Mastitis in housed dairy buffaloes: incidence, etiology, clinical finding, antimicrobial sensitivity and different medical treatment against *E. coli* mastitis.

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Abstract: Bovine mastitis is an important and a persistent infection in the buffalo population producing high economic losses. The study was conducted on 500 housed dairy buffaloes in El-Bahiera Governorate, Egypt. The purposes of study were to determine incidence of mastitis, bacterial isolates from mastitic milk, clinical findings of clinical mastitic buffaloes, antimicrobial sensitivity on bacterial isolates, monthly incidence of mastitis post calving and cure rate after different treatments of *E. coli* mastitis post calving. Incidence of subclinical mastitis more prevalent than clinical mastitis in housed buffaloes in percentages 18.5% and 9% respectively. *S. aureus, E. coli, St agalactia and St. dysgalactia* were the most common isolates in clinical mastitis. *E. coli, S. aureus,* C.N.S, Pseudomonas, *St agalactia,* and *St. dysgalactia* were the most common isolates in subclinical mastitis. Mixed infection observed in our study in which *S. aureus* and *E. coli* common cause in clinical mastitis 24.4% and *S. aureus* and *C.N.S* common cause in subclinical mastitis 18.9%. Clinical finding of clinical mastitic buffalo's variable according to causative agent in which ***S. aureus*** and ***E. coli*** the most sever cause of mastitis in the form of fatal peracute and acute with systemic reaction. 1st and 2nd month post calving were the highest incidence of mastitis in percentages 51.1% and 17.7% in clinical mastitis respectively, and 38.1% and 19.8% in subclinical mastitis; respectively. Amoxicillin and clauvilinic acid, Cefotaxime and Enrofloxacin were found most effective drugs against all isolates. The best results obtained in Forfenicol and ceftiofur groups in treatment of *E. coli* mastitis by cure rate 90%, only one case return to chronic with no case fatality. In Enrofloxacin group, cure rate 70%, only one case return to chronic with 20% Case fatality. In panterramycin group, cure rate 20%, three cases return to chronic with 50% Case fatality.

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1.Introduction

Bovine mastitis is an important and a persistent infection in the buffalo population producing economic losses; drop in milk production, increased cost of treatment and culling process ***(Dhakal and Thapa, 2002 and Singh and Bansal, 2004).*** Moreover there are no proper control measures in order to contain the disease because of its multifactorial nature. Economical losses from mastitis have been calculated $200 per cow per year or $2 billion per year for the United States ***(Jasper et al., 1982)***.

Mastitis is an inflammation of the mammary gland characterized by physical, chemical, bacteriological, cytological changes in milk and pathological changes in the gland. Clinical mastitis recognized by abnormal milk, gland swelling and /or systemic illness whereas subclinical mastitis characterized by apparently normal milk with an increase in SCC due to influx of leukocyte with reduces in milk production. The reduction in milk production attributed to sub-clinical mastitis may account for 70%-80% of the total losses (***Philpot and Nickerson,* 1991 and *Philip et al., 1993).***

Mastitis pathogens are found either in the udder (contagious pathogens: *S. aureus, Str. agalactia* and mycoplasma) or the cow's surrounding (environmental pathogens: *Str. uberis, Str. dysgalactiae* and *E. coli*) ***(Andrews et al., 1992).***Mastitis caused by *S. aureus* bacteria is extremely difficult to control by treatment alone. The organism usually does not respond to antibiotic treatment, and infected cows culled from the herd. *S. aureus* bacteria produce toxins that destroy cell membranes and can directly damage milk producing tissue. It produces an enzyme that inactivates most penicillin-based treatments, resulting in ineffective antibiotics ***(Jones et al., 1998).*** Formation of micro abscesses by *S. aureus* helps intramammary localization and protects *S. aureus* from polymorph nuclear cells (PMN) activity and antimicrobial therapy ***(Gudding et al., 1984).***

S. aureus and *E. coli* account for the majority of clinical mastitis cases in cattle ***Barkema at al. (1998).*** Intramammary infection by *E. coli* is acute in nature and generally clears within a few days ***Smith at al. (1993).*** Coliform intramammary infection highest during 2 weeks following drying off and in 2 weeks prior to calving ***(Radostits et al., 2007).***

The study was conducted on 500 housed dairy

buffaloes in El-Bahiera Governorate, Egypt. The purposes of study were to determine incidence of mastitis, bacterial isolates from mastitic milk, clinical findings of clinical mastitic buffaloes, antimicrobial sensitivity on bacterial isolates, monthly incidence of mastitis post calving and cure rate after different treatments of *E. coli* mastitis post calving.

