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Innovative tube cystostomy for the management of bovine clinical cases of obstructive urolithiasis

Jalal-ud-Din Parrah[1]*, Bashir A. Moulvi[1], Syed S. Hussain[1], and Sheikh Bilal[2]

[1]*Division of Veterinary Surgery and Radiology, Faculty of Veterinary Sciences and Animal Husbandry, Sher-e-Kashmir, University of Agricultural Sciences and Technology of Kashmir, Shuhama, Alusteng, GPO Srinagar, Kashmir, India*

[2]*Division of Veterinary Biochemistry, Faculty of Veterinary Sciences and Animal Husbandry, Sher-e-Kashmir, University of Agricultural Sciences and Technology of Kashmir, Shuhama, Alusteng, GPO Srinagar, Kashmir, India*

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ABSTRACT

The present study was carried out to evaluate a simple innovative tube cystostomy technique for the management of bovine clinical cases of obstructive urolithiais. The materials of this study formed 20 clinical cases of obstructive urolithiasis, equally and randomly distributed in two groups. Diagnosis of the disease was made on the basis of a history of anuria, clinical signs, radiographic and ultrasonographic examinations. The confirmed cases of obstructive urolithiasis were managed by two surgical techniques, i.e., tube cystostomy with Foley's catheter (group A) and tube cystostomy with simple polyvinyl chloride catheter tubing (group B). In all the animals litholytic agents, anti-inflammatory drugs and antibiotics, along with urine acidifiers, were given. The surgical techniques were evaluated on the basis of clinical, haematobiochemical parameters, and postoperative surgical complications. Duration of surgery and overall success rate were also recorded in each group. Haematobiochemical alterations returned to normalcy more quickly in the animals of group A as compared to those of group B. The survival rate was similar in the animals of both the groups; however complications like catheter blockade were found more often in group A animals. Tube cystostomy with polyvinyl chloride tubing may be a feasible method for the management of obstructive urolithiasis in field conditions. It needs more refinement and further evaluation before its recommendation for in field use.

Key words: calf, indwelling urethral catheterization, tube cystostomy, urolithiasis

*Corresponding author:

Dr. Jalal-ud-Din Parrah, Division of Veterinary Surgery and Radiology, Faculty of Veterinary Sciences and Animal Husbandry, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Shuhama, Alusteng, Post Box No - 494, GPO Srinagar, 190001, Kashmir, India, E-mail: drjdparrah@yahoo.co.in; drjdparrah@gmal.com

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Introduction

Treatment of obstructive urolithiasis is definitely surgical, once urethral obstruction is complete (HAVEN et al., 1993, HOUSE et al., 1996). The surgical techniques used include penile transaction with urethral fistulation (MISK and SEMIEKA, 2003), cystic catheterization (HUSSAIN and MOULVI, 1986), pelvic urethrotomy (RAVIKUMAR and SHRIDHAR, 2003), percutaneous tube cystostomy (STREETER et al., 2002) and bladder marsupialization (MAY et al., 1998) with various complications. Recurrent urolithiasis, calculi at multiple sites, badly damaged urethra, atonic bladder or severe cystitis are the common complications that may ensue in failure of surgical management of obstructive urolithiasis. Tube cystostomy, documented by WILLIAMS and WHITE (1991) provides an alternative surgical technique in the management of obstructive urolithiasis. Advantages of the technique include fewer recurrences, preservation of the reproductive function of the animal, an opportunity for the removal of cystic calculi and simplicity of the technique. Tube cystostomy, though reportedly successful in small ruminants (EWOLDT et al., 2006), is not widely used in large ruminants, especially cattle, according to the literature.

Keeping in view the infancy stage of the technique, it needs to be evaluated in more clinical cases before it may be advocated for routine field use. This study was thus undertaken to evaluate standard tube cystostomy for the management of obstructive urolithiasis in cattle and to modify it for ready use in field conditions.

Materials and methods

Twenty male cattle calves formed the material of the study, who were suffering from complete retention of urine, and presented for treatment at Teaching Veterinary Clinical Services Complex, Faculty of Veterinary Sciences and Animal Husbandry, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Srinagar during the period of October 2006 - April 2008. These animals were subjected to radiographic, ultrasonographic, haematobiochemical, and peritoneal fluid examinations for confirmation of the tentative diagnosis. Preoperatively, fluid and supportive therapy was given to animals with severe dehydration and/or uraemia as the case required. The animals were allowed to stabilize and were prepared for surgery at the earliest possible time. These clinical cases of obstructive urolithiasis were randomly divided into two equal groups: for tube cystostomy with Foley's catheter (Group A) and tube cystostomy with simple polyvinyl chloride tubing (Group B). All the animals underwent surgery under local infiltration of the left paramedian area. Cystorraphy was performed in ruptured bladders after necessary debridement, freshening of the wounds, irrigation of and removal of uroliths from the cystic lumen and neck. However in cases of intact urinary bladder, cystotomy was performed.

