



Study of risk factors and clinicopathological findings associated with urethral obstruction in tom cats in Kerala[#]

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Abstract

Twelve clinical cases of urethral obstruction in tom cats presented to University Veterinary Hospitals of Kerala Veterinary and Animal Sciences University at Kokkalai and Mannuthy that had undergone urinary diversion procedures on the day of presentation were selected for the study. Signalment and anamnesis of the animals were studied to find the risk factors associated with urethral obstruction. The prevalence of urethral obstruction was found to be higher in uncastrated Persian breed of cats, which were one to two years of age. All cats had history of being fed with dry commercial diet, lowered water intake and living indoor. The stress factors identified were inter-cat conflict, fear, relocation, presence of guests and change in owner's routine. Haemato-biochemical profile of these cats revealed significant changes in haematocrit and total erythrocyte count values. Elevated blood urea nitrogen, creatinine, phosphorus and potassium were observed which significantly reduced following bladder evacuation. Urinalysis revealed haematuria, proteinuria, leukocyturia and struvituria as frequently encountered findings in tom cats with urethral obstruction.

Keywords: Urethral obstruction, tom cats, FLUTD, risk factors

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Urethral obstruction is an emergency condition that is frequently encountered in feline practice. Tom cats were prone to urethral obstruction due to long and narrow urethra (Nye and Luther, 2018). The common identified aetiologies in urethral obstruction were urethral plug, uroliths, urethral spasm, urethral stricture and tumour. Various contributing risk factors for urethral obstruction were type of feed, pattern of housing, geography, climate, level of activity etc. (Dorsch *et al.*, 2014; Kochan and Simsek, 2022). Irrespective of aetiology, urethral obstruction impedes urine flow causing backflow pressure in kidney, resulting in loss of functional architecture of renal parenchyma thus impairing renal function. Urethral obstruction also leads to accumulation of various metabolites causing uraemia and prolonged obstruction results in urinary bladder rupture (Bartges *et al.*, 1996). The aim of present study was to investigate haemato-biochemical alterations and pathological changes in urine associated with urethral obstruction, and various risk factors that may lead to urethral obstruction in tom cats.

Materials and methods

The study was conducted on twelve tom cats presented to University Veterinary Hospital, Mannuthy, KVASU with a history of dysuria. Information regarding age, body weight, neutering status, feeding history and type of housing were collected from owners through a proforma. Clinical examination including observation of physiological parameters, abdominal palpation and penile examination was carried out on the day of presentation. Urinary diversion technique was performed to decompress the bladder. Complete haemato-biochemical profile was recorded in all twelve animals on the day of presentation, on seventh and 21st post-operative day to assess the health status of the animal. Urine collected was subjected to urinalysis including dipstick test, microscopic examination and bacterial culturing on the day of presentation and, urinary pH and specific gravity were monitored on the day of presentation and on seventh post-operative day. All the collected data on the day of presentation, seventh day of treatment and 21st day of treatment were analysed statistically by SPSS version 24.0.

Results and discussion

The tom cats in this study ranged in age from 10 months to seven years and the highest incidence of obstruction was observed between one and two years of age. The average age of animals presented with urethral obstruction was 2.4 years, which was in accordance with the findings of Krishna (2021). In present study, Persian (83.33%, n=10) was highly documented breed as reported by several authors (Ergin *et al.*, 2018 and Abdel-Saeed *et al.*, 2020). The highest incidence in Persian breed could be due to breed predisposition or increasing popularity of Persian cats in Kerala. The average body weight of tom cats was 4.15 kg, ranging from 3.2 to 5.9 kg. The highest incidence was observed in the body weight range of 3 to 4 kg, followed by more than 4 kg body weight. Kim *et al.* (2018) included higher body weight and body condition scores as risk variables for urethral obstruction. All the animals in the present study were found to be uncastrated which was in accordance with the study of Abdel-Saeed *et al.* (2020). These findings are contradictory to observations by Lew-Kojrys *et al.* (2017) and Piyaungsri *et al.* (2020), who found a higher frequency of urethral obstruction in castrated cat. Castration of tom cats may not be a popular practice in this locality which might led to higher representation of uncastrated cats in our study.

