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Severe anemia in cats with urethral obstruction: 17 cases (2002–2011)

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Abstract

Objective – To characterize clinical parameters of cats with severe anemia due to suspected urinary bladder hemorrhage associated with urethral obstruction.
Design – Retrospective case-control study.
Setting – University teaching hospital.
Animals – Seventeen cats with urethral obstruction and severe anemia (group "UO-A") that required transfusion were identified via medical record database search. Thirty cats with urethral obstruction and mild or no anemia (group "UO") were included as controls.
Interventions – None.
Measurements and Main Results – The median PCV of all cases at presentation was 28% (range, 9%–47%). Seven cats had PCV ≤20% at presentation, and all transfused cats had PCV ≤20% at the time of transfusion. Three cats did not receive a transfusion despite PCV ≤18%. Cats in the UO-A group had a significantly longer duration of clinical signs ($P = 0.001$), and were more likely to have a history of previous urethral obstruction ($P = 0.011$), have a heart murmur ($P = 0.002$), have a gallop rhythm ($P = 0.005$), and have lower blood pressure ($P = 0.007$) compared to those in the UO group. Additionally, UO-A cats had significantly lower pH, more negative base excess, higher BUN, and higher creatinine compared to UO cats. Duration of urinary catheterization was significantly ($P = 0.016$) longer in UO-A cats. All UO cats survived to discharge, whereas 4/17 (23.5%) UO-A cats were euthanized ($P = 0.013$).
Conclusions – A history of previous urethral obstruction and longer duration of clinical signs may be important risk factors for severe anemia in UO cats. Additionally, UO-A cats appeared to be more severely affected, as evidenced by lower blood pressure, more severe metabolic acidosis, higher BUN and creatinine, and worse outcome.

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Abbreviations

CI	confidence interval
OR	odds ratio
UO	cats with urethral obstruction and PCV >20%
UO-A	cats with urethral obstruction and PCV ≤20%

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Introduction

Feline urethral obstruction is common and can be life-threatening without rapid treatment. Etiologies, risk factors, clinical characteristics, and treatment recommendations have been described previously.[1–7] While the prognosis for urethral obstruction is generally good, mortality can vary, and ranged from 5.8% to 8.9% in several studies (including cases that died or were euthanized). Recurrence is common, affecting 22% to 36% of patients.[1,2]

It has been observed at this institution that cats with urethral obstruction can present with moderate to severe anemia suspected to be due to hemorrhage into the urinary bladder. While hematuria in cases of urethral obstruction has been frequently reported, to the authors' knowledge, there is no published information regarding severe anemia requiring transfusion in these cases. [2,6]

The purpose of this study was to report the clinical presentation of cats with urethral obstruction and severe anemia, and to describe the clinical parameters, risk

factors, and outcome in this population. We hypothesized that cats with urethral obstruction and severe anemia requiring transfusion would have higher morbidity and mortality than cats with urethral obstruction without severe anemia.

Materials and Methods

Medical records of all cats examined at the Matthew J. Ryan Veterinary Hospital of the University of Pennsylvania between January 2002 and July 2011 were reviewed for cases of urethral obstruction with anemia (group "UO-A"). Patients were included as UO-A if they were diagnosed with a urethral obstruction based on physical examination (firm, inexpressible urinary bladder); had extended database bloodwork including venous blood gas, serum creatinine, BUN, blood glucose, electrolytes, PCV, and total plasma protein performed at admission[a]; and had evidence of severe anemia with need for transfusion. Severe anemia with need for transfusion was defined as a PCV ≤20% with clinical signs attributable to anemia (tachycardia, hypotension, tachypnea, prolonged capillary refill time) during their hospitalization. Cats were excluded if they had an incomplete medical record, mild anemia (PCV >20%) that did not require transfusion, or anemia attributable to another cause such as chronic kidney disease. For comparison purposes, an unmatched control population of 30 cats with urethral obstruction and mild or no anemia (group "UO") was randomly selected from the same time period.

Information regarding signalment, history and clinical signs, initial and subsequent extended database data, imaging results, urine analysis and culture, necropsy findings, and outcome were recorded on a spreadsheet. Treatments and diagnostic tests were performed at the discretion of the primary clinician but generally included sedation and placement of an indwelling urinary catheter with closed collection system, intravenous fluids therapy, and supportive care. Patients were defined as survivors if they were discharged alive from the hospital and nonsurvivors if they died or were euthanized.