For tube cystostomy one cm stab incision was made on the cranioventral aspect of the bladder through a pre-placed purse string suture. A fenestrated polyvinylchloride catheter was passed through this incision and the pre-placed purse string suture was tightened (Fig. 1). The fixation of the catheter was further reinforced by applying a Lamberts suture through the catheter. Then a subcutaneous tunnel was created by making a nick in the skin with a BP blade at the intended site of the catheter outlet, near the prepucial orifice. Straight mosquito forceps were passed subcutaneously parallel to the laparocystotomy incision until they reached the level of the catheter inlet into the bladder. Again a nick with a BP blade in the abdominal muscles from inside the abdominal cavity was made for the mosquito forceps to pass through. The jaws of the forceps were opened inside the abdominal cavity to grasp the free end of the catheter (Fig. 2) to pull it through the subcutaneous tunnel out near the prepucial orifice, where it was anchored with the skin (Fig. 3). However, in group A animals, a Foley's catheter was introduced into the abdominal cavity from outside inwards across the already created subcutaneous tunnel. The Foley's catheter was introduced into the bladder lumen through the stab incision and its bulb was inflated with normal saline for fixation. The Foley's catheter was sutured at multiple sites on the ventral abdomen (Fig. 4).

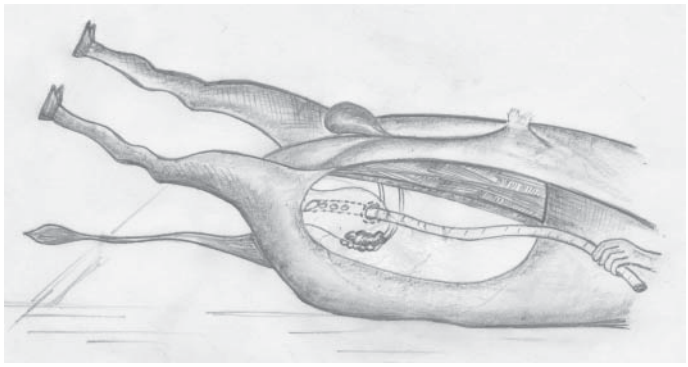

Fig. 1. Fenestrated polyvinyl catheter passed through stab incision and preplaced purse string sutures in the bladder

The surgical techniques were evaluated on the basis of physiological, clinical and haematobiochemical parameters, and postoperative surgical complications at 24, 48, 96 and 168 hours post-operation. The physiological parameters included heart rate (beats/min), respiration rate (breaths/min) and rectal temperature (˚C). The incision site was examined for healing status using various parameters such as swelling at the site of incision, pain, exudates and seepage of urine.

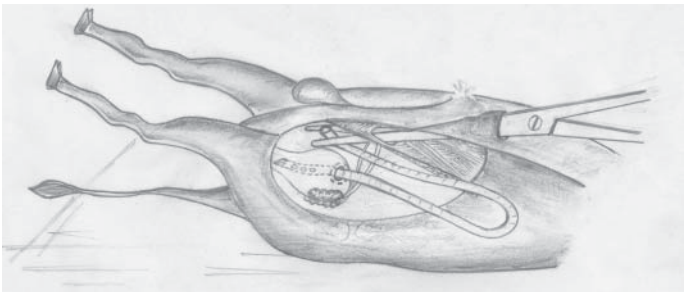

Fig. 2. Artery forceps passed through stab incision in skin and subcutaneously to grasp the catheter