In this study, all the tom cats were found to live in multi-cat households and were indoor cats. These findings are consistent with Buffington (2002) and Lew-Kojrys *et al.* (2017), who identified sedentary behaviour as a significant risk factor for feline idiopathic cystitis which could result in urethral obstruction. All tom cats were fed with commercial feed and had lower water intake and these findings were in accordance with Segev *et al.* (2011), Cooper (2015) and Sparkes (2018). History revealed previous incidence of uropathy in 50 per cent of the animals and Saevik *et al.* (2011) also observed that 37.6 per cent of cats suffered from previous episodes of FLUTD. A higher proportion (75%) of the tom cats in the study had recently experienced stressors such as cat fights, fear, transportation, visit of guests, and changes in owner's routine and it was in accordance with Taylor (2015). The average

Table1. Signalment and Anamnesis of the tom cats included in the study (n=12)

Cat	Age (Yrs)	Breed	Body weight (Kg)	Single/ multi-cat household	Duration of illness	Type of obstruction	First time occurrence/ recurrence	Feed/water intake
1	1.5	Persian	3.2	Single	2 days	Complete	Recurrence	Anorexia
2	1.5	Persian	3.4	Multiple	20 days	Partial	First time	Inappetence
3	5	Persian	5.3	Multiple	3 days	Complete	Recurrence	Inappetence
4	1	Persian	3.9	Multiple	2 days	Complete	Recurrence	Inappetence
5	7	Persian cross	4.1	Multiple	9 days	Partial	Recurrence	Inappetence
6	0.8	Persian	4.9	Multiple	2 days	Complete	First time	Inappetence
7	2.5	British short hair	3.5	Multiple	4 days	Complete	First time	Inappetence
8	2	Persian	5.9	Single	3 days	Complete	First time	Anorexia
9	1	Persian	4	Single	2 days	Complete	First time	Inappetence
10	2	Persian	4.4	Single	3 days	Complete	Recurrence	Inappetence
11	3	Persian	3.3	Multiple	3 days	Complete	Recurrence	Anorexia
12	2	Persian	4	Multiple	2 days	Complete	First time	Inappetence

duration of illness observed in the study was 4.5 days. All animals in the present study were presented after 48 hours of obstruction which contrasted with the findings of Hall *et al.* (2015) who noticed that 76 per cent of animals presented, were within 24 hours of sickness. This delay in presentation of cases was due to delay in transportation and referral nature of cases in the current study. Table 1 presents the detailed signalment and anamnesis of the cases.

There was no significant difference observed between physical parameters measured on the day of presentation, seventh day and 21st post-operative day (Table-2). A non-significant bradycardia was seen in 25 per cent (n=3) of the cats on the day of presentation, which was comparable to findings of Lee and Drobatz (2003). Segev *et al.* (2011) observed that circulatory shock or hyperkalaemia-induced bradycardia was the main complication of urethral blockage. The average respiratory rate measured on the day of the presentation was

consistent with research findings by Cooper *et al.* (2010) and Hall *et al.* (2015). According to Segev *et al.* (2011), tachypnoea, which was prevalent in the majority of cases on the day of presentation, might be due to pain, stress, metabolic acidosis, or uremic pneumonitis. Average rectal temperature (°C) of twelve animals selected for the study on the day of presentation was 38.58 ± 0.22 and this finding was in close accordance with observation of Neri *et al.* (2016). Physiological parameters are depicted in Table 2.

In the current study, 91.7 per cent of cases were dull and depressed on the day of presentation and Saevik *et al.* (2011) reported 86.2 per cent of cats with obstruction showed depression. Dullness could be an invariable finding in all cases due to acute abdomen and electrolyte imbalance occurring during urethral obstruction. Signs of anuria were noticed in all tom cats except two, which had dysuria with slight dribbling of urine. On abdominal palpation, all cats had distended, tense, painful

Table2. Details of the physiological parameters (Mean \pm SE) in tom cats (n=12)

Parameters	Day 0	Day 7	Day 21	F-value (P-value)
Rectal temperature (°C)	38.58 ± 0.22	38.74 ± 0.20	38.80 ± 0.27	0.246 ^{ns} (0.785)
Rate of respiration (per min.)	48.33 ± 8.83	41.44 ± 4.50	44.67 ± 6.59	0.425 ^{ns} (0.661)
Heart rate (bpm)	142.78 ± 8.001	132.67 ± 8.91	125.78 ± 7.56	0.932 ^{ns} (0.414)

^{ns}Non significant (P>0.05)

bladder which was observed earlier by Cooper *et al.* (2010) and Hall *et al.* (2015). On penile examination, 83.3 per cent of all tom cats had visible urethral/penile injury either manifested as penile trauma or prepuce swelling due to multiple or forceful transurethral catheterisation as observed by Corgozinho *et al.* (2007).

