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Rapid vascular uptake of contrast during a retrograde urethro-cystogram in a cat with chronic lower urinary tract disease

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Abstract

Case summary A 9-year male neutered domestic longhair cat was referred to our hospital for investigation of recurrent urinary tract obstruction. The clinical signs had started 12 months earlier and the cat had been catheterised on multiple occasions. Clinical examination and abdominal ultrasound of the abdomen was unremarkable but examination of the penis revealed it to be prolapsed and extremely erythematous and friable. A retrograde contrast urethrocystogram was performed, showing extravasation of the contrast medium and establishing the presence of partial leakage or a tear of the urethra. In subsequent radiographs, the contrast was seen being rapidly absorbed into the pelvic and systemic vasculature via the penile veins, internal and external pudendal veins, internal and external iliac veins, and, ultimately, the caudal vena cava. Later, the contrast medium was seen within the renal pelves. Retrograde urethrocystography revealed stenosis and irregularities of the caudal urethral mucosa consistent with strictures. A routine perineal urethrostomy was performed and the cat recovered well.

Conclusions and relevance Rapid vascular absorption of extravasated contrast medium has not been reported before. In this case, the increased blood supply to the distal urethra and penis is likely secondary to (chronic) inflammation, as demonstrated by the urethral strictures and the friable, oedematous nature of the penis. Whether the inflammation was caused by chronic obstruction or repeated iatrogenic trauma, or a combination of these factors, will remain debatable. Nonetheless, this case demonstrates that when a retrograde contrast urethrocystogram is considered, it is imperative that a contrast medium (or other intraurethral medication such as local anaesthesia) is chosen that is safe for intravascular use. Equally, an absolute aseptic technique is essential considering the potential for contaminants to be absorbed quite rapidly into the systemic circulation. Multiple catheterisations should be avoided when there is chronic inflammation, and alternative options should be considered when chronic disease is suspected.

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Case description

A 9-year male neutered domestic longhair cat was referred to the Small Animal Soft Tissue Surgery Department of our hospital for investigation of recurrent urinary tract obstruction. The clinical signs had started 12 months previously when a grass seed was incompletely removed from the urethra. Subsequently, the cat had been catheterised on multiple occasions owing to recurrent urethral blockage. Medical management (dexamethasone, meloxicam and prazosin) failed to alleviate the clinical signs, so referral was sought.

Upon arrival the cat was bright, alert and responsive. There were no reported changes to the home environment but the cat did not get on well with the other cats in the household. It was reported to be an outdoor cat during the day but was kept indoors at night,

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with no access to a litter tray. At that time, it was not on a urinary tract prescription diet. Physical examination was unremarkable and, with the owner's consent, it was decided to perform a conscious abdominal ultrasound examination followed by a contrast retrograde urethrocystogram study under general anaesthesia. Blood and urine (via ultrasound-guided cystocentesis) were also taken for evaluation.

The serum biochemistry was within normal limits showing normal electrolytes and normal renal parameters (urea, creatinine, phosphate). A urine culture and sensitivity test demonstrated a heavy growth of *Escherichia coli*, which was resistant to clavulanic amoxicillin but sensitive to marbofloxacin.

Abdominal ultrasound of the abdomen was performed using a Philips HDI 5000 machine and a microconvex 5–8 MHz transducer. Subjectively, normal kidneys and ureters, a distended urinary bladder with anechoic contents and a mildly dilated (3 mm in diameter) proximal urethra that extended towards the pelvic rim were seen. No obvious reason for the dilation, such as an obstruction, was identified in the urethra cranial to the pelvic inlet.

The cat was anaesthetised and examination of the penis revealed it to be prolapsed and extremely erythematous and friable (Figure 1). The cat received epidural morphine at 0.1 mg/kg (morphine sulphate; Martindale) and bupivacaine 1 mg/kg (Marcain; AstraZeneca), whereupon a urinary catheter was placed. Catheterisation of the distal urethra was challenging but a 3 F urinary catheter with end hole (1.3 mm × 11.0 cm Slippery Sam Tomcat; SurgiVet) was eventually inserted into the distal tip of the penis. A retrograde contrast urethrocystogram was performed by instilling 4 ml ionised contrast medium (61.2% w/v iopamidol equivalent to 300 mg iodine/ml [Niopam300; Bracco]) diluted 1:1 with sterile saline through the pre-placed urinary catheter into the distal urethra and then occluding the penile opening.[1] Iopamidol is a non-ionic contrast medium that results in a low osmolality when compared with ionic media. Radiographs were taken prior to administration and at predetermined times (immediately, 2 mins and 10 mins) after instillation of contrast medium into the urethra.

Plain radiographs of the abdomen showed good peritoneal serosal detail, a normal shape and size of both kidneys, a moderately distended urinary bladder and a small amount of formed faeces within the descending colon.

