 (20%)
2	Ciprofloxacin (5 µg)	13 (52%)	1 (4%)	11 (44%)
3	Enrofloxacin (10 µg)	17 (68%)	2 (8%)	6 (24%)
4	Amikacin (30 µg)	23 (92%)	-	2 (8%)
5	Gentamicin (10 µg)	21 (84%)	1 (4%)	3 (12%)
6	Ampicillin (30 µg)	20 (80%)	3 (12%)	2 (8%)
7	Streptomycin (10 µg)	18 (72%)	3 (12%)	4 (16%)
8	Erythromycin (15 µg)	20 (80%)	1 (4%)	4 (16%)
9	Tetracycline (30 µg)	20 (80%)	1 (4%)	4 (16%)
10	Chloramphenicol (30 µg)	20 (80%)	3 (12%)	2 (8%)
11	Clindamycin (2 µg)	16 (64%)	4 (16%)	5 (20%)

(Figures in paranthesis indicate %)

Campylobacter was highly sensitive to Amikacin (92%) followed by Gentamycin (84%), Chloramphenicol, Tetracycline, Erythromycin and Ampicillin (80%), Nalidixic acid (76%), Streptomycin (72%), Enrofloxacin (68%), Clindamycin (64%) and Ciprofloxacin (52%).

The sensitivity of *Campylobacter* to Nalidixic acid was 76% in the present study, whereas the resistance was 20%. The resistance in the present study was similar to the result reported by Adekunle and Onilude (2014). Lower resistance of 2.5 and 5% was reported by Wong et al, (2004)and Wieczorek et al, (2013) respectively, whereas, higher resistance of 94.6%, 58.1, 49.42%, 46%, 34.3 and 33.3% was reported by Joonbae et al. (2007), Bostan et al. (2009),Lehtopolku (2011), Tan et al (2009), Uaboi-Egberni et al (2011) and Rahimi et al (2011) respectively. The resistance to ciprofloxacin was 44% and the sensitivity was 52% in the present study. The resistance to Ciprofloxacin in the present study was almost similar to the results reported by Bostan et al (2009), Ljiljana et al (2009), Uaboi-Egberni et al (2011),Lehtopolku (2011), Angelovski et at (2011) and Rahimi et al (2011). Higher resistance (97.9%, 95.9%,87.9% and 65.5%) was reported by Mackiw et al (2012),Joonbae et al. (2007), Abiola senok et al. (2007) and Albert

(2013) respectively and low resistance of 10%, 9% and 4% was reported by Wieczorek et al, (2013), Christiane and Hunguette (1997) and Tan et al (2009) respectively. The sensitivity in the present study (52%) was lower than the sensitivity reported 100% by Adekunle and Onilude (2014) and Baserisalehi et al (2005) and 91% by Christiane and Hunguette (1997).

The resistance to Enrofloxacin by *Campylobacter* was 24% in the present study which was almost similar to the results reported by Koenraad et al (1995), whereas, higher resistance (84.2% and 48.8%) was reported by Joonbae et al, (2007) and Bostan et al (2009) respectively and low resistance of 13.5% and 8% was reported by Rahimi et al. (2011) and Tan et al (2009) respectively. The sensitivity to Enrofloxacin was 68%.

The resistance to Ampicillin was 8% and sensitivity was 80%. The resistance to ampicillin in the present study was almost similar to the results reported by Christiane and Hunguette (1997),Luber et al. (2003)and Rahimi et al (2011), whereas higher resistance of 100%, 62%, 48.6%, 48%, and 18.6% was reported by Baserisalehi et al (2005),Tan et al (2009), Uaboi-Egberni et al (2011), Adekunle and Onilude (2014)andVelazquez et al (1999) respectively. Christiane and Hunguette (1997) observed the sensitivity of 86.2%, which is almost similar to the present study (80%), whereas lower sensitivity (52%) was reported by Adekunle and Onilude (2014).

The sensitivity of *Campylobacter* to Streptomicin was 72% in the present study, whereas, the resistance was 16%. The resistance in the present study was lower than the resistance of 52% and 32.7% reported by Adekunle and Onilude (2014) and Rahimi et al (2011) respectively, whereas, higher than the resistance of 0-2.76% and 3.4% reported by Velazquez et al (1999)and Angelovski et al (2011) respectively. The sensitivity (72%) in the present study was higher than the sensitivity of 48% reported by Adekunle and Onilude (2014).The resistance to Erythromycin was 16%, whereas sensitivity was 80%. The resistance to Erythromycin in the present study was almost similar to the results reported by Uaboi-Egberni et al (2011), whereas higher resistance (59.2%, 56.9% and 54%) was reported by Baserisalehi et al (2005), Bostan et al. (2009) and Tan et al (2009) respectively and low resistance of 19%, 13.6%, 9.1%, 5.11%, 3.45% and 2.9% was reported by Lehtopolku (2011) Joonbae et al, (2007), Mackiw et al (2012) Angelovski et at (2011), Christiane and Hunguette (1997) and Ljiljana et al (2009)respectively. The sensitivity in the present study (80%) was lower than the sensitivity of 100%, 97.1%, 96.55% and 81% reported by Abiola senok et al (2007), Ljiljana et al (2009), Christiane and Hunguette (1997) and Lehtopolku (2011) respectively.

The resistance of *Campylobacter* to Tetracycline was 16% and sensitivity was 80%. The resistance to Tetracycline in the present study was higher than the resistance of 9.1%,6%, 5% and 2.9% reported by Mackiw et al. (2012), Tan et al. (2009), Wieczorek et al, (2013) and Ljiljana et al (2009) respectively, whereas, lower than the resistance of 72.7%, 69.1%, 62.1%, 42.9% 39.7%, 37.36%, 36.55%, 33.7%, 33% and 28% reported by Abiola senok et al (2007), Bostan et al. (2009), Albert et al. (2013), Uaboi-Egberni et al (2011), Angelovski et at (2011),Lehtopolku (2011), Christiane and Hunguette (1997), Rahimi et al. (2011), Baserisalehi et al (2005) and Adekunle and Onilude (2014) respectively. The sensitivity (80%) of Tetracycline was less than the sensitivity of 97.1% reported by Ljiljana et al (2009) and higher than 72%, 61.49% and 61.38% reported by Adekunle and Onilude (2014), Lehtopolku (2011) and Christiane and Hunguette (1997) respectively.

The resistance and sensitivity of *Campylobacter* to Chloramphenicol was 8% and 80% respectively. The resistance to Chloramphenicol in the present study was almost similar to the results reported by Ljiljana et al (2009), whereas, higher resistance of 36.2% was reported by Bostan et al (2009). A sensitivity of 94.4% reported by Ljiljana et al (2009), is higher than the present study (80%), whereas, lower sensitivity 33% was reported by Baserisalehi et al (2005).

The sensitivity of *Campylobacter* to Clindamycin was 64% in the present study, whereas, the resistance was 20%. The resistance in the present study was similar to the result reported by Lehtopolku (2011), whereas, lower than the resistance (100%) reported by Chen et al. (2010). The sensitivity in the present study (64%) was lower than the sensitivity of 81.03% reported by Lehtopolku (2011).

The sensitivity and resistance to Amikacin was 92% and 8% respectively in the present study, whereas 100% sensitivity was reported by Tan et al (2009) and Abd El-Baky et al. (2014).The sensitivity of *Campylobacter* to Gentamicin was 84% in the present study, whereas, the resistance was 12%. The resistance in the present study was lower than the resistance (20%) reported by Adekunle and Onilude (2014) and higher than the resistance of 2.9% and 1.7% reported by Ljiljana et al (2009) and Angelovski et at (2011) respectively. The sensitivity in the present study (84%) was almost similar to the results reported by Adekunle and Onilude (2014), whereas, higher sensitivity 100% and 97.1% was reported by Tan et al. (2009) and Ljiljana et al (2009) respectively and lower sensitivity (74%) was reported by Baserisalehi et al (2005).

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Small Ruminants Sector in India

Opportunities and Challenges

Opportunities

- Goat production is the most promising and fast growing livestock component in India.
- There is a growing demand for goat meat, which is income elastic and has wide acceptability across the societies and religions.
- Goat production could be started with less principal capital and requires less input, thus suitable for majority of landless, small and marginal land holders which constitute 80% of rural population.
- Intensive type goat farming is possible / suitable in semi-urban areas and locations around the cities.
- Small size and docile nature of goats made them manageable by women, elderly and even children.
- Quick returns and continuous cash flow which provides support during calamities and emergencies.
- Organized goat milk marketing is gaining momentum due to its medicinal values.
- Goat meat has huge export potential. Presently, the domestic demand being large, goat meat constitutes only 12% of the total meat export.

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Incidence of *Listeria monocytogenes* in milk and milk products

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Abstract :

Forty raw milk samples each from small farmers, government dairy farms, organized private dairy farms and bulk tank milk samples were tested, wherein the incidence of *L. monocytogenes* was 10% (4/40), 12.5% (5/40), 20% (8/40) and 30% (12/40) respectively and the overall incidence was 18.13% in raw milk. 180 samples (from 6 brands, 30 each) each of pasteurized milk, ice cream, cheese, butter, curd and butter milk were tested, wherein, the incidence of *L. monocytogenes* was 2.22%, 3.88%, 3.33%, 0.55%, 0% and 13.33% respectively. Silage feeding, unhygienic farm practices and storing of milk at low temperature have influenced higher incidence of this pathogen. Pasteurized milk had low incidence due to effective processing and avoiding post processing contamination, whereas, the low pH in curd did not favor *L. monocytogenes* growth.

Keywords: *Listeria monocytogenes*, raw milk, pasteurized milk, bulk tank milk, ice cream, cheese, butter, curd, butter milk.

Introduction

Listeria monocytogenes is a mesophillic and psychrotropic pathogenic microorganism, able to survive and grow even at low temperatures. The major source of human infection is the consumption of contaminated vegetables, milk, milk products and other food products (Ryser and Marth 1999). It has emerged as an important milk borne pathogen causing potential public health problems. Even though this organism was recognized as a human pathogen, it was recognized as food borne pathogen in Maritime Province of Canada in 1981 (Schlench et. al., 1983) and pasteurized milk as source of infection causing major outbreak in Massachusetts (Fleming et. al., 1985).

Its virulent strain can cause a serious disease called listeriosis, particularly in the risk populations including pregnant women, newborns, the very old and people, who are immunocompromised (Fleming et. al., 1985). Most often *Listeria* causes sepsis, meningitis, and miscarriage in susceptible hosts (Slutsker and Schuchat 1999). The incidence may be less compared to other food borne pathogens, but the severity and associated mortality exceeds 30% (Liu, 2006).

The major source of infection in the developed countries is milk, milk products such as cheese, flavored milk etc. In India, it was isolated from milk and milk products (Waghamare et. al., 2012). The incidence rate reported in India through milk is significantly low, probably due to improper checking of the milk regularly for this pathogen. The present study was carried out to evaluate the incidence of *L. monocytogenes* in raw and pasteurized milk and certain milk products sold in and around Greater Hyderabad Municipal Corporation (GHMC), Telangana State.

Material and methods

Sample collection: A total of 160 raw milk samples (40 each from small farmers, organized private dairy farms, government dairy farms and bulk milk tank samples) were collected from various sources in and around GHMC. 180 samples each (30 samples each from 6 brands) of pasteurized milk, ice cream, cheese, butter, curd and butter milk were collected from the local markets. The raw milk samples were collected aseptically in sterilized plastic bottles and pasteurized milk sachets were collected. Milk products like curd, ice cream, butter, cheese and butter milk were collected from food bazaars, malls and other stores. Samples were immediately brought to the laboratory on ice in an insulated container and stored at 4^{0}C till tested.

Enrichment and isolation : About 10ml or 10gm of milk and milk products were inoculated into 90ml Listeria Enrichment broth (LEB) in individual sterile polythene bags and homogenized thoroughly in a stomacher for 3-5 minutes and incubated at 37^{0}C for 24 hours. Loopful of inoculum from broth was streaked directly on polymyxin-acriflavin-lithium chloride-ceftazidime-aesculin-mannitol (PALCAM) agar and incubated at 37^{0}C for 24 hours.

Identification of *L. monocytogenes*: Isolation and identification of L.monocytogenes was done as per EN-ISO11290-1 (ISO, 1996). The greenish yellow glistening pointed colonies of 0.5mm diameter surrounded by diffuse black zone of aesculin hydrolysis on PALCAM agar were considered presumptive of Listeria species. The colonies showing precipitating zone due to phosphatidyl inositol specific phospholipase C (PI-PLC) activity were presumed as *L. monocytogenes.* The colonies were verified by Gram staining, catalase reaction, oxidase, tumbling motility (+), MR reaction (+), VP reaction (+), PI-PLC activity (+), CAMP test with *S. aureus* (+), nitrate reduction (-) and hemolysis on sheep blood agar, sugar fermentation tests i.e., lactose (+), saccharose (+), dextrose (+) were also conducted for confirmation.

Results and Discussion

Incidence in raw milk: Out of 160 loose raw milk samples (40 each from small farmers, organized private dairy farms, government dairy farms and bulk milk tank) collected from different sources, 29 (18.13%) samples were found to be positive for *L. monocytogenes*. The incidence of *L. monocytogenes* in raw milk in the present study was higher than the incidence of 1.17% (Tasci et. al., 2010), 1.2% (Ning et. al., 2013), 1.9% (Kongo et. al., 2006), 5.3% (Morobe et. al., 2009), 5.76% Boubendir et. al., 2011), 5.88% (Waghamare et. al., 2012), 8.33% (El Marnissi et. al., 2013), 13% (Carlos et. al., 2001) reported. Higher incidence of *L. monocytogenes* (37.9%) in raw milk than the present study was reported by Deniz et. al. (2004).

The incidence of *L. monocytogenes* in the milk collected from small farmers in the present study was 10%, which was higher than 5.88% reported by Waghamare et. al. (2012) in unorganized sector. The higher incidence of *L. monocytogenes* in the milk collected from unorganized sector might be due to poor sanitary conditions, unhygienic milkers and methods of milking or due to Listeriosis in animals.

The incidence of *L. monocytogenes* in the milk samples from organized private dairy farms in the present study was 20% and almost similar

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findings were reported by Sanaa et. al. (1993). Higher incidence in milk samples from organized farms might be due to use of silage, which supports this organism due to low pH conditions (Husu, 1990). The incidence in the milk samples from government dairy farms in the present study was 12.5%, which was less than the incidence (20%) in organized private dairy farms. Systematic hygienic practices followed in government dairy farms might be the reason for low incidence compared to organized private dairy farms. The incidence in milk samples from government dairy farms in the present study was higher than the incidence (8%) reported by Holko et. al. (2002) and Swetha (2009).

The incidence of *L. monocytogenes* in bulk tank milk samples in the present study was 30%, which was higher than the incidence of 1% (Waak et. al., 2002), 1.5% (Deutz et. al., 1999), 3.3% (Mahmoodi, 2010), 5.3% (Waghamare et. al., 2012), 7% (Desmasures et. al., 1997) 13% (Mugampoza et. al., 2011) 15.6% (Jay et. al., 2005), and 19.6% (Waak et. al., 2002) reported. Very low incidence (0.3%) in bulk tank milk samples was observed by Yoshida et. al. (1998). Higher incidence (37%) than the present study was reported by Haekkinen et. al. (2001). The higher incidence in the bulk tank milk might be due to chilling of milk and low temperature maintenance of tankers, which favor this organism. The incidence of *L. monocytogenes* in raw milk was less from small farmers (10%), followed by government farms (12.5%), private dairy farms (20%) and bulk tank milk samples (30%). This indicates that personal attention on hygienic practices will favor lower incidence of this pathogen.

Out of 180 pasteurized milk samples (30 each from 6 brands), four were positive for *L. monocytogenes* accounting only 2.22%. Among the six brands, brands II and V had one sample each (3.33%), and two samples (6.66%) in brand III were positive for *L. monocytogenes*. Pasteurization temperature destroys *L. monocytogenes* present in milk, therefore it is expected that pasteurized milk samples should not contain this pathogen. The presence of this pathogen in three brands could be due to improper pasteurization time-temperature combinations and or post pasteurization contamination of milk. The incidence in the pasteurized milk in the present study (2.22%) was higher than the incidence 0.66% reported by Waghamare et. al. (2012).Very low incidence (0.018%) of *L. monocytogenes* in pasteurized milk was reported by Frye et. al. (2005), whereas high incidence (5.0%) in pasteurized milk than the present study was reported by Ahrabi et. al. (1998).

The incidence of *L. monocytogenes* in ice cream in the present study was 3.88%, which was lower than the incidence of 6.6% (Swetha, 2009), 14.5% (Pednekar et. al., 1997) and 19.6% (Molla et. al., 2004) reported. Five out of 6 brands of ice cream tested in this study had *L. monocytogenes* ranging from 3.33% to 6.66%.

The incidence of *L. monocytogenes* in cheese was 3.33 in the present study and 5 brands had incidence of 3.33 to 6.66 and one brand tested negative. The incidence (4%) in cheese reported by Williams and Withers (2010) was almost similar to the present study. Higher incidence of 11.4%, 19% and 41.9% were reported by Almeida et. al. (2007), Rantsiou et. al. (2008) and Loncarevic et. al. (1995) respectively. Lower incidence of 0.8%, 2.4% and 2.8% were reported by Jakobsen et. al. (2011), Hahn et. al. (1999) and De Reu et. al. (2002) respectively.

The incidence of *L. monocytogenes* in butter was 0.55% in the present study. Only one brand of butter had 3.33% of *L. monocytogenes* and other five brands were negative. Higher incidence (9.3%, 12.4% and 18.9%) than the present study was reported by Lyytikäinen et. al. (2000), De Reu and Herman (2004) and De Reu et. al. (2004) respectively. This low incidence might be due to higher fat content (80%), which does not allow the growth of bacteria, but favor moulds only.

L. monocytogenes was not detected in curd in the present study. Zero incidence in yogurt, which is also a western fermented product comparable to Indian curd was reported by Brito et. al. (2008), Neves et. al. (2008), Mahmoodi, (2010) and Kongo et. al. (2006). Higher acidity and milk pasteurization process before addition of starter are effective barriers to the growth of pathogens including *L. monocytogenes* (Liu and Puri, 2008). The incidence of *L. monocytogenes* in butter milk in the present study was 13.33% (10% to 16.66%). This might be due to unhygienic handling during preparation of butter milk and the poor quality of water added.

The unclean hands of workers, poor quality of milk, unhygienic conditions of the manufacturing unit and water supplied for washing the utensils could be the source for accelerating the bacterial contamination of milk products beside the post manufacturing contamination (Masud et. al., 1988; Elmahmood and Doughari, 2007).

Table I: Incidence of *L. monocytogenes* in pasteurized milk and milk products

Sr. No.	Product	Number of samples positive (%)						Total (%) n=180
		Brand I n=30	Brand II n=30	Brand III n=30	Brand IV n=30	Brand V n=30	Brand VI n=30	
1	Pasteurised milk	-	1(3.33)	2(6.66)	-	1(3.33)	-	4(2.22)
2	Icecream	1(3.33)	1(3.33)	2(6.66)	1(3.33)	2(6.66)	-	7(3.88)
3	Cheese	1(3.33)	1(3.33)	2(6.66)	-	1(3.33)	1(3.33)	6(3.33)
4	Butter	-	-	1(3.33)	-	-	-	1(0.55)
5	Curd	-	-	-	-	-	-	-
6	Butter milk	4(13.33)	3(10.0)	5(16.66)	3(10.0)	4(13.33)	5(16.66)	24(13.33)

Table II: Incidence of *L.monocytogenes* in raw milk

Sr. No.	Source	No. of samples	No. of samples positive	Percentage
1	Small farmers	40	4	10.0
2	Organized private dairy farms	40	8	20.0
3	Government dairy farms	40	5	12.5
4	Bulk tank milk	40	12	30.0
	Total	160	29	18.13

Conclusion:

This study indicated that *Listeria monocytogenes* is present in India, in milk and milk products. So proper checking of the milk and milk products at all stages of processing/manufacture and implementing proper hygienic measures may decrease the incidence.

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Small Ruminants Sector in India

Opportunities and Challenges.....contd.

Opportunities

- Rise in wholesale price index of goat meat by about 50% during 2000-2001 to 2014-15 and this trend is likely to continue further.
- High conversion efficiency of even low grade roughage into high quality proteins like milk and meat. Providing high grade nutrition will increase this efficiency many fold.

Challenges

- Lack of cold-chain and knowledge of value addition of goat meat and meat products .
- Poor access to Government schemes and services.
- Limited expertise and information on goat business.
- **The biggest challenge is, however, high mortality, particularly at young age, due to emergence of endemic diseases like PPR and poor prophylactic support through vaccination.**

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Antibiogram of Bovine Mastitis in and around Proddatur, District Kadapa, (A.P.)

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ABSTRACT:

The study was carried out to investigate the antibiogram status of clinical mastitis among bovines in and around Proddatur. A total of 35 clinical cases of mastitis were studied for antibiotic sensitivity test. Antibiogram studies indicated that enrofloxacin was the most effective antibiotic followed by gentamicin, chloramphenicol, and ciprofloxacin. The least effective antibiotics were penicillin, streptomycin, doxycycline and oxytetracycline. It was concluded that antibiogram studies are necessary for treatment and control of bovine mastitis in a specified area or region.

Key Words: Antibiogram, Bovines, Clinical Mastitis

Introduction:

Mastitis is the inflammation of the mammary glands of dairy cows accompanied by physical, chemical, pathological and bacteriological changes in milk and glandular tissue. Bovine mastitis is a major disease that affects the dairy industry. It affects economics of dairy industry throughout the world and has become complex in management. Mastitis is the one of the major causes of antibiotic use in dairy cows (Mitchell et al., 1998). Treatment failure in mastitis is due to indiscriminate use of antibiotics without testing in-vitro drug sensitivity. These practices increase economic losses to dairy farmers due to costly treatment over a period of long time. The bacteria causing mastitis, rapidly acquire resistance due to frequent and indiscriminate use of antibacterials in treatment, which has been growing concern worldwide (WHO, 2000). The monitoring of antibiotic resistance is needed not only for effective treatment and control of mastitis but is an increasing threat in human medicine also and hence monitoring of the same was recommended by OIE (2001). The present investigation was undertaken to monitor antimicrobial sensitivity trend in bovine mastitis in and around Proddatur and to generate the data for therapeutic decisions.

Material and Methods:

A total of 35 milk samples from clinical cases in and around Proddatur were collected. The in-vitro antimicrobial sensitivity test of milk samples was conducted on Mueller Hinton agar (M/s Hi Media Laboratories Ltd., Mumbai) plates against commonly used antimicrobials in the field as per the method of Bauer et al. (1966). Minimal inhibitory Concentration (MIC) values of the bacterial organisms were analyzed against common antibiotic discs (M/s Hi Media Laboratories Ltd., Mumbai). The following antimicrobial discs namely ciprofloxacin (10µg), chloramphenicol (30 µg), enrofloxacin (10 µg), gentamicin (30 µg), tetracycline (30 µg), streptomycin (10 µg), penicillin (10 I.U.), cloxacillin (30mcg) and ampicillin (25mcg) were

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used. The in-vitro antibiogram studies of bacterial isolates revealed highest sensitivity for enrofloxacin followed by gentamicin, chloramphenicol and ciprofloxacin.

The animals were treated with injection Melonex @ 0.2mg/ kg IM, injection Avilin Vet @ 10-15 ml IM, and injection Tribivet @ 10ml IM for 5 days as supportive treatment along with specific drug. [Enrofloxacin- Floxidin (Intervet)]

Results And Discussion:

Enrofloxacin, gentamicin, ciprofloxacin and chloramphenicol are not commonly used for treatment of mastitis in the area of study resulting in higher efficacy of these drugs. Organisms causing mastitis were found to be sensitive to enrofloxacin, gentamicin (Dhakal et al., 2007, Kumar and Sharma. 2002) Chloramphenicol (Rao et al., 1989) and ciprofloxacin (Sudhakar et al., 2009) and least sensitivity to ampicillin (Dhakal et al., 2007) and cloxacillin (Rao et al., 1989). Similar antibiogram patterns were reported by Sumathi et al., (2008) and Choudhuri (2000).

Amoxicillin, ampicillin, cloxacillin, streptomycin and oxytetracycline are commonly used antibiotics in bovine mastitis. The bacteria causing mastitis showed resistance to these commonly used antibiotics. Indiscriminate and frequent use of these antibiotics in animals could be the reason for their failure in treatment of mastitis bacteria. Since, streptomycin has been extensively used along with penicillin for treating mastitis; it might have led to the development of high resistance in bacteria against this antibiotics.

It may be concluded that area specific antibiogram studies may be undertaken, not only to obtain high degree success in the therapy of bovine mastitis but also to avoid the risk of development of drug resistance.

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Improved post-partum reproductive performance in Frieswal cows by practicing individual feeding

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Abstract

The present study was undertaken to know the effect of individual feeding on the post-partum reproductive performance of Frieswal cows. Twenty Freiswal cows of similar age group at the time of first calving maintained under uniform housing and management conditions were selected for the study. The cows were separately tied and individually fed dry roughage, green fodder and concentrate mixture according to their milk yield. The oestrus exhibition was detected daily with the help of teaser bulls. Cows that showed standing oestrus were inseminated with frozen semen of Frieswal bulls. The data obtained was compared with eight Frieswal cows of similar age group maintained under routine group feeding and management system. The results showed an overall significant ($p<0.05$) improvement in the post calving reproductive performance of individually fed animals. The present study verifies that the individual feeding, in which each cow receives her own supplementary ration, presents an excellent opportunity for optimizing feed consumption. This approach can overcome the reproductive problems like delayed post-partum heat and occurrence of repeat breeding in post-partum cows to a certain extent.

Keywords: Frieswal cows, individual feeding, post-partum reproductive performance

Introduction

Parturition, important normal physiological process. However, it is mostly coupled with post-partum complications like drying off, reduced appetite, metabolic disorders such as ketosis, milk fever etc. The herd manager has to face challenges like prompt expulsion of placenta, speedy uterine involution, combat the adverse effect of negative energy balance, and maintain the constant increment of milk production along with early resumption of oestrous cyclicity. Frieswal is a strain developed by crossing Holstein Friesian with Sahiwal and stabilizing the exotic blood at 62.5% at ICAR-CIRC, Meerut (Mathur et al., 2013).It was reported that in spite of full maintenance, regular feeding and under farm conditions many of the animals do not manifest oestrus for pretty longer periods following parturition. It may be due to several physiological or environmental stresses acting singly or in combination, affecting the ovarian function post parturition. High milk production (lactational anoestrus), suckling, loss of body weight up to 90 days post-calving due to negative energy balance, nutritional deficiencies and uterine infections are some of the factors that delay resumption of post-partum ovarian activity. Optimum fertility of post-partum cows is known to be achieved by improved management and feeding. Hence, the present

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study was undertaken to know the effect of individual feeding on the post-partum reproductive performance of Frieswal cows.

Material and Methods

The present study was conducted at Military Dairy Farm, Meerut-Cantt. Twenty Freiswal cows of similar age group at the time of first calving (29 to 30 months) maintained under uniform housing and management conditions were selected for the study. The cows were separately tied and individually fed dry roughage (3.5-5.0 kg), green fodder (15-20 kg) and concentrate mixture (5.0-7.0 kg) /cow/day) according to their milk yield. The oestrus exhibition was detected daily (morning and evening) in all the cows with the help of teaser bulls. Cows that showed standing oestrus were inseminated with frozen semen of Frieswal bulls. The data obtained was compared with eight Frieswal cows of similar age group maintained at military dairy farm under routine group feeding and management system.

Statistical analysis

The data pertaining to the age in days at first post-partum heat and first post-partum to conception are presented as mean ± SEM (Table 1). The differences in mean values between control and treated groups are compared by t-test (Snedecor and Cochran, 1989) using SPSS software version 17.0.

Results and Discussion

The present investigation was undertaken to compare the effect of individual feeding on the post-partum reproductive performance of Frieswal cattle maintained at military farm. The results show an overall significant improvement in the post calving reproductive performance in all the parameters studied in treated animals. Table I shows a significant ($p<0.05$) reduction in the age (in days) at which primipara cows exhibited oestrus following calving, interval from calving to first post-partum heat (in days) and days taken to conceive in individually fed animals.

Table I. Reproductive performance of post-partum Frieswal cows.

Group	Age at 1st post-partum heat (days)	Interval from calving to 1st post-partum heat (days)	Interval from 1st post-partum heat to conception (days)
Treated	1003.75±21.09[a]	79.86±15.32[a]	77.60±13.16[a]
n	20	20	18
Control	1048.70±48.36[b]	97.88±19.13[b]	118.00±49.27[b]
n	8	20	8

Mean values (column wise) bearing different superscripts differ significantly (a:b = P < 0.05)

Moharatha (2007) reported that crossbred animals undergo severe nutritional stress, particularly in post-partum period due to increasing lactational stress. Such huge demand on the limited bodily resources of the stressed cows ultimately show its effect on the post-partum reproductive performance viz. delay in uterine involution, onset of first post-partum heat and reduction in the conception rate. When such animals are housed and fed in group (stall feeding), the physiological stress multiplies manifold particularly in those animals that are already weak due to calving stress. The jostling and struggle for feed always tilts in favour of strong animals which are at later stages of lactation. Thus weaker animal becomes progressively weaker. Several investigators have also hypothesized that the severity of negative energy balance delays the resumption of the first postpartum ovulation (Holness et al., 1978) and the level of feeding and body weight is known to affect cow fertility (Lamond, 1970). The effects of under feeding are greatest on lactating cows after calving. Weight loss post-partum, due to under feeding or high lactation demands, extends the post-partum anoestrous period (Entwistle, 1983). The nutritional status of animals as such is difficult to measure, and this complicates interpretation of nutrition x reproduction interactions (Haresign, 1984). An animal's nutritional status is usually assessed on changes in its live weight and body condition. The effect of nutritional deficiency can be gauzed by evaluating reproductive parameters which are much more evident immediately after post-partum period. The effects of poor nutrition differ depending on whether the main deficiency is in energy, protein, vitamins, minerals or trace elements. Under stall fed conditions stressed and weak animals suffer from deficiency of more than one component (Roberts, 1971).

This problem of supply of diminished nutrition to post-partum animals can be successfully addressed by adopting practice of individual feeding (Dindorkar et al., 1982).Our previous studies also indicated that Frieswal heifers fed individually resulted into early exhibition of oestrus as compared to stall fed heifers maintained in group under farm conditions (Mathur et al., 2013).

Thus, optimum fertility in post-partum cow can be achieved by a holistic approach i.e. by improving management, nutrition, application of advance reproductive technology and strategy to decrease the occurrence of disease of puerperal and its effective management (Moharatta, 2007) in combination with individual feeding.

Conclusions:

The present study verifies that the individual feeding, in which each cow receives her own supplementary ration, presents an excellent opportunity for optimizing feed consumption. This approach can overcome the reproductive problems like delayed post-partum heat and repeat breeding in post-partum cows to a certain extent.

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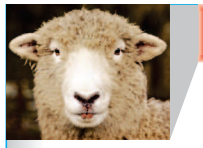


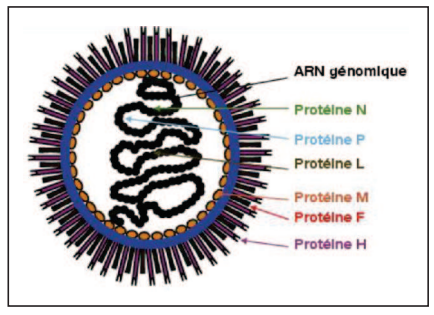
Small Ruminants Sector in India Threat to Development

Peste des Petits Ruminants (PPR)

- Peste des Petits Ruminants (PPR) is an acute, highly contagious, OIE-notified and economically important trans-boundary viral disease affecting sheep and goats.
- The disease was first detected in Africa in 1942, but today it has spread across all the continents. In India, the first report of PPR was from Tamilnadu in 1987.

Virus of Peste des Petits Ruminants (PPRV)

- PPRV - A ribomucleic acid virus
- Genus - Morbillivirus
- Family - Paramyxoviridae
- An enveloped virus, and hence sensitivity environmental changes. Rapid in activation of the virus occurs when exposed to condition outside the host environment. Consequently, only close contact between infected and susceptible animals is necessary for the disease transmission.



- The PPR virus is closely related to Rinderpest virus in cattle, Canine Distemper virus in dogs, Phosine Distemper in seals and Measles virus in human beings.
- There are 4 Lineages (ginotypes) of PPR virus which have been identified, specific to the given region.
  - Lineage 1 - Nigeria, Camaroon
  - Lineage 2 - West Africa, ICV, Senegal
  - Lineage 3 - East Africa (Ethopial), Sudan
  - Lineage 4 - Middle East, Arabia and Indian Sub-continent.
- All Indian vaccine strains and field isolated are of PPR virus-Lineage 4

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Successful management of Uterine Prolapse in non pregnant lactating Gir Cow

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Abstract-

The present study describes the simple technique of resolving the complete uterine prolapse in a lactating Gir cow. The method of suturing highlights the effectiveness in handling and approaches which can be easily replicated in field condition without any adverse effect on the production and reproductive health of the animal.

