

Uncommon therapeutic protocols in bovine urinary tract infections in veterinary practice

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Abstract

The present study was conducted to compare different therapeutic regimens for bovine urinary tract infections (UTIs), which commonly occur due to bacterial colonization of the urethra that ascends to the bladder and kidneys. A total of 45 UTI-affected animals were randomly divided into three treatment groups. Group I received long-acting amoxicillin trihydrate along with supportive therapy, Group II was treated with amoxicillin/sulbactam combined with ultrasound-guided flushing of the urinary bladder using dilute betadine and metronidazole, while Group III received enrofloxacin along with ultrasound-guided bladder flushing using dilute betadine (2.5%) and metronidazole (100 mg in 10 mL distilled water). Therapeutic response was assessed on the basis of clinical severity score and bacteriological cure from urine samples collected five days post-treatment. Chi-square analysis revealed that animals in Group III showed significantly better improvement compared to Groups I and II at the 1% level of significance. The successful outcome in Group III, achieved through the combined use of parenteral therapy, bladder catheterization with a Foley catheter, and urinary acidifier (ammonium chloride), highlights a promising approach for the effective management of bovine UTIs.

Keywords: Amoxicillin, Betadine, Cystitis, Metronidazole, Pyelonephritis

Highlights

- Combination therapy with parenteral antibiotics and bladder flushing showed superior efficacy in bovine UTI
- Bladder flushing with 2.5% liquid betadine and metronidazole (100 mg/10 mL distilled water) was done
- Percent efficacy of GROUP II was 53.33% when treatment given for 7 days which increased to 73.33% after 14 days treatment

Urinary system is one of the most vital systems in the animal's body. Any disturbance in this system functioning affects the functions of other systems because it contributes to the regulation and conservation of body fluid components, acid base homeostasis (Sandilands et al., 2013), responsible for removal of toxic wastes from the body (Divers & Peek, 2018) as well as hormone secretion that participate in systemic and renal dynamics regulation (Reece et al., 2015). Majority of urinary tract infections result from bacterial colonization in the urethra, which then ascends to the bladder and kidneys, causing infection. Conditions that cause damage to mucosa in lower portion of urinary tract such as post-parturient diseases predispose animal to pyelonephritis directly impacting animal health (Markusfeld et al., 1989). So, an early treatment is essential to reduce the financial loss to the farmer caused by UTI in lactating buffaloes.

Traditional treatment of pyelonephritis consists of fluid therapy, anti-inflammatory therapy, and

administration of antimicrobials, which are active against the involved pathogens (Van Metre, 2009). Also flushing of urinary bladder with diluted liquid betadine (2.5%) and metronidazole (100 mg in 10 mL distilled water), combined with parenteral antibiotic therapy and ammonium chloride orally @ 0.2 mg/kg body weight was shown to be a highly successful therapeutic regime for the treatment of a cystitis-pyelonephritis syndrome in buffaloes (Kumar et al., 2021). There is paucity of research concerning alternative therapeutic approaches for bovine urinary tract infections. So, keeping above facts under consideration, study was planned with the objectives is to compare different therapeutic regimen for bovine urinary tract infections.

The present investigation was carried out on clinical cases brought to Teaching Veterinary hospital. All UTI affected bovine were therapeutically managed by using different therapeutic options adopted during study. A total of 45 cases were randomly divided into 3 groups

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Table 1. Therapeutic trial groups

GROUPS	PROTOCOL
Group – I (n=15)	Amoxicillin trihydrate (LA) @ 10 mg per kg BW once daily IM for 7 days along with supportive therapy
Group – II (n=15)	Amoxicillin/sulbactam @ 12 mg per/kg BW IM bid x 7 days along with flushing of urinary bladder with dilute liquid betadine (2.5%) and metronidazole (100 mg in 10 mL distilled water)
Group – III (n=15)	Enrofloxacin along with flushing of urinary bladder with dilute liquid betadine (2.5%) and metronidazole (100 mg in 10 mL distilled water)

