COMPARATIVE EFFICACY OF DIFFERENT THERAPEUTIC REGIMES IN THE TREATMENT OF ACUTE BOVINE CLINICAL MASTITIS

Z.A. Akhoon, F.U. Peer and K.A. Sofi*

Division of veterinary Medicine, Faculty of Veterinary Sciences and Animal Husbandry,
S. K. University of Agricultural Sciences and Technology, Shuhama, Srinagar-190 006, India

Received: 27-02-2012
Accepted: 19-06-2012

ABSTRACT

A therapeutic trial was conducted on cases of acute bovine mastitis. In the therapeutic trial the subgroup I(b) treated with ofloxacin, a recovery rate of 60.67 per cent with mean recovery time of 8 days was observed. In subgroup 1(c) and vitamin c treated with ofloxacin and vitamin C a recovery rate of 66.67 per cent with a mean recovery time of 7 days was observed. In subgroup I(c) treated with ofloxacin alongwith vitamin E and selenium a recovery rate of 83.33 per cent with a mean recovery time of 6 days was observed. In subgroup II(a), treated with gentamicin alone, a recovery rate of 66.67 per cent with a mean recovery time of 7 days was observed. In subgroup II (b) treated with gentamicin alongwith vitamin C, a recovery rate of 66.67 per cent with a mean recovery time of 6 days was observed. In subgroup II(c) treated with gentamicin alongwith vitamin E and selenium a recovery rate of 83.33 per cent with a mean recovery time of 5 days was observed. The recovery was established by the clinical presentation in terms of swelling, pain, pulse, temperature and milk characteristics. The post-treatment milk chemistry values were significantly different from the pre-treatment values.

Key words: Acute clinical mastitis, Bovine, Therapeutic regimes.

INTRODUCTION

Mastitis a multiple etiological syndrome is caused by contagious organisms transmitted from cow to cow through milkers and milking machines. Mastitis is also considered as an environmental disease disseminated through unhygienic contaminated inanimate objects where animals are housed. Mastitis in milch animals continues to be a challenge for the practicing veterinarian. It is one of the most important problems of economic concern. In India, mastitis costs the farmers and dairy industry to the tune of Rs. 1607.20 crores annually (Singh and Singh, 1994). Ranjan et al. (2005) studied the ameliorative effect of L-ascorbic acid on intramammary antibiotic therapy in bovine clinical mastitis and reported higher recovery rates (80.95) in cows treated with L-ascorbic acid along with intra-mammary antibiotic therapy in cows treated only with intramammary antibiotic therapy (71.82%). Singh et al. (2000) in a study on the therapeutic role of vitamin E and selenium concluded that gentamicin alongwith vitamin E and selenium supplementation was more effective in the treatment of mastitis as compared to gentamicin alone. Pal et al. (1995) reported that oral administration of trisodium citrate alone @ 30 mg/kg body weight for 6 days proved to be effective in management of mastitis in 55.55 per cent cows. However, intramammary/parental administration of cloxacillin sodium, gentamicin sulphate or chloramphenicol was required for cent per cent recovery from mastitis alongwith trisodium citrate. Supplementation of vitamin E had beneficial effects both on cellular and humoral immunity of ruminants that results in decreased incidence of mastitis (Politis et al., 1996). The most important limitation of conventional therapy in mastitis is inability to clear infection from affected glands. The important reasons include (a) development of drug resistance, (b) inadequate perfusion of the drug to the target tissues, (c) altered action of the drug due to the changes in milk composition, (d) supplementation of micronutrients