Key words: Peri-vaginal suture, complete uterine prolapse, vaginal exploration

Introduction

Complete uterine prolapse is most commonly observed in large ruminants like cows, buffaloes and also sheep. The incidence and symptoms have been extensively elaborated in cows (Arthur et al., 1989 and Roberts, 1971). Though various patterns of suture in the vulvar lips have been employed, the prevention of the initial eversion of the vagina into the vestibulum is seldom achieved. The present study highlights the success of clinical management of complete uterine prolapse of a lactating Gir cow by a novel technique of retention suture.

History and clinical examination

A 6 year old pluriparous Gir cow in her 3rd lactation had the history of recurrent uterine prolapse for two times within 45 days post calving as reported at Bull Mother Farm, BAIF Development Research Foundation, Uruli Kanchan. Per rectal examination revealed follicular cysts on right ovary which leads to increased blood estrogen levels, might have been the etiology for the recurrence. Cow showed continuous straining due to obstruction at neck of the urinary bladder because of pressure by prolapsed mass. On physical observation, it was noticed that the cow was in standing position and prolapsed mass was hanging swollen and edematous. The animal was showing signs of discomfort.

Treatment

The cow was administered 5ml of Lignocaine hydrochloride (2%) through 1st inter coccygeal space to prevent straining and pelvic sensation in order to facilitate further vaginal manipulation. After allowing 4-5 minutes for the anesthesia to take its effect, the prolapsed part was cleaned thoroughly with water to get rid of soil, dust and dirt sticking to the mass. The mass was washed with normal saline and weak 1% luke warm potassium permanganate solution was applied liberally. The prolapsed mass was lifted by both hands to the level of vagina and was pushed with a moderate force into the vagina. Initially cervical

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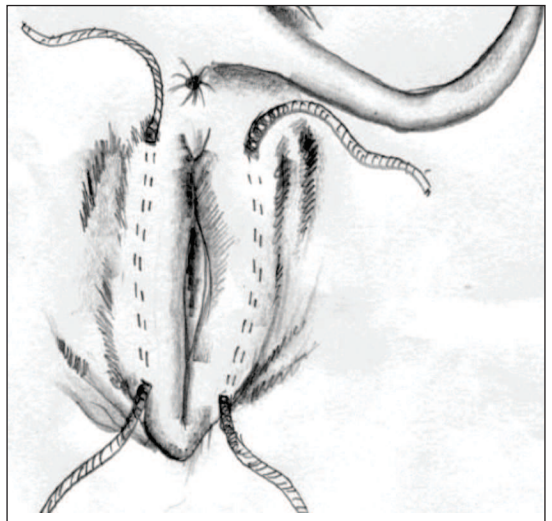

Fig 1: Vulva retention sutures

portion nearer to vagina was pushed while the mass was lifted by an attendant and later the complete uterus was pushed with complete reposition. A sense of relief was marked in the animal indicating successful replacement of the prolapsed mass.

Vulva retention suture of cotton tape of ¾ cm thickness was used as an alternative suturing technique (Fig. 1, 2 and 3). Vulval suture that do not pass through the vulval lips was given near the hairline starting from dorsal commissure to ventral commissure. Perivaginal needle carrying the suturing material was passed vertically from one side of the vulval lips from upper to lower commissure under the skin. Likewise the second suturing was made in the other side of the vulval lips in the same way. The terminal portion of each side of suture was tied together both dorsally and ventrally and considerable care was taken to keep the vaginal lips in apposition without gapping through a flexible knot. In this technique, no part of soft tissue of labia was involved which is delicate and prone to tearing. The additional advantage of this technique is that, the vaginal exploration can be made only by losing the knot with no further tampering of the

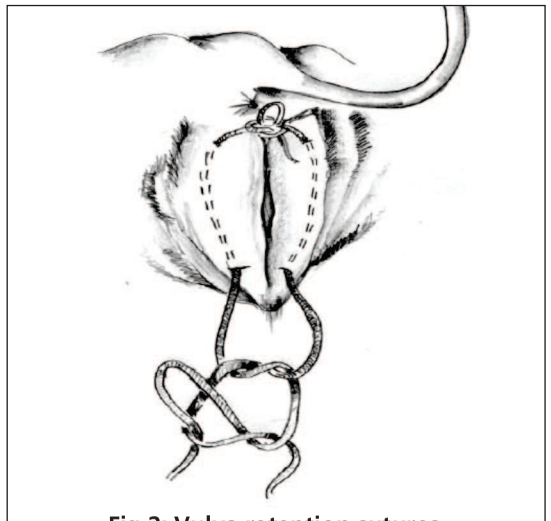

Fig 2: Vulva retention sutures

external genitalia.

Supportive therapy such as Ceftriaxone (15mg/kg body wt I /m), Nimesulide (0.5mg/kg body wt. I /m), Dextrose (1liter I /v) and Calcium borogluconate (450 ml I /v) was administered on 1st day, followed by Ceftriaxone and Nimesulide for another 5 days. To prevent the recurrence, FSH@1500 IU (Inj. Chorulon) I /m was given as a

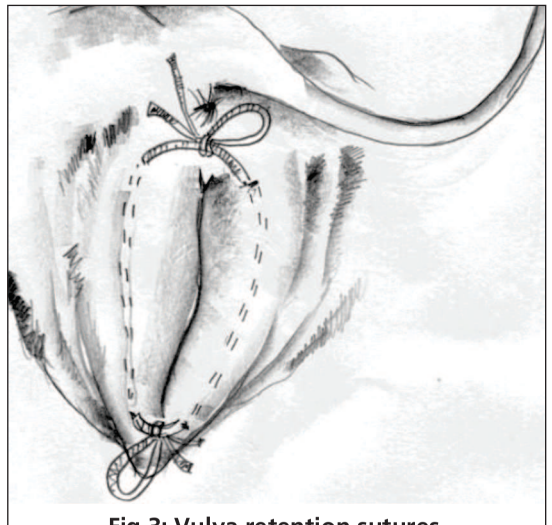

Fig 3: Vulva retention sutures

hormonal therapy for rupturing follicular cysts which ultimately reduces the estrogen level. Topical application of turmeric and camphor paste was used externally over the vulval lips as a fly repellant. The suture was retained for 7 days till complete recovery observed. The cow recovered completely and in subsequent heat, it was bred successfully to conceive .

Discussion

In cattle, eversion and prolapse of the uterus, occurs most commonly in mature females in the early lactation. The etiology of complete uterine prolapse in cow is not clear. However, over relaxation of pelvic structure, excessive relaxation of perineal region, flaccid uterus and hyper estrogenism are considered as predisposing factors (Jackson, 2004 and Hanie, 2006). The present suturing technique is more efficient and suitable in large ruminants where re-examination is sometimes needed and could be successfully employed in recurrent uterine prolapse.

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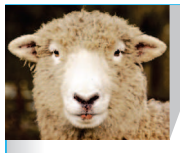

Small Ruminants Sector in India Threat to Development

***Peste des Petits Ruminants* (PPR)**

Epidemiology in India - 1

- PPR was reported first time in India in 1987 in Tamilnadu.
  - Between 1989 - 1993, it was reported from all Southern States (TN, Kerala, AP and parts of Karnataka).
  - Between 1994-1995, whole of Karnataka and part of Maharashtra.
  - Between 1994-2010, whole of Maharashtra, Gujarat, MP, Odisha, Bihar, Rajasthan, HP, UP, Uttaranchal, Chattisgarh, Zarkhand and J & K.
  - Between 2010-2013, Assam and parts of other North-Eastern States.
- PPR is among the top 10 diseases reported in small ruminants in India and stands **FIRST** among the viral diseases (Mortality wise)

Disease	Mortality (%)
PPR	34
Blue Tongue	24
Sheep and Goat Pox	14

Disease	Mortality (%)
Enterotoxemia	12
CCPP	5

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Melanoma in a crossbred cow

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(received 21/10/2015 - accepted 10/12/2015)

Abstract :
A rare malignant melanocytic tumour in the hoof of right hind limb in a crossbred cow, treated successfully with vincristine sulphate (0.025 mg/kg), iv, thrice at seven days interval is described.

Key words: Melanoma, CB cattle, Vincristine sulphate

Introduction

Melanomas are malignant melanocytic tumours commonly encountered in horses and dogs, occasional in swine, but are rare in cattle (Moulton, 1961 and Smith et al., 2002). In cattle, melanocytic tumours account for approximately 6% of all the tumours (Naghshinehet al., 1991). These tumours predominately affect young cattle less than 2 years of age with red, grey or black coats (Miller et al., 1995). Melanomas may occur anywhere in the body, but are commonly noticed in perineal region and the tail followed by head, udder, prepuce and limb(Miller et al., 1995). The tumors may also be found on the jaw (Britoet al., 2009), maxilla and less frequently in the eyes and interdigital space (Smith et al., 2002).However, reports of melanomas invading the hoof of cattle are rare.

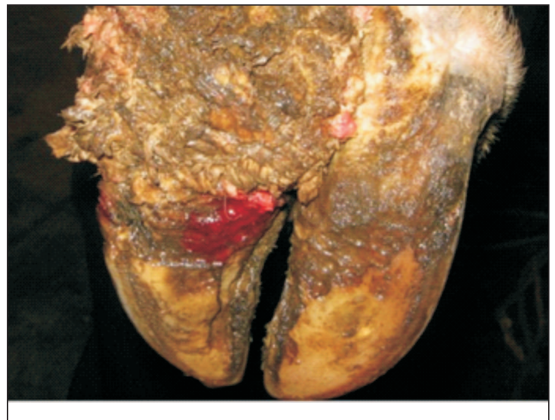

Fig. 1: Ulcerating mass arising from the hoof

Case History and Observations

A 4-year-old crossbred cow was presented to the University Veterinary Hospital, Mannuthy with an ulcerating mass in the hoof of the right hind limb. On clinical examination, the animal was found to be active and alert with normal physiological parameters. The animal was not bearing weight on the affected limb during rest and progression. On physical examination, the mass was found to involve the wall of hoof, sole and heel of the left claw and was painful and ulcerating(Fig. 1&2). A punch biopsy was taken from the mass after local infiltration of 2% lignocaine hydrochloride and was sent for histopathological examination. The histopathological section showed heavy deposition of widely spread melanin pigment that obscured the normal morphology of tumour cells. The cells were pleuomorphic ranging from cuboidal to fusiform type with irregular branching and heavy mitotic figures. The case was diagnosed as melanoma of low malignancy and the prognosis was considered reserved.

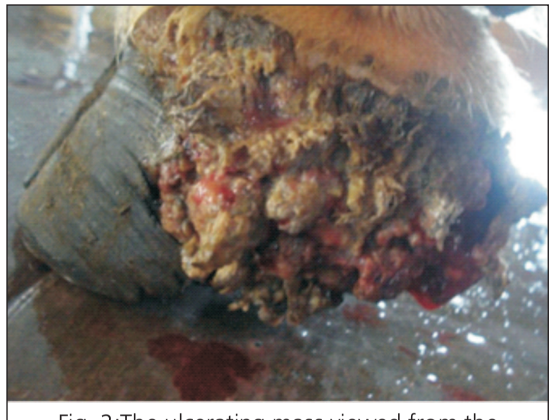

Fig. 2:The ulcerating mass viewed from the medial side

Treatment

As the lesion was practically not operable or required amputation of digits, a chemotherapeutic plan was devised using vincristine sulphate(Cytocristin, 1mg/ml, Cipla Ltd., Mumbai, India) @ 0.025 mg/kg BW intravenously thrice at an interval of seven days along with 10% formalin foot dip and topical application of copper sulphate. Meloxicam (Melonex, 5mg/ml,Intas pharmaceuticals, Ahmadabad, India) was given at the rate of 0.2 mg/kg BW intramuscularly for three days. Progressive remission of the mass with complete recovery was noticed by the fourth week(Fig. 3,4&5). The owner was advised to milk out the udder regularly and not to consume the milk. The animal appeared apparently normal during the therapy and no untoward signs were observed due to vincristine administration.

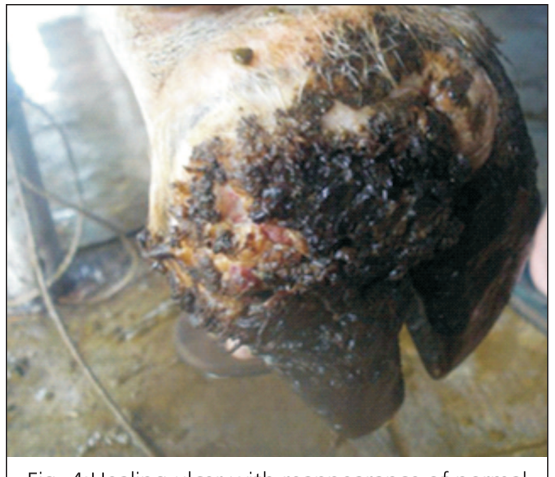

Fig. 4:Healing ulcer with reappearance of normal hoof during the third week of treatment

Discussion

Melanomas are tumours arising from epidermal, dermal, ocular and oral epithelia and may rarely invade tissues deeper than the subcutis (Smith et al., 2002). The abundance of melanin pigment is the most valuable marker for the identification of this tumour (Sreenuet al., 2003). The exact etiology and pathogenesis of this tumour is still unknown, although a disturbance in metabolism associated with graying is thought to be a cause

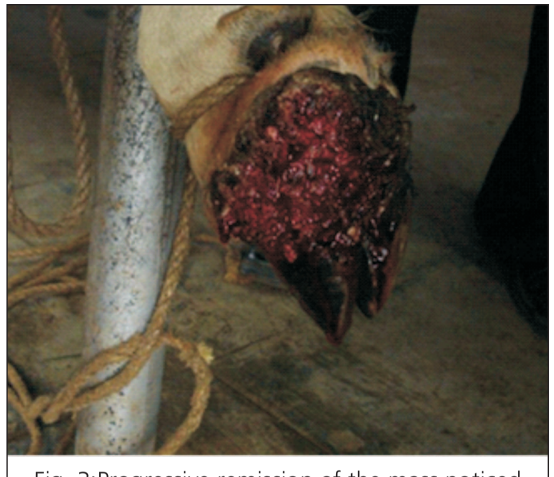

Fig. 3:Progressive remission of the mass noticed during the second week of treatment

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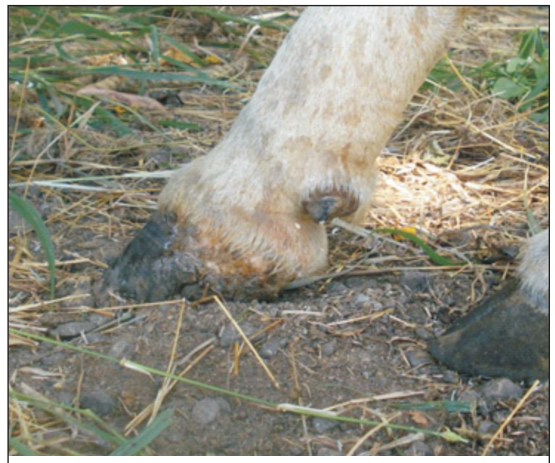

Fig. 5: Regained normal architecture of the hoof after complete recovery by the fourth week

(Theilen and Madwell, 1987). Melanomas recur frequently and are predisposed to metastasis to regional lymph nodes.In this case, recurrence or any signs of metastasis was not noticed for a period of one year after treatment. This could be due to the action of vincristine on mitotic figures of rapidly multiplying cells. Also, it could be stated that vincristine sulphate at scheduled doses could be considered as a drug of choice for melanoma (Udharwar et al., 2008). The use of an anticancer drug for the treatment of tumours in food animals is questionable. But, the administration of such drugs is inevitable when a life threatening cancer is encountered or when the diseased part requires mere amputation affecting ambulation as in the present case. However, the owner was advised not to consume the milk from the recovered animal and the animal did not show any signs of recurrence during an observation period of one year.

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A Report on occurrence of Tuberculosis in buffaloes

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(received 14/10/2015 - accepted 15/12/2015)

Abstract:

Treatment of four adult non-descript buffaloes with chronic watery diarrhoea, lymphocytosis and presence of acid fast bacilli in the fecal smear, with atropin, enrofloxacin and metronidazole has been described. The results of treatment were not favorable.

Keywords: Tuberculosis, Acid fast bacilli, buffaloes

Introduction:

Tuberculosis is a chronic, infectious, fatal disease of animals and a major global cause of death in humans (WHO 2008). Tuberculosis is caused by a group of closely related bacterial species termed as *Mycobacterium tuberculosis* complex. *Mycobacterium tuberculosis* has wide host range affecting cattle, buffaloes, sheep, goats, wild ruminants and humans (Harris and Barletta, 2001). Humans become infected by *Mycobacterium bovis* and *Mycobacterium tuberculosis* via milk, milk products and meat from infected animals (Hardie and Watson, 1992). The disease has become significant worldwide on account of economic losses, may be due to productive losses, treatment cost, reduced work capacity and mastitis.

Case History and Observations:

Four adult non-descript buffaloes were presented to the Teaching Veterinary Clinical Complex, Proddatur, Sri Venkateswara Veterinary University, Andhra Pradesh with a history of chronic watery diarrhea since one month. On general examination, they appeared very weak, emaciated, dull with rough hair coat. Clinical examination revealed slight increase in

temperature (about 102.4^{0}F), sunken eyeballs and watery shooting diarrhea.

Haematology revealed increased lymphocyte count and other parameters within the normal range. Faecal examination was found negative for parasitic ova but shedding of mucosal layer was noticed. On acid fast staining, faecal smear revealed the presence of thick medium sized acid fast bacilli resembling *Mycobacterium tuberculosis* and suggestive of Tuberculosis. (Fig. 1)

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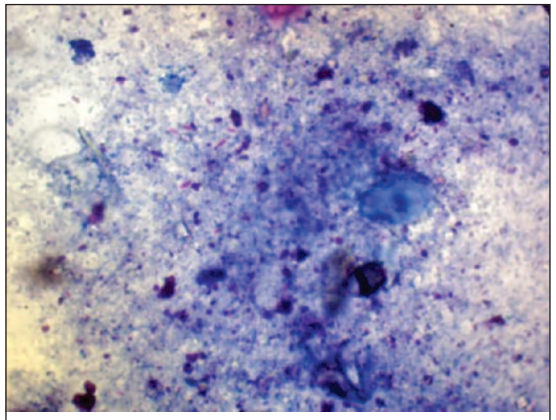

Fig. 1 Microscopic picture of faecal smear showing Acid fast tuberculous bacilli

Treatment and Discussion:

Animals were treated primarily with Inj. Atropine Sulphate @ 0.4mg/kg body wt I/M, Inj. Enrofloxacin @ 5mg/kg body wt I/M, Inj. Vit A 2ml I/M, Metronidazole @ 20mg/ kg body wt I/V once a day for 5 days. The animals were also given supportive fluid therapy of Ringers Lactate @2lt/ day for 8 days. Inspite of the treatment for 8 days, the symptoms did not subside and the treatment was discontinued at owner's request.

In general, the clinical symptoms are not observed in subclinical stage of the infection and the animals remain in carrier state. Whenever immunity goes down, bacteria escape the defense mechanism and clinical disease condition is established. Once the animals get infected, especially ruminants, they remain infected throughout their life time. Hence regular screening should be practiced atleast for every six months.

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Management of Prognathism in a Love Bird (Agapornis)

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(received 16/11/2015 - accepted 15/12/2015)

Abstract:

One year old love bird (Agapornis) with the overgrown upper beak and showing dullness was treated by debeaking using human nail cutter. The bird recovered uneventfully following post operative administration of multi-vitamin syrup and NSAID.

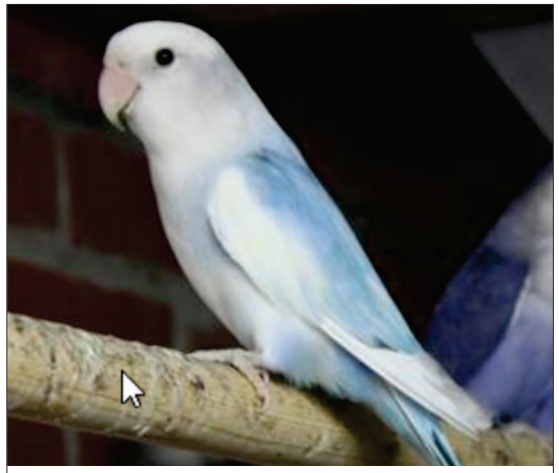
Keyword : Love Birds, Prognathism

Introduction

The beak is a sensitive and unique part of bird's body and can perform fine tasks like feeding a tiny chick, hulling a seed or gently preening feathers. The beak is also used for chewing, grooming, vocalizing, climbing, playing, caring for the young, and as a part of mating rituals. Three most common beak malformations are scissor beak, (lateral deviation of maxilla) compression deformities of mandible and pug beak (prognathism). The first two are common in macaws, while third is most common in cockatoos (Brown and Chitly, 2005). Different beak trimming methods such as red-hot blade, cold blade cut, capsaicin, robotic electrocautery device (ECD) trims, robotic infrared beak-trimming device (IBT) and laser beam method have been discussed previously by Glatz, 2000 and Henderson et al. 2009. In the present paper, successful management of overgrown upper beak in love bird is discussed.

History and Clinical Examination

One year old love bird (Agapornis) was presented to Teaching Veterinary Clinical Complex, Arawali Veterinary College, Sikar with the history of dullness, and overgrown upper beak. Clinical evaluation revealed all physiological parameters within the normal range. Clinical examination revealed overgrown upper beak directed downwards and reached to neck region (Fig. 1). Pressure on neck region due to overgrown beak had made the bird dull and depressed. Bird was not able to take feed easily.



A love bird (Agapornis)

Management

After clinical examination, immediate debeaking was planned in a love bird. Bird was properly

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Fig. 1. Overgrown upper beak directed downwards reaching to neck region

Fig. 2. Amputation of dead, overgrown beak with bone cutter

restrained. Demarcation between dead and live portion of the beak was clearly visible. With help of a bone cutter (Fig. 2), dead overgrown beak was amputated. Irregular margins of beak were rasped with the help human nail cutter's rasper for giving a regular shape (Fig. 3) of remaining intact beak. Multivitamin syrup (Vimeral) twice a day for 5 days and inj. Meloxicam 0.3 ml intramuscularly was advised to avoid the stress. Post debeaking recovery was uneventful.

Discussion

According to Gentle et al, (1990), beak trimming of chicks does not give rise to any long term painful consequences. A study on beak trimming has suggested that acute pain depend on the age at which the birds are trimmed and the method of beak trimming. Of the beak abnormalities, lateral deviation is thought to be congenital or induced by poor hand feeding technique, mandibular compression is thought to be induced by rough hand feeding technique and prognathism is thought to be congenital(Brown and Chitly, 2005).

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Fig. 3. Rasping of irregular beak margins with human nail cutter

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Effect of mineral mixture supplementation on milk production and reproduction - a village trial

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(received 23/04/2015 - accepted 01/06/2015)

Abstract:

An experiment was conducted on 15 milking cattle in early lactation and 10 non pregnant cattle to assess the effect of mineral mixture supplementation on milk production and reproduction. After 30 days of mineral mixture supplementation, an increase of about 10.58% was observed in milk production. All the non pregnant animals showed heat symptoms and 80% animals subsequently conceived.

Key words: Milk production; mineral mixture supplementation

Introduction:

Soil-plant-animal relationship is of great importance. If the soil is deficient in one or another minerals, the plants growing on that soil become deficient in that particular mineral. Subsequently, the animals suffer from deficiency in those minerals. It has been observed that level of minerals in feeds and fodder varies from region to region. The requirement of minerals has to be met out from the green fodder and concentrate being fed to the animals. But it is important to note that green fodder and concentrate may not fulfil the requirement of all the macro and micro minerals upto desired level. In the event of deficiency of minerals, milk production decreases significantly and animals do not show regular heat. Therefore it is necessary to supplement all the minerals and vitamins through supplementation.

Material and Methods:

An experiment was conducted at village PuthKhas District Meerut during Oct 2013 – Nov 2013 on 25 milking animals to assess the effect of mineral mixture supplementation on milk production and reproduction. To conduct this on farm trial, 15 milking cattle in early lactation and 10 Non pregnant cattle were selected. The animals were offered green fodder, dry fodder and concentrate according to their production potential. All the animals were provided 30 g mineral mixture (VM^{All}, MSD Animal Health Pune) daily for 30 days. All the animals were dewormed using Panacur Bolus (3 g/ animal). All the animals were treated with Taktic to control ectoparasites.

Results and Discussion:

Milk yield was recorded on day 1 and again on day 30 to assess the effect of mineral mixture supplementation. The non pregnant animals were observed early in the morning for symptoms of heat, if any.

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Effect of mineral mixture supplementation on milk production and reproduction:

Tn the 15 milking cows provided mineral mixture, the average milk production was increased from 9.07 ± 0.92 lit. per day to 10.03 ± 0.93 lit. per day, indicating an increase of 10.58 percent.

Out of 10 (cows 3, heifers 7) animals who were given mineral mixture @ 30 gm per day for 30 days, all the animals (100%) exhibited heat and 8 animals (80%) subsequently conceived after the insemination.

Summary and Conclusion:

It is concluded that mineral mixture supplementation has positive effect on milk production and reproduction. To fulfil the requirement of all desired minerals and vitamins, regular use of mineral mixture is advised.

Acknowledgement:

The author is highly thankful to M/s MSD Animal Health for providing mineral mixture. The cooperation received from key informant Shree Pankaj Singh Chauhan is duly acknowledged.

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Foetal mummification in a crossbred cow and its surgical management

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(received 09/11/2015 - accepted 15/12/2015)

Abstract

The present report describes successful management of mummified foetus in crossbred cow by cesarean section. Prior to cesarean section, the usual protocol for mummified foetus with Injection PGF 2α was followed but cow did not show any response to two Injections of PGF 2α. After cesarean section, animal showed oestrus after 65 days of treatment.

Introduction

Foetal mummification is associated with a series of morphological alteration that occurs to a foetus which dies and retained in uterus. However, the occurence of disease in cattle is very low (0.43 to 1.8%) and is usually reported between 3 – 8 months of gestation (Roberts, 1986). Most mummified foetuses will remain in uterus until treatment is given to expel them or until they are removed by caesarean section (Wenkoff and Manns, 1977). In the present communication, a rare case of failure to expel mummified foetus by treatment with PGF2 , to overcome this type of complication its surgical management has been placed on record.

Case history and observations

Six years old sahiwal crossbred cow was presented with a history of 300 days of gestation. At the relevant time, the animal was bred by artificial insemination and the pregnancy was confirmed by rectal examination on 60th day, clinically there was absence of visual signs of pregnancy. Per rectal examination revealed the closed cervix in addition to palpation of a hard bony mass adhering to uterine wall, while there was absence of cotyledons, fremitus and foetal fluid. The animal was apparently healthy and taking food and water normally. The case was diagnosed to be a foetal mummification and decided to treat medically.

Treatment

The choice of treatment for foetal mummification is Inj. Prostaglandin F2α so double shot of Lutalyse (PGF 2α) @ 25 mg was injected intra-musculary to the animal and kept under observation for lysis of CL and cervical dilatation. A long thick shred of brownish mucoid discharge from vulva was reported after 72 hours of therapy. On vaginal examination, cervix was found partially dilated and bony mass was palpated. Due to failure of complete dilatation of cervix after second shot of PGF 2α, cesarean section was the choice of treatment. The cesarean operation was done in standing position at the farm. The animal was controlled by both physical as well as chemical method, Lignocain hydrochloride 2% was used for para-vertebral regional anaesthesia. Ventral to the left

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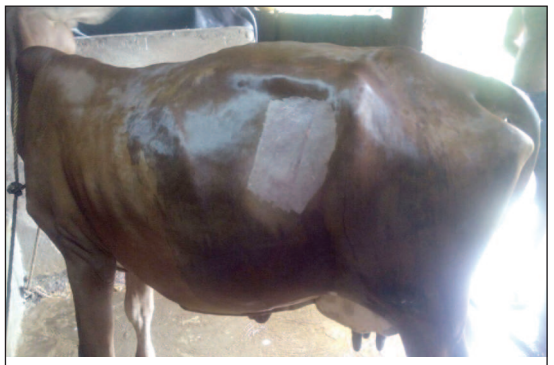

Fig. 1 Site selected for operation

paralumbar fossa was selected for operation (Fig. 1) and this area was prepared for operation by clipping, shaving and finally sterilizing with Tr. Iodine soaked cotton.

During operation, 1000ml of 5% Dextrose saline was infused intravenously to compensate dehydration from fluid and blood loss. Following aseptic preparation of the operative field, a 14 inches long vertical incision lateral to the paralumbar fossa was made to open the abdomen. The distended gravid uterus was pulled out through the incised opening .

Fig. 2: Showing bony pieces of mummified foetus.

Drapes and sterile gauge were used to prevent the leakage of uterine fluid to peritoneal cavity. A longitudinal incision along the greater curvature of uterine horn was made to remove the bony pieces of mummified foetus (Fig. 2).

The inner surface or endometrium and peritoneal cavity were thoroughly flushed out with normal saline and 200 ml Metronidazole was given to compensate visceral moisture and to combat anaerobic infection. The incised uterus, peritoneum and muscles were sutured with chromic catgut No. 2 subsequently and finally the skin was closed with silk thread (Fig. 3, 4 & 5).

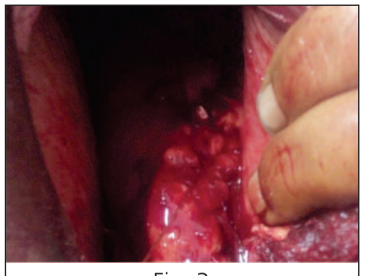

Fig. 3

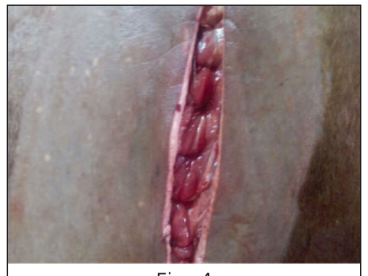

Fig. 4

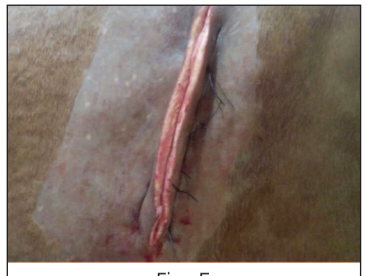

Fig. 5

Fig. 3, 4 & 5 showing the suturing of incised uterus, peritoneum, muscles and skin

A Tr. Benzoin seal was applied over the suture line. Post operatively Dextrose saline 5% (1lit./day) was continued intravenously for 3 days. Inj. Dicrystacine 2.5 gm was injected intramuscularly for 5 days to prevent bacterial infection. 15 ml of meloxicalm was injected intramuscularly daily for 5 days to reduce inflammatory pain and tablets Uterovet @ 10 bid, p/o were fed for 10 days. On the day 10th, the suture of skin was removed and animal recovered uneventfully (Fig. 6).

Discussion

The main goal when treating an animal with abnormal pregnancy, related to the foetus, is to expell the abnormal foetus so cow can become pregnant again within shortest possible time. The choice of treatment in cases of foetal mummification is Inj. of Prostaglandin F 2α to induce leutolysis, leading to expulsion of foetus within two to five days (Wenkoff and Manns, 1977). In the present case, luteal regression and uterine contractions were observed with the first PGF 2α Inj. but it was probably not enough to produce the continuous contractions required to expel mummified foetus. Therefore a second PGF 2α inj. was administered, but expulsion of foetus was not achieved. To overcome this, it was decided to deliver the mummified foetus by cesarean section as suggested by Arthur et al (1996). Treatment with PGF 2α in the present case might have resulted in maceration of mummified foetus and thus it was stuck at external os of cervix. This complication has already been discussed by Arthur et al (1996) and reported that treatment of mummified foetus with PGF 2α creates some complexity in cattle like maceration of foetus and getting stuck in the birth canal instead of expel out. The present animal showed postpartum oestrus after 65 days of examination, indicating that cesarean section had no harmful effects on subsequent oestrus activity of the animal.