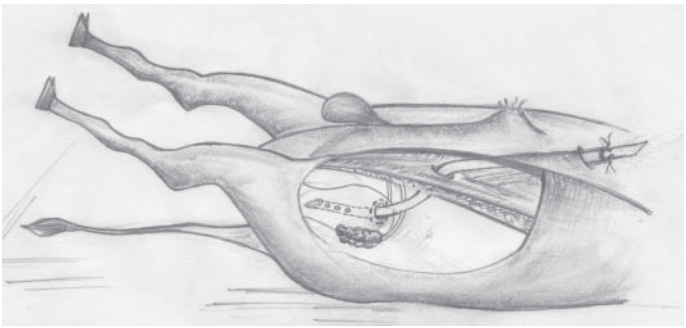

Fig. 3. Catheter exteriorized and anchored to the skin near prepuce

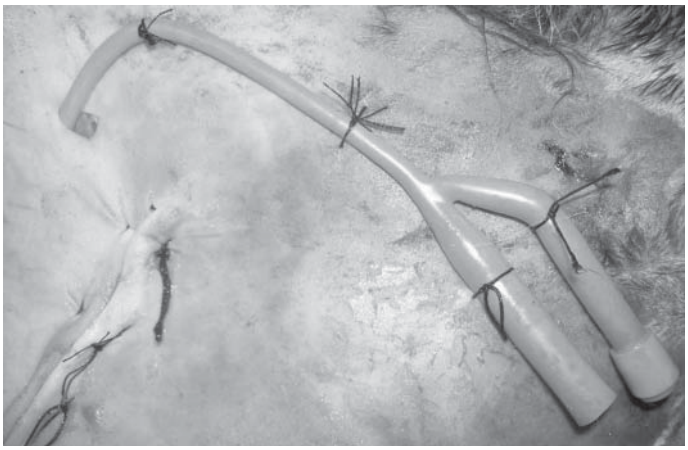

Fig. 4. Foley's catheter sutured at multiple sites on the ventral abdomen

For haematobiochemical studies, 5 mL blood was collected in sterile heparinised vials. One mL fresh blood was used for study of haematological parameters and plasma was separated from the rest and preserved for biochemical studies. The haematological parameters included: haemoglobin (Sahlis haemoglobin meter), packed cell volume (Wintrobe method), total leucocytic count (Haemocytometer) and differential leucocytic count (Giemsas staining) as per standard techniques (JAIN, 1986). Biochemical parameters included Sodium and potassium (flame photometer method), blood urea nitrogen, creatinine, total protein, calcium, magnesium and inorganic phosphorus by standard procedures using (Diagnostic Zrt. Commercial kits).

Duration of surgery and overall success rate, along with postoperative complications, were also recorded in each group. The data thus obtained was classified and subjected to statistical analysis as per the standard procedures (SNEDECOR and COCHRAN, 1976) and inferences drawn**.**

Results

The median time of completion of procedure in group A was 29 (25-35) and 35 (32-55) minutes in intact and ruptured urinary bladder cases. Similarly in group B it was 35 (35-40) minutes and 45 (30-65) minutes in intact and ruptured urinary bladder groups, respectively.

The postoperative alterations in the physiological parameters are recorded in Table 1. Pre-operatively rectal temperature was slightly lower, while heart rate and respiratory rates were slightly higher than the respective reference range without significant difference between the groups. Twenty four hours following removal of the obstruction the temperature showed a slight increase in both the groups and remained at the same level until the end of the study period in the animals of group A. In group B animals, the temperature again increased from 96 to 168 hours. Postoperatively, normalization of values was much earlier in group A than in group B. Heart and respiration rate started decreasing following surgery in both the groups until the end of the study period, where the heart rate was near normal in both the groups, however the respiratory rate did not reach the normal reference range. The change in these two parameters was faster in the animals of group A than in those of group B.

Table 1. Postoperative record of physiological parameters in obstructive urolithiasis calves of different groups

Parameters Mean ± SE	Group	Postoperative interval (hours)				
		0	24	48	96	168
Rectal temperature (°C)	A	38.16 ± 0.16	38.79 ± 0.03	38.81 ± 0.03*	38.84 ± 0.01*	38.84 ± 0.01*
	B	38.68 ± 0.19	38.86 ± 0.06	38.57 ± 0.17	38.82 ± 0.11	38.92 ± 0.04
Heart rate (Beats/minute)	A	104.9 ± 4.60	98.2 ± 3.24	92.2 ± 2.22*	85.8 ± 1.90*	77.4 ± 1.40*
	B	99.7 ± 4.62	97.0 ± 3.84	91.0 ± 2.95	88.6 ± 2.72	78.1 ± 2.19*
Respiratory rate (Breathe/minute)	A	34.1 ± 2.44	27.3 ± 0.85*	24.8 ± 0.45*	23.2 ± 0.24*	22.3 ± 0.36*
	B	31.2 ± 4.14	26.5 ± 3.19	25.5 ± 3.16	24.7 ± 0.72	23.1 ± 0.26

Values with superscript* are significantly ($P<0.05$) different from the corresponding base values

The postoperative alterations in clinical parameters are recorded in Table 2. The pain and swelling scores recorded at various Postoperative intervals in both the groups were suggestive of moderate pain and swelling 24 hours post-operatively. Thereafter the intensity was mild and finally by the end of the study period there was no pain or swelling. Abolition of swelling was earlier in group A animals.

Very mild exudation was seen in few animals of both the groups from 48 to 96 post-operative hours. Mild leakage of urine was noticed in one animal each in both the groups at 24 post-operative hours. Comparison of exudate scores and urine blockage among the groups showed no significant difference at any postoperative interval.

The postoperative alterations in haematological parameters are recorded in Table 3. Zero day levels of haemoglobin (Hb) were within the normal reference range and PCV values were higher than the normal reference range in both the groups. Postoperatively, a reduction in Hb and PCV level was recorded in both the groups from 24 hours and the trend continued until 168 hours. Comparison between the groups revealed no significant difference at any corresponding Postoperative interval, however return of PCV to normal level was earlier in group A animals.

At the time of admission, the TLC values were slightly elevated in group B, and slightly higher in group A, however without any significant difference among the groups. Removal of obstructions resulted in a continuous decrease in total count in both the groups up to the end of the study period. The mean ± SE TLC values did not show any significant ($P>0.05$) difference among the groups at any postoperative interval.

