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Therapeutic management of clinical mastitis in cows

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Abstract
The present study evaluated the efficacy of parental antibiotics and immunomodulator therapy for treatment of clinical mastitis in cattle. Total 24 cattle diagnosed for clinical mastitis and animals were classified in to four groups comprising of 6 animals in each group, for different therapeutic regimen viz. Group I, Group II, Group III and Group IV. Each group treated with antibiotics for 5-7 days respectively along with supportive medicines. the results indicated that the recovery rate from mastitis in buffaloes after 5 to 7 days of treatment were 100% in group I, II, III group and IV having 83.33%.

Keywords: Cattle, mastitis, antibiotic treatment

Introduction
Mastitis is an economically important disease and causes of culling of dairy cows globally. The hidden organism in the udder may flare up to produce clinical mastitis [13].
According to [14] mastitis is the most frequently encountered disease leading to reduced milk yield, increased treatment costs and culling rates and in severe cases leads to death. Mastitis is caused by various factors such as bacteria, fungi, mycoplasma, yeast along with stress reduced resistance, shape of udder and teats, inheritance of animal, environment including milking and feeding system [3].
Prevention and treatment of mastitis is the main concern of the dairy industry. Current practices of mastitis control are based on proper milking, hygiene, reduced exposure to environmental pathogen and dry cow antibiotic therapy [6].
Treatment of mastitis should be based on bacteriological diagnosis and take national and international guidelines on prudent use of antimicrobials into account. In acute mastitis, where bacteriological diagnosis is not available, treatment should be initiated based on herd data and personal experience. Rapid bacteriological diagnosis would facilitate the proper selection of the antimicrobial [12]. The present study deals with treatment of clinical mastitis in cows with antibiotics and supportive therapy.

Materials and methods
In the present study samples were collected from 24 cows suffering from clinical mastitis. The samples were collected from affected quarters aseptically for cultural and sensitivity examination by using standard procedure as per [5].These animals were classified in to four groups comprising of 6 animals in each group, for different therapeutic regimen viz. Group I, Group II, Group III and Group IV.

Table 1: Different therapeutic regimens for treatment of clinical mastitis in cow