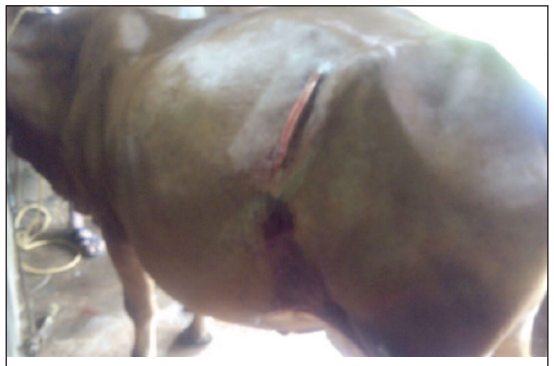

Fig. 6: Showing recovered animal

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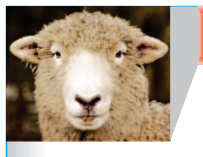
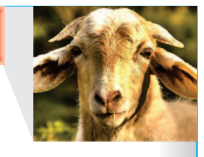


Small Ruminants Sector in India Threat to Development



***Peste des Petits Ruminants* (PPR)**

Transmission

- Close contact with infected animals is necessary.
- Large amounts of virus are present in all body excretions (nasal, conjunctival, intestinal) and secretions, especially in diarrhoeic faeces.
- Infection is mainly by inhalation, but could also occur through conjunctiva and oral mucosa.
- As live goats / sheep are traded and may be carried over long distances, the disease can be easily introduced to a new herd, area, region are even a new country unknowingly from animals incubating PPR.

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Common surgical affections of tail region in Camels and their management

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Abstract

The clinical investigation of tail region affections in 98 camels was carried out. Two type cases were recorded, tail gangrene and wound at tail. In all the cases of tail gangrene, clinical examination showed dry, painless, disfigured, discoloured, alopetic, cold on touch and 2 to 4 inches gangrenous stump at the end of tail. Tail gangrene cases were treated by amputation procedure. Retrospective studies on patterns of occurence of tail region in camels was carried out in 98 cases from 2001-2010. The 98 cases were recorded in term of sex, season. Majority of the cases were tail gangrene. Out of 98 cases recorded, 82 (83.67%) were males and 16 (16.32%) were females. The overall occurence of surgical affections was found to be highest in winter, 47 (47.95%) followed by rainy season, 31 (31.63%) and summer 21 (21.42%) respectively.

Key words: Camels, tail gangrene, tail wounds

Introduction

The camel is an important livestock species uniquely adapted to hot and arid environment. It produces milk, meat, wool, hair and serves for riding, as beast of burden and as a draft animal for agriculture and short distance transport. The family camelidae is divided into two genera. The genus camelus includes two species: *Camelus dromedarius*, (one-humped or Arabian camel), and the *Camelus bactrianus*, (two- humped camel). The second genus is the *Llama* comprising of four species (Mason, 1979). Purohit et al (1985) discussed surgical approach to tail gangrene in camel. Owners usually tie tail at its terminal end with a rope which is anchored to back hairs or saddle. This causes compression over blood supply of tail and gangrene develops. The tail is prone to various affections like dermatitis, trauma, necrosis, gangrene, fracture, paralysis, luxation, diskospondylitis, etc. (Nuss and Fiest, 2011). Diseases of the tail may be treated conservatively or by amputation. Zindoliya (2009) also recorded tail gangrene affections in camels. Most of these affections do not respond to the routine medical management and demand amputation of the tail. This paper discusses about the management of surgical affections of tail in camel.

Material and Methods

The animals in the present study were divided in two groups, (Group A and B). The animals of group A consisted of clinical cases presented to surgery clinics, College of Veterinary and Animal Science, Bikaner from April 2011 to December 2012. The animals presented to the hospital with the symptoms of tail affections were examined and the proper treatment was followed either by conservative or surgical methods. The animals brought for treatment were evaluated clinically and diagnosed based on the clinical symptoms. Animals of group B included ten years retrospective study of surgical affections of tail of region, which were recorded from outdoor register from the year 2001 to 2010. All the cases in Group A and B were recorded in terms of sex, season, age and treatment.

Diagnosis of tail region affections recorded in the present study were diagnosed on the basis of history and clinical examination. The nature of affection was evaluated on the basis of its clinical signs such as inflammation, suppuration, necrosis or gangrene etc. Chronicity of ailment was determined by history and previous treatment given.

Case History and Clinical Evaluation

Tail gangrene was recorded in 7 male and 2 female camels. Clinical examination revealed 2 to 4 inches gangrenous stump at the end of the tail. It was dry, painless, disfigured, discolored, alopetic and cold on touch. There was clear cut demarcation between dead and living tissue (Fig. 1). Wound at tail was observed in 2 male camels. The wounds surrounding was covered by dry blood clots. The wounds were reddish pink & healthy (Fig. 4).

Surgical management

In tail gangrene cases, feed and water was withheld for 24 hours prior to surgery. Animal was secured in sternal recumbency and sedated with xylazine hydrochloride (0.2 mg/kg body weight, i/v). 30-40 ml of 2% lignocaine hydrochloride was administered for epidural block. The site was prepared for aseptic surgery. A tourniquet was placed at the base of tail before operation to minimize the bleeding. Intercoccygeal joint was felt two inches above the gangrenous part and 'U' shape skin incision

Fig. 1: Tail gangrene showing dry and alopetic stump with demarcation between dead and living tissue (arrows).

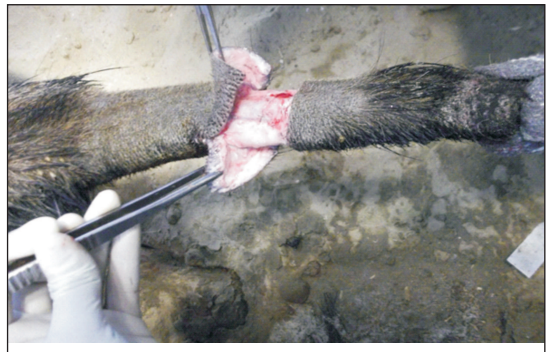

Fig. 2: Skin flaps on dorsal and ventral aspect of tail (arrows).

was given on dorsal and ventral side of tail. The skin flaps were prepared by blunt dissection and the flaps were reflected (Fig. 2). Ventral and laterl blood vessels were ligated to minimize the bleeding. The intercoccygeal joint was disarticulated by scalpel. Apposition of cutaneous flaps was done by suturing with horizontal mattress sutures using silk (Fig. 3). Postoperatively, operated part was bandaged. Oxytetracycline Injection 1500 mg, I.V. for 7 days and phenylbutazone Injection 3000 mg, I/M for 3 days was administered. Sutures were removed after 12 days.

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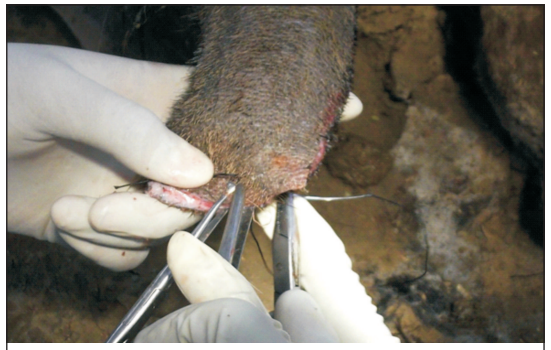

Fig. 3: Apposition of cutaneous flaps by suturing with horizontal mattress sutures (arrows).

In wound cases, wounds were irrigated with light potassium permanganate solution and thorough debridement done. Both wounds were dressed with 5% povidone iodine solution and irrigated with light potassium permanganate solution. The wound was dressed with lyramycin ointment on alternate days. Oxytetracycline injection 1500 mg, I.V. for 7 days and meloxicam injection100 mg, I.M. for 3 days was administered. Healing of wound occurred within 11-17 days.

Retrospective Study of Last Ten Years (2001-2010)

Total 98 surgical affections of tail region were studied between 2001- 2010.

The maximum affections recorded were tail gangrene 79 (80.61%) followed by wounds at tail 15 (15.30%), Contusion injury at base of tail 1 (1.02%), fracture of coccygeal vertebrae 1 (1.02%), dog bite wound at tail 1 (1.02%), maggot wound at tail and abscess at base of tail 1 (1.02%). The tail gangrene incidence was found more due to tourniquet applied in most of the cases. This causes compression of blood supply to the tail and subsequently gangrene developed.

Out of 98 cases recorded, 82 (83.67%) were males and 16 (16.32%) were females. The

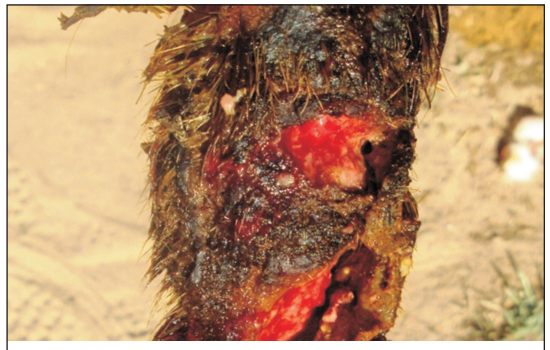

Fig. 4: Reddish pink & healthy wound at dorsal aspect of tail covered by dry blood clots.

incidence was found more in male camels, possibly because local people usually keep male camels for draft purposes.

In males, the highest incidence of tail gangrene was in 65 cases (66.32%), followed by affections of wound at tail 13 (13.26%), contusion injury at base of tail 1 (1.02%), fracture of coccygeal vertebrae 1 (1.02%), dog bite wound at tail 1 (1.02%), maggot wound at tail 1 (1.02%), abscess at base of tail 1 (1.02%) in females, the incidence of tail gangrene 14 (14.28%) was highest followed by affections of wound at tail 2 (2.04%).

In the summer season maximum affections recorded were tail gangrene 26 (26.53%) followed by affections wound at tail 2 (2.04%), contusion injury at base of tail 1 (1.02%), fracture of coccygeal vertebrae 1 (1.02%) and maggot wound at tail 1 (1.02%). In the winter season, maximum affections recorded were tail gangrene 17 (17.34%) followed by wounds at tail 3 (3.06%), dog bite wound at tail 1 (1.02%). In the rainy season maximum affections recorded were tail gangrene 36 (36.73%) followed by wound at tail 10 (10.24%), abscess at base of tail 1 (1.02%).

The overall occurrence of surgical affections was found to be highest in rainy season 31 (31.63%)

Table 1: Sexwise incidence of tail affections in camels

Sex	Tail gangrene	Wounds	Others	Total
Males	65	13	5	88
Females	14	2	-	16
Total	79	15	5	99

Table 2: Seasonwise incidence of tail affections in camels

Season	Tail gangrene	Wounds	Others	Total	%
Summer	26	2	3	31	31.6
Winter	17	3	1	21	21.4
Rains	36	10	1	47	47.9

followed by summer 21 (21.42%), winter 47 (47.95%) respectively. This may be due to wet and humid climate cause delay in wound healing.

Discussion

In the present study, the tail gangrene was seen to be developed due to tourniquet applied in most of the cases. This causes compression of blood supply of tail and subsequently gangrene developed. The incidence was found more in male camels, possibly because local people usually keep male camels for draft purposes. The incidence was found more in rainy season. This may be due to wet and humid climate which causes delay in wound healing. Similar were the observations of Gahlot and Chouhan (1992), Gahlot (2000) and Zindoliya, (2009) in camels.

It is usually believed that wound healing is slower in camel than in other mammals. In the present study, the early clinical healing was observed in those cases where planned surgery was done and healing occurred by first intension. Longer healing time was observed in cases where infection was present or in cases where wounds were prone to repeated trauma, similar observations have been recorded by Purohit (1990).

In the present study, the antibiotic used was oxytetracycline and phenylbutazone was used as non steroidal anti-inflammatory drug to control infection, reduce inflammation and relieve pain. It is concluded that careful clinical judgement, early surgical management with gentle handling of tissues, effective medication and sufficient rest brings about quick and better recovery in cases of surgical affections of tail in the camels.

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Surgical reconstruction of teat fistula and laceration in Ruminants

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Abstract

A Red Kandhari cow (first parity) had a teat fistula caused by stamp injury and teat lacerations in a Murrha buffalo (second parity) by barbed wire were included in this study. Presented forty eight hours after the injury, they had inflammation of the affected teat with swelling, a little bloody discharge and hypogalactia. The wounds, were contaminated with dung and mud, were treated under ring block using local anaesthesia. The reconstructive surgery was performed in both the cases to ensure early recovery from injury and return to normal milking. Both cases recovered very well without any complications. The fistula was successfully treated during the milking period.

Key words: Teat fistula, Teat laceration

Introduction

Teat affections in milking animals are common in ruminants, especially after parity, due to the physiological enlargement of the gland for production of milk. This condition predisposes to infections like mastitis, thelitis, udder oedema, allergic mammilitis, acquired trauma/injuries, teat fistula, teat lacerations and wounds of teat and udder (Ducharm et al.1987 and Velavan et al. 2014). The infections or injuries are to be addressed on a war footing manner to control infections and to avoid the complications, as otherwise it causes severe economic losses to the farmer by the loss of milk in same parity and also future milk production due to permanent disorders of teat and udder (Ducharm et al.1987). The present paper puts on record the successful treatment of teat fistula and the teat lacerations in ruminants during lactation.

Material and Methods

A Red Kandhari cow had a teat fistula caused by stamp injury and teat lacerations in a Murrha buffalo by barbed wire were included in this study. Red Kandhari had first parity whereas, the buffalo had its second parity. Both were presented forty eight hours after the injury and they had inflammation of the affected teat with swelling, a little bloody discharge and hypogalactia. The wounds were contaminated with dung and mud. The milk from affected quarter was tested for infection using mastrip technique. The milk appeared normal in both the cases. The reconstructive surgery was planned in both the cases to ensure early recovery from injury and return to normal milking. The cases

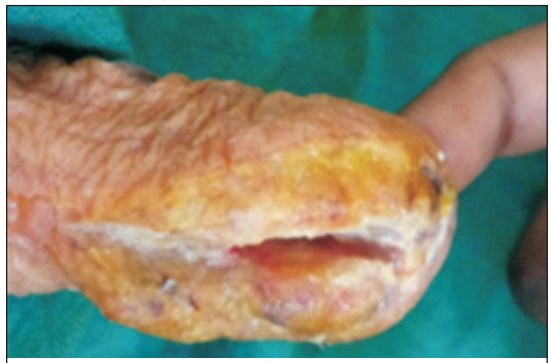

Fig 1: Teat fistula in a cow

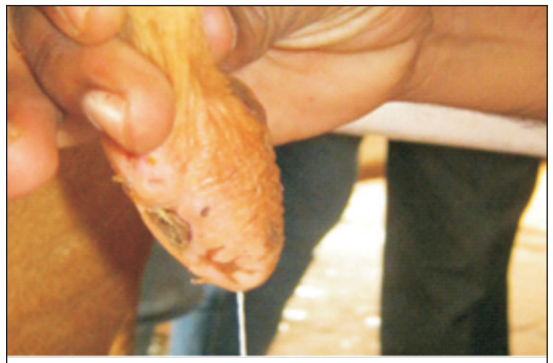

Fig 2: Repair of teat fistula full hand milking

were restrained in lateral recumbency under Xylazine sedation with the affected teat on upperside. The hind legs were tied together and extended backwards to expose the teat very clearly. Ring block was performed using lignocaine around 3-4 ml of 2% to desensitize the surgical area of the affected teat. A tourniquet was tied at the base of the teat to control haemorrhage and flow of milk through the teat cistern. The teats were cleaned with antiseptic solution using povidone iodine. The surgical site was surgically debrided carefully with caution to remove the devitalised tissue and the wound was freshened. A full length teat laceration in a buffalo was repaired using No.1-0 Mersilk in vertical mattress fashion for the apposition of the teat skin. Whereas, in teat fistula, the two layered suturing was performed using chromic catgut of No. 2-0 for inner layer and nylon of No.0.30mm suture for the teat skin. At the time of suturing the teat, siphon was kept inside the teat cistern to avoid the constriction of teat cistern. In first layer, the sub muscular layer was included in every bite without involving the mucosal layer but very close to it with interrupted vertical pattern to have eversion of sutured lines without stricture formation of mucosa and the bites were taken in such a manner to have the leak proof suturing. The patency was tested before suturing the second layer by hand milking. After the confirmation, the second layer was sutured with interrupted vertical mattress for teat skin. Post-operative antiseptic dressing with povidone iodine ointment and adhesive tape bandaging was put on the teat to prevent contamination of sutured site for initial three days. After three days, the bandage was removed and status of wound was assessed, dressed and rebandaged. After clear scar formation, the bandage was removed from the teat. Meloxicam injection was given parentrally for three days post-operatively. The antibiotic coverage was given for ten days using inj. Amoxicillin and Cloxacillin (3g per animal) parentrally and in addition the intra-mammary preparation of inj. Mammitel was infused into the affected teat every 12 hours interval to control the infection. Milk from the teat was milked out by using the teat siphon once in a day for seven to ten days post-operatively. The sutures were removed after scar formation on 12th day post-operatively. During the post-operative period, the self mutilation or injury due to calf suckling were prevented by regular monitoring of animals and antiseptic dipping of the teats in povidone iodine solutions till the recovery from the injury.

Result and Discussion

The surgical repair of teat injuries, lacerations and fistula should be performed with gentle handling of tissue (Aruljothi et al. 2012). Use of

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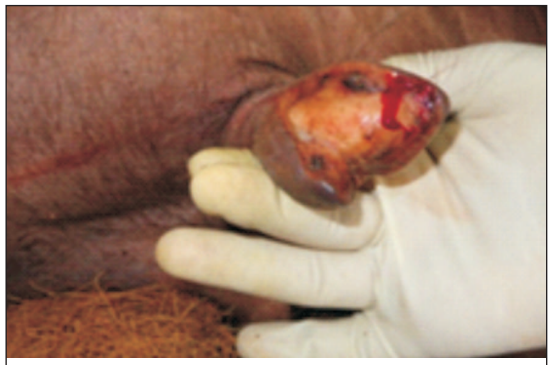

Fig 3: Full length teat laceration in a buffalo

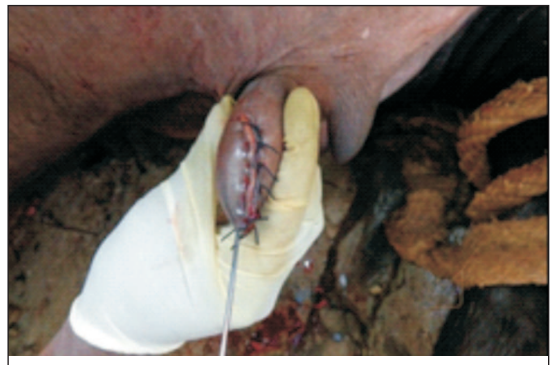

Fig 4: After repair of teat laceration

suitable suture material, instruments of smaller size with proper functional usage, suitable restraining, effective anaesthesia and analgesia and post-operative care with antibiotic coverage and hygienic condition of the wound are essential in getting the success in affections of teat and udder (Ducharm et al.1987, Schmit et al.1994 and Velavan et al. 2014). In this clinical study, all the above mentioned criteria were considered to get the desired outcome after surgery. The early presentation of cases for repair also accounted for faster healing without complications. However, in the present study, the cases presented even after forty eight hours after injury were repaired without complications. The complications are likely to be more in the cases presented with fibrotic wounds, necrosed and sloughed off wounds with very less healthy tissue (Ducharm et al.1987 and Velavan et al. 2014). In such cases repair leads to failures. Under such circumstances huge economic losses are incurred by the farmer. Makaday et al. (1991) observed that three layers suturing in lactating dairy animals with fine absorbable sutures gave good results. In this study, two layered suturing was performed using chromic catgut of No. 2-0 for inner layer and nylon No.0.30mm suture for the teat skin for teat fistula. Whereas, a full length teat laceration in a buffalo was repaired using No.1-0 Mersilk in vertical mattress fashion for the apposition of the teat skin.

The cases recovered very well without any complications. The fistula was successfully treated during the milking period.

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Postpartum recto-vaginal prolapse in a doe and its clinical management

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Abstract :

Successful clinical management of recto-vaginal prolapse in a doe is presented and discussed. The prolapsed mass was retracted into their respective orifices under caudal epidural anesthesia using 2.5 ml of 2% Lignocaine hydrochloride at sacro-coccygeal space. Preventive measure included application of the purse string sutures around the anal orifice and Buhner's suture through vulva. Post-operative management comprised of administration of antibiotic, anti-inflammatory drugs.

Keywords: Vaginal/rectal prolapse, doe, clinical management

Introduction :

Prolapse of recto-vagina is a disorder of ruminants occurring in late gestation or sometimes after parturition (Noakes et al., 2009). The incidence of parturition related disorders in caprine have been recorded to be about 38.80% (Purohit et al., 2006). Increase of estrogen and production of relax in that occurs during last trimester of pregnancy causes relaxation of pelvic ligaments and surrounding soft tissue structures (Wolfe, 2009). The contraction of relaxed tissue with increased intra-abdominal pressure due to pregnant uterus is considered main predisposing factor for prolapse of vagina and cervix (Kahn, 2005). In the present communication, successful clinical management of cervico-vaginal prolapse associated with rectal prolapse in a doe is discussed and placed on record.

Case history and observations :

A naturally bred non-descript three-year old pluriparous doe was presented with the history of severe straining, restlessness and round mass of vaginal and rectal mass protruding from the vulval cleft and anal orifice respectively, 48 hours after parturition without retention of placenta. Gynaecological examination of the animal revealed rectal and vaginal mass (Fig. 1). The rectum was prolapsed through the anal opening as a long tubular structure, moist and reddish in colour. Severe congestion and oedema of both the masses were noticed. The clinical examination revealed increased rectal temperature (103.5^{0}F), heart rate (104/minute), respiration rate (36/minute) and congested mucous membranes.

Obstetrical procedure :

Considering the severity and owner's agreement, restraint of the animal in lateral recumbency and obstetrical management was accomplished under caudal epidural anaesthesia using 2.5 ml of 2% Lignocaine hydrochloride (Xylocain, Astra IDL, Bangaluru) at sacro-coccygeal space. Oedematous and congested

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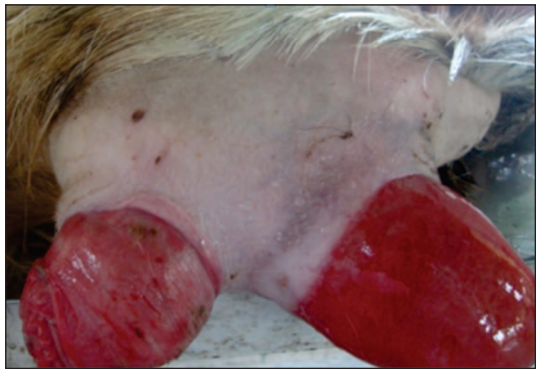

Fig.1: Post-partum recto-vaginal prolapse

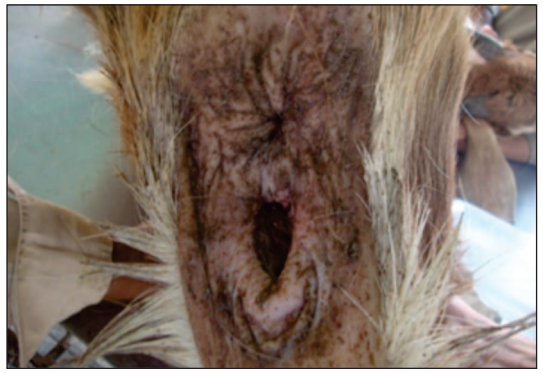

Fig. 2: Animal after reposition of prolapsed mass

masses were cleaned with the mild antiseptic solution of Potassium permanganate (1:1000), and ice cubes folded in a clean cloth were placed to reduce the oedema. The prolapsed mass was properly smeared with 2% Lignocaine jelly and attempt was made to reposition the mass into its normal anatomical position (Fig. 2) as per standard procedure (Roberts, 1971). To prevent recurrence of masses, application of the purse string sutures around the anal orifice and Buhner's suture through vulva was attempted. Animal was given parenteral therapy of injection Enrofloxacin (Floxidin, Intervet India Pvt Ltd, Pune) dosed at 2.5 mg /kg body weight, Meloxicam (Melonex, Intas Pharma, Ahmedabad) 2 ml, Tonophosphan (Intervet India Pvt Ltd, Pune) 2ml was given intramuscularly daily for three days and dressing with Povidone iodine (Betadine solution, Win Medicare, Mumbai, India) for 10 days was done. The sutures were removed after 7 days of treatment. The owner was advised to apply 2% Lignocaine jelly into the anal spincture and anterior vagina twice in a day to feed the laxative diet to the animal for at least 5 days.

Results and Discussion :

The animal showed good response to the management and recovered uneventfully after the completion of the treatment as the prolapsed did not recur. The cases of recto-vaginal prolapse are presented in both advanced pre-partum and immediate postpartum period. Prolapse occurs mainly after parturition when intra-abdominal pressure increases. The condition can be corrected with favourable prognosis, if management is initiated at early stage to avoid injury to prolapsed organs (Noakes et al., 2009). The favourable prognosis in present case could be due to timely management.

Cervico-vaginal prolapse has a hereditary tract and nutritional imbalance contributes to the occurence of vaginal prolapse (Kahn, 2005; Margaux, 2011). Especially poor quality high estrogenic content feeds and hypocalcemia have all been connected with this condition (Miesner and Anderson, 2008). The incidence of post-partum prolapse after 48 to 72 hours is rare (Roberts, 1971) and reported first time from this region.

Noakes et al. (2009) has reported that protruding tissue with their circulation impaired is prone to injury and infection. The resultant irritation causes expulsive straining efforts, thereby increasing the severity of prolapse. Thrombosis, ulceration and necrosis of prolapsed organ, accompanied by toxaemia and severe straining lead to anorexia, rapid deteoration in body condition and occasionally death. Enrofloxacin was given in the prevent case to prevent any infection that might occur during handling and suturing. Application of ice cubes caused softening of prolapsed mass and also moistened it, thus making manipulation and repositioning much easier. Epidural anaesthesia has been recommended to reduce straining and desensitize the perineum, thus providing easy and painless manipulation of prolapsed mass (Baltman et al., 2010).

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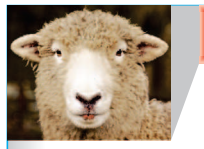

Small Ruminants Sector in India Threat to Development

***Peste des Petits Ruminants* (PPR)**

Pathogenesis

- By entering through ingestion or inhalation, PPR virus penetrates the retro-pharyngeal mucosa, sets up a viremia and subsequently specifically damages alimentary, respiratory and lymphoid systems. Infected cells undergo necrosis and in respiratory system, they may even proliferate. Death is due to severe diarrhoea and dehydration, before the respiratory lesions become severe. The death may be hastened by concurrent diseases like pneumonia, pasteurellosis, coccidiosis and coliform enteritis.

- Lymphoid necrosis, though present, it is not as marked as in Rinderpest. The immuno-suppression due to lymphoid involvement is not marked as most of the affected sheep and few adult goats may recover.

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Bovine Mastitis due to Yeast

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Abstract

Bovine mastitis is the inflammation of udder, a multifactorial disease involving inter-relationships between the host, the environment and infectious agents. A wide variety of microorganisms have been implicated as causative agent including many species of bacteria, fungi and algae. Antibiotic therapy, without identifying the mastitis causing organisms, is frequently the veterinarians' and dairy farmers' first choice of treatment of infected cows. The present report documents a case of subclinical mastitis in a crossbred cow in its third lactation, with a history of protracted mastitis despite the administration of intra-mammary antibiotics and hydrocortisone preparations. *Candida species* of fungi was isolated upon examination of milk sample in the laboratory.

Key words: Mastitis, crossbred cow, *Candida species*

Introduction:

Mastitis in dairy cattle is an inflammatory reaction of the udder. Infection of the mammary gland is the most common and most costly disease in the dairy industry. The symptoms of mastitis include abnormalities such as a watery appearance of milk, flakes, clots or pus in the milk (H. Krukowski 2001, Costa et al. 19998). Mastitis leads to a decline in potassium, lactoferrin, and casein content in milk. Because calcium in milk is associated with casein, the disruption of casein synthesis contributes to lower levels of calcium in milk. Milk from cows with mastitis also has a higher somatic cell count which lowers the quality of milk. Mastitis occurs when leucocytes are released into the mammary gland, usually in response to invasion by microorganisms through the teat canal. This disease can be identified by external symptoms such as swelling, heat, redness, hardness or painfulness of the udder.

Mastitis in CB cow

Next to bacteria, yeast are the common cause of mastitis. Yeasts are found in moist places that are rich in organic matter, and are easily isolated from teats and milking equipment (Gonzalez 1996)). The incidence of mastitis due to yeast is usually low in dairy herds and outbreaks are occasionally reported. Although the majority of the cases are mild, some intra-mammary infections may result in death of the affected animals (Tucker 1954)).

Case history and clinical findings:

A crossbred cattle aged 8 years was presented to Teaching Veterinary Clinical Complex, Veterinary College Hassan, with a history of subclinical mastitis. As the animal was newly purchased, the owner was unable to give clear history of the animal. The animal was in the third lactation and clinically revealed high temperature (104^0 F). The milk samples collected aseptically from all four quarters was watery with small thick flakes. Initially sample was subjected to CMT test. Further to isolate the causative agent, the sample was streaked on to Macconkey agar and Sabouraud dextrose agar, supplemented with chloramphenicol (0.4g/L) at 37°C for 24–72 hours. Individual colony obtained on the SDA agar were transferred to BIGGY agar for presumptive identification of organism.

Through CMT, milk samples were found positive for mastitis. Upon grams stain and Lacto phenol cotton blue stain, organisms took dark blue color (Fig. 1). The colonies on the plate appeared opaque, white and smooth with creamy texture. The microscopic smear showed oval to round budding blastospores suggesting *Candida spp*.

As soon as the fungal etiology of the outbreak was established, specific treatment with nystatin (25 mg), sulfadiazine (500 mg) and prednisolone (5 mg), two times daily, for a period of seven consecutive days was recommended. However owner did not present animal for treatment next day so future course was not traced out.

Discussion

Outbreak of fungal mastitis have been frequently reported from different countries like Egypt, Poland (Kaszak et al 2012), Denmark (Santos et al 2005), Italy, brazil (COSTA 2012). Even in India, the incidence of yeast mastitis has been repoted from places like Himachal Pradesh (Chahota et al 2001), Mathura (Pachauri et al 2013), Orissa (Misra and Pande 1986) Hissar, Tamil nadu and Kerala (Sukumar and James 2012). Fungal incidence in the present case may be attributed to unhygienic conditions of the animal sheds, high humidity along with favorable ambient temperature and development of antibiotic resistance in the bacteria which prolongs the course of treatment favoring chances for the fungal growth. However a prevalence study is required to know the status of disease and treatment with antifungal antibiotics.

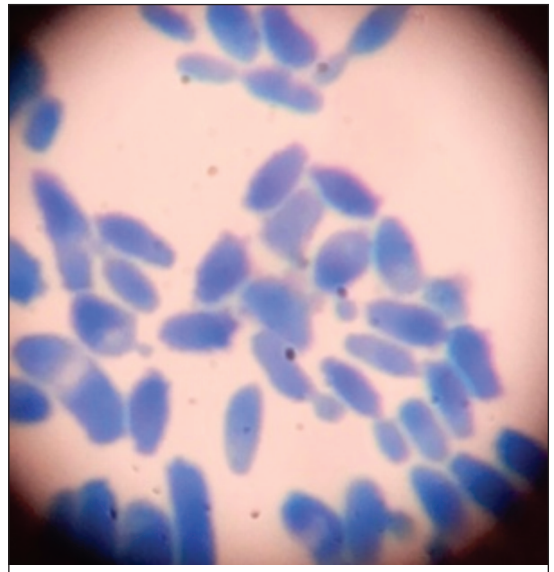

Fig 1: *Candida spp* in the mastitic milk

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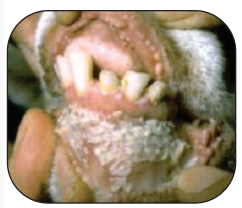
Small Ruminants Sector in India Threat to Development

***Peste des Petits Ruminants* (PPR)**

Clinical Signs

- The PPR can be seen in acute or sub-acute forms.
- Acute form seen mainly in goats 3-6 days after being in contact with the infected animals.
- High fever (above 40^{0}C) accompanied with dullness, sneezing and serous discharge from nose and eyes.

- Discrete necrotic lesions develop in the mouth and extend over the entire oral mucosa, forming diphtheric pleques. Profound halitosis and inability to eat due to sore mouth and swollen lips.



- Nasal and ocular discharges become more purulent, exudate dries up, matting the eyelids and occluding the nares.

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Successful chemotherapy of canine transmissible venereal tumour (CTVT) in a Great Dane male

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(received 12/10/2015 - accepted 15/12/2015)

Abstract

A Great Dane dog (3 years) with the history of abnormal growth over penis and prepuce since few weeks was diagnosed and confirmed by fine needle aspiration cytology (FNAC) and impression smear cytology to have CTVT. Since the growth was limited, vincristine sulphate @ 0.025 mg/Kg body weight along with pheniramine maleate @ 1ml intramuscular and routine dressing of wound with Povidone iodine was attempted. Three consecutive weekly injections of vincristine yielded good results with a complete regression within 21 days.