Zero day values of neutrophil count were above the normal value of 28 (15-45%) in both the groups without any significant ($P>0.05$) difference among the groups at the same

Table 2. Postoperative record of clinical parameters in obstructive urolithiasis calves of different groups

Parameters Mean ± SE	Group	Postoperative interval (hours)				
		0	24	48	96	168
Swelling score	A	0.00 ± 0.00	1.30 ± 0.14	0.90 ± 0.09	0.40 ± 0.12	0.00 ± 0.00
	B	0.00 ± 0.00	1.50 ± 0.21	1.20 ± 0.12	0.40 ± 0.20	0.00 ± 0.00
Pain score	A	0.00 ± 0.00	1.50 ± 0.16	0.80 ± 0.06	0.50 ± 0.11	0.00 ± 0.00
	B	0.00 ± 0.00	1.70 ± 0.14	0.90 ± 0.19	0.70 ± 0.07	0.00 ± 0.00
Exudation score	A	0.00 ± 0.00	0.00 ± 0.00	0.10 ± 0.09	0.10 ± 0.09	0.00 ± 0.00
	B	0.00 ± 0.00	0.00 ± 0.00	0.20 ± 0.11	0.10 ± 0.09	0.00 ± 0.00
Urine Leakage score	A	0.00 ± 0.00	0.10 ± 0.09	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00
	B	0.00 ± 0.00	0.10 ± 0.09	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00

0 = absent; 1 = mild; 2 = moderate; 3 = severe

Table 3. Postoperative record of haematological parameters in obstructive urolithiasis calves of different groups

Parameters Mean ± SE	Group	Postoperative interval (hours)				
		0	24	48	96	168
Haemoglobin (g %)	A	11.60 ± 0.28	11.50 ± 0.23	11.40 ± 0.18	11.20 ± 0.13	10.90 ± 0.09
	B	11.4 ± 0.51	11.5 ± 0.39	11.12 ± 0.26	11.06 ± 0.20	10.90 ± 0.10
PCV (%)	A	41.0 ± 0.84	38.2 ± 0.72	36.1 ± 0.41	34.7 ± 0.33	34.1 ± 0.22
	B	41.8 ± 1.32	40.8 ± 1.11	38.2 ± 0.63	35.8 ± 0.35	34.8 ± 0.35
TLC ($\times 10^3$/ mL)	A	7.77 ± 0.29	7.64 ± 0.25	7.55 ± 0.16	7.45 ± 0.12	7.37 ± 0.07
	B	8.23 ± 0.24	8.05 ± 0.19	7.80 ± 0.13	7.67 ± 0.07	7.58 ± 0.06
Neutrophil count (%)	A	36.6 ± 1.24	34.3 ± 0.73	29.4 ± 0.70*	28.4 ± 0.53*	27.4 ± 0.40*
	B	38.5 ± 1.55	38.3 ± 2.02	37.7 ± 1.52[a]	28.8 ± 1.42*	28.0 ± 1.09*
Lymphocyte count (%)	A	48.2 ± 1.68	52.4 ± 0.99	57.5 ± 0.71*	57.20 ± 0.54*	57.90 ± 0.41*
	B	48.6 ± 1.44	49.5 ± 0.94	49.8 ± 0.66[a]	59.0 ± 1.36*	58.9 ± 1.26*
Monocyte count (%)	A	4.0 ± 0.42	4.4 ± 0.40	5.0 ± 0.69	4.3 ± 0.52	5.0 ± 0.65
	B	5.4 ± 0.42[a]	4.60 ± 0.44	4.30 ± 0.38	4.90 ± 0.57	4.70 ± 0.22
Eosinophil count (%)	A	6.6 ± 0.93	8.50 ± 0.59	7.7 ± 0.81	9.3 ± 0.65	9.1 ± 0.52
	B	8.50 ± 0.72	7.00 ± 1.48	7.60 ± 1.09	7.90 ± 0.75	8.00 ± 0.75
Basophil count (%)	A	0.80 ± 0.06	0.40 ± 0.12	0.40 ± 0.08	0.80 ± 0.17	0.60 ± 0.18
	B	0.70 ± 0.08	0.30 ± 0.18	0.40 ± 0.27	0.60 ± 0.20	0.50 ± 0.21

Values with superscript* are significantly ($P<0.05$) different from the corresponding base values; values with superscript[a] are significantly ($P<0.05$) different from A value at the corresponding interval

interval. Consequent to the treatment, the neutrophil count decreased postoperatively in the animals of both the groups. A gradual fall in neutrophil count resulted in a significant ($P<0.05$) decrease at 48 postoperative hours onwards in group A and at 96 postoperative hours onwards in group B. Comparison of the groups revealed a significantly ($P<0.05$) lower neutrophil count in group A at 48 postoperative hours as compared to the other group at the same interval. Lymphocyte values showed a trend totally reverse to neutrophils.