*Corresponding author’s e-mail: drsofi.vet54321@gmail.com
such as zinc, copper, selenium may be necessitated in affected animals since they are increasingly lost through milk as a result of increased permeability of blood-udder barrier in mastitis (Upadhay and Dwivedi, 2004), (e) many antibiotics are unable to kill non-replicating bacteria (Sandholm et al., 1990). An unconventional approach involves the use of antioxidants in the therapy of bovine mastitis. The antioxidants act by (a) removing oxygen, (b) inhibition reactive oxygen species/reactive nitrogen species formation, (c) scavenging reactive oxygen species (ROS) and reactive nitrogen species (RNS, nitric oxide and nitrogen dioxide radicals), (d) binding metal ions needed for catalysis of ROS generation and (e) upregulation of indigenous antioxidant defences. The common antioxidants intended to be used in the present study are vitamin E, selenium and vitamin C (ascorbic acid). Ascorbic acid enhances and potentiates udder immunity to eliminate the mastiticogenic organisms and neutralises the toxic effects of free oxidative radicals by preventing lipid peroxidation viz optimisation of lysosomal myeloperoxidase enzyme system. It may alter the alkaline pH of milk to acidic side that may not be conducive to pathogenic bacteria. It builds up natural barrier of the mammary tissue through the synthesis of collagen from praline and lysine metabolic pathway (Peterkofsky, 1991). During phagocytosis of bacteria the inflammatory cells produce large quantities of free radicals which kill the bacteria within the phagocytic cells. These reactive oxygen species can also damage the DNA and cellular membranes of the phagocytic cells and the memory cells by their oxidation. The phagocytic and bactericidal role of polymorphonuclear cells (PMNs) is greatly depend on antioxidative agents present in the udder. Vitamin E the most important lipid soluble antioxidant is an integral component of lipid membranes. Selenium an important component of enzyme Glutathione peroxidase (Erskine, 1993), helps in the conversion of hydrogen peroxide to water and lipid hydroperoxide to alcohol. Vitamin E and selenium are essential for optimum polymorphonuclear (PMN) function which is considered to be the first line of defence in mammary gland. Keeping the view in above facts different therapeutic regimes was undertaken to know its comparative efficacy in the treatment of acute bovine clinical mastitis.

MATERIALS AND METHODS
Thirty six mastitic cows were divided randomly into two groups (Group I and Group II). These two groups were further subdivided into three subgroups with six animals in each subgroup making a total of 36 animals. Different treatment regimes were employed in each subgroup and following therapeutic trial was conducted.

<table>
<thead>
<tr>
<th>Group</th>
<th>Subgroups</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Floquinolone antibiotic (Ofloxacin) @ 6 mg/kg bd. wt. (i/m)</td>
<td>Ofloxacin @ 6 mg/kg bd. wt. (i/m) + vitamin C @ 25 mg/kg bd. wt. (i/m)</td>
<td>Ofloxacin @ 6 mg/kg bd. wt. (i/m) + vitamin E and selenium *(E-Care-Se) @ 1 ml/50 kg bd. wt.(i/m)</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>Gentamicin antibiotic alone @ 4 mg/kg bd. wt. (i/m)</td>
<td>Gentamicin @ 4 mg/kg bd. wt. (i/m) + vitamin C @ 25 mg/kg bd. wt. (i/m)</td>
<td>Gentamicin @ 4 mg/kg bd. wt. (i/m) + vitamin E, selenium *(E-Care-Se) @ 1 ml/50 kg bd. wt. (i/m)</td>
<td></td>
</tr>
</tbody>
</table>

*Each ml of E-Care Se contains Tocopherol 50 mg, Selenium 1.5 mg/ml

The response to treatment was evaluated on the basis of milk characteristics and the time taken for recovery. In order to arrive at a meaningful conclusion, the data obtained was analyzed using standard statistical methods as per Snedecor and Cochran (1989).

