B I O L I F E **O R I G I N A L   A R T I C L E**

Antibiotic Resistance Trends in Clinical Bovine Mastitis

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ABSTRACT

The present study was aimed to know and monitor the antibiotic resistance trends in the clinical cases of bovine mastitis from Nanded, Latur, Osmanabad and Beed districts of Maharashtra State, India. A total of 300 dairy animals from Nanded, Latur, Osmanabad and Beed districts of Maharashtra State, India, including cross bred and indigenous cattle and buffaloes over the period of five years (from 2008 to 2012) suffering from clinical mastitis were monitored for antibiotic resistance following standard disk diffusion method. The data obtained were analyzed. The gradual and constant decrease in sensitivity was observed for *Ciprofloxacin, Enrofloxacin, Streptomycin, Cephotaxim* and *Chloramphenecol*. The rate of acquiring resistance to these antibiotics was high. The sensitivity of mastitic bacteria to *Gentamicin* was found to be consistent throughout the study period. Higher sensitivity was recorded for combination of *Ceftriaxone + Tazobactum* and *Amoxycillin + Salbactum* as compare to *Ceftriaxone and Amoxycillin* alone, respectively. The sensitivity to *Amoxicillin, Ampicillin* and *Cloxacillin* reported was below 20%. The study signified the selection of proper antibiotics in therapy of mastitis. The results of the present investigation demonstrated the development of alarming level of resistance to frequently used antimicrobials in bovine mastitis.

.**Key words :** antibiogram, clinical mastitis, bovine, trends.

INTRODUCTION

Mastitis is an inflammation of the udder accompanied by physical, chemical and bacteriological changes in milk. Bovine mastitis is one of the devastating diseases causing huge loss to the dairy industry worldwide. The costs associated with mastitis are innumerous and include antibiotic treatment, reduced milk quality, reduced milk yield, increased culling rate and hazards to public health (Kurijogi and Kaliwal, 2011). The large population of low yielding dairy animals and mastitis are the major constraints of Indian dairy industry. Mastitis is widespread among dairy animals of the country. It has been estimated that the mastitis alone can cause approximately 70% of all avoidable losses incurred during milk production (Sumathi *et al.*, 2008). The disease also results in partial or complete damage to udder tissues and decreases productive lifespan of the animal.

Mastitis is 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* sensitivity. This practice increases economic losses to dairy farmers due to costly treatment over the period of long time. Also the mastitis bacteria are rapidly acquiring resistance due to frequent and indiscriminate use of antimicrobials in treatment, which has been growing concern worldwide (WHO, 2000). Resistance of mastitis pathogens to antimicrobial

agents is a well-documented challenge in dairy animals (Owens *et al.,* 1997; Lotthammer and Klarmann, 1999; Erskine *et al.,* 2002; Makovec and Ruegg, 2003; Pilkala *et al.,* 2004; Awandkar *et al.,* 2009; Moges *et al.,* 2011; Kurijogi and Kaliwal, 2011 and Bedada and Hiko, 2011). The monitoring of antibiotic resistance is needed not only for effective treatment and control of mastitis but is an increasing threat in human and veterinary medicine also. Hence, its monitoring is recommended by OIE (2001).

The present investigation was undertaken to monitor antimicrobial resistance trends in bovine mastitis and to generate the data for therapeutic decisions.

MATERIAL AND METHODS

Study area:
The present study was conducted to know and monitor the antibiotic resistance trends in the clinical cases of bovine mastitis from Nanded, Latur, Osmanabad and Beed districts of Maharashtra State, India.

Sampling:
The study was conducted on the cases of clinical mastitis presented for treatment to the college clinic and field veterinarians from Nanded, Latur, Osmanabad and Beed districts of Maharashtra State, India. The study comprised 300 dairy animals including cross bred and indigenous cattle and buffaloes over the period of five years (from 2008 to 2012). The udder and teats of mastitis positive animals were cleaned and dried. The milk samples were collected aseptically in 10 ml quantities following standard methods. The samples were transported to the laboratory in ice box and processed immediately.

Sample Processing:
These samples were subjected to antibiogram studies using readymade antibiotic discs (M/s. Hi-media Laboratories, Mumbai) as detailed in the Table No. 1 and standard disc diffusion method as previously described (Awandkar *et al.,* 2009). The sensitivity and resistance patterns were recorded by comparing the diameter of

zone of growth inhibition with the zone diameter interpretation chart provided by the manufacturer of the antibiotic discs. The obtained data were expressed in percentage.

RESULTS

The results obtained are shown in Table No. 1. The results revealed that the antimicrobial resistance of mastitis causing bacteria was gradually increased over the study period. This gradual increase in antimicrobial resistance was observed against *cephotaxime* (28.57% to 77.80%) followed by *streptomycin* (57.44% to 79.83%), *chloramphenicol* (10.89% to 51.43%), *ciprofloxacin* (16.98% to 41.43%), and *enrofloxacin* (25.49% to 48.57%). Highest and almost constant sensitivity was recorded against *gentamicin* (77.10% to 79.59%) followed by *ceftriaxone + tazobactum* combination (74%). The *ciprofloxacin*, *enrofloxacin* and *chloramphenicol* showed good efficacy (over 50 %) throughout the study period. The intermediate efficacy was recorded against *ceftriaxone* (30.56% to 40.00%) and *amoxicillin + salbactum* combination (41.82% and 42.86%). *Amoxycillin, cloxacillin* and *ampicillin* showed very poor efficacy (10.87% to 17.14%) against mastitis causing bacteria.

