

Management of obstructive urolithiasis by tube cystostomy technique in male buffalo calves

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ABSTRACT

The study was conducted on 35 male buffalo calves suffering from obstructive urolithiasis. The common clinical signs recorded were anuria, dull anxious look, kicking at the ventral abdomen, persistent efforts for micturition, which may be accompanied by rectal prolapse and pulsating urethra with contraction and relaxation of preputial orifice in cases with intact urinary bladder whereas bilateral distension of abdomen with fluid thrill, sunken eyes and no effort for micturition in cases of ruptured urinary bladder. The heart rate and respiratory rate were mildly elevated. The haematological parameters showed no significant changes. There was a significant increase in blood urea nitrogen, serum creatinine and plasma potassium which returned to near normal level in 48 h post-operatively. The pH of urine changed from alkaline to slightly acidic during the course of treatment. Ultrasonography was very effective tool for examining the status of urinary system in affected animals. Tube cystostomy had a high success rate in treating cases of obstructive urolithiasis in buffalo calves.

Key words: Buffalo calves, Obstructive urolithiasis, Tube cystostomy

Etiology of obstructive urolithiasis, a frequently encountered surgical condition in all species of animals but most commonly in males of cattle, buffalo and sheep leading to urethral obstruction, urethral or urinary bladder rupture and subsequent uremia (Gasthuys *et al.* 1996), is multifactorial but is mainly attributed to excessive or imbalanced intake of minerals particularly calcium, phosphorus and magnesium (McIntosh 1978). Age, sex, breed, season, hormonal imbalance, hydrophilic colloids, infection, vitamins and water intake by the animal play role in its etiology to a varying degree.

Conventionally, post-scrotal urethrotomy and urethrostomy are used for the treatment of urinary obstruction in bovines but are associated with urethral stricture formation and subsequent recurrence of the urethral obstruction. Other complications associated with these techniques are kinking or withdrawal of catheter, leakage of urine, infection and impotentia condi due to formation of adhesions at surgical site. The breeding value of treated calf is compromised. Moreover, in calves with ruptured urinary bladder, urethrotomy is of no use as urine accumulates in peritoneal cavity due to gravity. Tube

cystostomy is a urethral bypass technique which has become popular as a treatment for obstructive urolithiasis in calves with subsequent medical dissolution of the uroliths (Singh *et al.* 2004, Ewoldt *et al.* 2006). This technique is easy, requires less time, keeps the mating capacity intact and restores full urethral patency. The reporting of buffalo calves for the treatment of urine retention is showing an increasing trend in recent years. In buffalo calves, the smaller diameter of urethra and often deposition of sand like material in entire urethra makes urethrotomy more traumatic and difficult to perform. Tube cystostomy technique in such cases has clinically proven to be very effective. So, a detailed clinical study was planned to evaluate this technique by studying clinical, ultrasonographic, haematological, biochemical and electrolyte parameters as well as success rate and complications in buffalo calves suffering from obstructive urolithiasis.

MATERIALS AND METHODS

The study was conducted on 35 male buffalo calves suffering from obstructive urolithiasis. The signalment, duration of illness, pattern of urinary obstruction i.e. dribbling or sudden stoppage, water intake, previous treatment, type of feed given were recorded. The buffalo calves were examined for general body condition, colour of mucous membrane, heart rate, respiratory rate, rectal temperature and status of urinary bladder (ruptured/intact) by palpation, abdomenocentesis and ultrasonography. Ultrasonographic examination was done by 5 MHz sector

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transducer to evaluate the status and wall thickness of urinary bladder and the presence of urinary calculi, if any.

For haemato-biochemical examination, 5 ml of blood (4 ml in heparin and 1 ml in EDTA) was collected from the jugular vein before surgery and at 24 and 48 h after surgery. The different haematological parameters, viz. Hb, PCV, TEC, TLC and DLC were estimated by standard procedures. Plasma biochemical parameters including BUN, plasma creatinine, total plasma protein, albumin, albumin:globulin ratio (A:G), calcium, ALP, SGOT/AST and SGPT/ALT were estimated using automated clinical chemistry analyzer by commercial kits. Plasma inorganic phosphorus and plasma magnesium ion were estimated on a semi auto analyzer by commercial kits. Plasma sodium and potassium levels were estimated by flame photometry method.