2. Materials and Methods

A. Animals: Our study population consisted of 500 housed dairy buffaloes at El-Bahiera Governorate, Egypt and aged 4 – 8 years.

B. Clinical examination and collection of samples: 500 housed dairy buffaloes (2000 quarters) were examined for detection of clinical and sub clinical mastitis. For assessment of sub clinical mastitis, California mastitis test **according to *Schalm et al., (1971)*** and culturing were applied and for assessment of clinical mastitis, clinical udder and mik changes were reported and bacteriological examination. Milk samples were collected according to ***Marth and Steel, (1988).***

C. Isolation and identification of bacterial isolates: Bacterial methods were previously described ***(Cruickshank et al., 1975; Koneman et al., 1992; and Quinn et al., 1994).***

D. Antimicrobial sensitivity test: All the bacteria isolated through microbiological procedures were subjected to antimicrobial susceptibility testing by disc diffusion method ***(Anonymous, 2004).*** The sensitivity against penicillin, amoxicillin plus clauvilinic acid, Cefotaxime, enrofloxacin, gentamycin, spectinomycin, streptomycin, chloramphenicol, trimeth/sulfa and tetracycline was determined on Muellar-Hinton agar as described by National Committee for Clinical Laboratory Standards.

E. Treatment of *E. coli* mastitis: 4 groups of ***E. coli* mastitic** buffaloes were treated by different antimicrobials:

1. Group 1 (10 animals) treated by Nuflor, each ml of Nuflor contains 300 mg florfenicol. (Schering-Plough Animal Health, Germany). 3 ml/100 lbs body weight, given by i.m. A second dose should be given after 48 hours.
2. Group 2 (10 animals) treated by Excenel RTU, each ml contains ceftiofur hydrochloride equivalent to 50 mg ceftiofur. (Pfizer Animal Health) 2 ml/100 lbs. body weight i.m. for 3 successive days.
3. Group 3 (10 animals) treated by Enroflox 10%, containing 10% enrofloxacin (El-Nasr, Egypt); 1 ml/20–40 kg body weight, i.m. for 3 successive days.
4. Group 3 (10 animals) treated by Pan Terramycin, each ml of contains 33.3 mg of Oxytetracycline hydrochloride (Pfizer Animal Health) 1 ml/ 10 kg daily for 3 successive days.
5. Finadyne, containing 50 mg/ml flunixin meglumine (Schering- Plough Animal Health, Germany). Associated in treatment of all groups as anti-inflammatory.

3. Results.

3.1. Incidence of clinical and subclinical mastitis in housed dairy buffaloes.

Table 1. Incidence of clinical and subclinical mastitis in housed dairy buffaloes.

No. of dairy buffaloes examined	Clinical mastitis		Subclinical mastitis	
	No.	%	No.	%
500 buffaloes (2000 quarters)	180 quarters	9	370 quarters	18.5
	Chi-square value and significance = 67.10 ***			

*** Chi-square significant at **(*P*<0.0001)**

3.2. Bacterial isolates from clinical and subclinical mastitic milk.

Table 2. Bacterial isolates from clinical and subclinical mastitic milk.

Clinical mastitic milk(n= 180)			Subclinical mastitic milk (n=370)		
Bacteria	No.	%	bacteria	No.	%
S. aureus	66	36.6	*S. aureus*	82	22.16
E. coli	40	22.2	*E. coli*	96	25.9
St. agalactia	5	2.7	C.N.S	21	5.6
St. dysgalactia	4	2.2	Pseudomonas	13	3.5
S. aureus and *E. coli*	44	24.4	*S. aureus* and C.N.S	70	18.9
S. aureus and *St agalactia*	15	8.3	*E. coli* and *St. dysgalactia*	47	12.7
E. coli and *St. dysgalactia*	6	3.3	C.N.S and *St agalactia*	41	11.08

3.3. Clinical findings of clinical mastitic buffaloes.

Table 3. Clinical findings of clinical mastitic buffaloes according to bacterial isolates.