Statistical Methods

Continuous variables were not normally distributed, so median (range) were used to describe them. The Mann–Whitney test was used to compare these variables between cases and controls. Categorical variables were described using proportions and percentages, and the Fisher's exact test (if the expected number in at least 1 cell was <5) or chi-square test was used to compare these variables between groups. Odds ratios (OR) for selected variables were calculated along with the 95% confidence interval (CI) using the binomial exact method. A P-value of <0.05 was considered significant for all comparisons. All statistical analyses were performed using a commercially available statistical software package.[b]

Results

Forty-six cats with urethral obstruction and anemia were identified. Of these, 17 met the criteria for inclusion in study group UO-A. Of the cases that were excluded, 22 had mild anemia (PCV >20%) that did not require transfusion, 4 were transfused postoperatively following perineal urethrostomy or cystotomy, and 3 had incomplete or missing medical records. During the period of the study, 2132 cats were treated for urethral obstruction at our institution. With 17 UO-A cases during this time period, this equates to an incidence of 0.8%.

Signalment, presenting complaint, and clinical signs

The median age was 3.8 years (range, 2–12 years) for UO-A cases and 3.9 years (range, 0.75–12 years) for UO controls ($P = 0.20$). Domestic shorthair cats represented most of the cats in both groups (16/17 UO-A cases and 29/30 UO controls); 1 cat in each group was breed classified as "feline other." There was 1 intact male cat in each group; the remainder were castrated. Median body weight was 4.9 kg (range, 3–10 kg) for UO-A cases and 5.4 kg (3.4–11 kg) for UO controls ($P = 0.37$). There were no significant differences in signalment characteristics between groups.

Cases in the UO-A group were more likely to have experienced a previous obstruction (11/17 [65%]) compared to UO controls (8/30 [27%]; OR 5; CI 1.2, 22; $P = 0.01$). Additionally, UO-A cases had a significantly ($P = 0.001$) longer duration of clinical signs (median 3 days; range, 1–8 days) compared to UO controls (median 1 day; range, 1–3 days).

Physical examination and diagnostic test results

Table 1 summarizes the physical examination findings on presentation. Briefly, the UO-A cases were significantly more likely to have a heart murmur (OR 11; CI 2, 61; $P = 0.002$) or a gallop rhythm (OR 17; CI 1.7, 827; $P = 0.005$) compared to UO controls. Median Doppler blood pressure of the UO-A cases was 105 mm Hg (range, 40–155 mm Hg), which was significantly ($P = 0.007$) lower than that of UO controls (143 mm Hg, range 110–180 mm Hg).

The median PCV at presentation was 28% (range, 9–47) for UO-A cases and 44% (range, 29–54) for UO controls ($P < 0.0001$). Seven UO-A cases had PCV ≤20% at presentation, and all UO-A cases had a PCV ≤20% at the time of transfusion. Three UO-A cases did not receive a transfusion despite PCV of 10% (euthanized), 14% (euthanized), and 18% (survived). The remainder of surviving UO-A cats each received ≥1 transfusion.

Table 1: Physical examination and blood pressure findings for UO-A cases and UO controls

Parameter	UO-A Median (range)	UO Median (range)	*P*-value
Rectal temperature			
°C	38.1 (32.7–39.4)	37.5 (34.8–39.6)	
°F	100.5 (90.9–103.0)	99.5 (94.6–103.2)	0.46
Heart rate (beats/minute)	190 (120–240)	200 (120–300)	0.34
Respiratory rate (breaths/minute)	40 (12–105)	30 (16–80)	0.17
Heart murmur	10/17 (59%)	4/30 (13%)	0.002*
Gallop rhythm	6/17 (35%)	1/30 (3.3%)	0.005*
Doppler blood pressure (mm Hg)	105 (40–155)	143 (110–180)	0.007*

UO, group with urethral obstruction; UO-A, group with urethral obstruction and severe anemia. *Significant difference between UO-A and UO ($P < 0.05$).

At presentation, total plasma protein concentration in the UO-A cases (median 68 g/L [6.8 g/dL]; range, 50–130 g/L [5–13 g/dL]) was not significantly different from that in UO controls (median 80 g/L [8 g/dL]; range, 60–98 g/L [6–9.8 g/dL]; $P = 0.135$).

Table 2 summarizes the initial emergency clinicopathologic findings. Metabolic changes were more severe in the UO-A cases compared to the UO controls, including significantly higher BUN and creatinine concentrations, lower pH, more negative base excess, and lower PCV. There were no differences in venous PCO_2, potassium concentration, lactate concentration, or total plasma protein concentration at presentation.