After thorough clinical, haemato-biochemical and ultrasonographic examinations in all the animals, tube cystostomy was performed through a left pre-pubic paramedian approach and one end of Foley's catheter (#18 or 20) was fixed into the urinary bladder by inflating the balloon while other end was fixed at ventral abdominal wall near preputial orifice with transcutaneous sutures. Intraoperatively, 2–3 ml of urine was collected aseptically in a sterile urine collection vial and was processed for bacteriological culture, isolation and antibiotic sensitivity test. Also, 50 ml urine was collected in a beaker for the examination of physical properties of urine like colour, consistency, pH and specific gravity.

Post-operatively, animals were given ammonium chloride @ 500 mg/kg orally by dissolving in water daily for 20 days. The wound was dressed by 0.5% povidone-iodine solution and fly repellent spray twice daily till the healing of the wound. Broad spectrum antibiotics viz. cefotaxime (20 mg/kg b.wt.) and amikacin (10 mg/kg b.wt.) and an anti-inflammatory drug (ketoprofen @ 3 mg/kg body weight) were administered intramuscularly for 5 days. After 3 days of surgery, the Foley's catheter urine channel was blocked for 2–3 h twice daily to initiate micturation through urethra. Once dribbling of urine was noticed through urethra, the period of occlusion of Foley's catheter was increased gradually. The catheter was removed by deflating the balloon after establishment of complete urethral patency. Complications, if any, were managed accordingly. The overall success rate was calculated. The data were analyzed using One-Way analysis of variance (ANOVA) to compare the values among different subgroups at corresponding intervals and Student paired 't' test for the comparison of the different values with base values in different subgroups.

RESULTS AND DISCUSSION

During 2012–13, out of 2,044 cases reported for the treatment of different surgical conditions at TVCC Hisar, 297 (14.53%) animals were diagnosed as suffering from obstructive urolithiasis. Among bovines, buffalo calves had significantly higher incidence of obstructive urolithiasis (96.63 %) than cow calves (2.69 %) and bullocks (0.67 %). The reporting of the urolithiasis in bullocks and cattle calves

has decreased from earlier published report of Singh and Singh (1990) due to reduction in population of bullocks. The incidence of this infection in buffalo calves varied considerably with seasons and the maximum (67.67 %) was recorded from December to March with peak in January (36.36 %). High incidence during peak winter was probably due to reduced water intake by calves (Amarpal *et al.* 2004). The buffalo calves in the age group of 2–4 months were most commonly (51.42 %) affected, followed by the age group of 4–6 months (22.85 %), 0–2 months (14.28 %), 6–8 months (8.57 %) and 8–10 months (2.85 %). The buffaloes are seasonal breeder and 80% calving occurs during July to October which makes calves to attain the age of 2–6 months by December. After weaning, these calves were usually offered wheat or rice bran majority diet rich in phosphorus causing oversaturation of urine with phosphorus and imbalance of Ca:P ratio. Reduced intake of water during winter further concentrated minerals in urine (Singh 2005). This favored precipitation, nidus formation and subsequent deposition over it. The narrow urethral lumen added to it.

On clinical examination, twenty seven buffalo calves (77.14 %) had a fair, 6 (17.14 %) had poor and 2 had moribund body condition. The clinical signs varied according to the status of the urinary bladder and duration of urethral obstruction. The common clinical signs in early cases with intact urinary bladder were anuria, restlessness, inappetence to anorexia, frequent attempt to urinate, inward and outward movement of the flank during straining along with breath holding, pulsating urethra, twitching of the penis and maintaining urinating posture for prolonged periods. Sometimes rectal prolapse due to straining was also observed. However, in delayed cases with ruptured urinary bladder, anuria and bilateral distention of the abdomen with fluid thrill (*water belly*) and dehydration with sunken eyes were the most consistent clinical signs. Recumbent calves were showing great discomfort and dyspnea. When urinary bladder ruptured, there was temporary relief from pain and clinical signs disappeared for one to two days but in next few days calves were uremic.

The mean heart rate ($75.75 \pm 2.84/\text{min}$) and mean respiratory rate ($30.62 \pm 2.00/\text{min}$) were higher than normal values. These were attributed to pain and progressive systemic disturbances like dehydration, hyponatremia and hyperkalemia, intercompartmental fluid shift and myocardial ischemia. The mean rectal temperature ($37.88 \pm 0.158^\circ\text{C}$) was within the normal range. The extent of dehydration in buffalo calves varied from 4–10% with mean time of skin tent test 4.097 ± 0.31 sec. The dehydration was more in cases of ruptured urinary bladder due to shifting of more water from interstitial and intravascular fluid into the peritoneal cavity.