S. no	Groups	Therapeutic agents
1.	I	1. Injection Amoxycillin sodium +Sulbactum sodium 3g (Injection Powermox 3.0 g), manufactured by Biotech Veterinary Pharmaceuticals Pvt. Ltd.) @ 10 mg/kg b.wt, i.m.b.i.d, daily for 5 days. 2. Injection Meloxicam @ 30 ml/300 kg b.wt. (Injection Biogesic, manufactured by Biotech Veterinary Pharmaceuticals Pvt. Ltd., each ml contain 5 mg Meloxicam) o.i.d for 5 days. 3. Injection of Vitamin E and Selenium, administered @ 1 ml/50 kg body wt. (Injection Repronol, manufactured by Cadila Pharmaceuticals Ltd. Each ml contain Tochoferol 50 mg as dl-α-tocopherol acetate), benzyl alcohol 2%. Selenium as sodium selenite 1.5 mg). 4. Intramammary infusion of Ampicillin Sodium 75 mg + Cloxacillin sodium 200 mg b.i.d for 5 days (Tilox 5 gm intramammary infusion, manufactured by Vetoquinol.
2.	II	1. Injection Ceftriaxone 3000 mg +Tazobactam 75 mg administered @ 10 mg/kg b. wt, i.m. b.o.d daily for 5 days. (Intacef Tazo 3375 mg,manufactured by Intas Pharmaceuticals Ltd). 2. Injection Tolfenamic acid given @ 2 mg/kg b. wt. i.m, repeated after 48 hours (Inj. Maxxtol,manufactured by Intas Pharmaceuticals Ltd., each ml contain Tolfenamic acid 40 mg). 3. Local intramammary infusion of Colistin sulphate 5,00,000 IU + Cloxacillin Sodium 200 mg, repeated 12 hour interval for 5 days (Mammitel 10 gm, intramammary, manufactured by Intas Pharmaceuticals Ltd., each syringe contains Colistin sulphate 5,00,000 IU and Cloxacillin Sodium 200 mg). 4. Mammidium 50 gm orally for 4 days (Intas Pharmaceuticals Ltd., each 50 gm contain Tri sodium citrate 25 gm, Vitamin A 70,000 IU, Vitamin D 20,000 IU, vitamin E 1000 IU, Niacin 2000 mg, Thiamin 200 mg, Riboflavin 200 mg, Pantothenic acid 50 mg, Biotin 20 mg, Methionine 10 gm, Manganese sulphate 4 gm, Copper sulphate 1200 mg, zinc sulphate 500 mg, Selenium 4 mg, Live yeast spore 50000 million CFU.
3.	III	1. Injection of Sulbactum sodium 1.5 g + Cefoperazone sodium 3.0 g @ 10 mg/kg b.wt, i.m. b.o.d daily for 5 days (Injection Pathocef 4.5 gm, manufacture by Pfizer Animal Health India Ltd. 2. Injection Ketoprofane @ 3 mg/kg b. wt I.m. for 5 days (Injection Gluck 15 ml, manufacture by Bayer Pharmaceuticals Pvt. Ltd. Animal Health Division). 3. Intramammary infusion of Cefoperazone sodium (Mastiwok 10 ml intramammary suspension, Vetoquinol, each 10 ml pre-filled syringe contain Cefoperazone sodium IP equivalent to Cefoperazone 250 mg, excepient Q.S.) administered only once. 4. Uniselit (Premix antioxidant and trace mineral supplement (Dabur Ayurvet, each 10 gm contains vitamin E 500 IU, Selenium 2 mg, Zinc 360 mg, manganese 200 mg, Copper 125 mg, Cobalt 12 mg, Calcium 1200 mg, Phosphorus 600 mg and Crude protein 800 mg) administered 10 gm orally for 10 days.
4.	IV	1. Injection Amoxycillin sodium 3 g +Potassium Clavulanate 600 mg (Injection Moxykind-Clav 3.6 g, Vetmankind, each vial contain Amoxycillin sodium 3 g and Potassium Clavulanate 600 mg) i.m.b.o.d for 5 days. 2. Intramammary infusion of Amoxycillin sodium 250 mg and Potassium Clavulanate 300 mg injection (Moxykind-Clav 600 mg, manufactured by Vetmankind, each vial contain Amoxycillin sodium 500 mg and Potassium Clavulanate 600 mg) b.o.d daily for 5 days using all aseptic precautions. 3. Injection Artizone-S, Pfizer, each ml contain Phenybutazone + Sodium salicylate 20 mg, administered 15 ml i.m. in each animal for 5 days. 4. Oral solution of Stenot 30 ml daily (Manufactured by Natural Remedies Pvt. Ltd., each 10 ml contains extracts from Tulasi 25 g, Ashwagandha 20 g, Guduchi 15 g, Amalaki 10 g, Vidari 10 g, Amra 4 g, Silajatu 1 g, Preservatives 0.5 g, Excipients q.s.) for 5 days.

Results and discussion

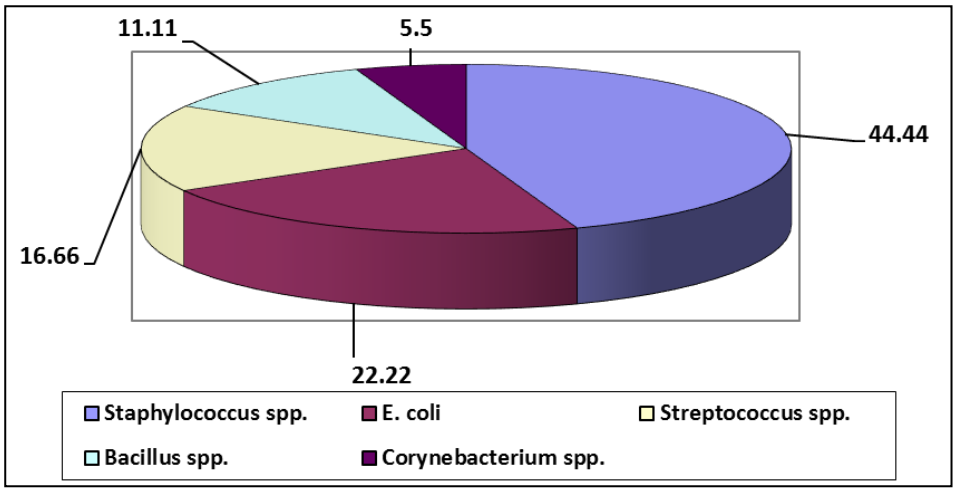
Total 24 clinically mastitis positive cows were randomly divided into 4 groups, having 6 animals in each group i.e. Group I (8 quarters), Group II (8 quarters), Group III (8 quarters) and Group IV (6 quarters), respectively.