The base value of monocytes in the animals of group B was significantly ($P<0.05$) higher than that of group A and slightly above normal reference values, 4% (2-7%). Postoperatively the monocyte values fluctuated with a decreasing trend without any significant differences from corresponding base values and remained within normal range in the animals of both the groups.

Table 4. Postoperative record of biochemical parameters in obstructive urolithiasis calves of different groups.

Parameters Mean ± SE	Group	Postoperative interval (hours)				
		0	24	48	96	168
BUN (mmol/L)	A	48.7 ± 3.3	35.9 ± 2.3*	21.9 ± 2.4*	21.3 ± 1.9*	17.1 ± 0.91*
	B	50.6 ± 3.1	42.0 ± 2.1*	32.7 ± 1.7*[a]	21.6 ± 2.0*	19.1 ± 0.89*
Creatinine (µmol/L)	A	491.0 ± 32	288.4 ± 14*	177.9 ± 16*	147.8 ± 5.9*	135.4 ± 4.3*
	B	475.0 ± 46	311.7 ± 13*	259.7 ± 9.0*[a]	173.2 ± 10.3*	151.6 ± 12*
Protein (g/L)	A	67.3 ± 1.9	67.0 ± 1.6	66.9 ± 1.6	66.4 ± 1.2	66.1 ± 1.1
	B	75.5 ± 2.8[a]	73.2 ± 2.8	71.2 ± 2.5	69.0 ± 2.4	67.2 ± 1.9*
Sodium (mmol/L)	A	132.0 ± 1.49	133.4 ± 1.07	134.7 ± 0.79	133.7 ± 0.68	134.6 ± 0.49
	B	133.0 ± 1.60	133.4 ± 0.72	134.5 ± 0.56	134.2 ± 0.42	134.4 ± 0.79
Potassium (mmol/L)	A	6.48 ± 0.36	5.99 ± 0.24	5.49 ± 0.21*	4.81 ± 0.19*	4.63 ± 0.16*
	B	6.77 ± 0.34	6.09 ± 0.25	5.84 ± 0.21*	5.21 ± 0.17*	4.67 ± 0.18*
Calcium (mmol/L)	A	1.40 ± 0.02	1.50 ± 0.027*	1.65 ± 0.03*[a]	2.08 ± 0.05*	2.37 ± 0.04*
	B	1.44 ± 0.024	1.55 ± 0.029*	1.77 ± 0.02*	2.05 ± 0.05*	2.32 ± 0.04*
Inorganic phosphorous (mmol/L)	A	4.53 ± 0.39	4.13 ± 0.26	3.44 ± 0.13*	3.18 ± 0.08*	2.84 ± 0.05*
	B	4.77 ± 0.34	4.12 ± 0.26	3.45 ± 0.18*	3.20 ± 0.12*	2.83 ± 0.07*
Magnesium (mmol/L)	A	0.91 ± 0.09	0.84 ± 0.07	0.95 ± 0.07	1.09 ± 0.04	1.06 ± 0.05
	B	0.99 ± 0.09	0.86 ± 0.07	1.00 ± 0.06	1.06 ± 0.05	1.06 ± 0.05

Values with superscript* are significantly ($P<0.05$) different from the corresponding base values, values with Superscript[a] are significantly ($P<0.05$) different from A value at the corresponding interval

The mean values of eosinophils and basophils percent in the animals of both the groups at all the intervals i.e. day 0 and other postoperative intervals, remained within the normal range, though lower. The values did not show any definite pattern postoperatively.

Comparison within and among the groups at different intervals did not reveal any significant differences at any postoperative interval.

The postoperative alterations in biochemical parameters are recorded in Table 4. As depicted in the table, the levels of BUN and creatinine on the day of reporting were above the normal range in the animals of both the groups without any significant ($P>0.05$) differences between the groups. Postoperatively, their levels decreased in both the groups and reached normal level at 48 postoperative hours in the animals of group A, and at 96 postoperative hours in the animals of group B. The decrease was significant ($P<0.05$) in both the groups at 24 postoperative hours onwards. After attaining the normal level, BUN and creatinine values continued their decreasing trend but remained within the normal range. Comparison of the groups revealed that BUN and creatinine were significantly ($P<0.05$) lower in the animals of group A at 48 postoperative hours than in the other group at the corresponding interval.

Total plasma protein values were within the normal range in both the groups at the time of admission with a significant ($P<0.05$) difference among the groups. The protein values decreased progressively in both the groups until the end of the study period, but remained within normal reference range at all the postoperative intervals in the animals of group B. In the animals of group A, protein levels drifted slightly below the normal reference range at 48 postoperative intervals and continued with the same trend up to 168 postoperative hours. Mean total plasma protein values did not differ significantly between the groups ($P>0.005$) at any postoperative interval. Likewise mean protein values did not differ significantly in either group ($P>0.005$) at any postoperative interval from their respective base values except the protein value of group B at 168 postoperative hours.