Table 2. Distribution of UTI affected bovine in different therapeutic regimens

Urinary tract infection	GROUP- I (Amoxicillin LA @ 10 mg/ kg BW od IM for 7 days along with supportive therapy)	GROUP- II (Parenteral antibiotic + flushing of urinary bladder with diluted liquid betadine (2.5%) and metronidazole (100 mg in 10 mL DW)	GROUP- III (Amoxicillin/ sulbactam @ 12 mg per/kg BW IM bid x 7 d + flushing of urinary bladder with diluted liquid betadine (2.5%) and metronidazole (100 mg in 10 mL DW)
Pyelonephritis (n=8)	8	—	—
Cystitis (n=10)	—	5	5
Cystitis + Urethritis (n=2)	—	—	2
Cystitis+ Cystoliths (n=9)	—	6	3
Cystitis- Pyelonephritis complex n=13)	4	4	5
Acute kidney injury (n=3)	3	—	—
Total animals	15	15	15

having 15 cases each as shown in Table 1. Supportive therapy in the form of parenteral analgesic/anti-inflammatory, vitamin B complex, ammonium chloride orally @ 0.2 mg/kg bwt and antioxidants-vitamin C were given as per individual requirement. Post treatment therapeutic evaluation was done based on bacteriological cure of urine sample collected 3 days after administration of last dose of antibiotic. Present study was conducted with ethical permission IAEC vide no. VCC/IAEC/2022/1624+51.

All 45 affected animals at Veterinary Clinical complex were randomly allocated into three treatment groups as detailed in Table 2. Therapeutic evaluation was done based on bacteriological cure rate by collecting and culturing the urine sample 7 and 14 days after treatment as shown in Table 3. Bacteriological cure rate of 46.67% was shown in GROUP III after treatment for 7 days which increased

to 86.67% after treatment for 14 days. The percentage efficacy of GROUP II was 53.33% when treatment was given for 7 days which increased to 73.33% after treatment for 14 days. While GROUP I had only 13.33% efficacy after 14 days as shown in Table 3. Parenteral antibiotic therapy along with flushing of urinary bladder with diluted liquid betadine (2.5%) and metronidazole (100 mg in 10 mL distilled water) and ammonium chloride orally @ 0.2 mg/kg body was shown to be a highly successful therapeutic regime for the treatment of urinary tract infection in bovine as compared to parenteral antibiotics alone. Chi-square analysis was performed to evaluate comparative therapeutic efficacy of different therapeutic regimens based on cull and recovered animals (Table 4). Culled animals encompass those that were either culled or expired, while recovered animals comprise those that recuperated after 14 days of therapy. Based on analysis,

Table 3. Comparative therapeutic efficacy of different therapeutic regimens in UTI

Group	No. of animals	Antibiotics used with dose rate and route	Recovery rate	Bacteriological cure rate after 7 days treatment	Bacteriological cure rate after 14 days treatment
A	15	Amoxicillin LA @ 10 mg/kg BW od IM for 7 day along with supportive therapy	2 recovered + 6 died+ 7culled	0%	13.33% (2)
B	15	Amoxicillin/sulbactam @ 12 mg per/kg BW IM bid x 7 d + flushing of urinary bladder with diluted liquid betadine (2.5%) and metronidazole (100 mg in 10 mL DW)	10 completely recovered + 1 show mild improvement + 4 culled 10 completely recovered + 3 show	53.33% (8)	73.33% (11)
C	15	Parenteral antibiotic + flushing of urinary bladder with diluted liquid betadine (2.5%) and metronidazole (100 mg in 10 mL DW)	mild improvement + 2 culled	7 (46.67%)	86.67% (13)

Table 4. Comparative therapeutic efficacy of different therapeutic regimens in UTI using Chi-square analysis (p<0.01)

	GROUP-I	GROUP- II	GROUP- III	Chi-square	p-value
Recovered	2	11	13*	18.7652*	0.000084
Culled/ died	13	4	2*		

it was concluded that animal allotted to treatment group-II, i.e., Parenteral antibiotic + flushing of urinary bladder with dilute liquid betadine (2.5%) and metronidazole (100 mg in 10 mL DW) found to have better improvement statistically in comparison to group I and II at 1% level of significance.

