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Biochemical changes during evaluation of pigtails catheter for the management of urethral obstruction in tom cats

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Abstract

Feline urethral obstruction (UO) is a common emergency in male cats, frequently accompanied by severe biochemical disturbances. This study assessed perioperative biochemical changes in six tom cats with UO managed by percutaneous cystostomy using a pigtail catheter. Preoperative evaluations revealed marked elevations in creatinine, blood urea nitrogen (BUN), calcium, phosphorus, and potassium, consistent with azotemia and electrolyte imbalance, while sodium remained within reference limits. Following urinary diversion, these parameters progressively declined and normalised over the treatment period, with no systemic adverse effects observed. The findings confirm that percutaneous cystostomy using a pigtail catheter is a reliable, efficient, and minimally invasive intervention. This approach offers a practical solution when urethral catheterisation is not successful, thereby reducing reliance on more invasive surgical procedures such as cystostomy or perineal urethrostomy.

Keywords: Pigtail catheter, percutaneous cystostomy, feline urethral obstruction, azotemia

Introduction

Feline urethral obstruction is the most frequently presented emergency condition in male cats, particularly those under seven years old, with an estimated incidence of 1.5 per cent in the general feline population (Beeston *et al.*, 2022) ^[2]. Male cats aged 2 to 4 years exhibited the highest incidence of UO, and risk of UO declined steadily with increasing age, suggesting that younger adult males are more predisposed (Jukes *et al.*, 2019) ^[10]. Several interventional strategies are available to relieve urinary obstruction, including cystocentesis, transurethral catheterisation, tube cystostomy, and perineal urethrostomy (George and Grauer, 2016) ^[8]. Percutaneous pigtail cystostomy is a minimally invasive and effective technique for urinary diversion in cats with UO, trauma, or neurologic dysfunction. It enables rapid bladder decompression, improving patient stabilisation when retrograde catheterisation is not feasible (Nurra *et al.*, 2022) ^[13].

Serum biochemical parameters, including creatinine, blood urea nitrogen (BUN), phosphorus, calcium, sodium, and potassium, are valuable indicators for monitoring physiological recovery and assessing prognosis in cats with urethral obstruction (UO). Feline UO was reported in male cats, with elevated serum creatinine (29%), increased BUN (33%), and hyperphosphatemia (25%). Potassium levels were <6 mmol/L in 76% of cases, 6–7.9 mmol/L in 12%, 8–10 mmol/L in 12%, and >10 mmol/L in 0.5%, reflecting varying degrees of renal and electrolyte disturbances (Lee and Drobatz, 2006) ^[12]. The present study aimed to evaluate perioperative biochemical changes in cats with urethral obstruction and interpret their significance in relation to healing and systemic stability.

Materials and Methods

The study was conducted in six clinical cases of tom cats presented to the Department of Veterinary Surgery and Radiology, Veterinary College, Bengaluru. A total of six cats with

urethral obstruction was randomly selected for the study, irrespective of age and body weight. Preoperative haematological and biochemical evaluations were performed to assess fitness for surgery. Preoperative radiological and ultrasonographic examination of the bladder and kidneys was performed to assess the extent of kidney damage.

Selected tom cats were fasted for 12 hours, with water withheld for 6 hours before surgery. The ventral abdomen was clipped, shaved, and aseptically prepared using 7.5% povidone-iodine, surgical spirit, and a final application of 5% povidone-iodine before draping. Premedication consisted of atropine sulphate, 0.04 mg/kg IM, administered 15 minutes before induction. Ceftriaxone, 25 mg/kg IV, was administered prophylactically. Anaesthesia was induced and maintained with tiletamine–zolazepam, 10 mg/kg IM. Cats were positioned in dorsal recumbency with hind limbs extended caudally, and percutaneous cystostomy using a pigtail catheter was performed according to the technique described by Nurra *et al.* (2022) ^[13], with slight modification.

Parameters analysed included serum creatinine, BUN, phosphorus, calcium, sodium and potassium. Mean $\pm$ standard error (SE) values were calculated for all parameters. Statistical analysis was performed using one-way analysis of variance (ANOVA) to compare values across different time points, with the level of significance set at p-value less than 0.05.

Results and Discussion

Table 1 presents the Mean $\pm$ SE values of serum biochemical parameters recorded during the study period. Renal parameters were markedly elevated on the day of presentation, indicating azotemia. Postoperatively, these values gradually declined and returned to normal following urine diversion through percutaneous cystostomy using a pigtail catheter, similar to the findings reported by Tamaraiselvi (2023) ^[15].