Etiology	Clinical observations	
S. aureus	**66**	Infected quarters characterized by acute swelling of quarters and milk are abnormal, bloody in 35 quarters and thick clots in 31 quarters. Systemic reaction with anorexia and fever. 6 cases characterized by fatal peracute *S. aureus* mastitis characterized by severe swelling of the quarters and pusy milk with marked systemic reaction as fever 41-42°C, complete anorexia, depression, recumbency ended by death. We observed that onset of 33 cases of *S. aureus* mastitis at first month post calving.
E. coli	**40**	Infected quarters characterized by acute swelling of quarters with edema till umbilicus and watery milk. Systemic reaction with anorexia and fever are observed. 7 cases characterized by fatal peracute ***E. coli*** mastitis characterized by severe swelling of the quarters, fever, recumbent ended by death. We observed that onset of 37 cases of ***E. coli*** mastitis at first 2 weeks post calving.

St. agalactia	**5**	Infected quarters characterized by swollen, painful, shed pusy milk without systemic reaction. Only 1 quarter associated with systemic reaction.
St. dysgalactia	**4**	Infected quarters characterized by swollen, painful, shed clotted milk without systemic reaction
S. aureus and ***E. coli***	**44**	Infected quarters characterized by swelling of quarters shed abnormal milk with thick clots and pus with systemic reaction.
S. aureus and ***St agalactia***	**15**	Infected quarters characterized by swelling of quarters shed abnormal watery milk with no systemic reaction.
E. coli and ***St. dysgalactia***	**6**	Infected quarters characterized by swelling of quarters with edema till umbilicus and clotted milk with systemic reaction.

3.4. Monthly incidence of post calving mastitis.

Table 4. Monthly incidence of post calving mastitis.

Months post calving	Incidence of clinical mastitis (180 quarters)		Incidence of subclinical mastitis (370 quarters)		Chi-square value and significance
	No.	%	No.	%	
1st month	92	51.1	141	38.1	8.39 **
2nd month	32	17.7	71	19.18	0.16 NS
3rd month	11	6.1	43	11.6	4.15 *
4th month	10	5.5	50	13.5	7.89 **
5th month	6	3.3	33	8.9	5.73 *
6th month	4	2.2	12	3.2	0.45 NS
7th month	5	2.7	4	1.08	2.17 NS
8th month	20	11.1	16	4.3	9.17 **

* Chi-square significant at (P<0.05)
** Chi-square significant at (P <0.01)
NS= non-significant chi-square value (P >0.05)

3.5. Antibiotic sensitivity results of bacterial isolates from clinical mastitic milk

Table 5. *In vitro* antibiotic sensitivity results of bacterial isolates from clinical mastitic milk

Antimicrobial agent	Sensitivity of different mastitis pathogens to different antibiotics								Chi-square value and significance
	125 S. aureus (66 single +59 mixed isolates)		*90 E. coli (40 single and 50 mixed isolates)*		*20 St. agalactia (5 single and 15 mixed isolates)*		*10 St. dysgalactia (4 single and 6 mixed isolates)*		
	No.	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*	
Penicillin	*15*	*12*	-	-	*11*	*55*	*4*	*40*	*53.76* ***
Enrofloxacin	*60*	*48*	*70*	*77.7*	*15*	*75*	*6*	*60*	*21.27* ***
Cefotaxime	*110*	*88*	*82*	*91.1*	*20*	*100*	*9*	*90*	*2.41 NS*
Amoxicillin and clauvilinic acid	*119*	*95.2*	*75*	*83.3*	*19*	*95*	*10*	*100*	*10.55* *
Chloramphenicol	*12*	*9.6*	*65*	*72.2*	*9*	*45*	*3*	*30*	*89.56* ***
Tetracycline	*14*	*11.2*	*51*	*56.6*	*8*	*40*	*3*	*30*	*51.37* ***
gentamycin	-	-	*56*	*62.2*	-	-	-	-	*125.02* ***
Trimeth/sulfa	*9*	*7.2*	*43*	*47.7*	*6*	*30*	*1*	*10*	*48.59* ***
Spectinomycin	-	-	*45*	*50*	-	-	-	-	*94.94* ***
Streptomycin	-	-	*33*	*36.6*	-	-	-	-	*65.68* ***