Cultural examination

The cultural isolation of organisms involving 30 clinical mastitic milk samples was carried out. On the basis of Gram staining, 14 quarters (46.66%) showed Gram positive, 4 quarters (13.33%) showed Gram negative organisms and rest 6 quarters (20.00%) showed mixed infection. From rest, 6 quarters (20.00%), no bacterial organism was isolated in spite of cows showing clinical manifestation of mastitis. Possibly the reason may be the microorganism belonged either to anaerobic class or Mycoplasma species. In group I and II no bacterial growth was seen in two quarters whereas in group III and IV no growth of bacteria was found in one quarter.

Table 2: Overall prevalence of various micro-organisms (Single infection) in clinical mastitic cows (n=24)

S. No.	Bacteria isolated	No. of infected quarters (18)	Per cent
1.	*Staphylococcus* spp.	8	44.44
2.	*E. coli*	4	22.22
3.	*Streptococcus* spp.	3	16.66
4.	*Bacillus* spp.	2	11.11
5.	*Corynebacterium* spp.	1	05.50



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The *Staphylococcus* spp. was the most frequent organism, accounting for 8 of the total [18] isolates (44.44%) followed by *Streptococcus* spp. 3 (16.66%), *E. coli* 4 (22.22%), *Bacillus* spp. 2 (11.11%), *Corynebacterium* spp. 1 (05.50%), respectively (Table 2 and Fig. 1).

Mixed infection was recorded in 6 quarters. The organism isolated in mixed infection was *Staphylococcus* spp. and *Streptococcus* spp., this combination was recorded in 3 (50%) quarters. In another 2 (33.33%) quarters *Staphylococcus* spp. *and E. coli* was recorded. One (16.66%) quarter showed the presence of *E. coli* and *Streptococcus* spp.

Amongst different bacteria isolated in present study *Staphylococcus* spp. was found to be the most prevalent organism followed by *E. coli*, *Streptococcus* spp., *Bacillus* spp. and *Corynebacterium* spp.

The high prevalence of *Staphylococci* spp. in the present study may possibly be due to the fact that these are present in large number in various body sites such as teat surfaces and teat orifices and *Staphylococci* can survive better in the environment than other micro organisms like *Streptococci* spp. In the present investigation single infection was 75 per cent and mixed infections were 25 per cent, which indicated that the single infection was more noticed or responsible for mastitis than mixed infections. Similar findings were reported by [9, 1, 10].

Treatment trial

The treatment was started soon after collection of milk samples on the random basis. The antibiotics were administered according to the cultural sensitivity. The efficacy was recorded after observing the clinical recovery and bacteriological recovery.

Table 3: Comparative efficacy of different therapeutic regimen in cows of different groups suffering from clinical mastitis (n=24)

S. No	Groups	No of animals	Cultural isolation of organisms on Nutrient agar plate						
			Organism isolated (Pre treatment)			Organism isolated (Post treatment)			% Efficacy of drugs
			Gram +ve	Gram -ve	Mixed	Gram +ve	Gram -ve	Mixed	
1.	Group I	6	3	1	2	-	-	-	100.00
2.	Group II	6	3	1	2	-	-	-	100.00
3.	Group III	6	3	2	1	-	-	-	100.00
4.	Group IV	6	4	1	1	-	-	1	83.33

Group I: (Amoxycillin sodium +Sulbactum sodium) the efficacy of this group was calculated and found to be 100 per cent. Almost similar results have been reported by [21, 23, 7, 16]. Supplementation of vitamin E has beneficial effect on both cellular and humoral immunity of ruminants resulting in decreased incidence of mastitis and other disease.