Table 1: Mean $\pm$ SE of serum biochemical parameters in tom cats

Parameters	Day 0	Day 2	Day 4	Day 6	Day 8	Day 14	Day 21
Creatinine (mg/dL)	13.05 $\pm$ 2.49	1.54 $\pm$ 0.18	1.34 $\pm$ 0.13	1.37 $\pm$ 0.06	1.37 $\pm$ 0.11	1.37 $\pm$ 0.05	1.31 $\pm$ 0.06
Blood Urea Nitrogen (BUN)(mg/dL)	178.14 $\pm$ 29.77	5.57 $\pm$ 0.51	36.13 $\pm$ 3.53	31.25 $\pm$ 2.62	31.25 $\pm$ 1.96	33.54 $\pm$ 1.46	29.53 $\pm$ 0.71
Calcium (mg/dL)	7.37 $\pm$ 0.92	8.50 $\pm$ 0.23	8.72 $\pm$ 0.20	8.71 $\pm$ 0.20	8.71 $\pm$ 0.16	9.03 $\pm$ 0.17	9.16 $\pm$ 0.07
Phosphorus (mg/dL)	13.47 $\pm$ 2.37	7.71 $\pm$ 2.90	6.41 $\pm$ 1.62	5.27 $\pm$ 0.68	5.27 $\pm$ 0.42	5.13 $\pm$ 0.24	4.91 $\pm$ 0.13
Sodium (mEq/L)	152.05 $\pm$ 2.47	150.17 $\pm$ 1.66	151.00 $\pm$ 0.93	149.50 $\pm$ 1.09	149.50 $\pm$ 1.28	149.17 $\pm$ 0.48	150.83 $\pm$ 0.31
Potassium (mEq/L)	7.35 $\pm$ 0.88	5.57 $\pm$ 0.51	5.15 $\pm$ 0.15	4.90 $\pm$ 0.14	4.90 $\pm$ 0.23	5.02 $\pm$ 0.12	4.77 $\pm$ 0.12

Serum biochemical parameters

Serum creatinine

The mean $\pm$ SE value of serum creatinine (mg/dL) before surgery was 13.05 $\pm$ 2.49. Postoperative mean $\pm$ SE values decreased and varied from 1.31 $\pm$ 0.06 to 1.54 $\pm$ 0.18. The variations in the mean $\pm$ SE values of the creatinine were statistically highly significant ($p < 0.01$) (Table 1, Fig. 1). These findings align with the observations of Gerber *et al.* (2005) ^[9], Lee and Drobatz (2006) ^[12], Saevik *et al.* (2011) ^[14], Tamaraiselvi (2023) ^[15], and de Moraes *et al.* (2024) ^[5]. The increase in creatinine was attributed to urethral obstruction leading to post-renal azotaemia, reflecting impaired kidney function secondary to the obstruction.

Blood Urea Nitrogen (mg/dL)

The mean $\pm$ SE value of blood urea nitrogen (mg/dL) before surgery was 178.14 $\pm$ 29.77. Postoperative mean $\pm$ SE values decreased and ranged from 29.53 $\pm$ 0.71 to 36.30 $\pm$ 4.35. The variations in the mean $\pm$ SE values of the BUN were statistically highly significant ($p < 0.01$) (Table 1, Fig. 2). This observation corresponds with the findings of Gerber *et al.* (2005) ^[9], Lee and Drobatz (2006) ^[12], Saevik *et al.* (2011) ^[14], Tamaraiselvi (2023) ^[15], and de Moraes *et al.* (2024) ^[5], who reported significant increases in BUN in obstructed cats. The rise in BUN is attributed to the inability to eliminate nitrogenous metabolites due to urethral obstruction and pre-renal azotemia caused by dehydration (Thomovsky, 2011) ^[16].

Serum calcium

The mean $\pm$ SE value of serum calcium (mg/dL) before surgery was 7.37 $\pm$ 0.92. Postoperative mean $\pm$ SE values ranged from 8.50 $\pm$ 0.23 to 9.16 $\pm$ 0.07. The variations in the mean $\pm$ SE values of calcium were statistically highly significant ($p < 0.01$) (Table 1, Fig.3). In the present study, hypocalcaemia was identified in 83.34% of cases at the time

of presentation. This finding corresponds with observations by Coady *et al.* (2019) ^[4] and Krishna (2021) ^[11], who reported similar biochemical alterations in feline uropathy. The underlying mechanisms proposed include calcium chelation secondary to phosphate retention, resistance to parathormone activity, and disturbances in acid-base equilibrium (Coady *et al.*, 2019) ^[4].