Keywords : CTVT, Vincristine, FNAC

Introduction

Canine transmissible venereal tumour (CTVT) is the tumor of external genitalia in dogs including other canids, primarily due to transfer of living cancer cells between dogs during mating or sometimes due to biting, sniffing, licking and scratching of affected areas (Cohen, 1985; Dominguez-Tejerina et al., 1996). The history of this cancer has long been published in Veterinary literature since 200 years back (Blaine, 1810) but transmissible nature of CTVT was first documented in the year 1876 by the Russian scientist Nowinsky (Nowinsky,1876). Experimental transplantation studies (Stubbs and Furth, 1934; Karlson and Mann, 1952; Kudo, 1974) indicated that the living tumour cells are the true infectious agents and can therefore be thought of as a 'new parasitic dog species' on its own. Strakova and Murchison (2014) reported that at least ninety countries worldwide are endemic to CTVT across all inhabited continents and its distribution is linked to the presence of free-roaming dog. In the recent decade, CTVT is known with several other names like transmissible venereal tumor (TVT), sticker's tumors, infectious sarcoma, transplantation sarcoma, infective venereal tumor and histiosarcoma (Stimmelmayr, 2010). Although CTVT affects the external genitalia due to their mode of transmission, some of the cases of tumor were also reported in eyes, skin and nose either with or without genital involvement (Stimmelmayr, 2010). Dogs of any breed, age or sex are susceptible (Betamuzi, 1992), however high rate of CTVT is common in females because infected males often mate with several bitches during oestrus in both kennels and free range. Still, there are no documentary evidences available that explains the heritable breed related prevalence of this tumor (Betamuzi, 1992). CTVT metastasis has mostly been described in adult male dogs,

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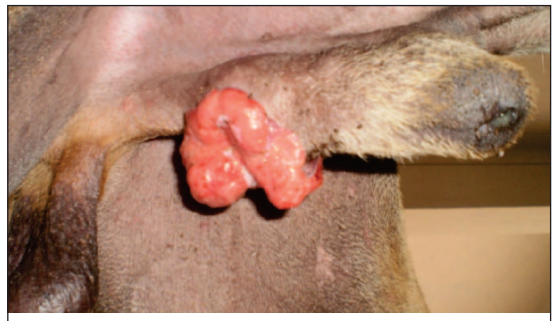

Fig. 1: A pinkish cauliflower like CTVT growth over the glance penis and prepuce in a Great Dane

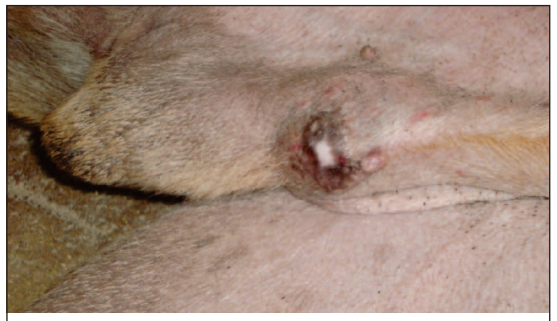

Fig. 2: Reduction of abnormal growth of CTVT after the chemotherapy

immunosuppressed and dogs in poor condition (Higgins, 1966; Pandey et al., 1989). In the male dog, the tumour is usually located on the caudal part of the penis, from the crura to bulbis glandis or the area of the glans penis, and occasionally on the prepuce (Karlson and Mann, 1952). Clinical signs of CTVT vary according to the localization of tumors and dogs with genital localization have a haemorrhagic discharge. The treatment approach mainly involves surgery, radiotherapy, immunotherapy, biotherapy and chemotherapy for CTVT (Martins et al., 2005). This study narrates the successful chemotherapy of canine veneral tumour (CTVT) in a 3 year old Great Dane.

History and Clinical Diagnosis

A 3 years old Great Dane male dog was presented to clinics, College of Veterinary Science, Tirupathi with a history of abnormal growth over penis and prepuce since few weeks. Upon clinical examination, a pinkish cauliflower like growth was noticed involving penis and prepuce. A tentative diagnosis of CTVT was made and confirmed by fine needle aspiration cytology (FNAC) and impression smear cytology. CTVT is a round cell tumor that may be closely similar to mast cell tumor which make it difficult to differentiate. It can be differentiated on the basis of vacuolation of cytoplasm as a persistant finding in mast cell tumors. Such clinical approach for diagnosis of typical CTVT in exfoliated cells by physical examination and cytological finding were earlier been validated by several clinicians (Lombard et al., 1968; Richardson, 1981).

Treatment

Since the growth was limited, chemotherapy with vincristine sulphate (Vincristine ®, Biochem) as a choice of drug for CTVT was decided. (Calvet et al., 1982). @ 0.025 mg/Kg body weight of animal. Calculated dose was mixed with 5 ml of distilled water and given strictly intravenous. One ml of distilled water was infused, prior and after drug administration. A treatment schedule of one injection per week for three weeks was followed. Later one more dose was given on 21st day as the growth was still persisting. In addition, pheniramine maleate (Avil Vet ®, Intervet SPAH) injection @ 1 ml total dose intramuscularly was given every time to counteract any allergic reaction due to the drug. Routine dressing of growth was done with povidone iodine (Betadine ®, Win-Medicare) solution.

Results and Discussion

The effect of chemotherapy was reflected in the reduction of abnormal growth over the glance penis and prepuce. Vincristine act by inhibiting mitosis, it forms bond with tubulin and prevent formation of mitotic spindles. Despite of various complications like gastrointestinal and neurological symptoms, weight loss, anemia etc., monochemotherapy with weekly injections of vincristine till complete clinical regression is considered to be effective and less toxic than other treatments (Nak et al; 2005). Three consecutive injections of vincristine yield good result in both males and females with a complete regression within 21 days (Khan et al., 2009). Similar effect has been seen in the present case with four doses and complete regression in one month. Similar results have been reported by other clinicians (Das et al., 1989; Bal Krishnan, 1997).

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Therapeutic management of Hemorrhagic Septicaemia in dairy animals – A clinical study

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Abstract

Clinical findings and successful treatment of haemorrhagic septicaemia in dairy animals viz. cattle and buffaloes, with the history of swelling on throat region, profuse salivation, lachrymation, mucopurulent nasal discharge, severe diarrhoea, high rise of body temperature and anorexia have been described. Blood picture showed bipolar organisms. The animals were treated with antibiotics ceftiofur sodium and sulphadimidine+trimethoprim combination along with supportive therapy. The animals recovered after 3 to 4 days of treatment.

Key words: Dairy animals; bipolar organisms; ceftiofur sodium, Sulphadimidime + trimethoprim

Introduction

Heamorrhagic septicemia (HS) is an acute infectious disease of cattle, buffaloes, sheep and goats, caused by *Pasteurella multocida* serotype B (*P. multocida*). The disease occurs mainly during rainy season, particularly in early monsoon. It spreads rapidly among herds, causing morbidity and mortality between 50% to 100%. Immunization against infectious agent is the only available tool in prevention and control of the disease. Multivalent vaccines are used annually in the endemic area. In spite of annual vaccination, the outbreaks of disease are recorded every year. This may be due to improper vaccination and low potency vaccine usage. Since this organism produces endotoxins, all manifestations of the disease are due to these endotoxins (Horadagoda et al., 2001). As endotoxins are associated with the effects on central circulation which lead to hypovolaemia, Administration of fluids are recommended for the early compensation of the circulation to increase the survival rate (Rivers et al., 2001), in addition to antibiotics.

Various drugs have been used effectively for the treatment of HS in the field confirming Ceftiofur sodium and sulphadimidine+trimethoprim combination as a drug of choice.

History and Laboratory findings

The blood samples, using EDTA as anticoagulant from dairy animals were brought to the laboratory with the history of high fever (105-106°F), swelling on throat region, profuse salivation, lachrymation, mucopurulent nasal discharge (Fig. 1), severe diarrhoea and anorexia. Visible mucus membranes assumed deep red color and animals were dull depressed with

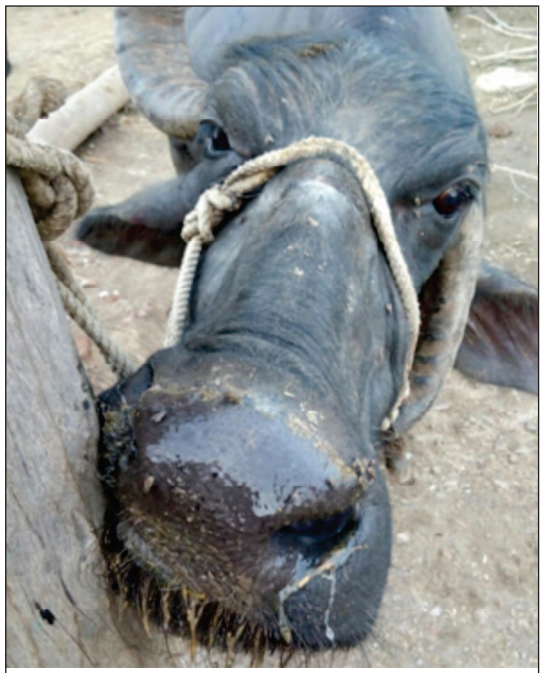

Fig. 1 : Profuse salivation, lacrimation and muco-purulent nasal discharge

increased vesicular moist rales and decreased and difficult breathing. Decreased level of haemoglobin concentration was observed in all the animals suffering from HS. Values of haematocrit were also decreased than its normal values during the course of disease. Examination of blood smears stained by Wright's stain showed bipolar organisms (Fig. 2).

Treatment and Discussion

The treatment started with Inj. Ceftiofur sodium (Tefrocef) 1gm I/m, Inj. sulphadimidine + trimethoprim (Biotrim), Inj. Meloxicam plus 20 ml, Inj. Chlorpheneramine maleate (Anistamin) 15 ml, Inj. Frusemide (Ridema) 10 ml Inj. Normal Saline 2 lit. I/v, Inj. Liver extract+ B complex (Tribivet) 10 ml, for 4 days s.i.d. Inj. Ridema was given single shot to reduce swelling. The clinical signs disappeared within three days of treatment. Blood smear examination after three days revealed complete absence of bipolar organisms. The efficacy of the therapy was judged on the basis of clinical recovery and absence of Gram negative bipolar organisms in blood smears.

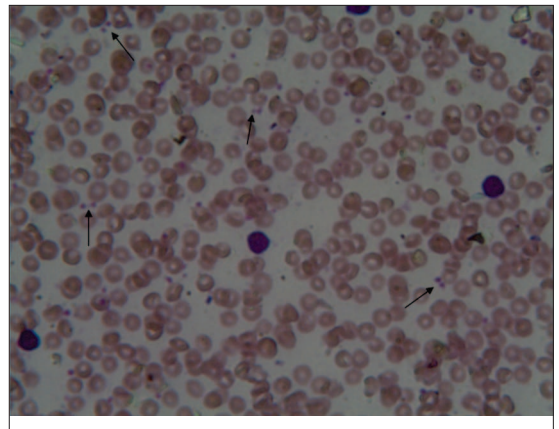

Fig.2 Microphotograph of blood smear showing bipolar organisms stained by Wright's stain

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Urea poisoning in a dog and its therapeutic management

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Abstract

Severe poisoning with urea and its treatment in nineteen months old German Shepherd male dog is reported. The clinical symptoms observed were high temperature, tachypnoea, tachycardia and profuse salivation. Treatment included oral vinegar and atropine sulphate intramuscularly.

Key Words: Urea poisoning, Dog, vinegar

Introduction:

Periodical manuring with urea fertilizers is a common practice in well-organized farms and gardens. Due to the narrow margin of safety and slight carelessness in application of urea (a bio-pesticide) severe poisoning in animals has been recorded. The present article records the poisoning encountered in a dog due to accidental ingestion of urea and its therapeutic management.

Case history and clinical observations:

A German shepherd dog, aged nineteen months, weighing about 26 kg was referred for treatment with a history of having accidental ingestion of urea 8 hours earlier. Physical examination of the dog revealed high-rise of temperature (107.90F), tachypnoea (160/minutes), tachycardia (140/minutes), and profuse salivation with protruding tongue, bluish conjunctival mucous membrane, twitching of frontal and temporal muscle, staggering gait, tenesmus, and general muscular weakness with lethargy. The dog was given 2% Acetic acid (Vinegar) 20 ml T.I.D orally for 3 days and Atropine Sulphate at the dose rate of 0.04mg/kg body weight intramuscularly. 500 ml of Dextrose (5%) with normal saline (Wockhardt) was administered intravenously

Profuse salivation with protruding tongue

along with injection Calmpose (Ranbaxy comp.) at the dose rate of 0.5mg/kg body weight. Injection Belamyl (Sarabai Ltf.,Baroda) 3 ml intramuscularly for 3 days was also given. After 3 days, the dog recovered uneventfully.

Results and Discussion:

On the basis of history, clinical observation and physical examination, the urea poisoning in the dog was suspected. Similar findings were also observed by Anon (1953) in cattle. Urea being an ammoniacal substance, gets accumulated in fat deposits and its sudden mobilization may result in liberation of the compound into the blood stream when ingested by an animal. In the present case, toxic effects of urea poisoning were corrected by administration of 2% acetic acid as reported by Abonyi et al., (1958) in cattle. DNS 5% through intravenous route to enhance diuresis as advocated by Radostits et al., (1994) was administered.

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Cesarean operation to reduce pre-pubic hernia in pregnant ewes

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(received 08/10/2015 - accepted 15/12/2015)

Abstract:

Clinical studies were conducted in two crossbred ewes with a history of trauma due to automobile accident in ventral abdominal area, restlessness, refusal of lying down and difficulty in the normal gait for the last 5-25 days. In both the cases swelling first appeared in front of the udder, which got stretched and progressed cranially. The clinico-physical examination revealed that ewes were in terminal stage of pregnancy, near to full term with live foetuses. The condition was suggestive of prepubic hernia due to traumatic rupture of prepubic tendon. Caesarean operation was attempted in the present cases successfully to deliver the foetus.

Keywords: Prepubic hernia, Caesarean operation, Prepubic tendon rupture, Ewes.

Introduction

Prepubic hernia is a traumatic hernia resulting due to rupture of prepubic tendon in small animals and is often associated with severe trauma to the caudal abdomen, dog fights and kicks by large animals (Beittenmiller et al., 2009). The prepubic tendon, also called the cranial pubic ligament is defined as "a strong squared fibrous blade attached to the cranial border of the pubic bones, from one iliopubic eminence to the other and as a complex structure, it extends directly the linea alba and the tendons of recti abdominis muscles, and receives part of the aponeurotic fibers of the symmetrical abdominal oblique and transverse abdominal muscles. Besides, it maintains connections, important in ungulates, with the origin of some muscles of the thigh, such as the pectineus and gracilis" (Barone, 2006). The increased weight of the gravid uterus, trauma, twins, hydrops of the fetal membranes and fetal giants are predisposing factors and because of a transverse rupture of the prepubic tendon, the gravid uterus drops downward into a sac formed by the skin and cutaneous muscles (Purohit, 2012). Pre-pubic tendon rupture is seen fairly often in horses, but rarely in sheep. The rupture of prepubic tendon makes lambing more difficult than normal, primarily because the force of contractions of the uterine musculature alone is not sufficient to expel the fetus or feti, and secondarily the sagging of the abdominal floor changes the relationship between the plane of the axis of the uterus to that of the pelvic cavity and with degeneration of the abdominal floor, regeneration is rare which makes prognosis generally poor (Smeak, 1998; Tyagi and Singh, 1993). In this communication, acquired prepubic hernia due to prepubic tendon rupture in pregnant ewes and its surgical management has been reported.

Case History :

Two crossbred ewes, aged 3-5 years and weighing between 32-49 kg were presented with the history of trauma due to automobile accident in ventral abdominal area, restlessness, refusal of lying down, difficulty in normal gait and unknown pregnancy for the last 5-25 days. The ewes were dehydrated and emaciated. In both the cases, swelling first appeared in front of the udder, which got stretched and progressed cranially. The downward ventral abdominal swelling ranging from 13- 18 inches, 8-11 inches, and 9-12 inches in length, breadth and circumference respectively on both sides but with the left side of the abdomen more pendulous than the right, causing difficulty in the locomotion of animals (Fig. 1 and 2). The clinico-physical examination revealed that ewes were in terminal stage of pregnancy, near to full term, with live foetuses. To correct the prepubic hernia due to traumatic rupture of prepubic tendon, an emergency surgical intervention was planned.

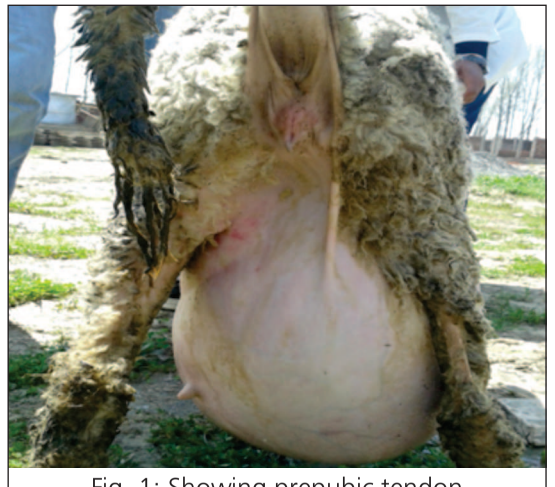

Fig. 1: Showing prepubic tendon rupture in a 5 year old ewe (caudal view)

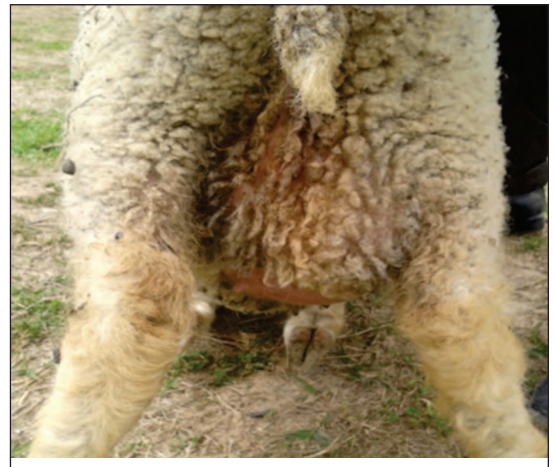

Fig 2: Showing prepubic tendon rupture in a 3 year ewe (caudal view)

Surgical management

The animals were given injection ceftriaxone (Intacef, Intas Pharma, Ahmedabad) @ 10mg/kg, IM and meloxicam (Melonex, Intas Pharma, Ahmedabad) @ 0.5mg/kg, intravenously administered 30 minutes prior to premedication. The animals were administered diazepam hydrochloride @ 0.5 mg/kg body weight intramuscularly and intravenous fluid (5% dextrose with normal saline) 500 ml was given. Five minutes later, lumbosacral epidural anaesthesia was induced using 2% lignocaine hydrochloride (Astra IDL, Bangaluru) at the rate of 4.6 mg/kg. The animals were positioned in dorsal recumbency, the cutaneous area surrounding the abdominal enlargement was prepared for aseptic surgery, a ventral midline abdominal incision was made from the xiphoid to the pubis, and extended through skin and subcutaneous tissues. The uterus was exteriorised and incised in relatively avascular site. The single live foetuses (male and female) with weight between 2.5kg and 2.8 kg were recovered from the ewes. The uterine mass was

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lavaged with copious volume of the warm normal saline and 2 boli of Furea bolus (Pfizer Company, Mumbai) and bleeding points ligated using No. 2-0 chromic catgut. The uterus was sutured with chromic catgut No.2-0 by cushing's followed by lamberts inversion suture pattern. The linea alba was incised from the cranial extent of the skin incision to the site of the tendon rupture. The linea alba was closed by using Polyglactin 910 No. 1 in simple interrupted pattern. The peritoneum was closed using No. 1 chromic catgut in a simple continuous pattern. Abdominal muscles were apposed using No. 2 chromic catgut in a continuous pattern. Excess skin of the sac was removed and then closed using Black braided silk No.1 in a horizontal mattress pattern. However, during the skin suturing, condition of one of the ewes aged 5 years deteriorated as it had complete degenerative changes in the rupture of prepubic tendon, succumbed later on. Postoperatively, ceftriaxone (Intacef, Intas Pharma, Ahmedabad) @ 10mg/kg, twice in a day and meloxicam (Melonex, Intas Pharma, Ahmedabad) @ 0.5mg/kg, once in a day intramuscularly were prescribed for five and three days respectively. Antiseptic dressing using 5% Povidone iodine (Betadine, Win-Medicare, Bangaluru) was continued twice daily till suture removal on day 12th. One ewe recovered uneventfully and was normal up to the last examination 6 month later.

Results and Discussion

In the present cases, automobile accident trauma to the abdomen has caused prepubic tendon rupture which led to prepubic hernia. Similar observations have earlier been reported by Waldron et al., (1986) and Shaw et al., (2003) in small animals. In the present study, pre-pubic tendon rupture occurred during terminal stage of gestation with extra heavy foetus, made use prone to prepubic hernia (Huso, 1941).

In pregnant ewes, with a prepubic tendon rupture, Caesarean section is suggested to save the progeny as the delay in surgery increases complications (Aleem et al, 2010; Purohit, 2012). Old pregnant ewe with a prepubic tendon rupture resulting in prepubic hernia few days before the lambing date even with intensive care do not deliver normally and the condition deteriorates when caesarean section is delayed.

Surgical intervention (caesarean section) is the only technique of choice which was attempted in the present cases successfully to deliver the foetus.

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Practical approach to antibacterial therapy of Mastitis

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Abstract:

The treatment of mastitis is a matter of great concern, not only for the dairy animal owner, but even for a Veterinarian who deals with the affected animals. The response to the treatment depends upon multiple factors like the severity of mastitis (subacute, acute, chronic), immune-status of the animal involved, duration of the disease, and most importantly, the choice of the antibiotic. This paper overviews the treatment of mastitis in a holistic manner, considering all the aspects of mastitis mentioned above.

Keywords: Mastitis, Subacute, acute, chronic, intra-mammory therapy, parenteral administration

Introduction:

The response to the treatment of clinical mastitis in cattle is influenced by a variety of factors, including the effectiveness of the cow's immune response, the severity of mastitis at the onset of treatment, the duration of infection at the onset of treatment, the causative pathogen, and the drug regimens and ancillary measures used. Drugs must be used in appropriate doses, by appropriate routes, at an appropriate frequency, and for an adequate duration to achieve the desired outcome. The antibiotic treatment is most likely to be effective if initiated early in the course of clinical mastitis. Delaying treatment for several days allows potentially susceptible pathogens, such as *Streptococcus uberis* and *Staphylococcus aureus*, to become well established and evade treatment and host defenses. The practical approach to treat mastitis as dealt with in details below shall help the Veterinarian in selecting an appropriate antibiotic, its route and duration of administration.

The spectrum of activity is to be considered first. Antimicrobial susceptibility test results can not be relied upon always for drug selection, as the cut-points used for most antibiotics are based on serum or interstitial fluid concentrations in humans after oral or intravenous dosing and cannot be assumed to be relevant to the treatment of mastitis. The targeted compartment (milk, mammary tissue, blood) should be considered when choosing an antibiotic treatment regimen. In streptococcal mastitis, organisms reside mainly in the milk compartment and intramammary antibiotic therapy is appropriate; there is little benefit to using parenteral antibiotics.On the other hand, cows with severe coliform mastitis are often bacteremic, and parenteral antibiotic administration may improve the outcome.

Intramammary route

The most common route of administration of antimicrobials in mastitis is the intramammary (IMM) route.

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- The advantages of this route are high concentrations of antibiotics achieved in the milk compartment of the mammary gland and low consumption of the antimicrobial substances as the drug is administered straight to the infection site.
- Disadvantages could be the uneven distribution of many antibiotics throughout the udder, risk for contamination when infusing the drug via the teat canal, and possible irritation of the mammary tissue caused by the drug . In addition, some in vitro studies have shown that antibiotics may disturb phagocytosis when given Intra-mammarily. Numerous intra-mammary products have appeared in market, but, without supportive sufficient scientific data on their efficacy.
- All of the drugs currently available as intramammary preparations are time dependent antimicrobials and hence need to be administered at periodic regular intervals (8-12 hours). Extending the duration of therapy is expected to be more effective than giving a higher dose at each treatment without extending the duration.
- Intra-mammary preparations with combinations of two or even three antibiotics were introduced to mastitis therapy due to suggested synergistic action and to cover all pathogens, gram-negative bacteria included. However, the fixed combinations have shown no superiority over single components in controlled clinical trials.
- Broad-spectrum intra-mammaries such as 3rd or 4th generation cephalosporins may enhance emergence of wide-spectrum beta-lactamase production among bacteria because, they are less efficient than narrow spectrum preparations against gram-positive mastitis pathogens, as they are more targeted towards gram-negative bacteria .

Parenteral route

A novel approach always has been to apply parenteral (systemic) administration as an adjunct to intra-mammary therapy.

- Systemic use of anti-microbials has been successful for increasing cure rates for chronic *S. aureus* intra-mammary infections in dry cows and lactating cows with anti-microbials such as fluorquinolones, macrolides, and tetracyclines which were selected as good pharmaco-kinetic candidates because of good volume of distribution (lipophilic), relatively long half-life, and high bio-availability (low serum protein binding).
- Because of a high degree of resistance to anti-microbials in commercial intra-mammary products, systemic antimicrobial therapy for the treatment of acute gram-negative mastitis has been attempted.
- It could be interpreted on the basis of pharmaco-kinetics, that intra-mammry route is preferred in subclinical, chronic and mild clinical mastitis, whereas, in acute clinical mastitis with swollen parenchyma and inflamed, blocked milk duct system, parenteral route is preferred together with Intra-mammary route.

ANTIBACTERIAL AGENTS

The antibacterials approved for bovine mastitis treatment include: pirlimycin, hetacillin, cloxacillin, amoxicillin, novobiocin, penicillin G, dihydrostreptomycin, cephapirin, erythromycin, novobiocin, and sulfa preparations.

Other agents used on extralabel use are : fluoroquinolones, penicillins, aminopenicillins, cephalosporins, chloramphenicol tetracyclines, aminoglycosides and macrolides.

- Milk antibiotic concentrations after systemic treatment are highest for macrolides, fluoroquinolones and trimethoprim and lowest for beta-lactams (penicillins and cephalosporins) and aminoglycosides (eg: gentamicin, amikacin).
- The use of fluoroquinolones (eg: . ciprofloxacin, moxifloxacin, orbifloxacin, difloxacin or enrofloxacin) and tetracyclines is better avoided in animals that are still nursing young ones as these antibiotics can be harmful to the growing animal
- Macrolides (eg: erythromycin), florfenicol, oxytetracycline, some fluoroquinolones and rifampin have good distribution to the udder following systemic administration.
- Sulfa drugs, penicillin G, ampicillin, ticarcillin and cephalosporins have intermediate or limited distribution following systemic administration.
- Ceftiofur, aminoglycosides, spectinomycin, colistin and polymixin B have poor distribution to the udder on systemic use.
- The dosage of beta- lactam drugs, but not the aminoglycosides may be greatly increased without the fear of toxicity to force a higher blood/mammary concentration gradient.
- Third generation cephalosporins (eg: cefotaxime, ceftriaxone, cefixime, ceftazidime, ceftizoxime, cefoperazone etc) though have high antibacterial activity against gram negative organisms, are less effective than 1st (eg: cephapirin, cefadroxil etc) and 2nd generation (eg: cefaclor, cefuroxime axetil, cefprozil, cefuroxime etc) cephalosporins against gram positive bacteria.
- Third generation cephalosporins have moderate activity against gram positive bacteria and are inferior in activity against staphylococci, thus are not to be preferred as the first choice antimicrobial agents in routine mastitis cases as the continuous use of these wide spectrum antibiotics may lead to enhanced development of resistance by the organisms; resulting in failure of therapy.

Cephapirin: A first -generation cephalosporin that has a wide spectrum of activity against gram positive and moderate activity against gram-negative organisms; cephapirin is more resistant to beta-lactamases than are the penicillins and is indicated (300mg/quarter, b.i.d) in the treatment of mastitis caused by susceptible bacteria, such as *Staphylococcus aureus* and *Streptococcus agalactiae*. However, cows with acute or peracute mastitis are often given other medications, such as systemic antibiotics and/or supportive therapy, concurrently with intra-mammary therapy.

Ceftiofur: Intramuscular administration of ceftiofur, a structural analog of cefotaxime, significantly reduces the bacteremia associated with coliform mastitis, though may not completely eliminate the udder infection.

Cefquinome: 1 mg/kg, IM, q24h (intramammary preparation in India) has proved to be more efficacious compared to ampicillin, amoxicillin-clavulanic acid, tetracycline treatment.

Tilmicosin: is a macrolide closely related to tylosin, is a narrow spectrum (gram positive) antibiotic, administered intra-mammarily (300mg) and is effective in staphylococcal and streptococcal infections.

Pirlimycin: a lincosamide antibiotic, active only against gram positive bacteria, is effective in eliminating pre-partum infections; not effective against coliforms.

Erythromycin is active primarily against gram positive bacteria, such as *Staphylococcus aureus* and *Streptococcus agalactiae*, *Strep. dysgalactiae* species, including penicillin resistant ones.

Intra-mammary therapy (300mg/quarter,bid-lactating animals; 600mg/quarter, b.i.d –non-lactating animals) alone is indicated only in the

treatment of subacute or subclinical mastitis manifested by mild changes in the milk or udder. Cows with acute or per-acute mastitis, should be administered systemic antibiotics and supportive therapy.

Amoxicillin and clavulanic acid (potassium clavulanate) is effective against beta-lactamase producing *Escherichia coli*, *Klebsiella spp.*, *Neisseria spp*. The combination has a spectrum of activity similar to that of a first or second generation cephalosporin. Amoxicillin-clavulanic acid injection is not compatible with and should not be reconstituted or mixed with dextrose solution or sodium bicarbonate solution for injection and also it should not be mixed with any other medication. Although amoxicillin and clavulanate potassium may also be effective against non-beta lactamase producing organisms, susceptible to amoxicillin alone, the combination drug should be reserved for use in the treatment of infections caused by or suspected of being caused by beta-lactamase producing organisms when amoxicillin alone would be ineffective.

THERAPY STRATEGIES

- The mastitic cows have lower concentrations of antioxidants viz: vitamin E, selenium, vitamin A, vitamin C and the minerals: zinc and copper, which are essential for maintaining and protecting udder health.
- Anti-oxidant supplementation of dietary rations improves anti-bacterial function of neutrophils and decreases incidence and severity of clinical mastitis
- The most effective therapeutic method for treating intra-mammary infections may be via systemic administration of antibiotic combined with intra-mammary infusion.
- Combination of multiple intramuscular injections with intra-mammary infusions over a three-day period results in highest tissue antibiotic concentrations.

Subacute clinical mastitis

- Intra-mammary infusion with an approved product for a minimum of three days, accompanied by frequent hand stripping to remove secretion and debris, is often adequate.
- Treatments should be continued until at least 24 hours after the disappearance of clinical symptoms.
- Otherwise, the infection may only be suppressed back to the subclinical level.
- A true cure, whereby all infecting microorganisms are eliminated from the affected quarter, occurs in only 10 to 50% of cases. The cure rate is dependent on how long the infection has been present, age of the cow, type of organism involved, and other factors.

Acute mastitis

Acute or systemic mastitis is most often caused by coliform and other gram-negative organisms. However, numerous other pathogens including gram-positive cocci and mycotic organisms can all result in severe mastitis.

The treatment recommended for coliform mastitis can be as follows.

- Suggested therapeutic regimens for coliform mastitis include anti-microbials, supportive fluids, stripping out of infected quarters, anti-inflammatory agents, glucose, bicarbonate, and calcium. However, the efficacy of therapy, particularly for anti-microbials, is unproven

  Anti-microbials such as aminoglycosides and cephalosporins , that have a high proportion of bacterial isolates susceptible in vitro , are often selected for use
- Typically, intra-mammary therapy to inhibit gram-positive growth in addition to parenteral (systemic) anti-microbials that have broad spectrum of activity are administered.

