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Source: Journal of Feline Medicine and Surgery Open Reports, 3(2)

Published By: SAGE Publishing

URL: https://doi.org/10.1177/2055116917733641

Case Report

jfms OPEN REPORTS

Journal of Feline Medicine and Surgery Open Reports
1–6

DOI: 10.1177/2055116917733641
journals.sagepub.com/home/jfmsopenreports

This paper was handled and processed by the European Editorial Office (ISFM) for publication in *JFMS Open Reports*

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Membrane-like structure in the urinary bladder neck of a young cat: diagnosis and treatment using balloon dilatation and a balloon-expandable metallic stent

Matias Ruiz-Drebing, Fui Yap, Mayank Seth, Ruth Dennis and Elisabet Dominguez

Abstract

Case summary A 33-month-old, spayed female domestic shorthair cat was referred to the Animal Health Trust for the investigation of urinary incontinence and straining to urinate. A membrane-like structure was detected in the bladder neck, which caused partial obstruction of the urinary bladder. A combination of different imaging techniques, including ultrasonography, radiography, CT and fluoroscopy, was essential in the diagnosis, surgical planning and treatment of this intravesicular stricture. During retrograde vaginourethrocystogram, unexpected subcapsular accumulation of contrast medium was seen around both kidneys on radiographs and confirmed with CT. Three different treatments were performed, including surgical debridement, balloon dilatation and placement of a self-expanding metallic stent across the stricture. Histopathology of the membrane was unable to differentiate whether the lesion was congenital or acquired. No urinary incontinence was observed 5 months after placement of the metallic stent.

Relevance and novel information This is the first reported case using fluoroscopic-guided balloon dilatation of the bladder neck for the treatment of a bladder neck stricture. Presence of renal subcapsular contrast medium secondary to a retrograde vaginourethrocystogram due to partial obstruction at the bladder neck in a cat has not been previously described.

Accepted: 30 August 2017

Case description

A 33-month-old spayed female domestic shorthair cat was referred to the Animal Health Trust for the investigation of urinary incontinence and straining to urinate without producing urine. This was first noticed when the cat was 9 months old. The cat had been treated with multiple courses of meloxicam (Metacam Oral Suspension; Boehringer Ingelheim) at 0.05 mg/kg q24h PO and amoxicillin/clavulanic acid (Synulox; Zoetis) at 20 mg/kg q12h PO.

On examination, vital signs were within normal limits. A constant slow dribbling of urine was observed from the vulva.

Results from a complete haematology and serum biochemical panel were unremarkable.

Abdominal ultrasonography showed a moderately filled urinary bladder. The bladder wall was diffusely thickened (3 mm) and showed mucosal irregularity (Figure 1). A membrane-like structure was seen within the lumen of the bladder neck, extending vertically from the mucosa of the dorsal wall to the mucosa of the ventral wall (Figure 2). Caudal to this membrane-like structure, the bladder neck and urethra were dilated to about 5 mm in diameter and the vesicoureteral junction could not be identified. A bilateral, mild dilation of the renal pelves was observed.

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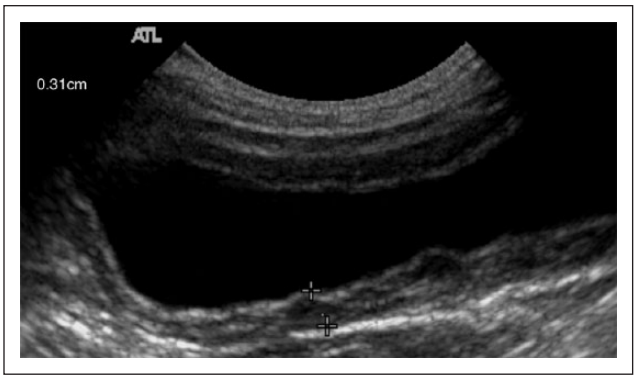

Figure 1 Sagittal ultrasonographic image of the urinary bladder. Thickening and irregular intraluminal surface of the wall of the urinary bladder due to secondary cystitis is evident