On ultrasonography, the intact urinary bladder appeared as a round body with tensed bladder wall. The bladder lumen was showing anechoic shadow indicating the presence of urine; however, scattered pin-point hyper-echoic shadows were also seen indicating the presence of suspended particles or sludge, which were confirmed after tube

cystostomy when sandy particles were observed in the urine. In cases of sub-serosal rupture of urinary bladder, there was thinning of the bladder wall with reduced echogenicity. The urinary bladder was partially filled and anechoic urine was also present in the peritoneal cavity along with floating intestines in it. In case of ruptured urinary bladder, there was complete disruption of hyperechoic wall with no urine inside the bladder lumen. The abdominal cavity appeared hypoechoic with floating viscera in it and on abdomen omentosis using 16G sterile needles in umbilical region, jet of urine came out.

There was a non-significant progressive decrease from the pre-operative value of Hb (12.92 ± 0.23 g%), PCV ($39.46 \pm 0.58\%$), TEC (6.27 ± 0.16 cu mm) and TLC (13.87 ± 0.47 cu mm) at 24 h and 48 h post-operatively due to rehydration by fluid therapy and increasing intake of food and water by animal following removal of urine from its body (Pandey and Singh 1989). The TLC and neutrophil ($60.66 \pm 2.17\%$) counts were higher in buffalo calves with ruptured urinary bladder due to stress, pain, extensive tissue necrosis and peritonitis (Gaunt 2000).

The higher pre-operative values of BUN and serum creatinine (Table 1) decreased significantly post-operatively towards normal level. The urea and creatinine gets reabsorbed into the systemic circulation when urine remains in the urinary bladder for longer time. Further, back-flow of urine causes hydronephrosis (Singh 2005), which reduces the glomerular filtration rate and ultimately decreased creatinine and urea excretion in urine. In ruptured urinary bladder, there is movement of urea from the urine in peritoneal cavity to interstitial and intravascular compartments. Even the secretion through saliva and recycling through rumen cannot compensate increased BUN and creatinine level in long standing anorectic cases (Sharma *et al.* 2006). The concentration of creatinine in blood increases mainly because of excretory dysfunction and renal damage and is not influenced by diet.

The pre-operative values of plasma protein and

albumin:globulin ratio (A:G) increased post-operatively but were still below the normal values till 48 h. The lower levels of total plasma proteins might be attributed to the anorexia arising from intense pain. An initial decrease was followed by a rise in A:G ratio. Albumin is a negative acute phase protein. It decreases during acute inflammation to enhance the protective and healing functions by focusing the metabolic activities of animals towards the synthesis of protective proteins viz. globulins.

Pre-operative plasma calcium level increased non-significantly in 48 h. Singh *et al.* (1987) reported hypocalcaemia and hyperphosphataemia in cases of urinary obstruction in animals but in present study, the plasma calcium and phosphorus remained normal though phosphorus decreased significantly post-operatively at 48 h because the larger fraction of sample population was of 2 to 4 months of age group and still getting milk as a part of their diet. Pre-operative hyperkalaemia and hypermagnesaemia decreased significantly to reach normal level at 48 h. This could be attributed to release of ions from the damaged cells due to possible tissue hypoxia in uremic cases. This was also due to correction of uremia and dehydration and clearance of potassium in the urine. The plasma sodium ion was normal in pre- as well as post-operative period. Sometimes, dehydration may mask its actual fall. The pre- and post-operative values of alkaline phosphatase was within the normal range though it decreased significantly post-operatively. This indicates that there was no major damage of liver and kidney. The higher pre-operative value of plasma SGOT and SGPT indicated non-specific tissue damage in different organs as was observed in goats by Singh (2005). These values decreased non-significantly at 24 h and 48 h post-operatively.

The colour of urine in affected animals varied from light yellow to smoky and brownish depending upon the duration of retention of urine and haemorrhage. The pH of urine was alkaline (7.37 ± 0.08) which became acidic (6.67 ± 0.11) at 48 h of surgery because of ammonium chloride

Table 1. Mean $\pm$ SE values of biochemical parameters in buffalo calves suffering from obstructive urolithiasis at different intervals