DISCUSSION

The present study was undertaken to record the trends in resistance to commonly used antimicrobials. The antimicrobial resistance may be qualified poor when bacterial resistance increases above 75.00% and favorable when resistance remains below 25.00% (Moges *et al.,* 2011). The antimicrobials used in the present study were selected based upon their frequent use in the study area. The *cephotaxime, streptopenicillin, chloramphenicol, ciprofloxacin* and *enrofloxacin* were commonly used antimicrobials in the cases of bovine mastitis. The mastitis causing bacteria showed steady increase in resistance to all these antimicrobials. While, the highest resistance was recorded to *amoxycillin, cloxacillin* and *ampicillin*. These antibiotics were in use prior to *cephotaxime, streptopenicillin, chloramphenicol,*

Table No. 1: Antibiogram trends in bovine mastitis

Antimicrobials	Sensitivity (%)					Resistance (%)				
	2008	2009	2010	2011	2012	2008	2009	2010	2011	2012
Ciprofloxacin (30 mcg)	83.02	69.01	70.10	56.97	58.57	16.98	30.99	29.90	43.03	41.43
Enrofloxacin (10 mcg)	74.51	73.24	59.10	48.88	51.43	25.49	26.76	40.90	51.12	48.57
Gentamicin (30 mcg)	79.59	79.32	77.10	78.26	77.14	20.41	20.68	22.90	21.74	22.86
Chloramphenicol (30 mcg)	81.11	72.26	63.90	56.06	48.57	18.89	27.74	36.10	43.94	51.43
Amoxicillin (30 mcg)	17.14	14.51	13.10	14.33	14.29	82.86	85.49	86.90	85.67	85.71
Ceftriaxone+Tazobactum (30/15 mcg)	---	---	---	74.55	74.29	---	---	---	25.45	25.71
Amoxicillin+Salbactum (30/15 mcg)	---	---	---	41.82	42.86	---	---	---	58.18	57.14
Ceftriaxone (30 mcg)	30.56	32.39	38.10	40.00	---	69.44	67.61	61.90	60.00	---
Cephotaxim (10 mcg)	71.43	65.52	22.20	---	---	28.57	34.48	77.80	---	---
Sreptomycin (10 mcg)	42.56	28.57	20.17	---	---	57.44	71.43	79.83	---	---
Cloxacillin (30 mcg)	11.09	11.11	---	---	---	88.91	88.89	---	---	---
Ampicillin (25 mcg)	14.29	10.87	---	---	---	85.71	89.13	---	---	---

(--- either discontinued due to lower sensitivity or not available in combinations)

ciprofloxacin and *enrofloxacin*. The present findings support the observations recorded by Moges *et al.* (2011) and Bedada and Hiko (2011). Indiscriminate and frequent use of these antibiotics in animals could be the reason for their ineffectiveness against mastitis bacteria. Since streptomycin has been extensively used along with penicillin for treating mastitis; it may have led to the development of high resistance in bacteria against this antibiotic. The *gentamicin* and *Ceftriaxone + Tazobactum* showed highest sensitivity to mastitis causing bacteria. This may be due to their least frequent use in the study area in treatment of clinical mastitis, resulted into no more development of resistance to these antimicrobials during the observation period.

Similar suggestion was given by Jaims *et al.* (2002) stating the development of antibiotic resistance is nearly always as a result of repeated therapeutic use and/or indiscriminate usage them.

Moreover, due to lack of prophylactic agents, chemotherapy continues to play a major role in therapeutic management of mastitis. For successful treatment antibiotic sensitivity test play a key role. Recently, higher antibiotics have been introduced in treatment of both clinical and sub-clinical mastitis. The emergence of antibacterial resistance among pathogens that affect animal health is of growing concern in veterinary medicine. Antimicrobial-resistant pathogens in animals have been incriminated as a potential health risk for human being from possible transmission of these agents as food borne pathogens.

Systematic records regarding the epidemiological studies on bovine mastitis including status of infection, antimicrobial resistance and therapeutic patterns would provide useful management information to dairy farmers and field veterinarians. This has been evident from countries where records have been documented regularly (Anakalo *et al.,* 2004). Thus there is need to routinely investigate and record the epidemiology of bovine mastitis and its antibiogram study in various parts of India.

CONCLUSION

The results of the present investigation demonstrated the development of alarming level of resistance to frequently used antimicrobials in bovine mastitis. This may be due to under dosing as well as prolong and indiscriminate use of antimicrobials in treatment of mastitis. These findings suggest the importance of implementation of systematic use of antimicrobials after *in-vitro* antimicrobial sensitivity test prior to their use in treatment and prevention of mastitis. Since the investigation is based on limited sample size and limited area, the additional studies involving larger area and more sample size are highly recommended.

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