In the present study, UTI affected bovine were divided into three groups of 15 animals each. Group- I was treated by Amoxicillin LA @ 10 mg/ kg BW od IM for 7 days along with supportive therapy, Group- II was treated by Amoxicillin/sulbactam @ 12 mg per/kg BW IM bid x 7d + flushing of urinary bladder with dilute liquid betadine (2.5%) and metronidazole (100 mg in 10 mL DW) and Group- III by Enrofloxacin @ 5 mg/kg BW intramuscularly + flushing of urinary bladder with dilute liquid betadine (2.5%) and metronidazole (100 mg in 10 mL DW). Choice of antibiotics was made keeping in mind the frequent use of these antibiotics in clinical practice and have good activity against many common urinary pathogens including those isolated in this study. Bacteriological cure rate of 46.67% was shown in GROUP III after treatment for 7 days which increased to 86.67% after treatment for 14 days. The percentage efficacy of

GROUP II was 53.33% when treatment was given for 7 days which increased to 73.33% after treatment for 14 days. While GROUP I had only 13.33% efficacy after 14 days. As most of UTI affected animals in our study had alkaline pH and alkaline pH enhances the expression of the flagella of *C. renale* and provides favorable conditions for the proliferation of bacteria (Stevens et al., 2007). The adhesion of *C. renale* bacteria to the epithelial cells of the bovine urinary tract is higher at pH of urine above 7.6 (Andrews et al., 2008). Enzyme urease is an important virulence factor in *C. renale* GROUP II cause it quickly and vigorously hydrolyzes the urea, and the resulting products (such as ammonia) stimulate the mucosal inflammation. So, for combating these animals given ammonium chloride which is having urinary acidifiers (Mavangira et al., 2010).

Chi square analysis concluded that animal allotted to treatment group-III i.e., Parenteral antibiotic + flushing of urinary bladder with dilute liquid betadine (2.5%) and metronidazole (100 mg in 10 mL DW) found to have better improvement statistically in comparison to group I and II at 1% level of significance. Parenteral antibiotics was administered as per antimicrobial

sensitivity pattern. Therefore, the successful treatment of affected animals in Group III, using urinary bladder catheterization with a Foley catheter alongside parenteral therapy and a urinary acidifier like ammonium chloride, paved the way for future advancements in treating urinary tract infections in bovines. Our goal is to clear the bladder infection with sufficient concentration of antibiotic at specific site along with detaching pyogenic thick layer attached to the bladder wall. Similar approach was adopted in the past in treating metritis in animals and cystitis in humans (Mido et al., 2016). Flushing of urinary bladder with liquid betadine and metronidazole proved effective in maintaining a high antimicrobial concentration within the bladder, as strains of *E. coli* and other bacteria can survive and multiply within uro-epithelium leading to failure of therapy in most of the affected cases. Aim of using systemic antibiotic therapy was to treat pyelonephritis and septicemia in the presented animals. Parenteral antimicrobial therapy is more likely to be successful if initiated at early stage and should be used for long period. Cystitis- pyelonephritis complex and acute kidney injury yields poor prognosis and failure to parenteral antimicrobial treatment as recorded in the presented cases (Constable et al., 2017). So, bladder flushing along with systemic antimicrobial therapy was adopted to achieve better response within short span of time (Saharan et al., 2020). Liquid betadine (2.5%) in this study was well tolerated by all the animals, with no signs of irritation or discomfort observed. Instead, it helped alleviate the existing pain in the animals. Judicious use of metronidazole is crucial, and in this study, it was administered at a low concentration (100 mg) for flushing the urinary bladder as an anti-infective, antiseptic, and anti-inflammatory agent. Like our research findings, it was suggested that urinary bladder flushing with liquid betadine and

metronidazole as effective therapeutic regime for buffaloes suffering from cystitis- pyelonephritis syndrome (Kumar et al., 2021).

Present study inferred that parenteral antibiotic therapy along with flushing of urinary bladder with diluted liquid betadine (2.5%) and metronidazole (100 mg in 10 mL distilled water) and ammonium chloride orally @ 0.2 mg/kg body weight, was shown to be a highly successful therapeutic regime for the treatment of urinary tract infection in bovine as compared to parenteral antibiotics alone.

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Author's contribution: TK, AY, AK: Conceptualized, conceived, and designed the study; AY, MS: Did laboratory analysis; TK, NS: Finalized the manuscript draft.

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