Parameters (Units)	Base value (before surgery)	At 24 h of surgery	At 48 h of surgery
BUN (mmol/L)	46.45 ± 0.82^b	37.11 ± 0.68^a	25.48 ± 0.48^a
Creatinine (μ mol/L)	433.94 ± 40.86^b	268.80 ± 29.96^a	212.81 ± 21.68^a
Plasma protein (g/L)	66.91 ± 1.22^b	63.69 ± 0.83^a	63.10 ± 0.86^a
Albumin (g/L)	30.78 ± 0.81^a	29.41 ± 0.57^a	28.76 ± 0.62^a
Globulin (g/L)	33.20 ± 1.42^a	34.27 ± 0.88^a	34.36 ± 0.71^a
A:G ratio	0.88 ± 0.03^a	0.87 ± 0.03^a	0.88 ± 0.03^a
Calcium (mmol/L)	1.72 ± 0.03^a	1.81 ± 0.03^a	1.82 ± 0.03^a
Phosphorus (mmol/L)	3.32 ± 0.14^b	3.07 ± 0.15^{ab}	2.77 ± 0.14^a
Sodium ion (mmol/L)	141.48 ± 0.61^a	142.28 ± 0.70^a	141.72 ± 0.51^a
Potassium ion (mmol/L)	6.65 ± 0.06^c	5.98 ± 0.06^b	5.16 ± 0.06^a
Magnesium ion (mmol/L)	0.91 ± 0.008^c	0.82 ± 0.006^b	0.67 ± 0.006^a
ALP (IU/L)	136.34 ± 5.60^b	110.78 ± 5.28^a	106.62 ± 5.39^a
SGOT (IU/L)	153.60 ± 6.70^a	152.99 ± 7.27^a	136.88 ± 6.00^a
SGPT (IU/L)	57.02 ± 2.80^a	52.22 ± 2.34^a	50.04 ± 13.80^a

Means with different superscript vary significantly ($P < 0.05$).

supplementation in diet (Senthilkumar *et al.* 2001). Urinary pH is influenced by diet, bacterial infection, storage time of urine in bladder and is usually determined by renal regulation of blood bicarbonate and hydrogen ion levels. Formation of phosphate, carbonate and struvite calculi is favored at the alkaline urine pH due to more rapid precipitation (Belknap and Pugh 2002). The specific gravity (1.015 ± 0.002) of urine was lower than the normal which increased (1.020 ± 0.003) at 48 h significantly post operatively indicating acute condition of kidney due to hydronephrosis.

Out of 35 samples, 24 urine samples showed no evidence of bacterial growth while in 11 urine samples, different types of micro-organisms were isolated with the maximum prevalence of *Staphylococcus* spp. followed by mixed growth of *Staphylococcus* spp. and *Streptococcus* spp., *Streptococcus* spp. and *Escherichia coli*. Sharma *et al.* (2006) also isolated *E. coli*, *Staphylococcus* spp. and *Klebsiella* spp. in uroperitoneum in buffalo calves. Bacterial infection might be the predisposing cause for urethral concretion formation in buffalo calves as formation of struvite uroliths increased when the urinary tract infection occurs (Osborne and Stevens 1981). The results of antibiotic sensitivity test (ABST) of the isolated micro-organism revealed that cephalosporine and fluoroquinolone groups of antibiotics were more effective against these isolated microbes in cultures.

The median time for initiation of urine dribbling was 8 days (4–15 days) and for free flow of urine was 9 days (5–16 days) from the urethral orifice. In clinical studies on cattle calf, it was 11 ± 8 days (Ewoldt *et al.* 2006) and 11.5 day (Rakestraw *et al.* 1995). The median time for removal of Foley's catheter after recovery was 14 days (8–20 days). Post-operatively, blockade of Foley's catheter lumen occurred in 12 cases out of 35 cases. It might occur due to urinary sludge, blood clot and concretions. Daily inspection and flushing of the catheter is required. Catheter obstruction may lead to rupture of urethra as reported in 1 case of this study. The infection of subcutaneous tunnel occurred in 8 cases as its external orifice was persistently exposed to environmental contaminations. It was managed with antiseptic dressing. The overall recovery rate was 91.42%. Three out of 35 buffalo calves died due to severe uremic condition within 6–12 h of surgery. Rakestraw *et al.* (1995) reported (85.74%), Singh (2005) reported 95% and Van Meter *et al.* (1996) reported 80% success rate of tube cystostomy in cases of urinary obstruction in small ruminants. To conclude, tube cystostomy along with oral administration of ammonium chloride @ 500 mg/kg for at least 20 days proved to be a highly effective technique in management of obstructive urolithiasis in buffalo calves especially in cases with ruptured urinary bladder and most of the altered haematological, plasma biochemical and

electrolyte values returned to normal level 48 h after surgery.

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