Results of haematological evaluation showed statistically significant reduction only in the values of volume of packed red cell and erythrocyte count after the day of surgery (Table-3). Non-significant elevated haemoglobin level was observed on the day of presentation. Juniores *et al.* (2020) and Krishna (2021) also noticed increase in haemoglobin value in cats with lower urinary tract disease and this increase was attributed to haemoconcentration. Increased haematocrit on the day of presentation was observed in the present study and it was in accordance with findings of Nye and Luther (2018) and Abdel-Saeed *et al.* (2020) who attributed this increase to dehydration. Relative erythrocytosis observed was due to haemoconcentration which was secondary to reduced fluid intake associated with this condition (Abdel-Saeed *et al.*, 2020).

Leucocyte values were in normal range in the present study as reported by Krishna (2021). Marginal thrombocytopenia was noticed on all days of observation and had no statistically significant difference. Thrombocytopenia was due to continuous platelet interactions with altered or damaged endothelial surface which was resulting in extensive activation of platelet, clumping, and clearance of platelets by the mononuclear phagocytic system (Saevik *et al.*, 2011 and Ellis *et al.*, 2018).

On statistical analysis, Blood Urea Nitrogen (BUN), creatinine, potassium and phosphorus showed progressive reduction when values on the day of presentation were compared to the values of seventh and 21st post-operative day (Table-4). Elevated BUN values were observed in 91.7 per cent (n=11) of our study population and this increase in BUN was due to inability to eliminate this metabolite due to obstruction and pre-renal azotemia caused by dehydration (Thomovsky, 2011). Increased creatinine level was observed in 91.7 per cent (n=11) of population which was due to its impaired elimination and pre-renal azotaemia (Gerber *et al.*, 2005, Saevik *et al.*, 2011 and Thomovsky, 2011). Significant

Table 3. Observations on haematological parameters (Mean \pm SE) in tom cats (n=12)

Parameters	Day 0	Day 7	Day 21	F-value (P-value)
Haemoglobin (Hb) g/dL	11.45 \pm 0.95	10.76 \pm 1.28	9.74 \pm 1.08	1.166 ^{ns} (0.337)
The volume of packed red cells %	41.89 \pm 3.11 ^a	36.09 \pm 3.03 ^b	36.567 \pm 2.71 ^b	4.253 [*] (0.033)
Total Erythrocyte count (10 ⁶ / μ L)	8.59 \pm 0.65 ^a	7.56 \pm 0.78 ^{ab}	7.07 \pm 0.72 ^b	3.8 [*] (0.042)
Total Leukocyte count (10 ³ / μ L)	16.52 \pm 1.80	12.80 \pm 3.75	14.43 \pm 3.09	0.604 ^{ns} (0.559)
Granulocyte (%)	43.12 \pm 10.78	41.33 \pm 8.88	38.10 \pm 6.53	0.274 ^{ns} (0.764)
Monocyte (%)	9.62 \pm 1.69	8.83 \pm 0.85	10.72 \pm 1.02	0.453 ^{ns} (0.556)
Lymphocyte (%)	43.98 \pm 9.55	49.17 \pm 8.66	51.18 \pm 6.75	0.622 ^{ns} (0.549)
Platelet count (10 ³ / μ L)	169.50 \pm 34.91	157.70 \pm 24.25	210.20 \pm 33.85	1.201 ^{ns} (0.324)

^{*}Significant at 0.05 (P<0.05), ^{ns}Non significant (P>0.05)

Means with different letter as superscripts differ significantly at 5% level

hyperkalaemia in the present study was due to its impaired elimination via urine (Lee and Drobatz, 2006 and DiBartola and Morais, 2012). Hyperphosphataemia on the day of presentation was due to decreased renal clearance of phosphorus in blocked cats (Finco and Cornelius, 1977 and Moe, 2008). On the day of presentation hypocalcaemia was noticed in 33.3 per cent of cases and normocalcaemia in 66.7 per cent of cases. Hypocalcaemia in uropathy cases might have resulted from calcium chelation due to phosphate retention, parathormoneristance, or acid-base imbalances (Coady *et al.*, 2019). When individual cases were noted on the day of presentation, mild hyponatraemia was observed in 41.7 per cent cases (n=5) whereas 8.3 per cent cases (n=1) showed severe hyponatraemia and 16.7 per cent (n=2) cases showed mild hypernatraemia. Finco and Cornelius (1977) and Krishna (2021) also reported hyponatraemia in urethral obstruction secondary to inappetence and vomiting. Frohlich *et al.* (2016) proposed natriuresis and hyponatraemia were due to inability of kidney to reabsorb sodium.