A contrast retrograde urethrocystogram (Figure 2), taken immediately postadministration of contrast medium, showed an area of extravasation of the contrast medium that could be seen cranioventrally to the distal urethra. A focal narrowing is visible in the mid-pelvic urethra at the level of the prostate gland, which is normal anatomy. The urinary bladder and urethra appeared subjectively normal in shape and were filling appropriately with contrast medium, without any evidence of calculi.

Figure 1 Examination of the penis under sedation revealed it to be prolapsed and extremely erythematous and friable (reproduced by kind permission of Kelly Bowlt)

Two minutes later a second contrast retrograde urethrocystogram was acquired (Figure 3), which showed that the contrast medium had extravasated from the urethra. Dramatically, the contrast could now be seen within the vasculature and is highlighting the penile veins – the internal and external pudendal veins, which drain into, respectively, the internal iliac and external iliac veins and, ultimately, the caudal vena cava.[2]

At 10 mins post-contrast injection, a third radiograph was taken (Figure 4), which showed contrast medium within the renal pelves (renal excretion), indicating that the contrast uptake had, indeed, been within the vasculature. Consequently, it was decided to perform retrograde urethrocystoscopy to evaluate the urethra.

Retrograde urethrocystoscopy revealed stenosis and irregularities of the caudal urethral mucosa consistent with strictures. The urethra proximal to the ischium was normal.

Further to discussion with the owners, it was decided to perform surgery to remove the damaged penis to create a larger opening through which urine could pass. A routine perineal urethrostomy was performed using a previously described technique (Figure 5).[3] The resulting stoma was large enough to accommodate a pair of needle holders up to the box lock.

The cat recovered well from the anaesthetic. Immediately after the anaesthetic, it underwent pain checks every 2 h for 8 h. During the following 3 days in hospital the cat was maintained on buprenorphine 20 µg/kg intramuscularly q6h (Vetergesic; Alstoe), marbofloxacin 10 mg orally (PO) q24h (Marbocyl; Vetoquinol), meloxicam 0.05 mg/kg PO q24h (Metacam; Boehringer

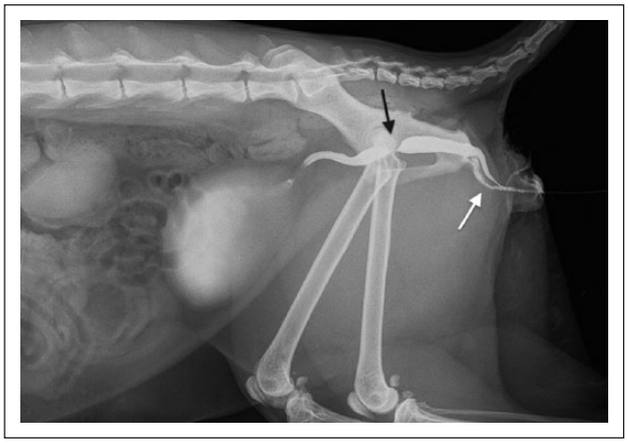

Figure 2 Contrast retrograde urethrocystogram, lateral projection (t = 0). An area of extravasation of the contrast medium can be seen cranioventrally to the distal urethra (white arrow). A focal narrowing is visible in the mid-pelvic urethra at the level of the prostate gland (black arrow), which is normal anatomy. The urinary bladder is normal in shape and filling appropriately with contrast medium

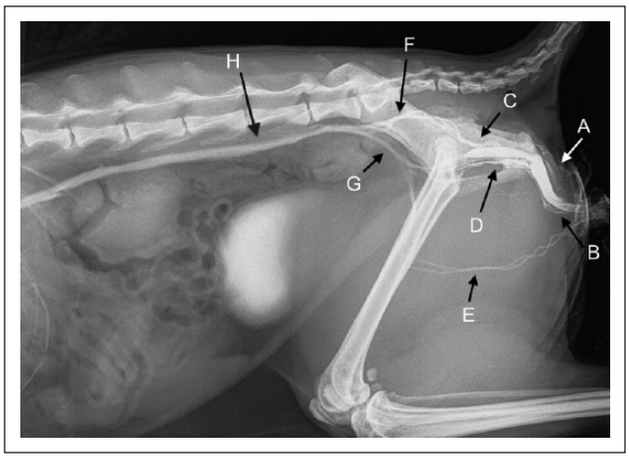

Figure 3 Contrast retrograde urethrocystogram, lateral projection (t = 2 mins). The internal (dorsally) and external (ventrally) pudendal veins drain blood from the penis. The internal pudendal joins the internal iliac vein, and the external pudendal drains into the external iliac. The iliac veins on each side unite to form the common iliac vein, and the two common iliac veins then converge into the caudal vena cava. A = dorsal penile vein; B = scrotal vein; C = internal pudendal vein; D = external pudendal vein; E = branch of the femoral vein; F = internal iliac vein; G = external vein; H = caudal vena cava

Ingelheim), cystophan 1 capsule PO q12h (Cystophan; Protexin) and prazosin 0.5 mg PO q12h (Hypovase; Pfizer). The cat did not urinate the first or second day after surgery, and a urinary catheter (3 F 1.3 mm × 11.0 cm Slippery Sam Tomcat) was passed easily into the urinary bladder once daily on both days. A repeat ultrasound of the urinary bladder and proximal urethra was