* Chi-square significant at (P<0.05)
*** Chi-square significant at (P<0.0001)
NS= non-significant chi-square value (P>0.05)

Table 6. Cure rate after different treatments of *E.coli* mastitis.

groups	Cure from mastitis		Return to chronic		Case fatality	
	No.	%	No.	%	No.	%
Nuflor 10	9	90	1	10	0	0
Excenel 10	9	90	1	10	0	0
Enrofloxacin 10	7	70	1	10	2	20
panterramycin 10	2	20	3	30	5	50
Chi-square value and significance	14.95 **		2.35 NS		11.60**	

** Chi-square significant at (P<0.01)
NS= non-significant chi-square value (P>0.05)

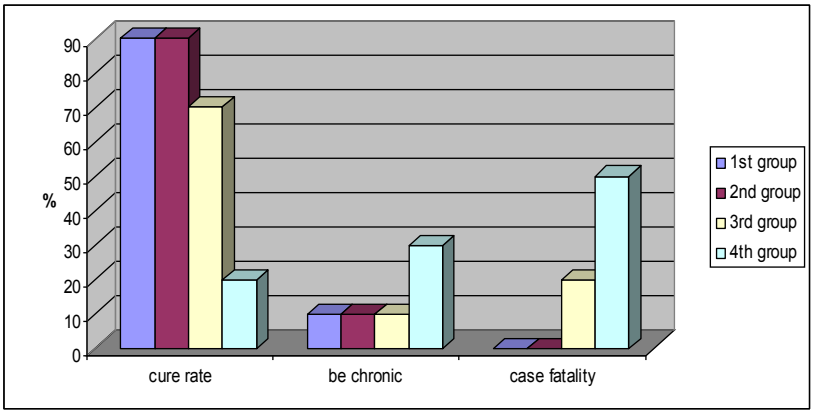

Figure 1. Cure rate after different treatments of *E.coli* mastitis.

4. Discussion

Mastitis has been and continues to be recognized as one of the major disease problems concerning the dairy industry. It is also one of the most costly diseases confronting the dairy farmer. Estimating economic losses resulting from mastitis becomes an extremely difficult task because of the many levels of infection and other factors. Mastitis is a global problem as it adversely affects animal health, quality of milk and economics of milk production and every country including developed ones suffer huge financial losses ***(Sharma et al., 2007).***

Table 1, showed that incidence of subclinical mastitis more prevalent than clinical mastitis in housed buffaloes in percentages 18.5% and 9% respectively by significant different value at (P<0.0001). Our results related to ***Pathak and Sharma, (1988)*** recorded the incidence of clinical mastitis in buffalo ranges from 8 to 40%. ***Sharma et al. (2004)*** reported 70.32% incidence of sub clinical mastitis in buffaloes, while ***Maiti et al. (2003)*** reported 70.37% incidence of sub clinical mastitis in cows.

Table 2, showed that *S. aureus, E. coli, St agalactia and St. dysgalactia* were the most common isolates in clinical mastitis. Clinical mastitis caused by Single infection or mixed infection. *S. aureus* was the most common single cause of clinical mastitis (36.6%), followed by *E. coli* (22.2%), *St agalactia* (2.7%) and *St. dysgalactia* (2.2%). *S. aureus* and *E. coli* was the most common mixed cause of clinical mastitis 24.4% followed by *S. aureus* and *St. agalactia* 8.3% and *E. coli* and *St. dysgalactia* 3.3%. Our results near to ***Farooq et al. (2008)*** tested eight hundreds milk samples from buffaloes for mastitis, out of which 75 (9.32%) were found positive. *S. aureus* was the most frequently isolated pathogen (44%) followed by *St. agalactiae* (22%), *E.coli* (16%) bacillus spp. (4%) and mixed growth (14%). Bacteriological examination of 80 quarter milk samples obtained aseptically from 56 buffaloes with acute mastitis revealed that coliform bacteria was the most common pathogen (45 cases) followed by *S. aurous* (seven cases) then *St. uberis* (three cases), and *St. agalactiae* (one case) ***El-Khodery and Osman (2008).***