The plasma sodium values were within but on the lower end of the normal range (132-152mmol/L) on day zero in the animals of both groups, without any significant difference between the groups. Postoperatively the values fluctuated around the base values until the end of the observation period in both the groups. Comparison of the groups did not reveal any significant difference at any postoperative interval of the study.

The plasma potassium values were above the normal reference range (3.9-5.8 mmo/L) on day zero in the animals of both groups without any significant difference between the groups. Postoperatively, levels of potassium decreased progressively in both the groups, with a significant ($P<0.05$) difference from their corresponding base values from 48 postoperative hours onwards, and touched the normal reference range at the same postoperative intervals.

In both the groups the mean values of calcium were below the normal range (2.43 - 3.10 mmol/L) on day 0. During the postoperative period, although calcium values increased significantly ($P<0.05$)from the corresponding base values in both the groups, the values were still slightly lower at 168 postoperative hours. Comparison among the

groups revealed that at 48 postoperative hours calcium values in the animals of group A were significantly ($P<0.05$) lower than that of group B. Phosphorus values showed a reverse trend to calcium.

Zero day values of plasma magnesium were within the normal range (0.74-1.10 mmol/L) with a non significant difference among the groups. At 24 postoperative hours, a decline in magnesium level was noticed in both the groups, which was followed by an increase in plasma magnesium level at 48 postoperative hours. In the animals of group A the values fluctuated around the corresponding base value without any significant difference beyond 24 postoperative hours. In the animals of group B, the increase in magnesium level recorded at 48 postoperative hours continued until 168 postoperative hours. Comparison among the groups did not reveal any significant ($P<0.05$) difference at any postoperative interval.

Different postoperative complications recorded in both the groups included catheter dislodgement (1 in each group), catheter loss (1 in each group), catheter blockade (3 in group A and 2 in group B), and urethral rupture (2 in group A and one in group B).

Survival rate was equal (90%) in both the groups. The median time of initiation of dribbling of urine from the external urethral orifice in the animals of group A and B was 6 (4-9) and 7 (3-9) days respectively. However, the median time of onset of free flow of urine from the external urethral orifice in the animals of both the groups was 9 days, with an average duration of 4-12 and 5-13 days respectively.

Discussion

Comparison of the different techniques revealed that tube cystostomy with Foley's catheter was found to be a less time consuming procedure than tube cystostomy with simple catheters. The reason for this could be the longer time required for anchoring the catheter with the cystic wall and the abdominal body wall, while no such procedure was required for the Foley's catheter and 2 or 3 simple sutures were required for fixing the Foley's catheter to the abdominal wall. In both the groups, the median time for completion of surgical procedures in ruptured urinary bladder cases was more than that in intact urinary bladder cases. This could be attributed to the fact that in ruptured urinary bladder cases, debridement procedures at tear sites and suturing of bladder at the inaccessible neck site were more time consuming

The slight increase in rectal temperature from their respective base values observed post-operatively in both the groups could be due to increased inflammation, and probably due to infection. The rectal temperature in group A remained constant throughout the observation period and within the normal reference range, as compared to fluctuations in rectal temperatures observed in group B. This difference in rectal temperature pattern

in these 2 groups could be attributed to the fact that the Foley's catheter was more comfortable and easy to fix as compared to a simple polyvinyl chloride catheter.

A gradual decrease in respiratory and heart rates was observed from day 1 in both the groups and tended to move towards normal by 168 and 24 hrs postoperatively respectively. The decrease in these values towards normalcy could be attributed to relief from pain and stress after removal of calculi or diversion of urine through the cystostomy catheter, removal of urine from the abdomen, flushing of the abdominal cavity, administration of fluids, painkillers, antibiotics and normal intake of food and water by the animals of different groups. The return of RR and HR towards normalcy was faster in the animals of group A, which indicates the superiority of tube cystostomy with a Foley's catheter over the tube cystostomy with a simple catheter.

Swelling at the site of operation could be due to increased vascular permeability at the site in response to the release of vasodilators like prostaglandins, bradykinin and histamine, resulting from a post-surgical inflammatory reaction (THOMPSON, 1984). Release of substance "P" due to trauma, by inciting inflammation and local oedema, is also responsible for increased swelling (KUCHINKA and RIEDESAL, 1995). Swelling at the operative site was the highest at 24 post-operative hours in both the groups, which could be due to seepage of abdominal urine along the catheter in some animals of these groups. Swelling was abolished in both the groups at 168 post-operative hours, which could be attributed to a decrease in the inflammation due to regular cleaning and use of anti-inflammatory drugs.

Pain is a natural body response to tissue injury and inflammatory processes. Moderate pain, noticed at 24 post-operative hours, reduced in intensity to a mild form from then onwards and was abolished by 168 post-operative hours in the animals of both the groups. The pain score, though non-significant, was lower in the animals where a Foley's catheter was used because of its greater tolerability by the animals. Reduction in pain could also be attributed to proper post-operative management, which included proper housing, daily cleaning of wounds and administration of pain killers and antibiotics.