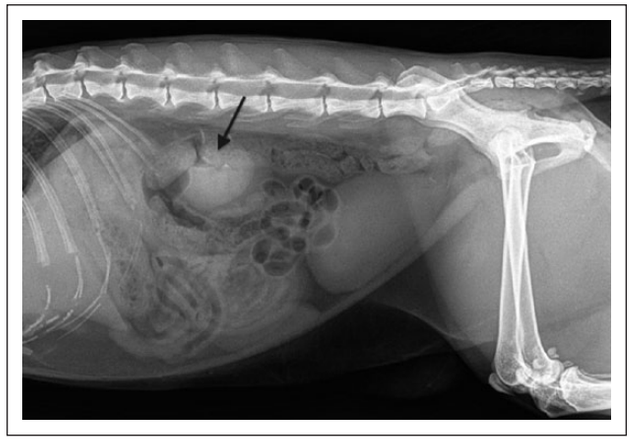

Figure 4 Contrast retrograde urethrocystogram, lateral projection (t = 10 mins). Contrast medium is present within the renal pelves (black arrow) demonstrating renal excretion and indicating that the contrast uptake had been within the vasculature

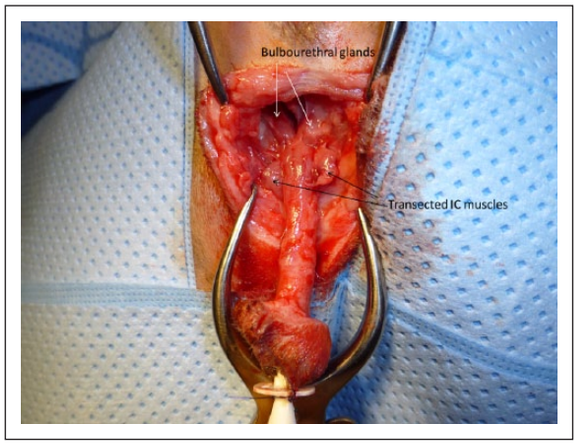

Figure 5 A perineal urethrostomy was performed using a previously described technique (Tobias) (reproduced by kind permission of Kelly Bowlt)

unremarkable. On the third day in hospital the cat urinated and defecated in its litter tray without assistance, and was subsequently discharged.

At discharge several dietary/environmental changes were suggested, including provision of a prescription urinary tract diet, a drinking fountain, a litter tray for overnight use and a pheromone diffuser (Feliway; Ceva). A follow-up appointment was recommended with the referring vet, at which time healing was progressing normally. The cat has since recovered completely and, at the time of publication, had not displayed any symptoms of urinary tract disease.

Discussion

The retrograde contrast study demonstrated that this cat had a patent urethra and urinary bladder. However, the extravasation of contrast material from the urethra

established that there was at least partial leakage or a tear of the urethra. Although extravasation of contrast medium is frequently seen in urethral tears,[4] it usually dissipates into the surrounding periurethral tissues. In this case, the extravasated contrast was almost immediately absorbed by the systemic circulation, suggesting an abnormal and increased blood supply of the distal urethra and penis. The rapid vascular uptake of the extravasated contrast, as seen in this case, has, to our knowledge, not been described before.

In the cat, the deep and dorsal penile veins facilitate the venous drainage of the penis. These veins then merge with the internal pudendal vein dorsally and the external pudendal vein ventrally. The internal pudendal vein drains into the internal iliac vein, whereas the external pudendal vein drains into the external iliac vein. The internal and external iliac veins merge to form the short common iliac vein before terminating in the caudal vena cava (see Figure 3).

The increased vascularisation of the lower urinary tract in this case is likely the result of inflammation. Whether the inflammation was secondary to chronic obstruction or repeated iatrogenic trauma, or a combination of these factors, will remain debatable. However, the chronicity of the disease is supported by the presence of chronic changes in the form of urethral strictures and the friability and oedematous nature of the penis.

From a clinical point of view, the increased vascularisation following (chronic) inflammation is important to recognise. It is well documented that traumatic catheterisation can cause urethral tears but perhaps some consideration of the effects of multiple non-traumatic catheterisations and the ensuing inevitable inflammation is warranted. In any case, due care must be taken in the selection of contrast media for potential retrograde studies. It is imperative that a contrast is chosen that is safe for intravascular use.[5] These principles also apply to any other medication that might be applied into the urethra. For example, multiple local anaesthetic agents are used in the urethra;[6] however, caution is necessary in the selection of an agent based on the potential for entry into the vasculature. Equally, an absolute aseptic technique is essential considering the potential for contaminants to be resorbed quite rapidly into the systemic circulation.

Conclusions

As demonstrated by this case, the potential complications of chronic lower urinary tract disease should not be underestimated. Multiple catheterisations and chronic inflammation should be avoided, and alternative options should be considered when chronic disease is suspected.

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Conflict of interest The authors do not have any potential conflicts of interest to declare.

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