RESULTS AND DISCUSSION
In the therapeutic trial, subgroup I (a), Ofloxacin alone was used for treatment which showed a recovery rate of 50 per cent with a
mean recovery time of 8 days. In subgroup I(b), Ofloxacin antibiotic along with vitamin C was used which showed a recovery rate of 66.67 per cent with a mean recovery time of 7 days. In subgroup I(c), Ofloxacin antibiotic along with vitamin E and selenium was used for therapy which showed a recovery rate of 83.33 per cent with a mean recovery time of 6 days. In subgroup II(a), Gentamicin antibiotic alone was used for therapy which showed a recovery rate of 66.67 per cent with a mean recovery time of 7 days. In subgroup II(b), Gentamicin along with vitamin C was used which showed a recovery rate of 66.67 per cent with a mean recovery time of 6 days. In subgroup II(c), Gentamicin along with vitamin E and selenium was used for therapy which revealed a recovery rate of 83.33 per cent with a mean recovery time of 5 days. The subgroup I(c) and II(c) showed significance as compared to other groups. The comparative efficacy of each treatment regime in the recovery of clinical mastitis is given in Table-1. The recovery was established on the basis of clinical presentation and changes in milk characteristics (Table-2).

Smith et al. (1984) for the first time supplemented vitamin E to the cows throughout the non-lactating period and reported 37 per cent lower incidence of clinical mastitis during the next lactation. Weiss et al. (2004) conducted an experiment to examine changes in ascorbic acid status following an intramammary challenge with E. coli. Oxidative stress occurs when the production of reactive oxygen metabolites (ROM) exceeds the capacity of the antioxidant system of the cell, tissue or body. Certain nutrients act as antioxidants and are components of antioxidant enzymes and have a direct effect on oxidative stress. The prevalence and severity of important health disorders in dairy cows, mastitis being one of them appear to be related to oxidative stress. Both water and fat soluble antioxidants are needed because free radicals are found in both areas of cells.

Vitamin E and selenium has been shown to reduce prevalence and severity of mastitis and reduce SCC (Smith et al., 1984; Weiss et al., 1997). Selenium and vitamin E act in an apparently synergistic way to protect the mammary gland. Deficiencies of vitamin E and Se are known to have the ability to alter prostaglandin synthesis. Prostaglandins influence function of smooth muscle tissue which surrounds the streak canal of bovine teat to keep it tightly closed (Monicada and Vane, 1979). Further in vitro studies conducted by Ndiweni and Finch (1996) reported the potential benefits of in vivo supplementation of dairy cows with vitamin E and Se in terms of enhancing their natural resistance to mastitis. This has been confirmed recently by Sharma et al. (2006) and by Goel et al. (2005) in cases of clinical mastitis in dairy cattle. Saluja (1999) tried combination of vitamin E and selenium with antibiotics as systemic dry cow therapy and observed 63.3 per cent efficacy of the combination. Recently Goel et al.

### Table 1: Comparative efficacy of different therapeutic regimes in the treatment of acute bovine clinical mastitis.

<table>
<thead>
<tr>
<th>Treatment group</th>
<th>Per cent efficacy</th>
<th>Mean recovery ± S.E time (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I(a) Ofloxacin alone</td>
<td>50.00 ± 3 (3/6)</td>
<td>8</td>
</tr>
<tr>
<td>I(b) Ofloxacin + vitamin C</td>
<td>66.67 ± 4 (4/6)</td>
<td>7</td>
</tr>
<tr>
<td>I(c) Ofloxacin + vitamin E and selenium</td>
<td>83.33 ± 5 (5/6)</td>
<td>6</td>
</tr>
<tr>
<td>III(a) Gentamicin drug alone</td>
<td>66.67 ± 4 (4/6)</td>
<td>7</td>
</tr>
<tr>
<td>III(b) Gentamicin + vitamin C</td>
<td>66.67 ± 4 (4/6)</td>
<td>6</td>
</tr>
<tr>
<td>III(c) Gentamicin + vitamin E and selenium</td>
<td>83.33 ± 5 (5/6)</td>
<td>5</td>
</tr>
</tbody>
</table>

Mean with different superscripts differ significantly (P<0.5); Mean 6.5 days ± S.E (0.17)
al. (2005) have reported early recovery in clinical cases when given along with antibiotics as compared to the cases treated with antibiotics alone. Similar findings have been reported for the increased phagocytic activity when vitamin E was provided with antibiotics in clinical mastitis (Mukherjee et al., 2007).