Very mild to mild exudation was noticed in a few animals of both the groups. The exudation was mainly serous in nature. Mild exudation is a natural body response to injury resulting from dilation of vessels and capillaries leading to their increased permeability (LEWIS, 1975; THOMPSON, 1984). In both the groups the exudation was slight in all the animals, suggesting that the technique is less traumatic. Mild leakage of urine at 24 post-operative hours in both the groups was due to seepage of urine along the sides of the catheter from the uroperitoneum. This seepage resolved quickly in both the groups.

A high PCV and Hb recorded in both the groups on the day of admission might have occurred due to dehydration (SHARMA et al., 1982; SOCKETT et al., 1986; RADOSTITS et al., 2000), as the elevated levels of these parameters are the indicators for dehydration (MEYER

et al., 1992). Decrease in postoperative values towards normalcy in both the groups at different intervals could be attributed to the onset of rehydration due to fluid therapy and normal intake of food and water following correction of the obstruction. The findings are in agreement with those of PANDEY and SINGH (1989). They attributed the decline in PCV and TEC to the toxic depression of bone marrow and reduced erythropoietin secretion from the kidneys in uraemic animals as earlier opined by LUND (2000).

Values of TLC in the animals of both the groups at the time of admission were either slightly above or towards the higher end of the normal range with neutrophilia, lymphopaenia and deranged leukogram (GERA and NIGAM, 1981; DOXEY, 1983; KELLY, 1984; MORRIS and LARGE, 1990; GAUNT, 2000; KERR, 2002). This could be attributed to dehydration, pain and stress as a result of urethral obstruction and infection. The return of TLC values towards normalcy during the postoperative period could be attributed to the removal of the inciting causes like stress, pain, infection, and return of appetite. The earlier attainment of normal TLC values in group A could be attributed to the greater tolerability of Foley's catheter by the animals.

The highly elevated base values of BUN and creatinine recorded in both the groups of this study could be due to the onset of acute renal failure manifested by a decreased glomerular filtration rate as a result of back pressure on the kidneys and absorption of these substances from the urine present in the bladder in the intact urinary bladder cases, or from peritoneal cavity in the ruptured urinary bladder cases of complete obstructive urolithiasis (SHARMA et al., 2006). KERR (2002) reported that creatinine levels elevate more quickly than urea levels at the start of the disease, and also decrease more quickly when an improvement takes place, thus this could be used for early diagnosis and recovery from the disease. However, during this study, changes in BUN and creatinine levels were similar and both could be used to ascertain the efficacy of treatment. Recovery was fastest in group A, where tube cystostomy was performed with a Foley's catheter, suggesting its superiority over the other technique.

The TPP levels in both groups, though within the normal range, were highest on day 0 as compared to subsequent intervals. These elevated zero day levels could be due to haemoconcentration caused by a decrease in fluid volume consequent to dehydration (DONECKER and BELLAMY, 1982; DOXEY, 1983; KANEKO et al., 1997). The non-significant decrease in TPP recorded postoperatively could be attributed to the rehydration process taking place in the animals, following intravenous administration of fluids and intake of water and fodder.

Base values of sodium were within but towards the lower end of the normal range and did not vary significantly during the postoperative period in the animals of either group. The reason for normal levels of sodium in the present study could be dehydration (DONAWICK, 1984), which might be responsible for maintenance of sodium level in

uraemic animals or may have masked the actual fall in the level of plasma sodium. Hyperkalaemia, recorded during this study in cases of obstructive urolithiasis, could be attributed to retention of potassium rich alkaline urine and release of potassium from damaged cells due to possible tissue hypoxia in uraemic conditions (BROBST et al., 1978; KULKARNI et al., 1985). The postoperative decrease in potassium values toward the normal range could be attributed to correction of uraemia and dehydration, and clearance of potassium in the urine (GERA and NIGAM, 1980; DONECKER and BELLAMY, 1982).

The lower and higher base values of calcium and inorganic phosphorous respectively could be due to feeding the calves with wheat bran and other concentrate diets, which are rich in phosphorous and low in calcium content (BROBST et al., 1978; DONECKER and BELLAMY 1982; KULKARNI et al., 1985; SOCKETT et al., 1986; SINGH et al., 1987). Additionally in the state of metabolic alkalosis, which was a common finding in most of the animals of this study, there is a further reduction in the proportion of ionized calcium, thus decreasing calcium levels. The postoperative improvement in the calcium value and decrease in phosphorous values might be due to the return of appetite, restoration of a normal acid-base balance, feeding calves with a balanced diet as the owners were advised and the inverse effect of the elevated calcium level in the blood.