Table 2, showed that *E. coli, S. aureus,* C.N.S, Pseudomonas, *St agalactia,* and *St. dysgalactia* were the most common isolates in subclinical mastitis. Subclinical mastitis caused by single infection or mixed infection. *E. coli* was the most common single cause of suclinical mastitis (25.9%), followed by *S. aureus* (22.16%), C.N.S (5.6%) and Pseudomonas (3.5%). *S. aureus* and C.N.S was the most common mixed cause of subclinical mastitis (18.9%) followed by *E. coli* and *St. dysgalactia* (12.7%) and C.N.S and *St agalactia* (11.08%). ***Sudhan et al. (2005)*** recorded that bacteriological isolations of subclinical mastitis revealed that *S. aureus* was the major pathogen (56.89%) followed by Micrococcus *spp.(15.51* %) *Bacillus spp.* (12.06 %), *S. epidermidis* (8.62 %), *Klebsiella spp* (3.44 %), *E. coli* (1.72 %) and Corynebacterium *spp.* (1.72 %). ***Hallén-Sandgren (2000),*** found that the most important isolations from sub-clinical cases were *S. aureus* (37%), CNS (31%) and *Str. uberis* (14%) in Sweden.

The majority of mastitis cases may be subclinical. Most cases of subclinical mastitis are caused by contagious organism such as *S. aureus* and *Str. agalactiae* or by environmental organisms such as non agalactiae Streptococcus spp., usually *Str. uberis* or *Str. dysgalactiae.* Total milk losses in quarters in subclinical mastitis have been calculated at 10-15% ***(Fetrow and Fred, 1980).***

S. aureus was the most common isolated pathogen in 37.5% of 40 milk samples from clinical cases. The isolated pathogens from sub-clinical cases and their relative frequencies were: *S. aureus* 62.8%, *St. agalactiae* 11.3%, *Enterococcus sp.* 8%, coagulase-negative staphylococci 7.4%, *St. uberis* 6.4%, *St. dysgalactiae* 1.8%, *E. coli* 1.5% and *S. hyicus*

coagulase- positive 0.6%. ***(Gianneechini et al., 2002).***

Table 3, showed clinical finding of clinical mastitic buffaloes according to bacterial isolates. 66 infected quarters by ***S. aureus***, characterized by acute swelling of quarters and milk is abnormal, bloody in 35 quarters and thick clots in 31 quarters associated with systemic reaction, anorexia and fever. 6 cases characterized by fatal peracute *S. aureus* mastitis characterized by severe swelling of the quarters and pusy milk with marked systemic reaction as fever 41-42°C, complete anorexia, depression, recumbency ended by death. Also observed that onset of 33 cases of *S. aureus* mastitis at first month post calving and this findings of are in accordance with ***(Radostits et al., 2007)*** acute and peracute *S. aureus* mastitis most common in early lactation. Acute swelling of gland with fever; milk is abnormal with thick clots and pus; gangrene of gland and teat in peracute form. Systemic reaction with anorexia, toxemia, fever, ruminal stasis. Peracute *S. aureus* mastitis occurs usually in the first few days after calving and is highly fatal. There is a severe systemic reaction with elevation of the temperature to 41-42°C, rapid heart rate (100-120 beats/min), complete anorexia, profound depression, absence of ruminal movements and muscular weakness, often to the point of recumbency.