- Macrolides such as erythromycin and tilmicosin are not effective against coliform bacteria.
- Penicillin, oxytetracycline (IV), ceftiofur, cephapirin and florfenicol offer some choices, although penicillin and ceftiofur do not penetrate udder tissue well.
- The efficacy of systemic ceftiofur as a treatment of clinical mastitis remains unproven and caution should be exercised in continuing antimicrobial therapy in cows with grossly abnormal milk, but with improved appetite, attitude, and milk production.
- Milking out the affected quarter every 2 -3 hours; oxytocin may be used to facilitate milk evacuation and remove toxic materials and debris; based on the fact that many mild cases of clinical mastitis are self-limiting and that the animals own defense mechanisms can successfully clear the infection. However the oxytocin treated cows may have more relapses and additional infections due to environmental streptococci.
- Corticosteroids are recommended only in per-acute toxic cases, but should never be used in other mastitis cases.
- Aqueous dexamethasone sodium sulfate, a single dose one time treatment is recommended and high dose or continued treatment is contraindicated. They suppress the natural defense mechanisms of the cow and administration during the last three months of pregnancy may also induce premature calving, followed by retained placenta and infection of the uterus.
- They do, however, aid in reducing swelling and pain and enhance the removal of toxic secretions as well as promote better diffusion of intra-mammary infusions
- Non-steroidal anti-inflammatory drugs (NSAIDS) such as flunixin meglumine, aspirin, phenylbutazone, meloxicam and ketoprofen may be used to reduce signs of inflammation and endotoxemia. Flunixin meglumine, is the logical drug of choice in most cases.
- Fluid replacement is necessary for those animals showing signs of dehydration. A severely affected cow may require 40 to 60 liters of fluid IV in the first 24 hr. Large volumes of balanced electrolyte solutions are administered intravenously (oral fluids are not absorbed in such cases.) 20 litres in the first one to two hours, and up to 60 liters over a 12-hour period.
- Although this is admittedly difficult and time consuming in a practical situation, convenient methods of fluid therapy administration should be developed. Commercial distilled water can be bought in large economical quantities and mixed with pre-weighed amounts of salt to provide the fluids needed.
- Alternatively, treatment with hypertonic (7.5%) saline solution (4ml/kg) will provide immediate expansion of extracellular fluid volume and temporarily counter some of the effects associated with endotoxemia. Cows should either voluntarily drink or be administered per os 5 to 10 gallons of water following hypersaline use.
- Caution should be exercised in administering hypersaline to cows with marked dehydration (diarrhoea, heat stress) or shock precipitated by causes other than endotoxin.
- If the cow cannot stand, administering 150 to 250 grams of sodium bicarbonate with the first three to 5 liters of electrolyte solution and adding 500 mL of 50% glucose to the first few liters of electrolyte restores vital body fluids, dilutes toxins, and counteracts acidosis.

- Because of the likelihood of clinical or subclinical hypo-calcemia and hypo-kalemia associated with acute coliform mastitis , calcium needs to be administered; more safely administered subcutaneously or diluted in 5-10 litres of IV fluids or orally and oral administration of potassium chloride in anorexic cattle. Dietary vitamin E and selenium reduce the severity and frequency of coliform mastitis. Thus, herd dietary selenium and vitamin E supplementation, particularly that for dry cows and heifers, should be reviewed periodically

Chronic mastitis

Many intra-mammary infections that are chronic or are observed as mild clinical cases offer a more voluntary approach to therapy.

- Elimination of infections can result in increased production and, in the case of contagious pathogens, remove the reservoir of infection for non-infected cows. However, many of these infections are of long duration, frequently recur with mild clinical mastitis despite previous therapy, and can add substantial costs and risks associated with treatment
- Given the slow onset of infection, identification of the pathogen should be performed before any extensive therapy is instituted. Drug distribution, although theoretically available in the mammary gland, may not be efficacious because of extensive fibrosis and micro-abscess formation in the gland.
- In herds with a high prevalence of *S. aureus* infections, the emphasis should be placed on teat dipping, culling, milking machine maintenance, milking hygiene, and segregation of infected cows to gradually reduce prevalence of infection.
- Antibiotic treatment may reduce shedding of bacteria by clinical cows, and thus help reduce the spread, but it will not reduce overall prevalence in the herd.
- Heifers calving with mastitis can be dry treated 50 to 60 days with approved dry cow therapy. Heifers can be treated 7 to 14 days prior to calving with one lactating tube per quarter. The quarters should not be stripped out prior to treatment.
- The teats should be sealed with an external teat sealant after treatment.
- Another management program that reduces new infections and calms heifers down significantly after calving is to run the heifers through the parlor once a day and dip their teats for approximately 7 days prior to calving.

Failure of therapy

The frequent therapy failures during acute mastitis are due, in part, to poor or uneven distribution of the drug throughout the intensely swollen udder parenchyma in which the duct system is either compressed or blocked by inflammatory products. Other reasons include: lack of contact between bacteria and antibiotics due to scar tissue formation, poor drug diffusion, and inactivation by milk and tissue proteins; microbial resistance to antibiotics; development of bacterial L-forms; metabolically inactive organisms; and improper treatment procedures like stopping the therapy too soon.

Certain mastitis-causing pathogens, such as *Mycoplasma*, *Prototheca*, *Nocardia*, *Pseudomonas*, and yeast are non-responsive or poorly responsive to antibiotics. Antibiotic therapy would be expected to fail and better to be avoided in these confirmed cases. Mildly affected cows with no bacterial growth or a low concentration of E. coli in milk also are unlikely to benefit from antibiotic therapy.

On the other hand, resolution of mastitis caused by *Streptococcus* species is enhanced when intra-mammary antibiotics are used, and antibiotic therapy should not be avoided in such cases.

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Prevention and control of mastitis in bovines by feed supplements

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Abstract

The risk that a cow develops mastitis largely depends on pathogen load at the teat end and it is the cow's ability to prevent bacterial infection in the mammary gland. Conversely, nutrition can have significant effect on the immune system, thereby affecting infection rate and severity of mastitis. Early lactation is also the time when most cows experience short-term malnutrition or intake of nutrients therefore, do not meet nutrient requirements. The immune system, as any physiological system, does not function optimally during periods of malnutrition. In addition, the immune system has high requirements for specific nutrients and when these nutrients are not provided in adequate amounts, immune function may suffer. This mini review explains the role of nutrition on mastitis during the periparturient (period immediately before and after calving) period.

Introduction

Mastitis in dairy animals is considered as one of the most important economic diseases resulting into huge economic loss to the country. Globally, the losses due to mastitis, accounts for about 38 per cent of the total direct costs of the common production diseases (Kossaibati and Esslemont, 1997). In India, the economic losses due to mastitis have increased about 115 folds in last five decades (Dua, 2001). In fact, the most expensive disease on dairy farms is mastitis. As per 2006 estimates referred in ICAR's National Agricultural Innovation Project, the estimated annual loss due to mastitis alone is nearly Rs16,702 millions. Mastitis is multietiological and defined as inflammation of mammary glands and is characterized by physical, chemical and usually bacteriological changes in milk and pathological changes in glandular tissues (Radostits, et al., 2000). It is also a matter of concern as presence of antibiotic residues in the milk is undesirable due to its public health concern. Traditionally, the mastitis control programmes are focused at use of chemical disinfectants, antiseptic or herbal teat dips (Maiti et al., 2004) and antibiotic therapy.

Various studies revealed that both clinical and sub-clinical mastitis affect the reproductive efficiency of animals at several levels. Mastitis delays the postpartum ovarian function and alters some of the key reproductive functions like ovulation, fertilization, implantation, and pregnancy maintenance, calving interval, number of services per conception etc. (Hansen et al., 2004). However, antibiotics were introduced long back for its control but the problem in dairy animals remained. Antibiotic treatment minimizes the losses but eventually leads to drug resistance. Therefore, attention is being paid to find alternative approaches. These approaches are confined to enhance udder defense mechanism and antibacterial system in milk by using immune regulatory micronutrients.

1. Trisodium Citrate

It has been widely demonstrated that citrate is the "harbinger of lactogenesis" (Peaker and Linzel, 1975). They reported that the amounts of citrate (130–160 mg per 100 ml) occur in the milk of cows and goats and the level of citrate in udder of cows, goats and women shoots up 46 times around parturition. These findings elucidate that citrate is apparently playing a vital role in milk synthesis and therefore, might be associated with mastitis in dairy animals. It has been reported extensively that mastitic milk is significantly low in citrate (Oshima and Fuse 1981). Investigations have also revealed that citrate levels are very low in milk of quarters affected with mastitis (33.71mg/ 100ml) (www.agranco.com/pdf/Mast-Ex_Catatlog.pdf). A certain minimum concentration of citrate is essential for the normal synthesis of milk in the alveoli in the udder. Therefore, inconsistency in the citrate content would result in faulty synthesis of milk in a particular quarter(s) of the udder. It has been observed that the affected quarters had very low concentration of citrate as compared with healthy quarters of the same animal (Dhillon et al., 1989). The deficiency of citrate in a particular quarter may be due to nutritional, metabolic or some other intrinsic unknown factors which need further investigation. Citrate, indeed, is the main constituent of the buffer system responsible for the maintenance of pH (~6.50) in the udder and regulates the homeostasis between Ca and H ions which maintains fluidity of milk (Faulkner and Peaker, 1982; Shennan and Peaker 2000). Hence, deficiency of citrate in udder would lead to the "clumping" of Ca ions which manifest as flakes in the mastitic milk. These flakes of Ca ions act like lime and probably injure the parenchymatous tissue in the udder alveoli due to reduced moderator effect of citrate. The recent studies (Rai et al., 2013) support the role of citrate in feed supplement. Sarfaraz et al. (2009) revealed that oral administration of tri-sodium citrate and levamisole HCl are viable alternative to antibiotic therapy for sub-clinical mastitis in buffaloes. Hence, the citrate ought to be supplemented in animal feed to prevent mastitis in dairy animals.

2. Ascorbic acid (Vitamin C)

Neutrophil function and the severity and incidence of mastitis in dairy cows are related to the intake of many antioxidant nutrients. Because vitamin C is the major water-soluble antioxidant in mammals, Weiss and Hogan, (2007), examined the effect of dietary vitamin C on neutrophil function and responses to intra-mammary infusion of lipopolysaccahride (LPS) in peri-parturient dairy cows. Vitamin C concentration in neutrophils isolated from milk were about 3 times greater than concentrations in blood neutrophils. The LPS infusion did not alter concentrations of vitamin C in plasma or milk, suggesting that the LPS model did not produce the same effects as a bacterial infection of the mammary gland with respect to antioxidant effects. Supplemental vitamin C had no effect on neutrophil phagocytosis or bacterial kill. Dietary vitamin C reduced the milk somatic cell count. Chaiyotwittayakun et al. (2002) suggested that ascorbic acid provided some potential benefit for recovery from acute mammary inflammation in dairy cattle.

3. *Curcuma longa*

The use of turmeric for coloring and flavoring food, for cosmetic purposes and for medicinal properties dates back to the ancient Vedic culture of India, used in almost all Indian curries. Turmeric has almost no calories and zero cholesterol. It is rich in dietary fiber, iron, potassium, magnesium and vitamin B6. One active ingredient in it is curcumin that may reduce swelling and pain and inflammation. Turmeric is highly therapeutic and is used in various drugs and pharmaceutics mainly because of its immunity boosting and anti-oxidant

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properties. It is a natural antiseptic and has antibacterial, antifungal, anti-inflammatory, antiallergic and wound healing properties. Hence feeding turmeric will prevent the incidence of mastitis in dairy animals.

4. Calcium & Phosphorus

Milk and blood serum from clinically mastitis infected, subclinically mastitis infected and healthy Friesian cows (15 samples from each of 3 groups) were evaluated for macrominerals (sodium, potassium, calcium, magnesium and phosphorus). The milk from cows infected with subclinical mastitis revealed a significant decrease in potassium ($P < 0.001$) and a significant increase in sodium and phosphorus content ($P < 0.01$). Similarly, the milk from cows with the clinical form of the disease showed a significant increase in sodium ($P < 0.001$) and a significant decrease in potassium, magnesium ($P < 0.001$) and calcium ($P < 0.01$). Comparison of healthy cow's milk with that from cows with subclinical mastitis revealed a highly significant increase in sodium ($P < 0.001$). Comparison of healthy cow's milk with that of clinically mastitic milk showed a highly significant decrease in levels of calcium, magnesium ($P < 0.001$) and potassium ($P < 0.01$). However, sodium increased highly significantly ($P < 0.001$). Comparison of macro-minerals in milk from cows with subclinical and clinical mastitis revealed a significant decrease in potassium contents ($P < 0.05$) compared with that of healthy cows. Potassium levels were found to decrease significantly ($P < 0.05$) in subclinically infected cow's blood serum. However, calcium and phosphorus showed a significant decrease ($P < 0.01$) in blood serum samples from the clinically infected cows (El Zubeir et al., 2005). Mastitis incidence and increased SCC level reduced calcium and phosphorus contents, ratio of Ca/P and titratable acidity (TA) of raw milk were found, while pH increased significantly by increasing SCC level (Raji et al., 2012). Calcium is required for muscle contractions and the teat sphincter of cows that increases the risk of bacterial invasion (Curtis et al., 1985). It might be concluded that regular availability of calcium and phosphorus to a lactating cow, may prevent the occurrence of mastitis.

5. Zinc and copper

Cows and heifers fed diets with 20 ppm supplemental copper had less severe mastitis and fewer natural infections when challenged mammary gland with E. coli (Harmon and Torre, 1994; Scaletti et al., 2003). Tomlinson et al. (2002) summarized results of 12 experiments and reported an overall significant reduction (196,000 vs. 294,000) in Somatic Cell Count (SCC) when Zinc was supplemented (between 200 and 380 mg of Zn/d).

Role of zinc includes tissue or cell growth, cell replication, bone formation, skin integrity, cell-mediated immunity, and generalized host defense (Gropper et al. 2005). The mammary gland is an organ that is derived from the skin, thus making zinc necessary to maintain the integrity of the keratin that lines the streak canal. Zinc has a significant effect on gene expression and cellular growth. Supplementing zinc resulted in a 33% reduction in somatic cell count (Suan and Robert, 2009). Zinc deficiency has been associated with reduced formation of both T and B lymphocytes and phagocytes (Sherman, 1992). T and B cells are the major cellular components of the adaptive immune response. Therefore, supplementing copper and zinc is beneficial in preventing and curing mastitis.

Conclusion

Nutrition is directly related to ability to prevent a bacterial infection in the mammary gland in the dairy cows/buffaloes. Nutrient deficient amount has been shown to be capable of altering immune system. The best recommendation at present is to provide a feeding program for dairy cows which should be balanced for essential nutrients which can meet the nutritional requirements. The aforesaid nutrients were formulated in a feed supplement that was tried and tested on 2500 cows suspected for mastitis and suffering from sub-clinical and clinical mastitis on field animals.

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Surgical techniques to repair third degree perineal laceration in equines

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Abstract :

Third degree perineal lacerations are most severe forms of perineal injuries and all layers of vestibule, perineal body and rectum. Various techniques like Goetz and modified Goetz, semi transverse closure technique and Aanes Technique have been described to repair injury. Maintenance of soft fecal consistency after surgery is advocated.

Key words: Perineal injuries, mares, Goetz and modified Goetz techniques, Aanes technique

Introduction :

Third degree perineal lacerations in equines are most severe form of perineal injury and involve all layers of vestibule, perineal body & rectum, with disruption of the anus. Severe anterior tears that penetrate the peritoneal cavity can lead to rapid death as a result of massive peritoneal contamination. Those cases which are presented within 4 hours of trauma can be successfully treated by emergency reparative surgery. Treatment at late stage (more than 4-6 hours) is invariably ineffective, as partial breakdown mostly occurs. In such cases, healing & granulation of the torn area usually takes 4 to 6 weeks and hence the surgery is usually delayed till all inflammation can subside. Surgical procedures are indicated in dystocia, traumatic bleeding or conversion of recto-vaginal fistula into third degree perineal laceration for subsequent repair.

Surgical Procedures

Equipment

Long handled instruments and monofilament absorbable suture materials are required. Self-retaining retractors (Balfour, modified finichietto) and a good light source (floor lamps, head lamps or fibre-optic lights) are useful.

Preparation and Positioning

Surgery is delayed for 4-6 weeks following laceration to allow wound contraction & inflammation to subside. Delaying surgery for this period allows the wound edges to strengthen & become clearly defined before repair is attempted. A gruel or pasture diet is fed 3 to 5 days prior to surgery, and the mare is fasted 1 day before the surgery. The mare is restrained standing in a stock and surgery is performed under epidural anaesthesia with or without sedation. Surgery can also be performed in a patient induced with general anaesthesia in lateral recumbency. After anaesthesia, the tail is secured and retracted. Fecal material is removed from rectum & vagina. The perineal region is rinsed followed by cleansing of rectal and vaginal lumens with a dilute povidone-iodinde solution. The perineal region is aseptically prepared.

Procedure

One- or two- staged technique can be applied, former is preferred but latter should be performed when there is excessive tension at the suture line. No distinct advantage or disadvantage exists between these techniques. Principles for all techniques include initial creation of rectal and vaginal shelves, minimal tissue tension and maintaining a soft faecal consistency after surgery.

Towel clamps or retention sutures are positioned along the dorso-lateral and ventro-lateral aspect of the defect to provide exposure. The cranial extent of laceration is extended 3 cm, creating a rectal and vaginal shelf. Dissection is continued laterally and caudally along the scar tissue line into the submucosa until the tissue flaps created can be apposed on midline without tension. Both mucosal surfaces are dissected 2 cm or more.

One-Stage repair

Goetz technique

Using no. 1 absorbable suture, a six bite pattern is used to close recto-vaginal shelf. The suture pattern begins within the vaginal lumen, allowing the knot to be secured within the vaginal lumen. Sutures are positioned approximately 1 cm apart; the suture pattern includes the vaginal mucosa but does not penetrate the rectal mucosa. The vaginal mucosa is closed over the newly created recto-vaginal shelf with no. 0 absorbable suture using a continuous horizontal mattress pattern. The rectal mucosa is left to heal by second intension. Closure of the recto-vaginal shelf and vaginal mucosa should extend to the cutaneous perineum. Caslick's procedure is then performed to appose the vulvar opening.

Modified Goetz technique

The vaginal mucosa is inverted into the vaginal lumen using no.0 absorbable suture using a Connell or Lambert pattern. This suture pattern is continued caudally to reconstruct the cranial half of the defect and then tied but not cut. Using no.1 absorbable suture, purse string sutures are used to close the recto-vaginal shelf. Sutures are positioned approximately 1 cm apart and should not pass through the vaginal or rectal mucosa. Once the cranial half of the recto-vaginal shelf is reconstructed, closure of the vaginal mucosa is completed, followed by closure of the remaining caudal half of the recto-vaginal shelf. The rectal mucosa is everted into the rectal lumen with no.0 absorbable suture using a Cushing or Lambert pattern. The closure of the recto-vaginal shelf and mucosal surfaces should extend to the cutaneous perineum. A Caslick's procedure is the performed to appose the vulvar opening.

Semi Transverse Closure Technique

Small marker incisions are made at the ventral aspect of the perineal body along the left and right mucocutaneous junctions; these markers will be used as the ventro-caudal points of the triangle used to construct the perineal body. The scar tissue mucosal junction along the recto-vaginal shelf is incised longitudinally and divided in its entirety. Rectal and vaginal mucosa are undermined approximately 7-10 cm from the recto-vaginal shelf. Beginning approximately 4 cm cranial to the external anal sphincter, a mucosal incision is made from the lateral edge of the recto-vaginal shelf ventro-caudally towards the original marker incision. A triangle shaped section of mucosa is excised; the exposed triangular section of submucosa will form the perineal body when sutured. The centre of the recto-vaginal shelf is grasped with Allis tissue forceps, pulling the shelf caudally to the cranial border of the proposed perineal body. The final configuration is in the shape of a Y, with the base of the Y pointing caudal. Beginning at the deepest corner on the right side, the recto-vaginal shelf is reconstructed with no.2

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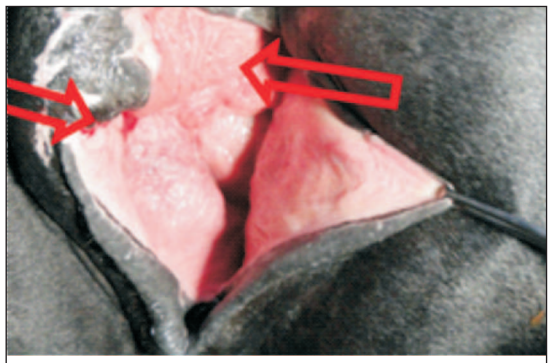

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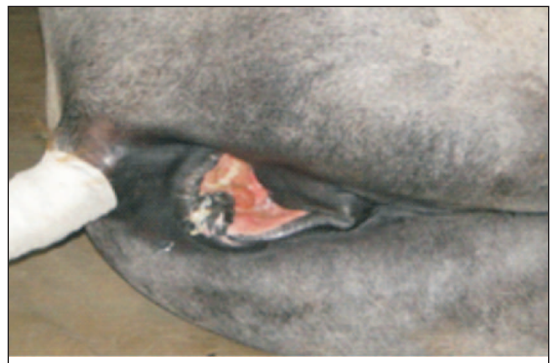

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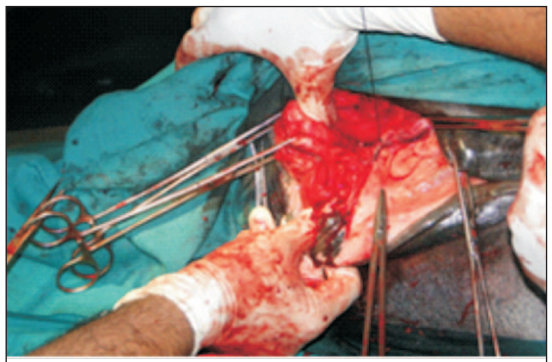

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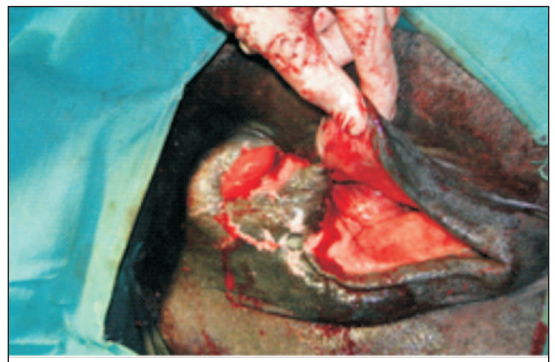

D

Fig. 1. Repair of third degree (A to D) laceration in a mare

absorbable suture using a simple continuous pattern ending at the centre of the shelf. The left side is closed in the same manner. Rectal and vaginal mucosal surfaces should not be penetrated.

Perineal body reconstruction begins at the caudal edge of the newly formed recto-vaginal shelf and is continued caudally. The first suture incorporates the caudal end of the newly formed recto-vaginal shelf and the right and left sides of the perineal body. The dorsal portion of the perineal body is closed first with no.2 absorbable suture using a Cushing pattern. Incorporation of the rectal, vaginal or anal mucosa should be avoided during closure. The remainder of the perineal tissue is closed with 2-0 absorbable suture using a simple interrupted pattern. Caslick's procedure is performed to appose the perineal skin & vulvar opening.

Two Stage Repair

Aanes Technique

The vaginal mucosa is inverted into the vaginal lumen with no.0 absorbable suture material using Cushing or Lambert pattern. This suture pattern is continued caudally to reconstruct the cranial half of the defect and then tied but not cut. Using no. 1 absorbable suture, purse string sutures are used to close the recto-vaginal shelf. Sutures are positioned approximately 1 cm apart and should not pass through the vaginal or rectal mucosa. If an excessive amount of tension or dead space is present, partial tightening of the purse-string sutures along with saggitally oriented simple interrupted sutures will help obliterate dead space. Once the cranial half of the recto-vaginal shelf is reconstructed, closure of the vaginal mucosa is completed, followed by closure of the remaining caudal half of the recto-vaginal shelf. Optionally, the rectal mucosa may be inverted into the rectal lumen with no. 2-0 absorbable suture material using a Cushing or Lambert pattern. Closure of the recto-vaginal shelf is continued to the level of the cutaneous perineum.

Closure of the perineal body is performed 3-4 weeks after the first surgery if recto-vestibular shelf is completely healed. If dehiscence occurs or a fistula is present, the first stage should be repeated. Closure of the perineal body is performed using perineal body reconstruction technique. A triangular section of the vestibular mucosa is reflected ventrally and removed from each side, with a triangle apex pointing cranially & the base along the mucocutaneous junction of the perineum. Closure of the ventral vestibular mucosal margins should be performed in a cranial to caudal manner with no. 2-0 absorbable suture in a simple continuous pattern. Deep perineal tissues should be apposed with no. 2-0 absorbable sutures using a simple interrupted pattern. Perineal skin is apposed with no. 0 non absorbable sutures using Ford interlocking pattern.

Recently a new modification of the surgical technique has been applied and it showed healing by first intension and subjects had good post-surgical fertility. In this technique, the rectovestibular shelf was corrected with three parallel 'circular' continuous suture rows distributed along the longitudinal axis of the vagina, and the perineal body was reconstructed with three divergent simple continuous rows.

Post-Operative Care

1. Exercise restriction
2. Medications: Tetanus prophylaxis; Broad-spectrum antibiotic are administered for 7-10 days; NSAIDS for 3-5 days.
3. Suture removal: Perineal and Caslick's sutures should be removed 10-14 days after surgery.
4. Dietary modification: Free choice access to grass, a gruel diet or both should be provided for 30 days with gradual return to normal diet. Occasionally mineral oil should be added to maintain soft faecal consistency.
5. Others: Sexual rest is recommended until the following breeding season.

Expected Outcome

Primary healing is reported to occur in approximately 70-90% of repaired third degree perineal laceration. Short term complications such as dehiscence or fistula formation are reported to occur in 12-24% of all surgical repairs (2, 4, 6, and 7). Third degree perineal lacerations recur in 5 to 50% of the foaling mares due to the inelasticity of the resultant scar tissue.

Complications

Suture dehiscence and subsequent fistula development are possible. These complications can be avoided with precise dissection, adequate tissue purchases and reduced tension on apposed tissues. Fistula formation may result in failure to conceive due to endometritis, pneumovagina of continued faecal contamination of the vaginal lumen. Uro-vagina may be a consequence of the mare's natural perineal conformation or the result of altering the perineal conformation during the recto-vaginal fistula repair and can be addressed with an urethroplasty procedure. Mares should be monitored during subsequent foaling because the fibrous tissue from the repair may reduce the

elasticity of the birth canal and predispose the mare to additional birthing trauma. As the sutures are progressively placed in the caudal tissue, care must be taken to avoid the narrowing of the rectal lumen, which will predispose the mare to tenesmus and constipation.

Comments

Epidural anaesthesia is occasionally insufficient for some recto-vaginal procedure. Local anaesthetic techniques have been developed to either supplement or replace epidural anaesthesia. The perineal area can be desensitized by infiltrating local anaesthetic laterally between the rectum and the pelvis. A needle long enough to extend approximately 1 inch cranial of the area to be desensitized should be used. One hand is inserted into the rectum and the needle is inserted through the skin at the 9 to 10 o' clock position lateral to the rectum. The needle is then advanced parallel to the rectum in the loose connective tissue lateral to the rectum. 20-40ml of local anaesthetic is injected as the needle is withdrawn. The procedure is repeated on the other side at the 2 to 3 o'clock position.

Another technique of sub-sacral anaesthesia has been described. After the tail is wrapped and retracted dorsally, one hand is inserted into the rectum to locate the sacral promontory. The hand is drawn back along the sacrum 2-3 cm from midline to locate the ventral sacral foramen. By counting back, the third ventral foramen (exit of the pudendal nerve) is found, the index or middle figure remains on this point. With the other hand, a needle (up to 6 inches in length) with a short bevelled point is inserted on midline a third of the distance from the anus to tail base & directed towards the ventral sacral foramen. A syringe is attached to the needle and approximately 20 ml of anaesthetic solution is injected. The syringe is removed and the needle withdrawn 5-6 cm until the point reaches the fourth sacral foramen (exit of the caudal rectal nerve) & 20 ml of anaesthetics solution is likewise injected. The entire procedure is repeated on the other side so that a total of 80 ml of anaesthetic is required. Within 5-20 minutes, areas desensitized by this block include the perirectal region, the entire caudal region overlying the semitendinosus and semimembranosus muscle and most of the perineum excluding the vulva and the area immediately surrounding the vulva. In males the penis and the retractor penis muscle will be desensitized.

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Recent therapeutic approaches in Cervical Induration in small ruminants

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Abstract :

Clinical problems during parturition occur when the cervix fails to dilate sufficiently or fails to dilate at all. Incomplete dilatation of cervix is one of the commonest maternal causes of dystocia in small ruminants. It is more common in these species due to its tough fibrous structure of cervix with substantial amounts of collagen. The etiology and therapeutic measures have been discussed.

Keywords: Cervical induration, Sheep and Goats, Prostaglandins

Introduction:

Incomplete cervical dilatation is a condition occasionally seen in ewes than in other domestic animals. It is more likely due to hormonal dysfunction which normally causes cervix to ripen or it is a failure of cervical tissue to respond. The degree of incompleteness of dilatation varies from virtually complete closure to the situation where there is just a small frill of cervical tissue present which is sufficient to reduce size of birth canal thereby causing obstruction. During the majority of gestation, cervix is stiff and non- stretchable to keep the foetus safely isolated in the uterus. Extensive remodeling of the connective tissue is necessary to enable the cervix to dilate at parturition. The collagen is one of the major components of cervical connective tissue, and because of its cross linked, three dimensional structure, it contributes greatly to the stiffness of cervix.

Etiology

The exact etiology of failure of cervical dilatation is unknown but number of predisposing factors like hypocalcaemia, hypophosphataemia, hormonal or mineral imbalances, uterine inertia and breech presentation have been clinically diagnosed and described. Primary causes of insufficient cervical dilatation are more difficult to diagnose, because most likely they originate from a disturbed regulation of either cellular or biochemical processes in the cervix. They need to be distinguished from secondary causes like uterine inertia, such as occurs during hypocalcemia or in the case of slow progressing labour such as with a too large foetus or an abnormal foetal presentation. Partial dilation of the cervix results in the cervical canal opening only a few centimeters (Braun, 1997).

The cervix may fail to dilate because of severe fibrous induration or sclerosis of cervix (Roberts, 2004). Prolonged dystocia often results in failure of closure of the previously dilated cervix. Hormonal imbalance or altered endocrinology has also been suggested as a cause of the failure of cervical dilatation (Das et al., 2008). Incomplete cervical dilatation in a Gaddi goat has been reported to be the cause for uterine rupture by Adarsh Kumar et al., (1998) and it is further supported by Arthur et al., (1989) with

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interpretation that convulsive limb movements and respiratory failure before death of foetus might be responsible for the same.

Therapeutic approaches

Clinical experience indicates that many cases of parturient does and ewes fail to respond to traditional therapeutic regimes for cervical dilatation. Various treatments with estradiol, relaxin, prostaglandins, oxytocin, calcium borogluconate, valethamate bromide and antibiotics have been used for cervical dilatation in farm animals but they have produced variable responses.

Fletcher et al., (1993) proposed that cervical ripening at parturition can be induced with 100 µg of Misoprostol intravaginally. Cervical relaxation in sheep was not observed 45 min after intra- cervical administration of 400 µg Misoprostol (Ataman et al., 2000). Alan and Tasal (2002) induced parturition in goats at 132 and 68 h when prostaglandin analogue Misoprostol was administered orally (400 µg, four doses, every 2 h) and cervically (800 µg, two applications, 8 h apart), respectively. Azawi et al., (2012) reported ring womb condition in Shami does and they have observed complete cervical dilatation after 20 minutes of treatment using 3 tablets of PGE1 (Misoprostol @ 600 µg) dissolved in 10 ml normal saline solution, which was infused in the partially dilated cervical canal.

In small ruminants, antiprogestogen Mifepristone has also been used to induce parturition in ewes (Gazal et al., 1993). Antigestagens are synthetic steroids that bind with strong affinity to progesterone receptors and competitively displace endogenous progesterone. Progesterone-receptor blockers such as algepristone and mifepristone are competitive antagonists of the progesterone receptors (Bann et al., 2005).

Ali (2011) used Prostaglandin F2 in treating the ring womb condition in ewes and does carrying dead fetuses where the mean intervals from treatment to complete cervical dilatation were 63.0 ± 11.6 hr and 41.5 ± 13.3 hr for ewes and does, respectively. Das et al., (2010) treated a case of incomplete cervical dilatation in a doe with Valethamate Bromide (Epidosin) @ 16mg IV, Calcium Sandoz (Calcium glubionate 1.375 g, Calcium gluconate 10% w/v) 10 ml IV, Dexamethasone @ 10 mg IM and normal saline solution 500 ml IV and achieved full dilatation of the cervix after about half an hour.

Conclusion

Clinical cases of failure of cervical dilatation are always considered as emergencies to safeguard life of fetuses and hence effective, early and prompt cervical dilatation is expected through the treatment by obstetrician. Prostaglandin and their analogues have been proved to be effective in the cases of induction of parturition which also includes effective cervical dilatation. On the same analogy, standardization of treatment protocols with PG, PGF2 or PGE2 is necessary in clinical cases of failure of cervical dilatation.

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Scrub Typhus: a silent killer disease of zoonotic importance

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Abstract

Scrub typhus or tsutsugamushi disease is an acute febrile bacterial illness caused by *Orientia tsutsugamushi* and transmitted by bite of *Leptotrombidium Spp*. mites of Trombiculidae family. Scrub typhus is endemic to a geographical region, known as the "tsutsugamushi triangle" which include southern Asia, south-eastern Asia, and the western Pacific. After an incubation period of 6-21 days, Scrub typhus may begin insidiously with headache, anorexia, or malaise. In some cases, scrub typhus appears abruptly with chills and fever; rash and eschar may also be present. If untreated, serious complications may occur involving various organs. People of all ages are affected by it. The Rickettsial diseases remain grossly underdiagnosed as routine laboratory tests are unlikely to be diagnostic and presentation nonspecific. IFA has been considered as the gold standard for serologic detection of scrub typhus antibodies and is also currently the reference standard. The treatment should be initiated as early as possible. The conventional treatment includes broad spectrum antibiotics like doxycycline (adults) and chloramphenicol (in pediatric population).