Serum phosphorus (mg/dL)

The mean $\pm$ SE value of phosphorus (mg/dL) before surgery was 13.47 $\pm$ 2.37. Postoperative mean $\pm$ SE values decreased and ranged from 4.91 $\pm$ 0.13 to 7.71 $\pm$ 2.90. All tom cats showed hypophosphatemia preoperatively. The variations in the mean $\pm$ SE values of the phosphorus were statistically highly significant ($p < 0.01$) (Table 1, Fig.4). This observation aligns with reports by Lee and Drobatz (2006) ^[12] and Tamaraiselvi (2023) ^[15], both of whom documented elevated serum phosphorus levels in urinary obstructed cats, attributing the abnormality to reduced renal clearance of phosphate due to urinary tract obstruction.

Serum sodium (mEq/L)

The mean $\pm$ SE value of sodium (mEq/L) before surgery was 152.05 $\pm$ 2.47. Postoperative mean $\pm$ SE values ranged from 149.17 $\pm$ 0.48 to 151.00 $\pm$ 0.93. The variations in the mean $\pm$ SE values of the sodium were statistically nonsignificant ($p > 0.05$) (Table 1, Fig.5). In the present study, the mean serum sodium concentration remained within the reference range. These findings are in line with earlier reports by Finco and Cornelius (1977) ^[6] and Krishna (2021) ^[11], who associated hyponatraemia in obstructed cats with reduced intake and emesis. Additionally, Frohlich *et al.* (2016) ^[7] suggested that natriuresis and subsequent sodium depletion may stem from impaired renal tubular reabsorption in such cases.

Serum potassium (mEq/L)

The mean $\pm$ SE value of potassium (mEq/L) before surgery was 7.35 ± 0.88 . Postoperative mean $\pm$ SE values decreased and ranged from 4.77 ± 0.12 to 5.57 ± 0.51 . Hyperkalaemia was observed in 83.34 per cent of the population, and the remaining 16.36 per cent showed normokalaemia. The variations in the mean $\pm$ SE values of the potassium were statistically highly significant ($p < 0.01$) (Table 1, Fig.6). Similar findings have been documented by Lee and Drobatz (2006) [12], Saevik *et al.* (2011) [14], Ay *et al.* (2021) [1], Krishna (2021) [11], Tamaraiselvi (2023) [15], and de Moraes *et al.* (2024) [5], who attributed the elevated serum potassium levels to compromised urinary excretion secondary to obstruction.

Post operatively all the serum biochemical parameters post operatively gradually decreased, becoming normal over the course of treatment, similar to the results obtained by Tamaraiselvi (2023) [15].