The normal zero day values of plasma magnesium could be attributed to dehydration and the resorption of magnesium from urine in the abdominal cavity in a few cases. In the anorectic animals the magnesium level would have been lower, as magnesium concentration in the blood and extracellular fluid are determined by the balance between the dietary intake of magnesium, loss in faeces and homeostasis by kidneys (RADOSTITS et al., 2000). This viewpoint could be substantiated by the fact that rehydration by administration of intravenous fluids led to a fall in magnesium levels at 24 postoperative hours. The increase in magnesium noticed could be attributed to dietary advice to the owners and return of appetite, so that volatile fatty acids were produced, which provide energy for the active transport of magnesium across the rumen wall thus increasing magnesium absorption.

Catheter loss was observed in one animal of each group, while in one animal of group B the catheter was retrieved back into the abdominal cavity. Retrieval of the polyvinyl chloride catheter back into the abdominal cavity through a subcutaneous tunnel could be due to a broken stitch anchoring the tube cystostomy catheter to the skin and the pulling force applied to catheter by the contracting urinary bladder. Foley's catheter dislodgement in another animal of group A could be attributed to deflation of the bulb of the catheter (FORTIER et al., 2004).

One polyvinyl catheter and 3 Foley's catheters were blocked by the 3rd postoperative day. The blockade might have occurred from urinary sludge, blood clots, sandy material left in the urinary bladder, and mucosal shreds (RAKESTRAW et al., 1995). The occurrence

of simple catheter blockade was lower in group B than in group A, which could be attributed to fenestration of the polyvinylchloride catheter as compared to single point exit in the Foley's catheter. Uretheral rupture following blockade of tube cystostomy catheters might be due to accumulation of urine in the urinary bladder that created pressure over the lodged calculi. This pressure dislodged the calculi but sometimes caused a perforation in weak and necrosed urethra (FORTIER et al., 2004; VAN METRE, 2004; RAKESTRAW et al., 1995).

The median time of initiation of dribbling of urine in the animals of group A and B was 6 and 7 days respectively, and initiation of free flow of urine through the external urethral orifice was 9 days. The free flow of urine through the external urethral orifice could be due to the interplay of many factors. Reduction in inflammation and urethral spasm by administration of anti-inflammatory drugs, drying up of calculi by diversion of urine through the tube cystostomy catheter, dissolution of urethral calculi by acidic urine caused by oral administration of ammonium chloride and of sodium chloride along with drinking water, pulverization of calculi by the litholytic effect of cystone tablets, and occlusion of tube cystotomy catheter helped in achieving urethral patency by flushing the urethra of all debris and calculus material (EWOLDT et al., 2006; RAKESTRAW et al.,1995).

Conclusion

From the findings of this study it can be concluded that tube cystostomy is a practicable, quick and reliable method for the management of obstructive urolithiasis in cattle. Tube cystostomy with polyvinylchloride tubing could be cheaper and safer than standard tube cystostomy for the management of obstructive urolithiasis in cattle, especially in field conditions. However, the technique needs further refinement and more evaluation before it can be recommended for use in field conditions.

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PARRAH, J. D., B. A. MOULVI, S. S. HUSSAIN, S. BILAL: Uvođenje novog katetera u cistostomiji kliničkih slučajeva opstruktivne urolitijaze u goveda. Vet. arhiv 81, 321-337, 2011.

SAŽETAK

Ovo istraživanje bilo je provedeno radi prosudbe vrijednosti novoga jednostavnoga postupka cistostomije pri obradi kliničkih slučajeva opstruktivne urolitijaze u goveda. Dvadeset goveda s klinički dokazanom opstruktivnom urolitijazom bilo je nasumce podijeljeno u dvije skupine po deset goveda. Dijagnoza je bila postavljena na osnovi podataka o anuriji, prisutnim kliničkim znakovima te na osnovi radiografske i ultrazvučne pretrage. Potvrđeni slučajevi opstruktivne urolitijaze bili su obrađeni dvama kirurškim postupcima: cistostomijom kod koje je bio rabljen Foleyev kateter (skupina A) i uporabom jednostavnoga polivinil-kloridnoga katetera (skupina B). Svima životinjama bile su primijenjene litolitičke tvari, protuupalni lijekovi, antibiotici i sredstva za zakiseljavanje mokraće. Kirurške tehnike bile su vrednovane na osnovi kliničkih, hematoloških i biokemijskih pokazatelja i postoperativnih kirurških komplikacija. Za svaku skupinu uzeto je u obzir trajanje operacije i njezina uspješnost. Promjene u hematološkim i biokemijskim pokazateljima brže su se vratile na normalne vrijednosti u životinja skupine A u odnosu na skupinu B. Stopa preživljavanja bila je slična u životinja obiju skupina. Međutim, komplikacije poput začepljenja katetera bile su češće u životinja skupine A. Cistostomija pri kojoj je rabljen polivinil-kloridni kateter lako je izvediva metoda za obradu opstruktivne urolitijaze u terenskim uvjetima. Ipak, prije preporuke za terensku uporabu nužno je njezino daljnje usavršavanje.

Ključne riječi: tele, kateterizacije uretre, cistostomija, urolitijaza