Key words : Scrub typhus, *Orientia tsutsugamushi*, *Leptotrombidium*, Eschar, Doxycycline.

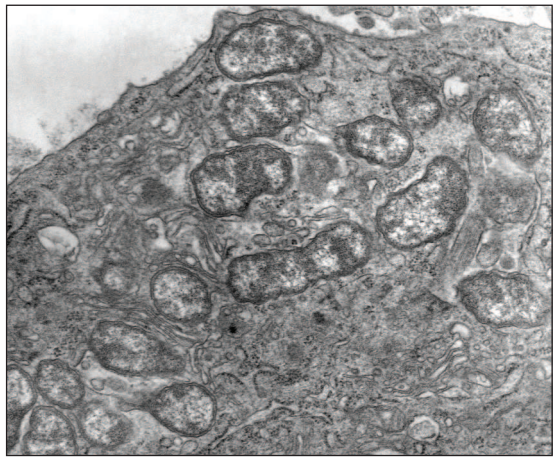
Introduction:

Scrub typhus is a vector-borne zoonotic disease caused by the obligate intracellular gram negative bacterium *Orientia tsutsugamushi* [1]. The disease usually presents itself as an acute febrile illness with a typical primary necrotic lesion (eschar), generalized lymphadenopathy, rash, and non-specific symptoms such as fever, headache, myalgia and cough [2]. Hepatic impairment is frequently observed but overlooked in the acute stage of scrub typhus [3]. It is transmitted by *Trombiculidae* mites [4].

The term scrub is used because of the type of vegetation (terrain between woods and clearings) that harbours the vector; however, the name is not entirely correct because certain endemic areas can also be sandy, semi-arid and mountain deserts [5,6].

Scrub typhus is also known as Tsutsugamushi disease, Tropical typhus, Rural typhus, Japanese river fever and Flood fever [7]. The name Tsutsugamushi is derived from two Japanese words: Tsutsuga, meaning something small and dangerous, and Mushi, meaning creature [8].

Scrub typhus is a public health problem in Asia, where about 1 million new cases are identified annually and 1 billion people may be at risk of this disease. In India, the presence of scrub typhus has been known for several decades [9] and its presence has been documented in at least 11 Indian states [10].



Orientia tsutsugamushi

Trombiculidae mite

Historical background:

First identification of causative agent of scrub typhus was by Nagayo and co-worker in 1930. They called this organisms as *Rickettsia orientalis* but the name was changed to *R. tsutsugamushi* in 1948 and then *O. tsutsugamushi in* 1995 [5].

Scrub typhus, a dreaded disease in pre-antibiotic era, is a militarily important disease that caused thousands of cases in the Far East during the Second World War. Soldiers were exposed to chigger bites in forest areas during the military operation. It is estimated that 36,000 soldiers were either incapacitated or died during World War II [11].

Etiology

Scrub typhus is caused by *Orientia tsutsugamushi* which is Gram negative bacteria. The bacterium was initially categorized in the genus Rickettsia but is now classed in a separate genus, Orientia, in which it is the only species [5]. It differs from the other members in its genetic make-up and in the composition of its cell wall structure since it lacks lipopolysaccharide and peptidoglycan and does not have an outer slime layer [12]. There are considerable differences in virulence and antigen composition among individual strains of *O. tsutsugamushi*. It has many serotypes (Boryon, Karp, Gillian, Kato and Kawazaki) [13].

It is 0.5 µm wide and 1.2 to 3.0 µm long, and is an obligatory intracellular organism that can be cultivated on L929 cells. They stain blue with Giemsa's stain and are readily visible under microscope [14]. The organism is highly virulent and should only be handled in a laboratory with biosafety level 3 facilities [13].

Epidemiology:

The distribution of the disease corresponds with the distribution of *Leptotrombidium Spp*. of *Trombiculidae family* [8].

Host

A number of small rodents particularly wild rats of subgenus *Rattus* are the natural hosts for scrub typhus [16]. The rodents and acarine hosts do not succumb to the disease. Thus the field rodents and the vector mites act as a reservoir and between the two the infection perpetuates in nature. The migration of infested or infected rodents leads to establishment of new foci of disease [8]. The persons at a high risk are fruit farmer, forest worker, bush walker, off road tourist, military persons and park ranger [17].

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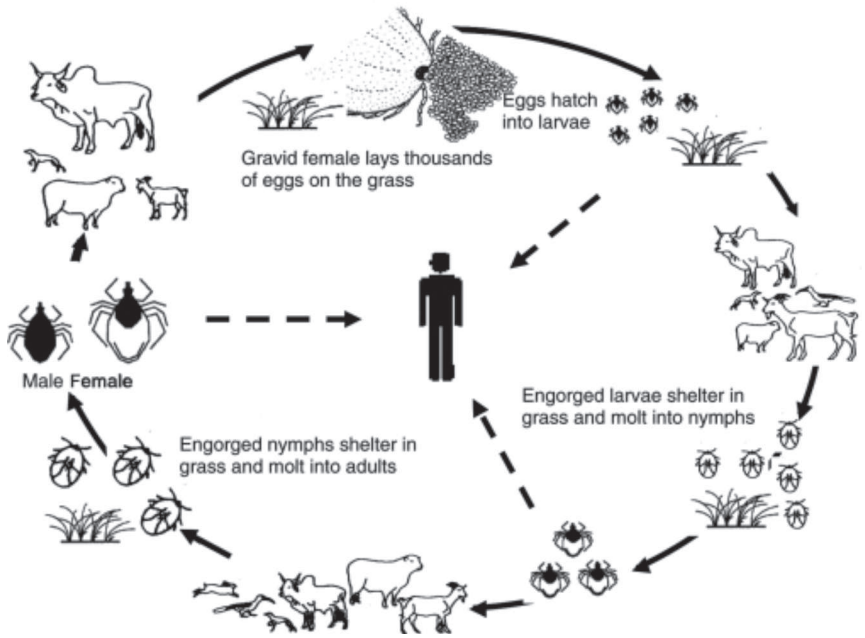
Leptotrombidium species distribution:

Vector Leptotrombidium	Localities
L. delience	Prevalent in Australia, China, India, Malaysia, New Guinea, Pakistan, Philippines, and Thailand; present in Sumatra (Indonesia), Myanmar, and Pescadores islands (Taiwan).
L. akamushi	Japan and Solomon Islands.
L. arenicola	Indonesia and Malaysia.
L. Fletcheri	Indonesia, Malaysia, New Guinea, and Philippines.
L. scutellare	Japan; present in China, Korea, Malaysia.
L. palidum	Japan and Korea; present in Primorski Krai.

Epidemiological factors

Effect of Season : The seasonal occurrence of scrub typhus varies with the climate in different countries. It occurs more frequently during the rainy season. However, outbreaks have been reported during the cooler season in southern India [18].

Areas : Infected mites have been found in sites as varied as subarctic regions, seashores, mountains up to 10,000 feet, rain forests, river banks, semiarid deserts, rice paddies, and urban areas. These small geographic regions are high-risk areas for humans and have been called scrub-typhus islands [19, 8].



Life cycle of *Trombiculidae* mite

Vector: Presence of vector is very much important for disease occurrence. *Schoengastiella ligula*, in addition to the *Leptotrombidium species*, has been incriminated as a vector of scrub typhus and especially so in India. However, no outbreak has been attributed to *S. ligula* as a vector [20].

Age : People of all ages are affected by it.

Sex : Both men and women are equally affected by scrub typhus [14]. In Korea, significantly more female were infected than males. In Japan, the number of males infected was slightly higher than the number of females. These remarkable differences in gender distribution are believed to reflect cultural differences between Korea and Japan in terms of work, clothes and ornamentations [21].

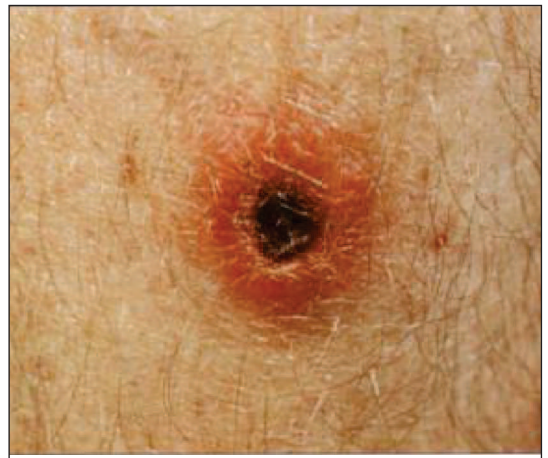
Scrub typhus is endemic to a part of the world known as the "tsutsugamushi triangle"(Fig.), which extends from northern Japan and far-eastern Russia in the north, to northern Australia in the south, and to Pakistan and Afghanistan in the west [8].

Lifecycle and Transmission:

The adult mites have a four-stage lifecycle: egg, larva, nymph and adult. The larva is the only stage (chigger) that can transmit the disease to humans and other vertebrates, since the other life stages (nymph and adult) do not feed on vertebrate animals [22]. The infection is transmitted to man and rodents by some species of infective trombiculid mites ("chiggers") which feeds on lymph and tissue fluid rather than blood [23]. When an infected chigger feeds on a host (human or other animal), the bacteria are transmitted to the host [19]. Man is an accidental host. Person-to-person transmission of infection has not been reported [24].

Symptoms:

The severity of the symptoms varies widely, depending on the susceptibility of the host, the virulence of the bacterial strain, or both [25]. Scrub typhus may begin insidiously with headache, anorexia, or malaise. In some cases, scrub typhus appears abruptly with chills and fever; rash and eschar may also be present [26]. The classic case description includes an eschar at the site of chigger feeding, regional lymphadenopathy, and a maculopapular rash [25]. Eschar is a black necrotic lesion resembling a cigarette burn usually found in areas where skin is thin, moist or wrinkled and, where the clothing is tight [2].



An eschar at the wound site

Diagnosis:

The disease remains grossly under diagnosed as routine laboratory tests are unlikely to be diagnostic and presentation nonspecific [14]. The diagnosis mainly depends upon the patient history (travel to endemic areas and history of mite bite) and the clinical symptoms (an eschar at the wound site is the most useful diagnostic clue).

Laboratory Diagnosis

1. Giemsa Staining Technique smears from peritoneal fluid, liver, spleen and kidney were made and Giemsa stained to reveal *O. tsutsugamushi* [27].
2. Weil-Felix Proteus Agglutination Test Weil Felix test has been used widely in India for diagnosing of scrub typhus. It is highly specific; however it lacks sensitivity [2]. Diagnostic Weil-Felix agglutination (detectable after 5 to 10 days following the onset) shows ≥ four times rise in titre to proteus OX-K and no reaction to proteus OX-2 or OX-19 (in 50-70% of patients); a single titre ≥ 1:160 is also diagnostic (normal is ≤ 1:40.) [7].

Newer Techniques

1. Indirect Immuno Fluorescence (IFA) IFA has been considered as the gold standard for serologic detection of scrub typhus antibodies and is also currently the reference standard [28], but they require highly trained personnel and production of antigens may vary among different laboratories, leading to inconsistencies in the interpretation of results [29].
2. Indirect Immuno Peroxidase (IIP)
3. Enzyme-linked Immunosorbent Assay (ELISA)

   The specific gold standard techniques are not available in our country and the isolation of the organisms in animals or cell culture is limited by the lack of containment facility as well as the lack of expertise in handling these high risk group pathogens [30].

Commercial Kits

1. Pan-Bio ® Rapid diagnostic enzyme dot blot immunoassay. (PanBio Pty. Ltd, Brisbane, Australia)
2. Standard Diagnostics (SD) BioLine Tsutsugamushi-Assay. (Standard Diagnostics Inc. Yongin-si, Kyonggi-do, Korea)

These kits appeared in the market but still far from the reach of most of the developing countries due to their high cost [31].

PCR (Polymerase Chain Reaction)

- A real time quantitative PCR (rtq-PCR) method is also being used as a means to provide quantitative information on O. tsutsugamushi especially chigger specimens.

Treatment:

The treatment should be initiated early in the course of disease to reduce morbidity and mortality. [32]. The conventional treatment includes broad spectrum antibiotics like doxycycline (adults) & chloramphenicol (in pediatric population). Rifampicin & azithromycin have been used successfully in areas where scrub typhus is resistant to the conventional therapy [33].

Doxycyclin - IV 5 mg/kg twice a day for 7 days

Orally 200 mg/day for 7 days

Chloramphenicol - Orally 50 mg/kg/day for 7 days

Prevention and Control:

The risk of developing scrub typhus is higher in fruit farmers, chestnut gatherers. So, as far as primordial prevention is concerned, the best measure would be to avoid going to such places like farms, areas abundant of bushes, rodents and domestic animals [23].

Primary prevention includes health promotion and specific protection. Health promotion encompasses health education & environmental modification in the context of scrub typhus. Health Education of the people regarding the modes of transmission and personal prophylaxis is of paramount importance and can go a long way in prevention of the disease [14]. There is no vaccine available. People who enter infected areas can be protected by impregnating their clothing with dimethyl phthalate and renewing the repellent frequently. Topical DEET (N, N-diethyl-m-toluamide) applied to exposed skin will prevent tick, flea, and chigger bite. Bites may also be limited by wearing long trousers that are tucked into boots [34]. Control of the rodent and marsupial reservoirs may also assist to prevent chiggers coming into areas where humans are living and working. Simple options such as sealing food containers and burying waste will help with this [16].

Once the disease has occurred in an individual, then comes the role of secondary and tertiary prevention which includes early diagnosis and treatment. The early diagnosis of acute scrub typhus can greatly reduce the chance of life threatening complications and guide optimal therapy [23].

Conclusions:

Scrub typhus is an emerging disease, which is under-diagnosed in many geographical areas because of limited awareness in doctors and till not developed good diagnostic facilities. Early diagnosis and treatment are most useful to reduce the mortality and morbidity associated with the disease. Scrub typhus is also endemic in many parts of India and therefore surveillance should be continued in all these area.

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Animal Assisted Therapy

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Abstract:

AAT is one of the therapies that involves domesticated pets, farm animals, birds and marine animals (Dolphins) as a form of treatment. It has been developed to assist physical, physiological and psychological health benefits of the individuals by means of socializing animals with man. As a result of this therapy, the bond between the humans and companion animals becomes strong, in turn improving emotional, social or cognitive function of an individual.

Keywords: Animal Assisted Therapy, Golden Retrievers, Dolphins

Introduction:

Diseases are increasing at an alarming rate worldwide. The science community indulges in various research activities in the development of drugs for curing the newly evolving disease. The face of the therapeutics has been changed by the development of new antibiotics. Most of the infectious organisms have become resistant to the majority of the drugs that have developed during the past years. It may take long years to develop new antibiotics. Search of alternatives is the need of hour to overcome the infectious and contagious diseases. One of the alternatives that has been implemented without side effect is Animal Assisted Therapy (AAT).

AAT relies on the attachment theory, proposed by John Bowlby, who describes the interpersonal relationship between humans by elucidating the bond of children to their mother. Researchers proved that the negative behavior tends to decrease with positive effect such as physical activity and communication skills focusing on their quality of life. It also states that stress can be eased by animals which creates a harmonious relationship with the patient.

Types of AAT:

Animals such as dogs, cats, horses, hamsters, rabbits, birds and fish that include sea mammals are involved in AAT. Pet animals and farm animals are commonly available in therapy all over the world. Pigs, snakes, tortoises are used as companion animals and used as therapy animal in rare cases.

1. The most usual types of AAT and commonly used animal in AAT is canine-assisted therapy (CAT) and dog respectively. Golden Retrievers are generally applied in this

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therapy for friendly behavior. CAT is applicable to group as well as individual therapy scenario.

2. Feline assisted therapy (FAT) is another type of AAT but least used as therapy animals but as pets.
3. Hippotherapy related to use of horses, donkeys and mules and involves the patients riding, grooming and feeding the animals thereby sharing the emotions between them. Hippo therapy is generally employed in physical or mental challenges.
4. Dolphin assisted therapy (DAT) implies that the patients require to swim or interact with dolphins maintained in captivity. DAT became popular in European countries for curing the illness, reducing the disability and providing relief in mental disorders in both children and adults. DAT is applied in patients suffering from autism, Down syndrome and cerebral palsy. This therapy enhances and restores the motor function, speech, language and also helps to increase the patient's attention. Nathanson's theory named after clinical psychologist David Nathanson explains that the interaction of physically ill children with dolphins helped them to get motivated to complete the task on their own.

Reports on AAT:

A study reports that patients with a therapy dog showed elevated mood, reduced pain, comfort and stress compared to patients without therapy dog. Another report states that patients with therapy dog favored positive environment had reduced heart failure due to significant decrease in neurohormone level, blood pressure and anxiety.

Merits of AAT:

Animal Assisted interventions have a part in the increased physical function and overcome dementia in older patients by means of reducing apathy, loneliness and depression. The animal assisted therapy reduces depression, chronic pain and anxiety in people under intense medical treatment. Immune status of the patients is improved by having a dog at home. Dogs can assist people with physical disabilities and also to navigate outside the home. Positive interactions between patients and animals motivate the ill health patients by way of feeding the animal with food, water and grooming.

Child behavior tends to change and the same can be analyzed by their behavior, tone of voice and affection with the animals. Pets are grown in home for the purpose of fun, relaxation and security. Dolphin therapy is an effective therapy in the condition of autism that motivates the child to communicate.

AAT is mostly employed in nursing homes to reduce the anxiety levels of mentally ill patients. Mood and psychosis of these patients are wavy. The patients indulged in AAT may have reduced anxiety scores by the combined effect of traditional therapy and human-animal bonding. Stress relief, increased morale and calmness, decreased preoperative anxiety and medication are other notable benefits that improves the patient outlook.

Criticisms:

AAT is one of the best methods to deal with depression, anxiety, autism and attention deficit hyperactivity disorders in children. But several criticisms have been raised regarding the effectiveness of AAT. It is kept aside due to lack of research or limited studies on its effect on patient's long term improvement. Among those, Dolphin assisted therapy has been criticized highly for rearing dolphins in their artificial environment as part of humanitarian concern.

Conclusion:

Keeping aside the criticism, the animal assisted therapy favors the most reliable methods of treating the ailments in human patients. Awareness about the use of animals as AAT have been improved. The happiness of the owners will always be the ultimate goal of the pets.

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Urea Poisoning in Cattle

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Abstract:

As urea is incorporated in ruminant feed as a source of non-protein nitrogen, its toxicity often occurs if the consumption of urea is more than its utilization and excretion. The toxicity of urea is mainly attributed to the faulty management. The details of etiology, clinical signs, diagnosis, laboratory testing, treatment and prevention of urea toxicity are enumerated.

Keywords: Urea, Non-protein nitrogen, Vinegar

Introduction

Urea poisoning is one of the commonly suspected toxicities of cattle, as urea is used as a source of non-protein nitrogen (NPN) in feed supplements. In ruminants, nitrogen from urea is released in the rumen as ammonia and is used by rumen micro flora for synthesis of protein. This protein then becomes available to the animal through the normal processes of digestion and absorption. However, if more urea is consumed than the rumen organisms can metabolise, the ammonia is absorbed from the rumen into the blood. The ammonia is then converted back to urea in the liver, and is then excreted by the kidneys. This pathway can easily be disturbed, when excess ammonia and urea circulate in the blood, causing poisoning. Poisoning can occur rapidly from a few minutes to four hours after consumption. Suspect urea poisoning if cattle are found dead close to the supplement.

Etiology

- Excess consumption of urea.
- Sudden introduction to high quantities of urea.
- Irregular consumption of urea.
- Wet supplement containing urea.
- Urea separating out from the supplement after transport; re-mix prior to feeding.
- An insufficient diet mix, which could allow pockets of high urea concentration. Granular urea may also settle out of dry diets
- An excess of urea in the diet due to miscalculation.
- Cattle drinking puddles with high urea content (as the urea, being highly soluble, washes out of the diet with rain).

Clinical Signs

The death rate for urea poisoning is high. Animals exhibit severe abdominal pain, shivering, drunken gait, bloat, salivation, forced rapid breathing and violent struggling and bellowing. Signs of poisoning can include twitching of ears and facial muscles, grinding of the teeth, frothy salivation, abdominal pain, frequent urination, weakness, staggering, and terminal spasms. Often, animals are found dead near the source of the urea supplement.

Diagnosis of Urea Poisoning

The most useful diagnostic indicators are the history of access to urea and the signs shown by live, affected animals. Laboratory tests of blood samples are not very helpful, and no specific changes are seen at post-mortem examination. The following are general indicators of urea poisoning:

- History of access to urea.
- Laboratory testing of collected blood and rumen fluid immediately after death may indicate urea poisoning.
- Post-mortem – bloat; white foam in airways; ammonia odour when the rumen is opened; rumen pH 7.5-8.0.

Often a large pool of rumen fluid is seen on the ground at the nose of the beast. The animals usually suffer severe bloat and the fluid build up in gases forces the rumen fluid out through the mouth when the animal dies. Rumen and reticulum samples in formalin for subsequent diagnosis be preserved.

1. History of Access to Urea

Recent feeding history is important. Cattle become accustomed to metabolising urea, but if they miss out for a couple of days, and then are allowed sudden access, or if they consume more than normal, then poisoning can occur. Urea is very soluble and dissolves rapidly into puddles of water that can form on blocks after rain. Cattle that lick up these puddles can consume excess urea. Recommended feeding quantities vary according to what other feed is available and whether the cattle are accustomed to urea. Tolerance is decreased by starvation and by a low protein, high fibre diet. About 35 g of urea per day is considered sufficient for a 400 kg cow (i.e. approximately 0.1 g/kg body weight). It is recommended that urea should provide no more than 3% of the concentrate ration, or 1% of the total feed intake, and no more than one third of the total nitrogen intake should be NPN. In cattle, 0.3-0.5 g/kg/day (e.g. 120-200 g for a 400 kg cow) is considered to be toxic and 1-1.5 g/kg/day (e.g. 400-600 g for a 400 kg cow) can be fatal.

2. Laboratory Testing

Blood ammonia levels can be measured, but this is only useful in live, sick animals. Proteins in the blood break down rapidly after death and produce ammonia, so testing blood from dead animals is of no value. For the same reason, the handling and storage of blood after collection is very important. Blood must be taken into lithium heparin or EDTA, placed immediately on ice and the plasma separated within 30 minutes of collection. Plasma may be stored for 2 hours at 4°C before testing, or frozen immediately and kept frozen until ready to test. These restrictions on measuring blood ammonia make it impractical as a diagnostic test in field situations. If it is important to measure blood ammonia levels, blood from animals that appear unaffected as well as from sick animals be collected and all samples be treated the same way. If all samples show elevated ammonia, then it is likely to be a non-specific elevation (i.e. due to storage). Ammonia levels in rumen fluid can also be measured, but only fluid taken straight after death is likely to be of any value. It must be however frozen immediately and kept frozen until tested.

3. Post Mortem Examination And Histopathology

Animals decompose rapidly after death from urea poisoning and there are no specific signs of poisoning. Post-mortem examination immediately after death can show evidence of bloat, generalised congestion of the carcase, excess fluid in the pericardial sac, pulmonary oedema with excess stable white foam in the large airways and haemorrhages on the heart

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(epicardial and endocardial). There can be a marked ammonia smell when the rumen is opened. The pH of fresh rumen contents is a useful test that can be done in the field. An alkaline rumen (pH greater than 7.5-8) is suggestive of urea poisoning. There is very little in the literature on histopathological signs, but there appear to be inflammatory changes in the rumen, particularly in animals that may survive the initial poisoning but die or are euthanised a day or two later. Inclusion of formalin-fixed sections of rumen and reticulum from animals that die from suspected urea poisoning, will assist diagnosis.

Treatment of Urea Poisoning

Treatment is rarely effective. However, if cattle may be handled, a stomach tube can be passed to relieve the bloat and then used to drench the animal with a large volume of cold water: 45 L for an adult cow is suggested, followed by 2-6 L of 5% acetic acid or vinegar. This dilutes rumen contents, reduces rumen temperature and increases rumen acidity, which all help to slow down the production of ammonia. Treatment may need to be repeated within 24 hours, as relapses can occur. Rumenotomy and removal of rumen contents is suggested for valuable animals.

Prevention

Poor mixing and keeping urea-fortified diets dry in feeding troughs be avoided. Amount greater than 1 per cent urea on a dry matter basis should not be fed.

Summary of Best Practice

- If cattle have not been previously supplemented, start with pure salt; slowly and then gradually introduce urea supplement – increasing it slowly and gradually to about 0.1g/kg body weight/day. (35-40 g/day for a 400 kg cow).
- Ensure that cattle get regular (daily) access to supplement, once supplementation has started.
- If cattle unavoidably miss out on urea supplementation for a couple of days, then restart them at a lower intake level.
- Prevent over-consumption of supplement mix or blocks (e.g. by using salt to regulate intake).
- Feed supplement mixes or blocks under a roof to prevent urea getting wet and dissolving.
- Suspect urea poisoning if cattle are found dead close to the supplement.

Small Ruminants Sector in India Threat to Development

***Peste des Petits Ruminants* (PPR)**

National Scientific Forum on PPR

- Even with excellent network of Veterinary Services and good quality vaccines available in India, the livestock keepers engaged in sheep and goat rearing are not able to take advantage of these facilities, resulting in high mortality among small ruminants (30-60%) due to PPR. The Government of India has therefore proposed recently to establish a **National Scientific Forum** to ensure interaction among all the stake holders -farmers, scientists, producers of vaccines and field Veterinarians to identify and solve the challenges in the control of PPR in India.

The Blue Cross Book January 2016 Vol. 33 : 141-144

Your problems ?

Expert's solutions

An expert

Dr. Nitin Markandeya,
Prof. of Animal Reproduction, Veterinary College, Parbhani

The most sought after Veterinary Gynaecologist in Maharashtra, Dr. Markandeya is associated with large number of dairy co-operatives and private dairies in Maharashtra as a consultant to resolve the problems in dairy animals reproduction.

Dr. Markandeya has published 182 research publications, participated in 10 international, 37 national and 29 regional conferences, besides organizing 32 training courses for field Veterinarians. His extension acumen is evident by his 800 popular articles, 50AIR programs, 9 booklets, 23 audio-video CDs and enumerable lectures for dairy farmers. Recently he has been conferred a fellowship by ISSAR at Bangalore on 3rd December 2015.

Q.1 What is the suitable approach to treat endometritis to achieve successful conception in infected buffaloes

A : Clinical endometritis can be diagnosed with cervical pH, metricheck score and white side test at field level. It is necessary to follow results of antibiotic sensitivity test by sending samples to investigation laboratory. Principally, line of treatment consisting of long acting antibiotic, immune-modulators, PG for luteolysis on day 10th of cycle give higher success rate to control mixed and non specific uterine infection. Preference to Intra uterine or systemic administration of antibiotic is case depend on infection severity and chronicity of the case. Use of alpha- tocopherol through intrauterine route along with new generation fluroquinolones is a recent concept in veterinary practice. For avoiding drug resistance, combination therapies against gram+ve, gram-ve, aerobic and anaerobic infections with supportive drug for endometrial mucosa is considered as recent effective line of treatment. Metronidazole is the most commonly used intrauterine

chemotherapeutic agent against anaerobic organisms from genital tract. However, use of Ornidazole is still more efficacious with advanced versions of quinolones derivatives. Uterine infection affect follicular quality by reducing progesterone production, reducing number of surface follicles and increasing toxic LPS concentration, hence, one cycle rest after treatment oestrus for insemination is useful for reduction of uterine endometrial inflammation and also for development of fresh follicles for increasing chances of conceptions.

Q.2 How to effect speedy cervical dilatation in parturient farm animals while resolving dystocia cases.

A. Ample teasing to the cervix at an interval of 10 minutes by fingers with lubricant is useful and cheap method. Cervical tissue is weak respondent to drugs in long standing cases of torsion. Natural prostaglandin gel containing Dinaprostone (PGE2) @ 3 gm endocervicaly with simultaneous intramuscular 2 ml injection of synthetic prostaglandin containing Cloprostenol sodium @ 250 mcg / ml is useful for cervical dilatation as Dinaprostone gel consist of prostaglandin E2 mixed with gel vehicle to improve local retention of the drug and administration of PGF2a or its analogues has a direct luteolytic effect causing a dramatic fall in plasma progesterone level. Misoprostol tablet (PGE1) @ 1000 g endo-cervically also gives efficient response. Exogenous administration of Dexamethasone @ 20 mg IM and Stilbesterol @ 30 mg IM simultaneously leads to production of prostaglandins, which in turn co-ordinates for accomplishment of subsequent parturition. The most widely used treatment is Valethamide bromide @ 20 ml IM for cervical dilatation in bovines.

Q.3 What are the new adoptable hormonal protocols to initiate oestrus and ovulatory response in dairy animals.

A. Progesterone is a fertility hormone and thus exogenous or endogenous elevation of level of the progesterone initiates oestrus in dairy animals. Hence, PRID or CIDR or ear implant methods have assured success in induction of ovulation and this protocol leads to fertilization. Progesterone primed GnRH therapy is also adoptable in anoestrus cases. Induction of oestrus in dairy animals without considering their cyclic and non cyclic status, particularly in silent breeder buffaloes, is possible at any stage of oestrus or anoestrus with GnRH-PG-GnRH protocol and its dozen other modifications. This will combine various reproductive techniques like induction of oestrus, synchronization of oestrus, induction of ovulation and fixed time insemination.

Q.4 Why insemination method of breeding has low success rate under field condition

A. Artificial insemination is a bio-technique and its use necessitates critical and scrupulous attempt in every case of oestrus. Compromise and deviational attitude leads to failure of technology. Sample assessment of semen dose on monthly basis to check quality of semen, selection of correct oestrus for insemination, perfect thawing procedure, selection of site of insemination on skillful experienced criteria, undisturbed animal during attempt of insemination and post insemination follow up can lead to high success rate of insemination at field level. one insemination-one conception is only possible, if insemination is attempted to regular oestrus, clean oestrus and monitored oestrus. Awareness campaign and extension link for farmer breeders is very poor under field conditions and hence majority animal owners are not involved in technology adoption.

Q.5 What should be the strategic procedure in abortion cases at field level.

A. Attend the case within 6-8 hours and record detail history. Carry seven sterile vials and do not use preservatives. Collect pieces of placenta and 5 ml. blood in separate vials. Perform foetal post mortem and record noticeable changes. Collect foetal material in separate vials (foetal heart, abomasal contents and pieces of spleen, lung, liver). Transfer the vials containing samples in thermos with ice. Submit the material to investigating lab at an earliest. Collect convalescent phase serum (approx. 3 weeks after abortion). Swab from uterine discharges, cervical swab, smears from vaginal, uterine discharge and serum samples collected at the time of abortion and after 21 days etc are the samples essential from aborted dam. Entire aborted foetus, heart blood of foetus in sterile Pasteur–pipette, stomach contents of foetus 1-2 ml in test tube, fresh foetal membranes and cotyledons with pleural fluid, kidney and liver of the foetus can be collected for laboratory evaluation. It is necessary to procure samples of sire like serum, preputial washings and semen. After all it is mandatory to investigate every case of abortion to rule out possibility of infectious cause.

Q. 6 How to deal with cases of kinked cervix in large ruminants

A. Altered cervical orientation than the normal straight course is termed as kinked cervix. In majority cases, os cervix is no longer corresponding with the rest course of the cervix. Lacerations at the time of handling of dystokia cases and subsequent scar tissue formation in os cervix increase its rigidity. Passing of AI gun and uterine catheter is difficult in such cases. Cervix is fibro-elastic in ruminants and hence absence of rigidity is helpful to reorient os cervix by rectal manipulation. Resistant cases can be treated with Valethamide bromide @ 20 ml IM a day before expected date of oestrus so that cervix will be sufficiently dilated on the day of oestrus for insemination. Non respondent cases can be double inseminated to increase chance of conception. Inadvertently, natural service can be recommended in cases of kinked cervix.

Q.7 How to detect delayed ovulation or its failure in cyclic animals and what therapeutic measures can be adopted to assure ovulation.

A. Ovulation generally occurs 6 to 12 hours after cessation of oestrus in large ruminants. Sequential per rectal examination is necessary to detect ovulation, delayed ovulation or anovulation. In case of delayed ovulation, follicle is characterized by increase in size, thinning of wall, decreased turgidity and greater fluctuation on repeated palpations after oestrual stage. Anovulation can be diagnosed by non availability of CL formation on tenth day of cycle. Anovulatory follicle is reduced after fourth fifth day of cycle and the follicle is completely degenerated by day 10th. Similarly, failure to detect a regressing CL in ovary during oestrus may indicate anovulatory nature of the preceding cycle. Always, LH surge is necessary for ovulation and hence endogenous or exogenous stimulus to increase LH level is necessary. Injection of GnRH is preferred to boost ovulation in clinical cases than that of the injection of HCG.