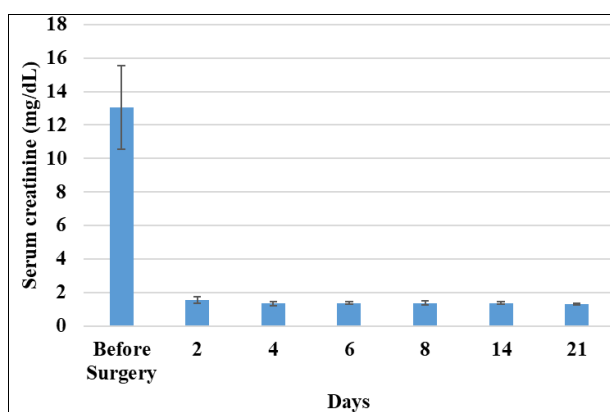


Fig 1: Mean ($\pm$ SE) Serum creatinine (mg/dL) in tom cats

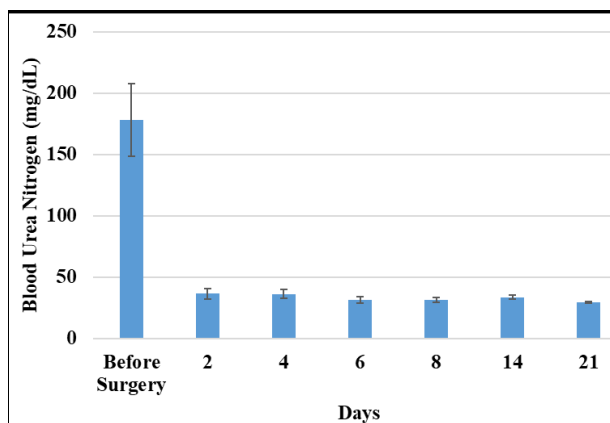


Fig 2: Mean ($\pm$ SE) Serum blood Urea Nitrogen (mg/dL) in tom cats

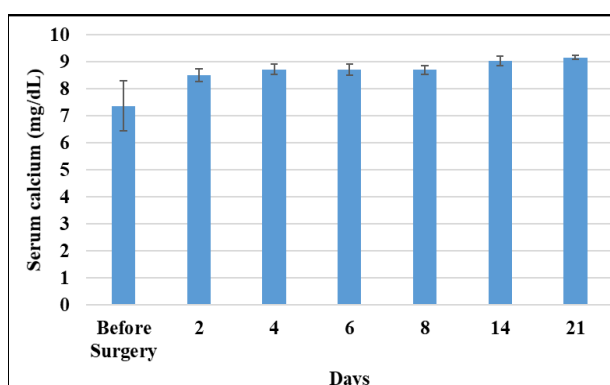


Fig 3: Mean ($\pm$ SE) Serum calcium (mg/dL) in tom cats

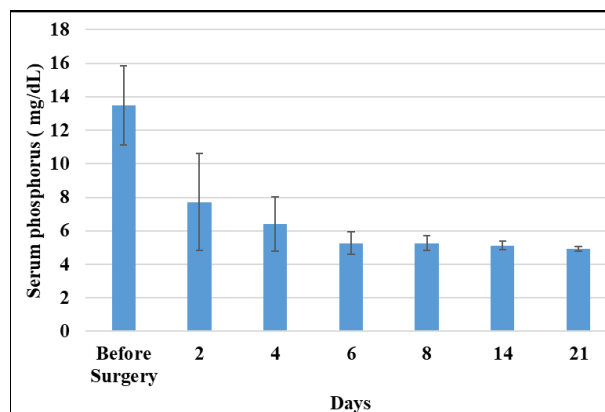


Fig 4: Mean ($\pm$ SE) Serum phosphorus (mg/dL) in tom cats

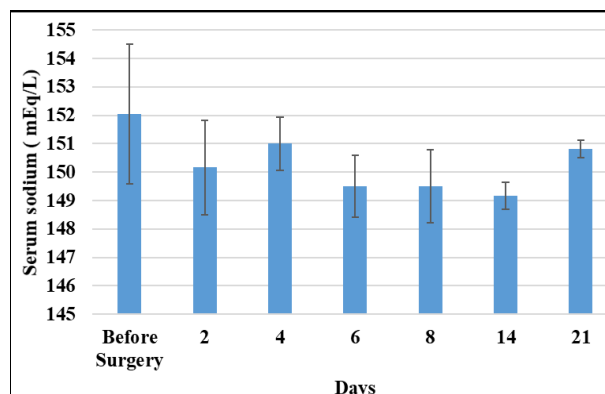


Fig 5: Mean $\pm$ SE Serum sodium (mEq/L) in tom cats

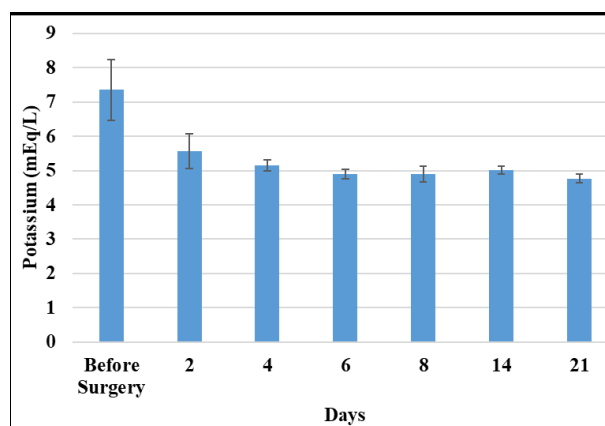


Fig 6: Mean $\pm$ SE Serum potassium (mEq/L) in tom cats

Conclusion

Cats with urethral obstruction managed through percutaneous cystostomy using a pigtail catheter exhibited rapid normalisation of biochemical parameters and no evidence of systemic adverse effects. Elevated preoperative values of creatinine, blood urea nitrogen, calcium, phosphorus, and potassium progressively declined to within reference ranges, while serum sodium remained stable throughout. These findings provide evidence that percutaneous cystostomy using a pigtail catheter was a safe, effective, and minimally invasive technique. It represents a valuable advancement over conventional tube cystostomy and offers a practical alternative to more invasive surgical procedures such as cystotomy or perineal urethrostomy, particularly in cases where urethral catheterisation fails. This study underscores the clinical utility of this approach and strongly supports its broader adoption in feline practice.

Conflict of Interest

Not available

Financial Support

Not available

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