Additional diagnostic tests (urine analysis, urine culture, imaging studies) were performed at clinician discretion at various time points during hospitalization in some patients. Complete urine analysis including urine color, turbidity, glucose, bilirubin, ketones, specific gravity, blood, pH, protein, urine protein sulfosalicylic acid precipitation to detect albumin, globulins and Bence-Jones proteins, urobilinogen, and sediment examination was performed in 17 cats (6 UO-A cases, 11 UO controls). Urine from 29 cats was described grossly, with urine from 13/15 (86.7%) UO-A cases and 3/14 (21.4%) UO controls described as blood tinged ($P < 0.001$). UO-A cases were 24 (CI 2.6, 288; $P < 0.001$) times more likely to have grossly bloody urine than UO controls. A urine culture was performed in 13 cats (6 UO-A cases, 7 UO controls). Ten cats had no growth reported; of the remaining 3, positive cultures included *Escherichia coli* (UO), *Escherichia coli,* and *Proteus spp.* (UO), and *Streptococcus faecalis* (UO-A).

Abdominal radiographs were performed in 10 cats (5 UO-A, 5 UO). Of the UO-A cases that had abdominal radiographs performed, 2 were within normal limits and 3 had cystic calculi. In the UO controls, all abdominal radiographs performed were within normal limits. Nine cats had focal urogenital or full abdominal ultrasound performed (6 UO-A cases, 3 UO controls). In the UO-A cases, 3 cats had cystic calculi and 3 had suspected blood clots (hypoechoic heterogenous masses) within the urinary bladder. In the UO controls, 1 cat had a suspected small blood clot and sediment in the urinary bladder, 1 cat had cystic calculi, and 1 had no abnormalities noted. Of cats with abdominal imaging, 5 (3 UO-A and 2 UO) mentioned above had both radiographs and ultrasound performed.

Outcome

The median length of hospitalization for UO-A cases (2 days; range, 0–16 days) was not significantly different than that for UO controls (1 day; range, 1–4 days; $P = 0.28$). However, UO-A cases had a significantly longer median duration of urinary catheterization (72 hours; range, 22–96 hours) compared to UO controls (24 h; range 4–60 h; $P = 0.013$). All 30 UO controls survived to discharge, compared to 13/17 (76.5%) UO-A cases ($P = 0.013$). Of the 4 UO-A cases that did not survive, all were euthanized; reasons for euthanasia (financial vs related to perceived prognosis vs decompensation) could not be determined from the medical records. One of the euthanized cats had a necropsy performed, which revealed severe diffuse chronic transmural fibrosis and fibroplasia of the urinary bladder with multiple fibrin thrombi and a luminal blood clot. Follow-up, ranging from <4 months to 8 years, was available for 13/47 cats (6 UO-A and 7 UO). Four of 13 (30.8%, 1 UO-A and 3 UO) had a repeat episode of urethral obstruction. Two cats reblocked within 1 month, 1 within 4 months, and 1 had another episode of UO 2.25 years later.

Discussion

The purpose of this study was to report a series of cases of feline urethral obstruction with severe anemia and to attempt to characterize risk factors for developing anemia and outcomes. Based on clinical findings, imaging studies, and a necropsy report available for 1 of these patients, it is suspected that hemorrhage into the urinary bladder was the underlying cause of the severe anemia. Cats were presumed to have hemorrhage into the urinary bladder if they had severe anemia with a

Table 2: Initial clinicopathologic test results for UO-A cases and UO controls

Parameter (reference interval)	UO-A Median (range)	UO Median (range)	*P*-value
PCV (30–45%)	28 (9–47)	44 (29–54)	<0.0001*
TPP			
(60–85 g/L)	68 (50–130)	80 (60–98)	0.135
[6.0–8.5 g/dL]	6.8 (5–13)	8 (6–9.8)	
pH (7.30–7.40)	7.25 (6.96–7.39)	7.34 (7.09–7.42)	0.026*
P_vCO2 (33–43 mmHg)	34.5 (26.9–52.1)	39.6 (28.4–50.3)	0.294
BE (−1 to −7 mmol/L)	−14 (−21.1 to −6.6)	−5.5 (−18.8 to 2.2)	0.006*
BUN concentration			
(5.0–11.4 mmol/L)	35.7 (13.9–>35.7)	13.2 (7.1–>35)	
[14–32 mg/dl]	100 (39–>100)	37 (20–>100)	0.003*
Creatinine concentration			
(88.4–176.8 μmol/L)	1158.04 (335.9–>1768)	168 (97.2–>1768)	0.015*
[1.0–2.0 mg/dl]	13.1 (3.8–>20)	1.9 (1.1–>20)	
K^+ (3.5–4.8 mmol/L)	5.7 (3.2–11.2)	4.1 (3.09–9.53)	0.151
Lactate concentration (0.5–2.0 mmol/L)	1.95 (0.1–20)	1.6 (0.5–5.2)	0.442