All tom cats selected for the study had haematuria following surgery except one animal which had yellow coloured urine. This finding was in accordance with Segev *et al.* (2011), Neri *et al.* (2016) and Lew-Kojrys *et al.* (2017) who observed haematuria in most of the cases of urinary obstruction. Average pH value of the

urine on day of presentation following surgery was 6.40 ± 0.10 with a range of 6.0 to 7.0 and on seventh post-operative day was 6.55 ± 0.26 with a range of 5.0 to 8.0 and no statistically significant difference were observed between days, which is contradictory to the findings of Neri *et al.* (2016) and Krishna (2021) who observed higher average pH of urine in FLUTD. In the present study specific gravity of urine on the day of presentation was 1.013 ± 0.003 and on seventh post-operative day was 1.009 ± 0.002 and this was contradictory to values observed by Neri *et al.* (2016) and Kovarikova *et al.* (2020) who reported specific gravity values as 1.032 and 1.040 respectively. The reduction in specific gravity in present study was attributed to renal impairment caused by chronicity of obstruction and delayed presentation of cases and post-obstructive diuresis (Adams, 2013). In the present study, presence of blood cells, proteinuria and leucocyturia were reported. Bilirubinuria, glucosuria, ketonuria and nitrituria were not observed except one animal which showed positive result for presence of nitrite on day of presentation and these findings were in accordance with Krishna (2021). Kovarikova *et al.* (2020) attributed intra-vesicular haemorrhage secondary to chronic urinary retention in urinary obstructions as a cause of haematuria in such cats. Leucocyturia was observed by Segev *et al.* (2011) and inflammation of bladder was attributed as a cause. Proteinuria reported in presented study was attributed to urothelial injury and the penetration of acute phase proteins into

Table 4. Observations on serum biochemical parameters (Mean \pm SE) in tom cats (n=12)

Parameters	Day 0	Day 7	Day 21	F-value (P-value)
Blood Urea Nitrogen (BUN)(mg/dL)	93.27 \pm 12.87 ^a	25.19 \pm 3.17 ^b	23.62 \pm 2.36 ^b	26.214** (0.001)
Creatinine (mg/dL)	7.37 \pm 1.22 ^a	1.22 \pm 0.13 ^b	1.40 \pm 0.20 ^b	23.564** (0.001)
Calcium (mg/dL)	9.98 \pm 0.52	9.95 \pm 0.29	9.86 \pm 0.37	0.041 ^{ns} (0.960)
Phosphorus (mg/dL)	11.52 \pm 1.36 ^a	7.17 \pm 0.27 ^b	6.83 \pm 0.33 ^b	10.397** (0.001)
Sodium (mEq/L)	150.44 \pm 2.58	151.30 \pm 2.67	148.67 \pm 1.84	0.371 ^{ns} (0.696)
Potassium (mEq/L)	5.48 \pm 0.45 ^a	3.99 \pm 0.15 ^b	4.03 \pm 0.14 ^b	8.734 [*] (0.015)

*Significant at 0.05 (P<0.05), **Significant at 0.01 (P<0.01), ^{ns}Non significant (P>0.05)

Means with different letter as superscripts differ significantly at 5% level

Table 5. Observations on urine pH and specific gravity (Mean \pm SE) in tom cats (n=12)

Parameters	Day 0	Day 7	t-value (P-value)
pH	6.40 \pm 0.10	6.55 \pm 0.26	0.557 ^{ns} (0.591)
Specific gravity	1.013 \pm 0.003	1.009 \pm 0.002	1.4 ^{ns} (0.188)

^{ns}Non significant ($P > 0.05$)

urine (Segev *et al.*, 2011 and Lew-Kojrys *et al.*, 2017). In the study population, 50 per cent of the tom cats were positive for the struvite crystal and most cases had RBC and leucocytes on microscopic examination of urine. This was in accordance with observations of Saevik *et al.* (2011), Segev *et al.* (2011) and Ay *et al.* (2021). All urine samples were negative for bacterial growth except one which showed presence of *Escherichia coli* on urine culturing. Infection noted in this animal might be due to iatrogenic cause of repeated transurethral catheterisation. Litster *et al.* (2007), Passmore *et al.* (2008) and Saevik *et al.* (2011) also reported that *E. Coli* was a common finding in urinary infections of cats.

Conclusion

The study revealed that age, body weight, breed, neutering status, housing and type of diet could be taken as risk factors for urethral obstruction. Cats with previous history of uropathy and animals that were exposed to any stress factors, were predisposed for urethral obstruction. Dullness, inappetence, tachypnoea, bradycardia, tense distended bladder were common clinical findings in cats with obstruction. It can be inferred that change in haematological parameters like increased haematocrit and erythrocyte, were secondary to dehydration. Elevated BUN, creatinine, phosphorus, potassium and decreased sodium and calcium, were characteristic findings of urethral obstruction. Presence of RBC, WBC, protein and struvite crystal in urine samples were also frequently observed.

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Conflict of interest

The authors declare that they have no conflict of interest.

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