Group II: (Ceftriaxone-Tazobactum and Colistin sulfate and Cloxacillin Sodium) was used to treat the six cases of bovine mastitis along with Tolfenamic acid. There was a dramatic improvement in the udder health and milk quality in all cases by the 5th day of treatment. The present efficacy of this group was calculated and found to be 100.00 per cent. Almost similar results have been reported by [23, 15, 2, 11]. The combination was found very effective against Gram-negative bacteria also.

Group III: Cefoperazone sodium was used to treat the six cases of bovine mastitis along with Ketoprofane of (anti-inflammatory, analgesic and antipyretic) along with Cefoperazone sodium intramammary infusion. The cases were recovered in 5 days. The present efficacy of this group was calculated and found to be 100 per cent. Almost similar results have been reported by [22, 18]. When Cefoperazone was administered intramammary twice a day the clinical cure was good but bacteriological cure was not good due to its inability to penetrate deep into the mammary tissue and encapsulation of the pathogen.

Group IV: (Amoxycillin sodium and Potassium Clavulanate) was used to treat the six cases of bovine mastitis along with Phenyl Butazone having anti inflammatory, anti pyretic and analgesic activity. The cases were recovered in 5 days. The present efficacy of this group was calculated and found to be 83.33 per cent. Turutoglu *et al*. (2006) showed a 100 percent activity of amoxycillin/clavulanic acid to *Staphylococcus spp.* isolates. Amoxycillin and clavulanic acid is a beta lactamase inhibitor [19]. Reported that zinc deficiency in ruminants results in weakening of skin and other stratified epithelia (i.e. Keratinocytes). Because mammary gland is essentially a skin gland and the importance of keratin lining of the streak canal in prevention of infection is well known, speculation that Zinc supplementation may enhance resistance to mastitis is tempting. Zinc is also known to be associated with enzyme involved in the phagocytic oxidative burst [4], in cellular maturation and functioning of B and T l ymphocytes and macrophages. As such Zinc boost immune function in general, supplementation of Zinc methionine resulted in increase milk production and decrease in somatic cell count. However [20], reported beneficial effects of a Zinc-chelate on rate of new, naturally occurring intramammary infection also generally Zinc-chelates are supplemented because they are more bioavailable to the ruminant compared with inorganic zinc [19]. Reported a relation between copper and immune function has been shown by decreased resistance to infection in animals that were copper deficient. Vitamin E supplementation of diet increased intracellular killing of *Staphylococcus* spp. and *E. coli* by bovine blood neutrophils. The recommended and legal upper limit for selenium concentration in dairy cow ration is 0.3 ppm which corresponds to an approximate intake of 3 mg/day for dry and 6 mg/day of Se for lactating cow. It has clearly demonstrated that diets of the dairy animals can influence the resistance to intramammary infection [8]. The change in the sensitivity pattern of different organisms to different chemotherapeutic agents in different areas may probably due to the type of chemotherapeutic agent commonly used there. Ampicillin and penicillin drugs have proved to be inefficient in therapy because of the development of resistant strains of bacteria against them due to their prolonged, improper and indiscriminate use in the field. The refractiveness of certain bacterial isolates to a particular antibiotic may be due to indiscriminate use of antibiotic therapy and involvement of large number of pathogenic bacteria [17].

Conclusion

The present study has shown that mastitis, particularly clinical type, and revealed *Staphylococcus*, *E. coli*, *Streptococcus*, *Corynebacterium, and Bacillus* bacteria is an important cause of mastitis. The present study has also revealed that *S. aureus* is an important cause of clinical mastitis. Mastitis is usually spread from cow to cow at milking if the milking hygiene is not good enough. The mastitis situation could be improved by improving milking procedures and hygiene. Antibiotic therapy with Supplementation of vitamin E has beneficial effect on both cellular and humoral immunity of ruminants resulting in decreased incidence of mastitis and other disease. Zinc supplementation may enhance resistance to mastitis in cows.

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