Table 3, showed 40 infected quarters by ***E. coli*** characterized by acute swelling of quarters with edema till umbilicus and watery milk associated with systemic reaction with anorexia and fever. 7 cases characterized by fatal peracute ***E. coli*** mastitis characterized by severe swelling of the quarters fever, recumbent ended by death. Also observed that onset of 37 cases of ***E. coli*** mastitis at first 2 weeks post calving. Our result near to ***El-Khodery and Osman (2008)*** **found that** clinically, hotness, swelling and painful reaction with serous excretion containing clots was recorded in buffaloes with coliform mastitis. ***E. coli*** cause inflammation of the mammary gland in dairy cows around parturition and during early lactation with striking local and sometimes severe systemic clinical symptoms. This disease affects many high producing cows in dairy herds and may cause several cases of death per year in the most severe cases **(*Burvenich, 2003).***

Table 3, showed 5 cases of ***St. agalactia*** mastitis characterized by swollen, painful quarters shed pusy milk without systemic reaction. Only 1 quarter associated with systemic reaction. ***St. agalactia*** was significant cause of chronic mastitis, abnormal gland when the inflammation of the gland is severe but there is no marked systemic reaction, The milk yield of affected glands is markedly reduced ***(Radostits et al., 2007).*** 4 cases of ***St. dysgalactia*** mastitis characterized by swollen, painful quarters shed clotted milk without systemic reaction.

Table 3, showed 44 infected quarters by ***S. aureus*** and ***E. coli*** characterized by swelling of quarters shed abnormal milk with thick clots and pus with systemic reaction. ***Staphylococcus aureus*** **and** ***E. coli*** were the major pathogens of bovine mastitis. The signs of pyrexia, tachycardia, depression, loss of milk yield and severe inflammatory swelling of udder, indicated acute type of mastitis. ***(Chakarbarti, 2000)***

Table 3, showed 15 infected quarters by ***S. aureus*** and ***St agalactia*** characterized by swelling of quarters shed abnormal watery milk with no systemic reaction. 6 Infected quarters by ***E. coli*** and ***St. dysgalactia*** characterized by swelling of quarters with edema till umbilicus and clotted milk with systemic reaction.

Table 4, explain the incidence difference of post calving mastitis. 1st and 2nd month post calving were the highest incidence of clinical mastitis and subclinical mastitis in percentages 51.1%, 17.7% and 38.1%, 19.18% respectively. 6.1%, 5.5%, 3.3%, 2.2%, 2.7% and 11.1% incidence of clinical mastitis in 3rd, 4th, 5th, 6th, 7th and 8th month's respectively. 11.6%, 13.5%, 8.9%, 3.2%, 1.08% and 4.3% incidence of subclinical mastitis in 3rd, 4th, 5th, 6th, 7th and 8th month's respectively. Our results in accordance with ***Corbett (2009)*** who suggests that the highest number of clinical mastitis cases occurs during the first week of lactation, and that the lactating cow is more likely to develop clinical mastitis during the first three months of lactation than the remainder of the lactating period and ***Moroni et al. (2006)*** reported that, the incidence was highest during the 30 days after calving. ***Javed Iqbal and M.Siddique (1999)*** found that mastitis was more prevalent in cows during the first month of lactation (24.9%). Lakshmi Kavitha et al. (2009) found that the buffaloes in the first stage of lactation (1-4 months) and the last part of dry period (10-12 months) were more prone to mastitis.

From these results statistical analysis explain higher significant difference value ($P<0.01$) in between clinical and subclinical mastitis incidence in 1st, 4th and 8th month post calving and significant difference value ($P<0.05$) in between clinical and subclinical mastitis incidence in 3rd and 5th month post calving and no significant difference value ($P>0.05$) in between clinical and subclinical mastitis incidence in 2nd, 6th and 7th month post calving.

Table 5 showed that, sensitivity of different clinical mastitis pathogens to different antibiotics during the study period. Amoxicillin and clauvilinic acid, Cefotaxime and Enrofloxacin were found most effective drugs against 125 *S. aureus* isolates. Cefotaxime, amoxicillin and clauvilinic acid, enrofloxacin, chloramphenicol, gentamycin, Tetracycline and Spectinomycin were found most effective drugs against 90 *E. coli* isolates. Cefotaxime,

amoxicillin and clauvilinic acid, enrofloxacin and penicillin were found most effective drugs against 20 *St. agalactia* isolates. Amoxicillin and clauvilinic acid, Cefotaxime and enrofloxacin were found most effective drugs against 10 *St. dysgalactia* isolates.