BE, base excess; K^+, blood potassium concentration; TPP, total plasma protein concentration; UO, group with urethral obstruction; UO-A, group with urethral obstruction and severe anemia. *Significant difference between UO-A and UO ($P < 0.05$).

lack of obvious hemorrhage elsewhere and no historical evidence of chronic disease. This presumption is also supported by the cases' physical examination findings, imaging studies the clinician determined were indicated, and necropsy findings in 1 cat consistent with hemorrhage into the urinary bladder.

While the authors do not have any direct evidence as to why bladder hemorrhage might occur in a subset of cats with urethral obstruction, several possibilities exist. Cases in this study's UO-A group (11/17 [65%]) were more likely to have been previously blocked than UO controls (8/30 [27%]). These findings contradict those of a previous study that reported that cats with previous obstruction tended to be less metabolically compromised than cats experiencing their first obstruction event.[5] It is difficult to explain why cats with multiple urethral obstruction episodes of may be more likely to experience bladder hemorrhage, except to speculate that cats with repeat events have previous injury to the bladder wall, predisposing them to hemorrhage. This hypothesis may be supported by the 1 patient in this study that had a necropsy performed. That cat had a history of one episode of urethral obstruction the previous year, and its necropsy revealed severe, diffuse, chronic transmural fibrosis, and fibroplasia of the urinary bladder. Cases in the UO-A group also had a significantly longer duration of clinical signs compared to UO controls. Intuitively, it makes sense that prolonged urinary bladder wall pressure could cause more significant mucosal injury and hemorrhage. In previous reports of hematuria in cats with urethral obstruction, inflammation, high pressure within the urinary bladder, and previous cystocentesis or catheterization attempts have been implicated.[2,6,7] Similarly, UO-A cases were more metabolically compromised, including more severe acidemia due to metabolic acidosis, and higher BUN and creatinine concentrations. Severe uremia and acid-base changes have been reported to contribute to platelet function abnormalities, including impairment of platelet-platelet and platelet-vessel wall interactions.[8,9] Combined with more severe bladder mucosal injury due to previous obstruction and longer duration of clinical signs, these may be additive risk factors for hemorrhage.

Cases in the UO-A group were more likely to have physical heart abnormalities including a murmur or gallop rhythm, although these were inconsistent with only 59% and 35% of the cats with severe anemia having these abnormalities, respectively. These cats also had lower blood pressure. These findings can be consistent with blood loss anemia, but specific heart disease was not ruled out in these cats.[10] Additionally, there is no follow-up information indicating whether these auscultable cardiac findings resolved along with resolution of anemia and hypovolemia.

Surprisingly, the length of hospitalization was not significantly longer in the cats with severe hemorrhage. This may reflect the small number of cases and hence decreased power, but may also indicate that once volume is replenished, anemia is corrected, and metabolic abnormalities are corrected, these cats respond rapidly. While length of hospitalization was not significantly different between groups, duration of urinary catheterization was

significantly longer in UO-A cases than in UO controls. The catheter dwell time discrepancy likely reflects our institution's general protocol to leave the urinary catheter in place until the urine appears clear. While mortality (4/17 [23.5%]) was greater in the UO-A cases, all deaths were all due to euthanasia. The confounding factors of cost and retrospective study design make conclusions on outcome difficult to interpret. Mortality among UO-A cases was much higher than in previous reports of cats with urethral obstruction, in which mortality ranged from 5.8% to 8.9%.[2,11]

This study has several limitations, including its retrospective nature and small sample size, which make it difficult to make generalizations about larger numbers of cases in various hospitals. While it is difficult to definitively determine the etiology of anemia in these cases, we suspect urinary bladder hemorrhage as the major source based on their clinical evaluations. Despite these limitations, the authors believe that cats presenting with urethral obstruction and severe anemia are at risk for higher morbidity and mortality than their nonanemic counterparts, and cats with hematuria or anemia should be closely monitored for the need for transfusion.

Footnotes

[a] CCX, Nova Biomedical, Waltham, MA.
[b] Stata 11.0 for Windows, College Station, TX.

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