Q.8 Is manual removal of placenta essential in delayed cases and how much success is possible on its attempt

A. Placental expulsion takes place within 6 to 8 hours in dairy animals and maximum 2 hours in small ruminants. In all cases of parturition, preventive strategies are available but are not being adopted at present. Herbal ecbolics before a week or two before term are most safe to avoid the retention. All cases can be treated immediately after parturition with intra-uterine bolus administration to expedite placental expulsion. Unresolved and delayed cases can be handled manually with full gloved hand, but squeezing of caruncles, screwing of fimbriated

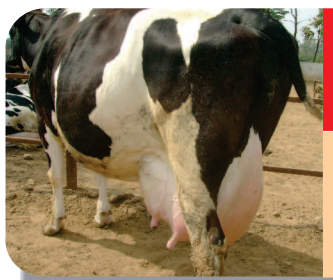
papillae of cotyledons and separation of placentomes is necessary with avoiding of excessive pull to placental mass. It should be kept in mind to separate placentomes for 10 minutes and leave the rest to dislodge at their own accord with pressure of hanging placental mass.

Q.9 Imposed ban on animal slaughter has raised number of infertility cases under field condition

A. Imposed regulation has no relation with infertility condition. Percentage infertility has always been alarming since last 50 years as AI has brought to the light many infertility problems. Average number of life time calving is very low in our country and the regulation will avoid slaughter of valuable animals under low productivity and infertility stamps. It is well known fact that 95 per cent infertility problems are managemental only. It is now good opportunity for field vets to treat all cases of infertility and to make the animals compulsorily pregnant for benefit of owners. Planning, improved management and nutritious feeding of animals is now mandatory for every animal owner. Thus regulation will avoid not only slaughter of animals, but will also put into practice use of reproductive technologies to improve pregnancy rate under field conditions.

Q.10 How to confirm completion of uterine involution in dairy animals.

A. Uterine involution takes approximately 30 days in cows, 25 days in buffaloes and 35 days in crossbreds. Site size and tone of uterus are the important criteria to adjudge uterine involution. After involution, both horns should return to pelvic floor with symmetric position and there should not be any tone to the uterine horns. Pre-pregnancy status is achieved by the uterus and is indicative of completion of uterine involution. Speedy involution is possible after preventive therapeutic measures in dairy animals and use of herbal uterine cleanser, ecbolics and tonics play important role to restore uterine health. Reducing period of negative energy balance, it is possible to achieve uterine involution at an early date.

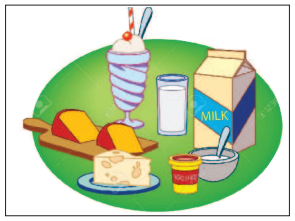


In next issue -
Your Problems on Mastitis Therapy

Readers/Field Veterinarians are requested to send their questions / problems on the above topic via email or by post.

News...National...

NDDB's new campaign "Farmers First"



In a bid to make consumers, particularly those in urban areas, aware of the roll of farmers in meeting their milk and milk products requirements, so also the need to support these farmers, NDDB has launched a nation-wide campaign to support dairy co-operatives brands to help farmers in their distress. The consumers are being appealed through this campaign to purchase and consume only those milk products manufactured and marketed by dairy co-operatives owned by dairy farmers themselves.

NDDB intends further to make use of all types of media in this nation-wide public interest campaign, including news papers, hoardings, videos, social networking posters, banners, leaflets, pamphlets etc. Shri Nana Patekar, a noted actor, has provided his effective voice, free, for this campaign. Prasar Bharati, India's public service broadcasters, has also engaged itself in "Farmers First" campaign of NDDB to help the farmers in distress.

Source : Internet

NDDB aims at reducing milk production cost

Through the network of large number of dairy co-operatives in the country and participation of around 16 million dairy farmers, NDDB is presently procuring 40 lacks liters of milks per day. Since last 2 years, with the provision of Rs. 17361 crores, NDDB is implementing National Dairy Plane Phase 1 with the sole aim of increasing productivity of Indian milch animals to around 200 - 220 million tones per year by the end of the present decade (2020-21). In addition, NDDB also proposes to provide access for small milk producers to organized milk processing sector through improved facilities for milk procurement and transport.

The major focus of NDDB to increase the productivity of animals is on providing frozen semen doses of elite bulls and also on providing information on ration balancing to the milk producers. NDDB contemplates to reduce the cost of milk production through its initiatives for breeding, feeding and milk procurement.

Source : Internet

ICAR - National Institute of Animal Nutrition and Physiology, Adugodi, Bangalore 560030

(Sardar Patel Outstanding ICAR Institute Award 2012)

The National Institute of Animal Nutrition and Physiology was established in 1995 with the mandate of conducting fundamental studies on basic physiological and nutritional problems related to biophysical translation of nutrients for productive functions. The research work carried out and contemplated hold key for providing solutions to the existing and emerging problems in livestock production and productivity by understanding the mechanisms at cellular and molecular level.

Infrastructure

1. Experimental Livestock Unit A well designed experimental livestock unit is available for maintaining animals required for various experiments of the scientists. Facilities are available to maintain cattle, buffaloes, sheep, goat, poultry, laboratory animals etc. The unit also maintains weighing balance for large and small animals, feed block machine, feed grinder, feed mixer, pulverizer cum mineral mixing plant and chaff cutters.

2. Fodder Production Unit A well established fodder production unit with the infrastructures for all farm operations is available for providing green fodders to the experimental animals round the year. Various fodder crops like jowar, maize, lucerne, hybrid napier and fodder tree species are cultivated.

3. Agricultural Knowledge Management Unit The center caters for online preliminary examination to ARS/NET ASRB, a benefit to the students of the southern states. This state of the art facility has provision for 100 candidates to take examination at a time and it is one of the 24 centers across the country.

4. Agricultural Technology Information Centre (ATIC) The ATIC is serving as a single window system for information dissemination. The technologies developed and popularized by the Institute are showcased by the ATIC. It is equipped with information kiosk and state of art teaching/ meeting hall with a capacity for 40 persons.

State of art facilities

Omics Laboratory A central core facility to cater the requirement of scientists to use genomic, proteomic, transcriptomic and bioinformatic tools in the existing research programmes. The laboratory is involved in mapping the microbial biodiversity associated with gut in Indian livestock and study of stress related transcriptome to understand molecular targets for managing stress.

Micronutrient Laboratory The laboratory has advanced facility for estimation of almost all the range of macro and micro minerals in feeds. Currently the laboratory is working on developing molecular markers for Cu and Zn status in sheep, chelated minerals and applications of nano minerals in animal feed formulations.

Feed Additives and Nutraceuticals Laboratory The laboratory has facilities for screening of probiotic organisms and preparation of prebiotics from agricultural by products. The laboratory is equipped with high performance liquid chromatography, tangential flow filtration system and other sophisticated equipments.

Rumen microbiology laboratory The ruman microbiology laboratory is involved in isolation of anaerobic fungi for lignocellulose degradation. The laboratory also maintains a part of Veterinary type cell culture on rumen microbes. It is equipped with facilities for anaerobe culture, gas chromatography, electroporator, capillary electrophoresis, q-PCR and other equipments.

Radioisotope laboratory It is a designated Type-II radio isotope laboratory and is under the regulations and supervision of BARC. It is equipped with multi well gamma and beta (liquid scintillation) counters with automation software, ELISA reader, refrigerated centrifuge and other necessary facilities for quantifying biological molecules like steroid/ protein/ peptide/ amine hormones, hormone receptors etc.

Feed quality and safety Laboratory The laboratory is equipped with automated instruments for analyzing proximate principles, in vitro digestibility studies of animal feeds, analysis of pesticide residues etc. It caters the analytical requirements of the in-house projects and outside agencies like milk federations, commercial firms and farmers.

Energy metabolism laboratory This laboratory is primarily involved in basic research in bioenergetics. It is equipped with automatic bomb calorimeter, gas chromatography system, O_2 analyzer, CO_2 analyzer, methane analyzer, rumination-chewing monitor and expired gas collection system with digital gas meter, twin shaker water bath and real time thermal cycler.

Fermentation technology laboratory The laboratory is involved in the culture, isolation and large scale cultivation of aerobic fungi and characterization and purification of fungal enzymes. It is equipped with sonicator, refrigerated centrifuge, bioreactor, TFF system, freeze drier and trinocular microscope with fluorescence attachment.

Reproductive physiology laboratory This laboratory is involved in assessing the quality and fertilization capability of sperm and gonadal functions in male and female animals. It is equipped with computer assisted semen analyzer, viscometer, small volume spectrophotometer with peltier heated cuvette stage, nanodrop spectrophotometer, electrophoresis and blotting apparatus, CO_2 incubator, phase contrast microscope, inverted microscope, cold handling unit, thermal cycler, gel documentation system and hybridization oven.

Molecular biology laboratory The laboratory is engaged in assessing the role of peptides/proteins and nucleic acids in female reproduction and developing immune diagnostic kit for detecting early pregnancy and subfertile bulls in buffalo. It is equipped with ultracentrifuge, image analysis system, phosphorimager, spectrophotometer, low pressure chromatography system, ultrafultration assembly, cell culture facility and other sophisticated equipments.

Technologies developed

Data base on animal and feed resources The Institute has developed district and state level database of animal and feeds and fodder resources available in the country. The databases are updated and refined for predicting the requirements of feeds and fodder in different parts of the country. Prediction equations are developed to project future production and demand of the feeds. Remote sensing technology is being used for assessment, which would help in devising necessary strategies to address the shortages of feed resources for improving productivity of livestock.

Area Specific Mineral Mixture for livestock This is a more practical and cost effective method of supplementation and avoids antagonistic effects of excess levels of other minerals thereby improving the bioavailability of micronutrients. Mineral mapping for different agro-climatic zones has been carried out.

Modulating BUN levels for enhancing reproduction Protein intake (degradable/non-degradable) in relation to fermentable carbohydrates and ratios of absorbed amino acids influence blood urea nitrogen levels in cattle. When the concentration of blood urea crosses 19 mg %, impaired fertility is observed. The presence of urea significantly increases the secretion of PGF_2 and PGE_2. To modulate protein:energy ratio to bring down the high BUN levels, supplementation of locally available grains like ragi is suggested to ameliorate reproductive problems in cattle especially the postpartum fertility and lowered conception rate.

Specific Mineral Mixture for small ruminants There are no specific mineral mixtures available for small ruminants. The requirement of minerals for small ruminants vary considerably as compared to large ruminants due to their physiological needs. Specific mineral mixtures for small ruminants have been developed and are found to be useful in improving productive efficiency and immunity in small ruminants.

Production of prebiotic from agro-industrial by products Nutraceuticals are the substances isolated from food ingredients, which have beneficial effect on the digestive process through manipulation of health promoting bacteria and improve general health and immunity. Protocols for prebiotic formulations have been developed from agriculture wastes like finger millet straw, corn by products and natural grass by production of xylo-oligosaccharides (XOS), which would be cost effective source for improving production and health in livestock.

Combination test for identifying sub-fertile semen Conception rates following artificial insemination are poor especially in buffaloes (~30%). One of the reasons for this is the inability to identify subfertile bulls and thus the quality of the semen used in the AI programs. Routine tests of sperm concentration and mass activity that are used by the semen collection centers are not able to detect semen of subfertile quality. To address this problem, a highly reliable advanced combination test that can detect semen of subfertile bulls has been developed, which involves assessing acrosomal and functional membrane integrities of the sperm.

Detoxification of castor, neem and karanja cakes Due to shortage of concentrate feeds, there is a need to explore newer unconventional feeds. Most of these feeds contain antinutritional factors. A simple cost effective detoxification method using the process of dehulling, defatting and chemical treatment has been developed for neem seed cake, karanja cake and castor seed cake, which can replace 50% of crude protein of soya bean meal in the concentrate mixture. This would enable in reducing the feed cost and as well enhance the feed basket.

Red spectrum of light enhances egg production Egg production is dependent on the relative activation of two pathways. The inhibitory pathway is activated by stimulating retinal photoreceptors by the incandescent band of the spectrum, and the stimulatory pathway is activated by direct action of the red band on photoreceptors in the brain. Use of near red (675 nm) of the spectrum using red bulbs increased egg production during 72 week period from 77.89 to 85.21%. This technology will help in augmenting the existing management procedures in commercial poultry farms for enhancing egg production without additional cost.

Areca sheath - a promising roughage source The areca sheath, a by-product of areca tree is found to contain less lignin and silica and nutritionally superior to paddy straw. However its use has been limited due to the physical structure. Technology developed to process areca sheath in total mixed rations which reduces the cost of feeding dry fodder by 50% with increase in milk yield and mitigate shortage of dry fodder.

Production of lignolytic enzymes from immobilized aerobic fungi Lignolytic enzymes viz. laccase, LiP and MnP have been produced in bulk by immobilizing various white rot fungi on cheap inert matrices and used for pretreatment of the crop residues. Incorporation of these lignolytic enzymes would help in lignin degradation and enhance utilization of poor quality roughages.

Enteric methane reduction using plant secondary metabolites Methane accounts for 2-12 % loss of dietary gross energy in ruminants. Therefore, reducing ruminal methane not only improves the efficiency of nutrient utilization, but also helps to protect the environment from warming. Plant secondary metabolites such as tannins as rumen modifiers are potential compounds since they are natural products which are environmental friendly and therefore have a better acceptance with regard to food safety issues. Studies carried out at NIANP has shown that tropical tree leaves containing-tannins such as Autocarpus integrifolis, Jatropha curcus and Sesbania grandiflora have the potential to significantly suppress methanogenesis. Therefore tannins contained in these plants could be of interest in the development of new additives in ruminant nutrition.

Feeding garlic for reducing stress Egg production was significantly higher in experimental birds fed with garlic compared to control birds for the periods 61 to 72 week and 73 to 86 week. Eighty percent hen day egg production at 86 week was achieved with the feeding of garlic as against 74 percent in control birds. Experimental birds had 83.5 and 79.8 percent hen day egg production for the period 61 to 72 week and 73 to 86 week respectively. Whereas the corresponding hen day egg production for the control group birds was 78.6 and 74.2 respectively. Experimental group of birds fed with 1% garlic in feed produced 1.73 percent more eggs per day as compared to control group for the period 20 to 90 weeks of egg production.

Pioneer's Profile

Dr. V. Pandurang Rao - A Centurian

Professor of Anatomy (Retd) College of Veterinary science, Tirupati (AP)

The rarest of rare Veterinary academician, who considered teaching not only a profession, but a passion, known for his discipline, equanimity, unbiased attitude and disposition is completing a century of his life with simplicity endowed with intellect, wisdom and knowledge. He has been a role model of parent, teacher and prefect.

Born on 16th September 1916 in Chennai (then Madras) had his early schooling in that city and graduation (GMVC and B.V.Sc) from Madras Veterinary College in 1942. Starting his carrier as Veterinary Assistant Surgeon in earstwhile Madras state in 1942, he landed in his alma-mater as Assistant Lecturer in Anatomy in 1947, a subject which he loved, nurtured and developed throughout his academic life till his superannuation in 1976. On separation of Andhra Pradesh from Madras State, Dr. Rao shifted to Department of Anatomy of Veterinary College, Baptla in 1954 and later to Tirupati in 1957. During the days when post graduation in Veterinary subjects was rare in India, Dr. Rao was deputed to Kansas State University in USA for M.S. in Veterinary Anatomy between 1958-59. Dr. Rao had occasions to visit countries like Germany, France, Italy and UK for advance training in Anatomy.

Dr. Pandurang Rao has to his credit a monumental work of establishing a Veterinary Anatomy Department in Veterinary College, Tirupati, truly from the scratch. No Anatomy department in a Veterinary College anywhere in the World is complete unless it has a Anatomical museum, which is comprised of skeletal models of as many species of animals, the preserved, bottled and neatly labeled organs of animals, charts and flow diagrams of different body systems. Preparation of Histology slides to the perfection is a stupendous job. With his thorough knowledge of the subject, untiring efforts, efficiency, diligence, technical know-how and above all, the devotion to work, Dr. Pandurang Rao accomplished the task of establishing a Anatomy Museum, which is now a matter of appreciation from all the dignitaries who visit the institute. This museum of Tirupati Veterinary College is one of the most commendable one among all Veterinary academic institutions in India. No doubt, Dr. Pandurang Rao taught his students not only Veterinary Anatomy in a interesting way, but he also taught discipline, the time sense, punctuality and regularity in studies.

Apart from his subject, Dr. Rao has innate love for humanity. Tough soft by nature, gentle and sensitive, he always used to be assertive and strict follower of the rules.

The Veterinary College, Tirupati, celebrated Dr. Rao's birth centenary on 19th September 2015 to glorify his guidance and training legacy in Veterinary Anatomy that made his students to follow his footprints to earn name and fame as Veterinary Anatomists and Veterinary surgeons not only in India, but also abroad.

Guidelines To Contributors

The contributions to the journal are accepted in the form of review articles, research articles (clinical / field studies), case reports, other information pertaining to animal health and production. The decision of the Editorial Board members will be final regarding acceptance of the article for publication. The manuscript should be typed on one side of the paper with double spacing except for footnotes and references for which single spacing be used. The style of reference citing should be followed as shown below.

The manuscript should be arranged in the following order:

Title:

Name/s of author/s:

Place of work :

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Key words :

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Results and Discussions :

Summary / Conclusions :

Acknowledgment : (If necessary)

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Books : Name/s of author/s., year of publication in parenthesis, title of the book, edition (Bold), name of publishers (Italics) and place.

Tables and Figures: Tables are to be numbered in Roman numbers (1 II and so on). Each table should have a clear title. Figures should be of good quality and numbered in Arabic numbers (1,2,3 and so on).

Clinical articles and short communications: Not exceeding 3 to 4 typed pages. In case reports, history, observation, tentative and confirmatory diagnosis, line of treatment and follow up on the case should be given. Trade names of drugs should be given in the Material & Methods and their details like composition, manufacturer etc. as a footnote.

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AkzoNobel

Transmix™

	Instant	Sustained
Energy supplementation	Simple sugar	Gluconeogenic precursors
Supplementing mineral demand	Ionic calcium & magnesium chloride	Chelated Ca vitamin D_3
Essential nutrients to ease transition period stress	Microbial protein	Inactive dry yeast culture

Instant & Sustained
Nutrients supplementation for maximizing profits in transition period

Precaution :
Take necessary precaution to avoid accidental entry into Trachea, Lungs & contact nearest veterinarian if animal exhibits any signs of discomfort

Floxidin™ LA (Vet)

(®Enrofloxacin 10%)

First Line Treatment with Right Dose

Presentation: 50 ml

WITHDRAWAL PERIOD :
Milk : 84 hrs.
Meat : 14 days

Convenience

Effective Higher Tissue Levels

Broad Spectrum Solutions for Multiple infections

Indications

- **Systemic Infections** - Mastitis, Metritis, Pneumonia, Gastro-intestinal infections
- **Soft Tissue infections** - Wounds, Post Surgical recovery, supportive treatment in cases of FMD

Dose of Floxidin™ LA (VET)

Body wt(Kg)	Floxidin™ LA (Ml)
30	3
50	5
100	10
200	20
300	30
400	40
500	50

At the dose rate of 1ml/ 10 Kg BW

RECENT INTRODUCTION

Nobivac® KC

COMPOSITION

Each (0.4 ml) dose Contains Brodetella bronchiseptica strain B-C_2 - $\geq 10^{8.0}$ CFU and canine para influenza virus stain Cornell $\geq 10^{3.0}$ $TCID_{50}$

INDICATIONS

Active immunization of dogs against Kennel Cough.

DOSAGE AND ADMINISTRATION

Nobivac KC aims to make administration as easy as possible:

- Low 0.4 ml dose
- Single nostril only
- Can be used with or without applicator

PRESENTATION

One box contains 5 vials of dose and 5 vials of diluent along with one applicator

Ovilis® PPR

COMPOSITION

Freeze dried vaccine after reconstitution with diluent Contains Live attenuated PPR virus NLT 2.5 $TCID_{50}$ per single dose (1 ml).

INDICATIONS

For the active immunization of sheep and goats of 4 months and above age against PPR disease.

DOSAGE AND ADMINSTRATION

1 ml per animal by subcutaneous route.

PRESENTATION

Vials of 100/50/25 doses.

HORMONES

Receptal® VET.

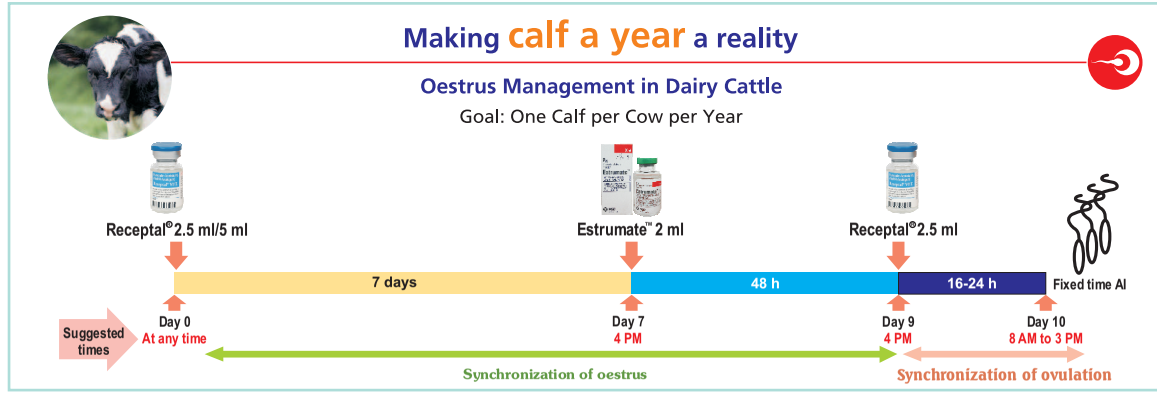
COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each ml contains : Buserelin acetate 0.0042 mg equivalent to 0.004 mg buserelin.	• True anoestrus	5 ml, IM	Vial of 10 ml and 2.5 ml
	• Improvement of conception rate (at the time of AI)	2.5 ml, IM	
	• Ovarian cyst (Follicular), Irregular oestrus, Nymphomania	5 ml, IM	
	• Delayed ovulation & Anovulation	2.5 ml, IM	
	• Improvement of pregnancy rate (11-12 days post AI)	2.5 ml, IM	WITHDRAWAL PERIOD Milk : 0 (Zero) days Meat : 0 (Zero) days
	• Improvement of post partum fertility (10-15 days post-calving)	5ml, IM	

CHORULON®

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each vial contains human Chorionic Gonadotrophin (hCG) 1500 IU as freeze dried pellet of natural glycoprotein human Chorionic Gonadotrophin	• Improvement of conception rate (cows/buffaloes)	1500 IU at AI or mating, IM or IV	Box containing 5 vials (1500 IU each) with 5 vials of solvent
	• Enhancement of luteal function post AI	1500 IU, 4-6 days post AI, IM	
	• Cystic Ovarian Disease (anoestrus, prolonged estrus, nymphomania)	3000 IU, IV	
	• Induction of ovulation (mares)	1500-3000 IU, IM or IV, 24 hours before AI/mating	WITHDRAWAL PERIOD Milk : 0 (Zero) days Meat : 0 (Zero) days

FOLLIGON®

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each vial contains Pregnant Mare Serum Gonadotrophin injection (Freeze dried) 1000 IU	Females:	Cow/Buffalo	Box containing 5 vials (1000 IU each) with 5 vials of solvent
	• Anoestrus	Anoestrus : 500 - 1000 IU IM	
	• Super ovulation	Super ovulation: 1,500-3,000 IU, IM between day 8-13 of cycle	
	• Increase of fertility rate after progestagen pre-treatment	300-750 IU, IM, at the end of a progestagen treatment	WITHDRAWAL PERIOD Milk : 0 (Zero) days Meat : 0 (Zero) days



ANTI-INFECTIVE

COBACTAN 2.5%

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each ml of suspension contains 29.64 mg Cefquinome Sulphate (equivalent to 25 mg Cefquinome).	Cattle • Respiratory disease caused by *Pasteurella multocida* and *Mannheimia haemolytica* • Digital dermatitis, infectious bulbar necrosis and acute interdigital necrobacillosis (foul in the foot) • Acute *E. coli* mastitis with signs of systemic involvement Calf • *E. coli* septicaemia	1 mg cefquinome/kg bw Ml (2ml/50 kg bw) 1 mg cefquinome/kg bw Ml (2ml/50 kg bw) 1 mg cefquinome/kg bw Ml (2ml/50 kg bw) 2 mg cefquinome/kg bw Ml (4ml/50 kg bw)	50 ml multidose vial. WITHDRAWAL PERIOD Milk : 1 day Meat : 5 days

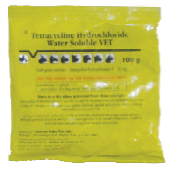
COBACTAN LC

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each syringe of 8 gm contains 75 mg Cefquinome sulphate as active ingredient.	For the treatment of clinical mastitis in lactating cows caused by *Staphylococcus aureus, Streptococcus uberis, Streptococcus dysgalactiae, Escherichia coli* & other entero-bacteria susceptible to cefquinome.	Gently infuse the contents of one syringe into the teat canal of the infected quarter every 12 hours after each of 3 successive milkings. Milk out the affected quarter (s). After thoroughly cleaning & disinfecting the teat & teat orifice, gently infuse the contents of one syringe into affected quarter. Disperse the product by gently massaging the teat & udder of the affected animal.	Box of 3 injectors with 3 isopropyl alcohol soaked towels WITHDRAWAL PERIOD Milk : 84 hours Meat : 2 days

Floxidin™ VET

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Floxidin 10% injection : Each ml contains - Enrofloxacin I.P. 100 mg	- Alimentary canal e.g. Enteritis, calf scours. - Respiratory tract e.g. Pneumonia - Urogenital system e.g. Metritis, cystitis - Skin e.g. Bacterial dermatitis, pyodemra. - Mastitis, & Haemorrhagic Septicaemia.	Floxidin can be given once daily, for 3-5 days. Cattle, Sheep & Goat 2.5-5 mg/kg body weight IM Dog/Cat (adult) 5 mg/kg body weight IM Camel 2.5 mg/kg body weight IM	15 ml, 50 ml Now also available 100 ml WITHDRAWAL PERIOD Milk : 3.5 days Meat : 14 days

Tetracycline WSP VET



COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each gm contains Tetracycline Hydrochloride I.P. 50 mg	In Sheep & Goat : Pneumonia, Joint ill, Anthrax, Septicaemia, Contagious Caprine Pleuro-Pneumonia, Scours, Acute Mastitis, Acute Metritis, In Cattle : Infectious diseases like Haemorrhagic septicaemia, Anthrax, Black Quarter, Leptospirosis, Foot Rot & Contagious Bovine Pleuro-Pneumonia, Calf Scours, Calf Diphtheria, Pneumonia, Septicaemia, Acute Metritis, Acute Mastitis.	Sheep & Goat : 1 gm/kg body weight Cattle : 2.5-5 gm/15kg body weight for 5 days	Sachet of 100 grams WITHDRAWAL PERIOD Milk : 7 days Meat : Cattle-15-22 days, Poultry-5 Days

METRICEF™

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each single dose syringe of 19 g contains: Cephapirine Benzathine intrauterine suspension in pre filled syringe-500 mg	• Subacute/chronic endometritis in cows over 14 days postpartum • Repeat breeders (3 or more unsuccessful inseminations).	Single dose syringe to be administered intra-uterinely	Single dose (19 g) syringe provided with a separate disposable catheter and a glove. WITHDRAWAL PERIOD Meat & offals : 24 hours Milk :0 (Zero) hours

PARASITE CONTROL

butox® Vet

Highly effective & safe ectoparasiticide only for external use.
Ideally suited for control of ticks, mites, lice & flies of livestock, poultry, dogs & farm houses.

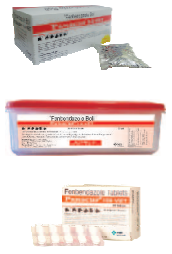
COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each ml contains : Deltamethrin I.P. 12.5mg	To control the ectoparasites in cattle, sheep, goats, horses, camels, dogs & farm houses.	Spray or dip : Ticks : 2 ml/lit Mites : 4 ml/lit Flies : 2 ml/lit Lice : 1 ml/lit	Aluminium container of 5 ml, 15ml, 50 ml, 250 ml and 1 lit with plastic measuring cup WITHDRAWAL PERIOD Milk : 0 (Zero) day Meat : 20 days

Taktic® 12.5% EC

Broad spectrum ectoparasiticide against ticks, mites, lice & keds

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each ml contains : Amitraz I.P. (Vet) 125 mg	1. For prevention & control of ectoparasitic infestation like ticks, mites, lice & keds in cattle, sheep, goat, camel & pig. 2. Taktic kills tick, mite and lice. 3. Taktic kills organochlorine, organophosphate & pyrethroid resistant strains of ectoparasites.	Taktic 12.5%/lit of water for ticks : Cattle/Buffaloes/Camel: 2.0 ml Sheep/Goat : 4.0 ml Pigs : 4.0 ml Taktic 12.5%/L of water for mites and keds : Cattle / Camel : 2.0 ml Sheep/Goat : 4.0 ml Pigs : 4.0 ml	Tin Container of 15 ml, 50 ml & 250 ml with plastic measuring cup WITHDRAWAL PERIOD Milk : 7 hrs after applications Meat : 1 day for Cattle & Goats & 7 days for Pigs & Sheep

Panacur® VET



COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
The active ingredient of Panacur is Fenbendazole which is the research product of Intervet/Schering-Plough Animal Health. Each 1.5 g Bolus contains 1.5 g of active Fenbendazole. I.P. Each 150 mg tablet contains 150 mg of active Fenbendazole. I.P.	Infestation of cattle, buffaloes, sheep, goat & horses with gastro-intestinal nematodes, lungworms & tapeworms such as *Haemonchus spp., Ostertagia spp., Trichostrongylus spp., Cooperia spp.* and *Nematodirus spp.*	Recommended for cattle, sheep, goat, horses & pigs. Panacur 150 mg table per 30 kg body weight & Panacur 1.5 gm bolus per 300 kg body weight (5 mg Fenbendazole per kg body weight). Dose for horses : 7.5mg/kg bw	Box of 5 x 2'- 1.5 gm bolus Box of 5 x 2'- 3 gm bolus Box of 5 x 10'- 150 mg tablets. WITHDRAWAL PERIOD Milk : 0 (Zero) day Meat : 8 days

Panacur® 25% Wettable powder (vet)

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each gram contains Fenbendazole I.P 250 mg	Infestations of cattle, buffaloes, Sheep & goats with gastro-intestinal nematodes, lungworms & tapeworms such as *Haemonchus spp., Ostertagia spp., Trichostrongylus spp., Cooperia spp., Nematodirus spp., Neoascaris vitulorum, Oesophagostomum spp., Chabertia spp., Bunostomum spp., Gaigeria pachyscelis, Capillaria, Trichuris spp., Strongyloides spp., Dictyocaulus filaria, Dictyocaulus viviparus, Moniezia spp., Infestation of dogs with Ancylostoma spp., Infestation of horses with strongyles, Ascarids, Ascarids (Parascaris), Oxyuris & Strongyloides Infestation of pigs with Hyostrongylus rubidus, Oesophagostomum spp., Ascaris suum, Trichuris suis & Metastrongylus spp.*	Recommended for cattle, sheep, goat & pigs. Infestation with gastrointestinal nematodes & lungworms : (5 mg Fenbendazole per kg body weight) Suspension to be made by mixing clean water as: 6 g with 100 ml 60 g with 1 lit. 120 g with 2 lit.	6 g sachet, 60 g & 120 g container WITHDRAWAL PERIOD Milk : 0 (Zero) day Meat : 8 days

PARASITE CONTROL

Panacur® 2.5% Suspension (VET)

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each ml contains 25 mg of Fenbendazole I.P.	Infestation of cattle, buffaloes, sheep & goats with gastrointestinal nematodes lungworms & tape worms such as *Hoemonchus spp., Ostertagia spp., Trichostrongylus spp., Cooperia spp., Nematodyrus spp.,*	Dose recommended for cattle, buffaloes, sheep, goats & pigs' infestation with gastrointestinal nematodes & lungworms: (5 mg Fenbendazole per kg body weight)	90 ml 450 ml and 1 lit HDPE bottle pack of Panacur 2.5% suspension. WITHDRAWAL PERIOD Milk : 0 (Zero) day Meat : 8 days

Tolzan® Plus-L

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Oxyclozanide I.P. - 3.4% w/v Levamisole Hydrochloride I.P. - 2.5% w/v	• Tolzan Plus-L treats the round worms and liver flukes in cattle, sheep and goats • Tolzan Plus-L controls adult and immature stages of conical flukes also (Paramphistomum spp.) • Tolzan Plus-L can be used safely in pregnant animals during all stages of pregnancy. • Tolzan Plus-L can safely be given to all cattle, sheep and goats without any pre-dosing, starving or change of diet.	Cattle: 90 ml for 300 kg live mass PO Sheep and goats: 9 ml for 30 kg live mass PO	120 ml HDPE bottle, 1 Ltr can WITHDRAWAL PERIOD Milk : 0 (Zero) days Meat : 14 days

Tolzan® F VET

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each ml of suspension contains Oxyclozanide I.P suspension of 3.4% w/v	1) Tolzan -F is used in the treatment of acute & chronic Fascioliasis in cattle, buffaloes, sheep & goats. The important species are : a) *Fasciola hepatica* b) *Fasciola gigantica* 2) Tolzan -F is also used to treat paramphistomiasis. The species involved are : *P. microbrothriodes, P. microbrothridium, P. gotal, P. orthocoelium* 3) Tolzan -F also acts on *Monezia* tapeworm in sheep.	Cattle & Buffalo : Orally 10-15 mg/kg body weight Sheep & Goat: Orally 15 mg/kg body weight	90 ml HDPE bottle & 1 ltr jerry can. WITHDRAWAL PERIOD Milk : 0 (Zero) days Meat : 14 days

Berenil® VET 7% RTU

As treatment & control therapy of Babesiosis, Trypanosomiasis and Theileriosis

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each ml contains : Diminazine Aceturate 70 mg Phenazone B. P. 375 mg	Babesiosis & Trypanosomiasis, Tenacious Trypanosomiasis, Theileriosis & mixed infections, Pyrexia of Unknown Origin	Babesiosis and Trypanosomiasis at 5-10 ml per 100 kg b.w. Resistant strains of Trypanosomiasis at 10 ml per 100 kg b.w. Theileriosis & Mixed infections at 5 -10 per ml 100 kg b.w. along with antibiotic (3-4 antibiotic injections on alternate days)	Amber coloured vials of 20 ml, 30 ml and 90 ml WITHDRAWAL PERIOD Milk : 3 days Meat : 20 days

SUPPORTIVES

Tonophosphan® VET

Injectable phosphorus preparation for improving metabolism, milk production & fertility in livestock. Its content of organically bound phosphorus is 20%.