From these results statistical analysis explain higher significant difference value ($P<0.05$) in response of all isolates against penicillin, enrofloxacin, spectinomycin, streptomycin, chloramphenicol, trimeth/sulfa and tetracycline and these result indicate variable efficacy of these antibiotics against isolated bacteria. Also there are lowest significant difference value ($P<0.0001$) in response of all isolates against amoxicillin plus clauvilinic acid and these result indicate efficacy of these antibiotic against isolated bacteria. Also there are no significant difference value ($P>0.05$) in response of all isolates against Cefotaxime and these result indicate higher efficacy of these antibiotic against all isolated bacteria.

Resistance of *S. aureus* to penicillin is more prevalent and this findings of are in accordance with those of ***Iqbal et al. (1984)*** found that 92.86 percent of *Staph. aureus* isolates from cow milk were resistant to penicillin. ***Costa et al. (2000)*** found high sensitivity of *Staphylococcus aureus* to gentamycin (80%), which is disagree with the findings of present study. ***Dhakal et al. (2007)*** found that enrofloxacin had the highest average sensitivity (91%) and less effectiveness of amoxicillin to all the isolates may be due to the resistance produced in the bacteria due to extensive use of this antibiotic in cattle and buffaloes. ***Farooq et al. (2008)*** recorded that Norfloxacin, Gentamycine and Choramphenocol were found most effective antibiotics tested *in vitro* against *Staphylococcus aureus, Streptococcus agalactiae, E.coli* , bacillus spp. and mixed growth .

Table 6 and figure 1, explain difference in cure rate after different systemic treatments of *E. coli* mastitis. The best results obtained in Florfenicole and Ceftiofur groups by cure rate 90%, only one case return to chronic with no case fatality. In Enrofloxacin group, cure rate 70%, only one case return to chronic with 20% Case fatality. In Panterramycin group, cure rate 20%, three cases return to chronic with 50% Case fatality.

From these results statistical analysis explain higher significant difference value ($P<0.01$) in cure rate and case fatality in between different groups and no significant difference value ($P>0.05$) in return to chroncity in between different groups.

On theother hand, ***El-Khodery*** and ***Osman*** (2008) evaluate the efficacy of ceftiofur in the treatment of buffaloes with acute coliform mastitis. Parenteral ceftiofur neither improved clinical signs nor returned milk to pre-infection production level, whereas intramammary ceftiofur and combination of intramammary with parenteral ceftiofur improved the clinical signs in 10/15 and 12/15 buffaloes, respectively. On quarter level, 3/17, 12/17 and 15/21 quarters recovered in groups received parenteral, intramammary and combination therapy, respectively.

Severe mastitis is usually treated systemically. The goal of antibacterial therapy is to attain effective concentrations of the drug at the site of infection. For bovine mastitis, there are three potential therapeutic targets, or pharmacologic compartments. The ***first*** (and most commonly targeted compartment) consists of the milk and the epithelial lining of the ducts and alveoli of the mammary gland. Pathogens (*Streptococcus agalactiae*, *Streptococcus dysgalactia*, *coagulase-negative staphylococci*) that typically reside in this compartment are generally noninvasive and are not believed to cause abscess formation in the parenchyma. The ***second*** compartment consist the deep tissue of the mammary gland. Systemic administration is typically indicated for pathogens such as *Staphylococcus aureus* or *Streptococcus uberis* that are invasive or create abscesses. Cefquinome, a fourth-generation cephalosporin that has good tissue distribution and low MIC for gram-negative bacteria, was determined to be beneficial in reducing deleterious clinical outcomes of experimentally induced *Escherichia coli* mastitis. Recent evidence has suggested that the primary target for the treatment of severe coliform mastitis should be the ***third*** compartment of mastitis therapy: the cow. Bacteremia can occur as a consequence of coliform mastitis and studies of naturally occurring cases have reported beneficial clinical outcomes for cows treated with oxytetracycline and ceftiofur **(Cebra *et al.*, 1996).**

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