Ascorbic acid (vitamin C) has a multidimensional bioactive role in the body system, the most important being that of an antioxidant. It is an important weapon in the body's armoury and is involved in the neutralization of the toxic peroxides and other reactive oxygen species (ROS) released during bacterial infection, which cause tissue injury (Bendich et al., 1986). Singh and Pachauri (2003) observed a significant decrease in the level of ascorbic acid in milk and blood of both subclinical and clinical cases of mastitis and suggested its supplementation during the disease (Table 2). From the present study, it may be concluded that ascorbic acid therapy and antibiotics can be used concurrently to modulate the immune response and improve the prognosis of cases of acute bovine mastitis. In conclusion, Gentamicin @ 4mg/kg body weight (I/M) along with vitamin E and Selenium was proved as an effective therapy against acute bovine clinical mastitis.

### Table 2: Effect of treatment as milk chemistry in bovine mastitis (Mean±S.E.)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Group I(a)</th>
<th>Group I(b)</th>
<th>Group I(c)</th>
<th>Group II(a)</th>
<th>Group II(b)</th>
<th>Group II(c)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PH</td>
<td>Pre-treated</td>
<td>Post-treatment</td>
<td>Pre-treatment</td>
<td>Post-treatment</td>
<td>Pre-treatment</td>
<td>Post-treatment</td>
</tr>
<tr>
<td></td>
<td>7.1±0.064</td>
<td>6.7±0.015</td>
<td>7.2±0.048</td>
<td>6.7±0.018</td>
<td>6.9±0.075</td>
<td>6.7±0.029</td>
</tr>
<tr>
<td>EC (ms/cm)</td>
<td>6.8±0.68</td>
<td>4.2±0.02</td>
<td>6.5±0.44</td>
<td>4.2±0.01</td>
<td>5.9±0.78</td>
<td>4.1±0.03</td>
</tr>
<tr>
<td>Specific gravity</td>
<td>1.048±0.001</td>
<td>1.023±0.0003</td>
<td>1.056±0.0011</td>
<td>1.021±0.0009</td>
<td>1.065±0.0003</td>
<td>1.024±0.006</td>
</tr>
<tr>
<td>SCC x 10^5</td>
<td>8.75±2.7586</td>
<td>2.758±0.88405</td>
<td>2.758±2.17580</td>
<td>2.1758±6.6754</td>
<td>2.1758±1.57690</td>
<td>2.1758±8.6489</td>
</tr>
</tbody>
</table>

In conclusion, a therapeutic trial was conducted on cases of acute bovine mastitis. In order to modulate the immune response and improve the prognosis of cases of this disease, it may be concluded that ascorbic acid therapy and antibiotics can be used concurrently to neutralize the toxic peroxides and other reactive oxygen species (ROS) released during the disease. From the present study, it was observed that the level of ascorbic acid in milk and blood of both subclinical and clinical cases of mastitis decreased. Singh and Pachauri (2003) observed a significant decrease in the level of ascorbic acid in milk and blood of both subclinical and clinical cases of mastitis and suggested its supplementation during the disease. From the present study, it may be concluded that ascorbic acid therapy and antibiotics can be used concurrently to neutralize the toxic peroxides and other reactive oxygen species (ROS) released during the disease. From the present study, it was observed that the level of ascorbic acid in milk and blood of both subclinical and clinical cases of mastitis decreased. Singh and Pachauri (2003) observed a significant decrease in the level of ascorbic acid in milk and blood of both subclinical and clinical cases of mastitis and suggested its supplementation during the disease. From the present study, it may be concluded that ascorbic acid therapy and antibiotics can be used concurrently to neutralize the toxic peroxides and other reactive oxygen species (ROS) released during the disease. From the present study, it was observed that the level of ascorbic acid in milk and blood of both subclinical and clinical cases of mastitis decreased. Singh and Pachauri (2003) observed a significant decrease in the level of ascorbic acid in milk and blood of both subclinical and clinical cases of mastitis and suggested its supplementation during the disease.
REFERENCES