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each ml contains : Sodium salt of 4-dimethylamine, 2-methylphenyl-phosphinic acid 0.2 g	As a tonic in general metabolic disorders, debility, exhaustion, repeat breeding & infertility due to phosphorus deficiency. For disorders of bone formation as in rickets & osteomalacia. To promote callus formation in fractures in combination with calcium & vitamin D. For treatment of tetany & paresis resulting from calcium, magnesium & phosphorus imbalance (as in milk fever).	Large Animals : 5-20 ml. Small Animals : 1-3 ml. In chronic conditions- Large Animals : 2.5-5 ml Small Animals : 1-2 ml.	Vial of 10 ml and 30 ml Now also available 100 ml vial

VM all™

CONTENTS PER KG	BENEFITS	DOSAGE	PRESENTATION
Each Kg contains a nutritional value of : Cobalt 120mg, Copper 1000mg, Magnesium 5000mg, Iron 2500mg, Potassium 100mg, Manganese 2000mg, Flourine 60mg, Calcium 150g, Selenium 10mg, Vit A 1200000 IU, Vit D3 120000 IU, Sulphur 0.70%, Vit E 1200 IU, Iodine 300mg, Zinc 5000mg, Phosphorus 60g, Niacinamide 4g, Vit K 200mg, Sodium 8mg.	To improve on fertility. To safeguard health and growth. To optimize milk yield and fat.	Ruminants Mix 100-200 g per 10 kg of feed depending on the availability of other fodder/feed. For direct feeding, Cow and Buffalo: 25-30 g/head/day Calf, Sheep and Goat: 15-20 g/head/day Aqua: Mix 100g to 10 kg of fish feed.	1 kg Zip-Locked pouch with measuring spoon. 5 Kg & 25 Kg bag

VM all™ - P

CONTENTS PER KG				BENEFITS	DOSAGE	PRESENTATION
Each KG contains a nutritional value of (When packed):				• To improve on fertility • To safeguard health and growth. • To optimize milk yield and fat.	Ruminants Mix 100-200 g per 10 kg of feed depending on the availability of other fodder/feed. For direct feeding, Cow and Buffalo: 25-30 g/head/day Calf, Sheep and Goat: 15-20 g/head/day Aqua: Mix 100g to 10 kg of fish feed.	25 kg Sealed bag Now also available 5 Kg bag
Cobalt	150 mg	Vit A	1200000 IU			
Copper	2200 mg	Vit D3	120000 IU			
Iodine	325 mg	Vit K	200 mg			
Iron	2500 mg	Vit E	500 IU			
Magnesium	6000 mg	Calcium	225 g			
Manganese	2200 mg	Phosphorus	90 g			
Potassium	100 mg	Niacinamide	1000 mg			
Sodium	8 mg	Biotin 2%	500 mg			
Sulphur	1%	Bioactive				
Zinc	9000 mg	chromium	65 mg			

SUPPORTIVES

Rumicare® (Vet)

Normalises milk production by restoring ruminal activity.

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each gm powder contains : Calcium Propionate 480.00 mg Methionine 40.00 mg Picrorhiza Dry Extract 2.00 mg Cobalt Gluconate 0.32 mg Vitamin B_6 IP 0.32 mg Dextrose Anhydrous IP 428.00 mg	Bloat, digestive disorders caused by decreased activity of reticulum & rumen or sudden dietary changes &/ or intoxication. As a supportive therapy in diseases caused by foreign bodies & hypo-glycaemic conditions in cattle, calves, sheep & goats.	Adult Cattle : 125 gm sachet twice daily, (once in 12 hours Young Animals : 65 gm (approx) once or twice daily Sheep & Goat : 32 gm once or twice daily	125 g sachet

Avilin® Vet

For quick relief from allergic manifestations.

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each ml contains: Pheniramine maleate IP 22.75 mg.	Itching due to eczema, dermatitis, urticaria, skin oedema, insect bites, photo-dermatitis, rhinitis, tail eczema in horses, stomatitis & inflammation of the hooves of cattle, serum sickness, paresis during pregnancy, toxaemia & retention of placenta, pulmonary oedema in cattle, pulmonary emphysema in horses.	Large animals : 5-10 ml. Small animals : 0.5-1 ml. or more. By IM or IV route	Amber coloured vial of Avil 10 ml and 33 ml WITHDRAWAL PERIOD Milk : 2 days Meat : 7 days

Prednisolone Acetate Injection

For quick relief from ketosis.

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each ml contains : Prednisolone acetate I.P. 10 mg	Prednisolone is indicated in ketosis in dairy cattle, shock, inflammations (especially rheumatic arthritis, dermatitis, bursitis) and allergic conditions of livestock	Cattle, horses : 5-20 ml. Calves, pigs : 2.5-5ml. Piglets, dogs, cats :1-3 ml. or as recommended by Veterinarian.	Vial of 10 ml WITHDRAWAL PERIOD Milk : 3 days Meat : 5 days

Vetalgin® VET

Highly effective analgesic, antispasmodic, antirheumatic & antipyretic agent.

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each ml contains : Analgin I.P. 0.5 g Chlorbutol (as bacteriostat) 0.4% w/v	For relief from pain, fever, labour, spastic condition of cervix during parturition, rheumatic conditions, neuritis, neuralgia, retention of placenta, dysentry, bloat & gastritis in domestic animals.	Preferably intravenous, otherwise intramuscular or combination of IV/IM injection. Horse : 20-60 ml Cattle : 20-40 ml Foal, Calf : 5-15 ml Sheep, Goat : 2-8 ml Pig : 10-30 ml Dog : 1-5 ml	Vial of 33 ml WITHDRAWAL PERIOD Milk : 2 days Meat : Cattle 12 days/Pig 3 days & Horse IV 5 days

RUMINANT BIOLOGICALS

BOVILIS™ Clovax

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each 2 ml dose contains inactivated & concentrated FMD antigen of FMD virus serotype O, A, Asia-1, NLT $3PD_{50}$ for each serotype	For the active immunization of cattle, buffalo, sheep and goats against Foot and Mouth Disease.	Cattle, Buffalo & Calves: 2 ml, Sheep & Goat: 1 ml by deep intramuscular route	Vials of 25 doses (50 ml).

BOVILIS™ HSBQ

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each 2 ml dose contains formaldehyde inactivated anacultures of pasteurella multocida P52, sufficient antigen to give 4 PU in mice potency as per I.P.	For the prophylaxis against Haemorrhagic septicaemia and Black quarter disease in cattle and buffaloes	2 ml of vaccine per animal by deep intra-muscular route	Vials of 100 ml(50 dose)

BRUCELLA ABORTUS (STRAIN 19) VACCINE LIVE Freeze dried I.P.

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each 2 ml dose contains not less than $4x10^{10}$ colony forming units of Live attenuated Brucella abortus strain 19 organisms	For the active immunization of female calves of cattle and buffaloes against Brucella abortus infection	2 ml of reconstituted vaccine per animal by subcutaneous route only	Vials of 5 doses with sterile diluent

BOVILIS™ ET

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each 2 ml dose contains inactivated bacterial anacultures of *Clostridium perfringens* Type D, NLT 1500 MLD_{100} per dose.	For active immunization of sheep and goats against Enterotoxaemia type D	Sheep/Goats - 2 ml by subcutaneous injection only.	Vial of 50 doses (100 ml)

Clostridium Perfringens Vaccine Inactivated IP

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each 2 ml dose contains inactivated *Clostridium perfringens* Type B 250 MLD_{100} per dose Type C 250 MLD_{100} per dose Type D 1500 MLD_{100} per dose	For active immunization of sheep and goats against Lamb dysentery, struck & Enterotoxamia	2 ml per animal by subcutaneous route	Vials of 25 doses (50 ml).

Nobivac®:Puppy DP

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each 1 ml dose contains : live infectious canine distemper virus strain Onderstepoort minimum 5.0 log_{10} $TCID_{50}$ Live infectious canine parvo virus strain 154 minimum 7.0 log_{10} $TCID_{50}$	Active immunization of dog against CDV and CPV.	Reconstitute one vial of Nobivac Puppy DP in one vial of Nobivac Solvent & inject subcutaneously.	One box contains 10 vials of 1 dose.

Nobivac®:DHPPi

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each 0.5 ml dose contains : Live infectious canine distemper virus (CDV) strain Onderstepoort at least 4.0 log_{10} $TCID_{50}$ Live infectious canine adeno virus type 2 (CAV_2) strain Manhattan LPV_3 at least 4.0 log_{10} $TCID_{50}$ Live injections canine parvo virus (CPV) strain 154, at least 7.0 log_{10} $TCID_{50}$ Live injections canine para-influenza virus (CPI) strain cornell at least 5.5 log_{10} $TCID_{50}$	Vaccination against CDV, CAV2, CPV & CPi. Besides providing protection against CAV2 disease entities such as respiratory tract infections, the vaccine also protects against infectious canine hepatitis (ICH) caused by CAV1.	Reconstitute the contents of one vial of Nobivac DHPPi in one vial of Nobivac Solvent, Nobivac Lepto, Nobivac Rabies or Nobivac RL immediately prior to use & inject subcutaneously.	One box contains 10 vials of 1 dose.

Nobivac®:Lepto

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each dose contains inactivated strain of: Leptospira interrogan serotype canicola strain Ca-12-000-(1500 units) Leptosprira interrogan serotype icterohaemorrhagiae stain 820k-(1000 units)	Active immunisation against Leptospirosis caused by *L.icterohaemorrhagiae* & *L.canicola of Leptospira interrogans.* Animals are protected against clinical disease, & also against becoming renal carriers after challenge.	Inject 1 ml of Nobivac Lepto subcutaneously. Nobivac Lepto can also be used to reconstitute Intervet's freeze dried vaccines Nobivac Puppy DP & Nobivac DHPPi.	One box contains 10 vials of 1 dose

Nobivac®:Rabies

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each 1 ml dose contains rabies virus (Pasteur RIVM Strain) inactivated ≥ 2 IU	For the active immunisation of healthy dogs, cats, cattle, sheep, goats, horses and in principle all healthy mammals against Rabies & can be used for both (prophylactic immunisation & post bite therapy.	1 ml by subcutaneous or intramuscular injection. Shake well before use.	One box contains 1 ml x 10 vials or one box contains 10 ml x 10 vials

Nobivac®:RL

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each 1 ml dose contains : Rabies virus inactivated antigen suspension ≥ 3.0 IU Leptospira interrogans sero group Canicola ≥ 40 hamster PD_{80} Leptospira interrogans sero group icterohaemorrhagies ≥ 40 hamster PD_{80}	For the active immunisation of dogs against rabies, and canine leptospirosis caused by *L.interrogans* serogroups *canicola* and *icterohaemorrhagiae*.	1 ml by subcutaneous injection. Can be used to reconstitute Nobivac DHPPi. Intended for dogs from 8 weeks of age onwards.	One box contains 1 ml x 10 vials.

Taktic® 5% EC

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each ml contains : Amitraz I.P. 50 mg	It is indicated for the topical treatment of Demodectic & Sarcoptic Mange, ticks & lice in dogs.	Mixing Rate / lit of water: Ticks & lice - 6 ml Mites - 10 ml 3-5 applications for mange and 2 applications for ticks and lice at weekly intervals. Taktic to be used as dip or spray	Glass bottle of 25 ml with plastic measuring cup

San Coat®

CONTENTS	BENEFITS	DOSAGE	PRESENTATION
Essential Fatty Acids (Linoleic Acid, Alpha Linolenic Acid, Gamma Linolenic Acid, Eicosapentaenoic Acid and Docosahexaenoic Acid) Vitamins (Vitamin A and E, Biotin and Pyridoxine) Zinc and Inositol Omega 6 and Omega 3 fatty acids in 6:1 ratio	San Coat is indicated as an aid in the management of allergic and inflammatory skin conditions like alopecia, dull and dry hair coat, pruritis, atopic dermatitis, *Malassezia pachydermatis*, pyoderma, mange etc. in dogs.	Pour measured dose on food once daily according to the following schedule. 0.3 to 1.0 ml per kg body weight. Under 7 kg - 3.75 ml 7 - 23 kg - 7.5 ml Over 23 kg - 15.0 ml	Container of 150 ml (bettix shape)

DELVOSTERON™

COMPOSITION	INDICATIONS	DOSAGE	PRESENTATION
Each ml contains proligestone Injection 100 mg	Suppression & postponement of oestrus in the bitch, treatment of pseudo pregnancy in the bitch, suppression and postponement of oestrus in the queen and suppression and postponement of oestrus in the ferret.	Dogs Body weight / Dosage < 3 kg / 1.0 ml 3-5 kg / 1.0-1.5 ml 5-10 kg / 1.5-2.5 ml 10-20 kg / 2.5-3.5 ml 20-30 kg / 3.5-4.5 ml 30-45 kg / 4.5-5.5 ml 45-60 kg / 5.5-6.0 ml > 60 kg / 1 ml/ 10 kg	20 ml Vials

BLADDER STRENGTH

COMPOSITION		BENEFITS	DOSAGE	PRESENTATION
Active Ingredients per Tablet :		• Deals with urinne incontinence problems in male and female dogs which is due to less level of estrogen on testosterone. • These dogs are basically geriatric dogs, bitches post sparying , animals with poor anatomical disposition or having urinary tract infection.	Give one tablet per 14 Kg or 30 ponds of body weight. half tablet for animal - less than 30 Ponds of weight If giving more than one tablet, divide between AM and PM	30 tablets presentation
Pumkin Seed Powder	150 mg			
Rehmannia glutinosa (root) Powder	150 mg			
Wild Yam Extract	150 mg			
Soy Protein Extract	100 mg			
Corn Silk Powder	60 mg			
Saw Palmetto Extract	60 mg			
OliveLeaf (15% Oleuropein) Extract	50 mg			
Pyridoxine HCl (Vitamin B6)	25 mg			

CANINE PLUS

COMPOSITION		BENEFITS	DOSAGE	PRESENTATION
Guaranteed Analysis Represents Minimum Levels per Tablet Unless otherwise Specified :		• Enhances immunity, support bone formation. Blood formation • Nerve formation, skin health, general health, antistress and antioxidant function	Directions for use or as directed by a veterinarian : Under 20 kg : 1 tablet daily Over 20 kg : 2 tablets daily When more than one tablet per day is required, dividing between AM and PM is optional.	30 and 60 tablet presentation
Moisture (max	5.655%			
Methionine	3.75 mg			
Calcium (6.25%)	37.5 mg			
Phosphorus (3.13%)	18.75 mg			
Potassium (0.03%)	0.187 mg			
Magnesium (3.13%)	18.75 mg			
Iron (3750 ppm)	2.25 mg			
Copper (3.33 ppm)	0.002 mg			
Zinc (1250 ppm)	0.75 mg			
Iodine (10 ppm)	0.006 mg			
Selenium (3.33 ppm)	0.002 mg			
Vitamin A	450 IU			
Vitamin D3	37.5 IU			
Vitamin E	3.75 IU			
Thiamine (Vitamin B1)	3.75 mg			
Riboflavin (Vitamin B2)	1.875 mg			
Panthothenic Acid	3.75 mg			
Niacin	3.75 mg			
Vitamin B6	1.875 mg			
Folic Acid	0.001 mg			
Vitamin B12	0.001 mg			
Choline	3.75 mg			
Biotin	0.001 mg			
Ascorbic Acid (Vitamin C)	9.375 mg			
Bromelain (Pineapple)	0.675 GD Units			

DERMA STRENGTH

COMPOSITION		BENEFITS	DOSAGE	PRESENTATION
Active Ingredients per 1 tablet :		• Collagen production • Skin texture • Circulation • Immune system response and circulation • Tissue recovery • Normal histamine levels • Provides support during allergy season	Directions for use or as directed by a veterinarian : Give 1 tablet per 10 kg of body weight daily. If giving more than 1 tablet daily, divide between AM and PM.	30 tablet
Methylsulfonylmethane (MSM)	75 mg			
N, N-Dimethylglycine Hcl (DMG	50 mg			
DL-Methionine	50 mg			
L-Cysteine	50 mg			
Grape Seed (Vitis vinifera) Extract	30 mg			
Ascorbic Acid (Vitamin C)	25 mg			
L-Proline	25 mg			
Perilla (Perilla frutescens) seed Extract	20 mg			
dl-alpha Tocopheryl Acetate (VitaminE)	10 IU			
Zinc (Zinc Citrate)	5 mg			
Hyaluronic Acid (HA)	5 mg			
Niacinamide (Vitamin B3)	4 mg			
Retinyl Acetate (Vitamin A)	37 IU			

CARDIO STRENGTH

COMPOSITION		BENEFITS	DOSAGE	PRESENTATION
Active Ingredients per Capsule :		• Dogs and cats with pre-existing sub-optimal cardiovascular functions • Breeds of dogs and cats that are predisposed to cardiovascular stress • Support of geriatric patients	Directions for use or as directed by a veterinarian : Cat : Give 1 capsule daily. Dogs : Give 1 capsule, per 10 kg of body weight, daily. If giving more than 1 capsule, divide between AM and PM.	30 and 60 tablet
L-Carnitine HCl	125 mg			
L-Taurine	125 mg			
N, N-Dimethylglycine HCl	25 mg			
d-alpha Tocopheryl Succinate (Vitamin E)	30 IU			
Coenzyme Q10	10 mg			
Folic Acid	0.9 mg			
Magnesium (as Magnesium Citrate)	0.5 mg			
Potassium (as Citrate/Malate)	.01 mg			
Selenium (as Sodium Selenite)	0.007 mg			

GLYCOFLEX

COMPOSITION		BENEFITS	DOSAGE	PRESENTATION
Active Ingredients per Tablet :		• Glyco FLEX Canine represents our comprehensive support for dogs needing moderate joint support. • These delicious chewable tablets are also recommended for adult and maturing dogs, sporting and working breeds as well as support normal recovery after orthopedic surgery.	Directions for use or as directed by a veterinarian : Up to 15 kg :½ tablet daily 15.5 kg-30 kg : 1 tablet daily 30.5 kg-45 kg : 2 tablet daily 45.5 kg & over : 2 ½ tablets daily If giving more than 1 tablet, divide between AM and PM.	30 and 60 tablet presentation
Glucosamine HCl (Shrimp and Crab)	375 mg			
Pena Canalicus (Glycomega™ brand Green Lipped Mussel)	300 mg			
Methylsulgonylmethane (MSM)	250 mg			
N, N-Dimethylglycine HCl (DMG)	50 mg			
Manganese (as Mn Proteinate)	5 mg			

RENAL ESSENTIALS

COMPOSITION		BENEFITS	DOSAGE	PRESENTATION
Active Ingredients per Tablet :		• Renal circulation • Immune and antioxidant defense system function • Homocysteine balance • Normal fluid retention • Stress management • Kidney and liver function • Normal detoxification	Directions for use or as directed by a veterinarian : Give 1 tablet per 10 kg of body weight, day For dogs less than 7 kg, give 1/2 tablet daily If giving more than 1 tablet, divide between AM and PM.	45 tablets presentation
Astragalus Root Powder	60 mg			
Rehmannia glutinosa Root Extract	50 mg			
Nettle (Urtica dioica) Seed Extract	50 mg			
Cordyceps sinensis Extract	50 mg			
Lecithin	50 mg			
L-Arginine	50 mg			
N, N-Dimethylglycine HCl (DMG)	25 mg			
Potassium (K Gluconate)	8.25 mg			
Inositol	8 mg			
Pyridoxal 5-Phosphate (Vitamin B6)	8 mg			
Thiamine (Vitamin B1)	4 mg			
Riboflavin (Vitamin B2)	4 mg			
Choline	4 mg			
Folic Acid	0.15 mg			
Methylcobalamin (Vitamin B12)	0.05 mg			

POULTRY PRODUCTS

Live Vaccine

Nobilis® Gumboro 228E

COMPOSITION	INDICATIONS	DOSE & ROUTE	PRESENTATION
Each dose contains : Live Gumboro disease virus strain 228E at least 2.0 log_{10} EID_{50}	The vaccine is recommended for active immunization of chicken against Gumboro Disease (IBD)	One dose per bird through drinking water	1000 ds 2500 ds

Nobilis® Gumboro D78

COMPOSITION	INDICATIONS	DOSE & ROUTE	PRESENTATION
Each dose contains : Live Gumboro disease virus strain D78 at least 4.0 log_{10} $TCID_{50}$	The vaccine is recommended for active immunization of chicken against Gumboro Disease (IBD)	One dose per bird through drinking water	1000 ds 2500 ds

Nobilis® ND Clone 30

COMPOSITION	INDICATIONS	DOSE & ROUTE	PRESENTATION
Each dose contains : Live Newcastle Disease strain Clone 30 at least $10^{6.0}$ ELD_{50}	The vaccine is recommended for active immunization of chicken against Newcastle Disease	One dose per bird through drinking water, spray, intranasal/intra ocular	1000 ds 2500 ds 5000 ds

Nobilis® IB H120

COMPOSITION	INDICATIONS	DOSE & ROUTE	PRESENTATION
Each dose contains : Live Injectious Bronchitis virus strain H120 at least 3.0 log_{10} EID_{50}	The vaccine is recommended for active Immunization of chicken against Infectious Bronchitis	One dose per bird through drinking water, spray, intra-nasal / intra-ocular	1000 ds 2500 ds 5000 ds

Nobilis® MG 6/85

COMPOSITION	INDICATIONS	DOSE & ROUTE	PRESENTATION
Each dose contains : Live Mycoplasma gallisepticum strain MG 6/85 minimum $10^{6.9}$ CFU	The vaccine is recommended for active immunization of chicken to reduce the clinical signs of Mycoplasma gallisepticum infection.	One dose per bird through intraocular	1000 ds

Cell Associated Vaccine

innovax™ ND-SB1

COMPOSITION	INDICATIONS	DOSE & ROUTE	PRESENTATION
Each lyophilised ampoule per dose (1 ml) contains : Live Turkey Herpes virus strain HVT/NDV-F at least 1534 PFU/bird Marek's disease virus serotype 2 strain SB-1 at least 1514 PFU per bird dose	The vaccine is recommended for active immunization of chicken against Marek's Disease (MD) and Newcastle Disease (ND)	0.2 ml injection subcutaneously per chick in the neck	2000 ds 4000 ds

Inactivated Vaccine

Nobilis® MG inac

COMPOSITION	INDICATIONS	DOSE & ROUTE	PRESENTATION
Each dose contains : Inactivated Mycoplasma gallisepticum strain MG 6/85 NLT 0.23 units	The vaccine is recommended for active immunization of chicken against infections caused by Mycoplasma gallisepticum.	0.5 ml S/C	500 ml (1000 ds)

Nobilis® E. coli inac

COMPOSITION	INDICATIONS	DOSE & ROUTE	PRESENTATION
Each 0.5 ml dose contains : F11-antigen Suspension containing 100 µg F11-68.3 mg FT-antigen Suspension containing 100 µg FT-68.3 mg	The vaccine is recommended for passive immunization of broilers against colibacillosis by vaccination of broiler breeders	0.5 ml S/C or I/M	500 ml (1000 ds)

Nobilis® Salenvac T

COMPOSITION	INDICATIONS	DOSE & ROUTE	PRESENTATION
Each ml contains, Formalin killed cells of Salmonella Enteritidis (phage type 4 strain 109) : 2 x 10^9 cells inducing $\geq$ 2 RP*, Formalin killed cells of Salmonella Typhimurium DT104 : 2 x 10^9 cells inducing $\geq$ 2 RP* (*relative potency)	The vaccine is recommended for active immunization of chickens against S. enteritidis and S. typhimurium and to give passive immunity against these agents in the progeny	0.1 ml for day-old chicks and 0.5 ml for older birds I/M	500 ml (1000 ds)

Nobilis® Newcavac

COMPOSITION	INDICATIONS	DOSE & ROUTE	PRESENTATION
Each 0.5 ml dose contains: Inactivated ND virus (Clone 30) inducing $\geq$ 4 log_2 HI Unit per 1/50® of a dose or $\geq$ 50 PD_{50} units/dose	The vaccine is recommended for booster vaccination of layers and breeding stock for protection against Newcastle Disease throughout the laying period	0.5 ml S/C or I/M	500 ml (1000 ds)

Nobilis® ND Broiler

COMPOSITION	INDICATIONS	DOSE & ROUTE	PRESENTATION
Each 0.1 ml dose contains: Inactivated Newcastle Disease virus (Strain Clone 30) cantoning $\geq$ 20 PD_{50} units/dose or inducing $\geq$ 4 log_2 HI Unit per 1/50 dose	The vaccine is recommended for the vaccination of Newcastle Disease in day-old chicks in areas where ND is endemic	0.1 ml S/C or I/M	200 ml (2000 ds)

Nobilis® Corvac

COMPOSITION	INDICATIONS	DOSE & ROUTE	PRESENTATION
Each 0.5 ml dose contains: Inactivated Avibacterium paragallinarum Strain 083 (serotype A), at least 1 CPD_{70}*, Strain Spross (serotype B), at least 1 CPD_{70}, Strain H-18 (serotype C) at least 1 CPD_{70}. (*CPD_{70} : 70% chicken protective dose)	The vaccine is recommended for protection against Avibacterium paragallinarum infections in chicken	0.5 ml S/C	500 ml (1000 ds)

Nobilis® Coryza

COMPOSITION	INDICATIONS	DOSE & ROUTE	PRESENTATION
Each 0.25 ml dose conrains : Inactivated Avibacterium paragallinarum Strain 083 (serotype A) at least 1 CPD_{70}, Strain Spross (serotype B) at least 1 CPD_{70}, Strain H-18 (serotype C) at least 1 CPD_{70}	The vaccine is recommended for protection against Avibacterium paragallinarum infections in chicken.	0.25 ml I/M or S/C	250 ml (1000 ds)

Nobilis® Reo inac

COMPOSITION	INDICATIONS	DOSE & ROUTE	PRESENTATION
Each dose contains : Inactivated Reovirus strains 1733 and 2408, inducing $\geq$ 7.4 log_2 ELISA units/dose per 1/50th dose	The vaccine is recommended for booster vaccination of breeding stock against Avian Reovirus to protect their offspring against Avian Reovirus infections	0.5 ml S/C or I/M	500 ml (1000 ds)

Nobilis® G + ND

COMPOSITION	INDICATIONS	DOSE & ROUTE	PRESENTATION
Each dose contains : Inactivated infectious Bursal Disease virus (Strain D78) inducing $\geq$ 14.5 log_2 VN units/dose, Inactivated Newcastle disease virus (Strain Clone 30) inducing $\geq$ 4 log_2 HI units per 1/50th of a dose or containing $\geq$ 50 PD_{50} Units/dose	The vaccine is recommended for booster vaccination of future breeders to protect against Newcastle Disease throughout the laying period, and to induce high maternal antibody levels against infectious Bursal Disease in their offspring.	0.5 ml S/C or I/M	500 ml (1000 ds)

Nobilis® IB + ND

COMPOSITION	INDICATIONS	DOSE & ROUTE	PRESENTATION
Each dose contains: Inactivated Infectious Bronchitis virus (strain M41) inducing $\geq$ 6.0 log_2 HI units/dose, Inactivated Newcastle Disease Virus (Clone 30) inducing 4 log_2 HI units per 1/50th of dose or $\geq$ 50 PD_{50} units/dose	The vaccine is recommended for the booster vaccination of layers and breeding stock for protection against Newcastle Disease and the Massachusetts type of Infectious Bronchitis.	0.5 ml S/C or I/M	500 ml (1000 ds)

Nobilis® IB multi + ND

COMPOSITION	INDICATIONS	DOSE & ROUTE	PRESENTATION
Each dose contains : Inactivated Infectious Bronchitis virus (Strain M41) inducing $\geq$ 4.0 log_2 VN units/dose, IB virus (Strain D249G) inducing $\geq$ 4.0 log_2 VN units/dose, Inactivated Newcastle Disease virus (Strain Clone 30) inducing $\geq$ 4.0 log_2 HI units per 1/50th dose or containing $\geq$ 50 PD_{50} units/dose	The vaccine is recommended for booster vaccination of layers and breeding stock for protection against the Massachusetts and D207/D274 (and related nephropathic) serotype of Infectious Bronchitis and Newcastle Disease.	0.5 ml S/C or I/M	500 ml (1000 ds)

Nobilis® IB + G + ND

COMPOSITION	INDICATIONS	DOSE & ROUTE	PRESENTATION
Each dose contains : Inactivated Injections Bronchitis virus (strain M41) inducing $\geq$ 6.0 log_2 HI units, Inactivated Injections Bursal Disease virus (Strain D78) inducing $\geq$ 14.5 log_2 VN units, Inactivated Newcastle Disease Virus (Strain Clone 30) inducing $\geq$ 4 log_2 HI units per 1/50th of a dose or Containing $\geq$ 50 PD_{50} units/dose	The vaccine is recommended for breeding stock: as a booster vaccination to protect against Newcastle Disease and the Massachusetts serotype of Infectious Bronchitis, and to induce high maternal antibody levels against Infectious Bursal Disease in their offspring	0.5 ml S/C or I/M	500 ml (1000 ds)

Nobilis® Reo + IB + G + ND

COMPOSITION	INDICATIONS	DOSE & ROUTE	PRESENTATION
Each dose contains : Inactivated Injections Bronechitis virus (Strain M41) inducing > 6.0 log_2 HI units Inactivated Injections Bursal Disease virus (strain D78) inducing > 14.5 log_2 VN units Inactivated NDV (Strain Clone 30) > 4 log_2 HI units per 1/50th of dose containing > 50 PD_{50} units/dose Inactivated Reo virus (Strain 1733 & 2308) inducing > 7.4 log_2 ELISA.	For vaccine of Chicken against disease caused by Reo-virus, infectious Bronchitis virus of Massachusetts type Newcastle Disease virus & injections bursal disease virus.	0.5 ml S/C or I/M	500 ml (1000 ds)

Feed Supplement

Enradin®

CONTENTS PER KG	BENEFITS	INCLUSION RATE	PRESENTATION
Each 1 Kg of Enradin contains 80 gm of Enramycine HCL	Helps in ease the incidence of sub-clinical necrotic entritis in chicken	5-10 ppm (63-125 gm) per ton of feed	20 Kg Withdrawal period - 7 days Avoid use in laying hens

Amnovit®

CONTENTS PER KG	BENEFITS	INCLUSION RATE	PRESENTATION
Scientifically Balance formulation of vitamins and amino acids	Helps in relieving the stress conditions by supporting vitamins and minerals	Through water 1gm/lit for 5-7 days Through feed 500gm/ton for 5-7 days	1 Kg

Pharma Product

Floxidin™

COMPOSITION	INDICATIONS	DOSE & ROUTE	PRESENTATION
Enrofloxacin 10% oral solution	The product is recommended for treatment of the common infections caused by gram-positive, gram-negative, anaerobes and mycoplasma species	10 mg per kg BW for 3-5 days	5 Lt Withdrawal period - Meat - 8 days Eggs - Stop using 14 days before laying

VAC-SAFE®

CONTENTS	BENEFITS	INCLUSION RATE	PRESENTATION
An effervescent tablet that dilutes easily and neutralizes the chlorine in the water	Helps in improving the quality of drinking water during vaccination	1 tablet /100 Lt water	Box of 30 tablet