Figure 2 Sagittal ultrasonographic image of the bladder neck. A membrane-like structure is seen crossing the lumen of the bladder neck, extending from the mucosa of the dorsal wall to the mucosa of the ventral wall. The vesicourethral junction is not clear. Cranial is to the left of the image

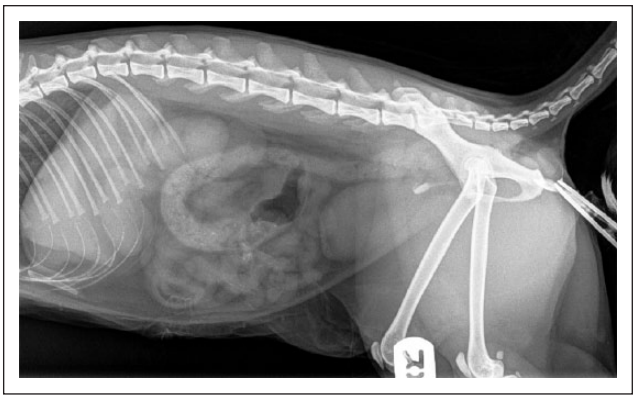

Figure 3 First retrograde vaginourethrogram. Contrast medium is seen filling the urethra but stops abruptly at the level of the bladder neck

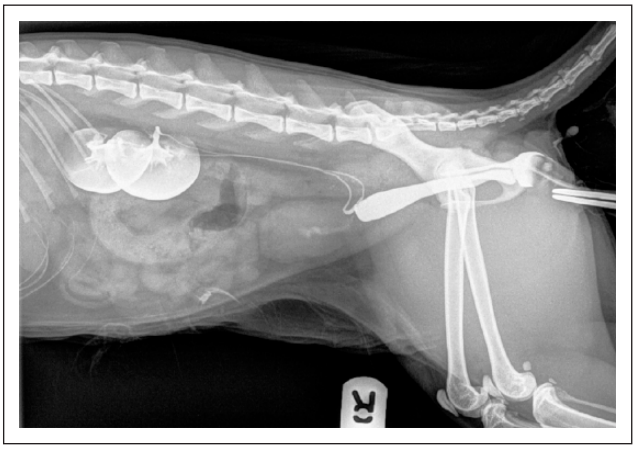

Figure 4 Second retrograde vaginourethrocystogram. The urethra and bladder neck are distended with contrast medium (CM), but the vesicourethral junction cannot be identified. Ureters and the renal silhouettes are opacified in a retrograde fashion by CM and only a small volume of CM enters the body of the urinary bladder

Ultrasound-guided cystocentesis was performed and urinalysis identified bacteriuria and pyuria. The bacteriology result showed growth of *Enterococcus* species, which was susceptible to amoxicillin/clavulanic acid.

To better characterise the lesions observed on ultrasonography, a radiographic contrast study of the urinary tract was planned.

A retrograde vaginourethrocystogram was performed using an 8 FG Foley male dog catheter and 2 ml soluble, non-iodinated ionic contrast medium (CM) (Iopamidol 300 mg I/ml [Niopam; Bracco]). CM was seen in the urethra and bladder neck, but only a small volume passed into the body of the bladder (Figure 3).

A further 3 ml of CM were used, injected against mild resistance (Figure 4). The urethra was seen to be markedly distended and widened cranially. The CM column widened up to 10 mm before terminating abruptly with a rounded contour in the region of the trigone. This termination was suspected to be related to the presence of the membrane visualised on ultrasonography. CM was also observed filling the ureters, which entered the bladder in the region of the trigone, but only a small volume of CM was seen within the body of the urinary bladder. For this reason, only a small communication between the body of the urinary bladder and the urethra and bladder neck through the membrane-like structure was suspected. The ureters were assumed to terminate caudal to the membrane due to the ureteric reflux noted. CM filled the entire length of both ureters, the renal pelves and renal silhouettes. This was an unexpected finding, and therefore further immediate assessment of the kidneys was performed.

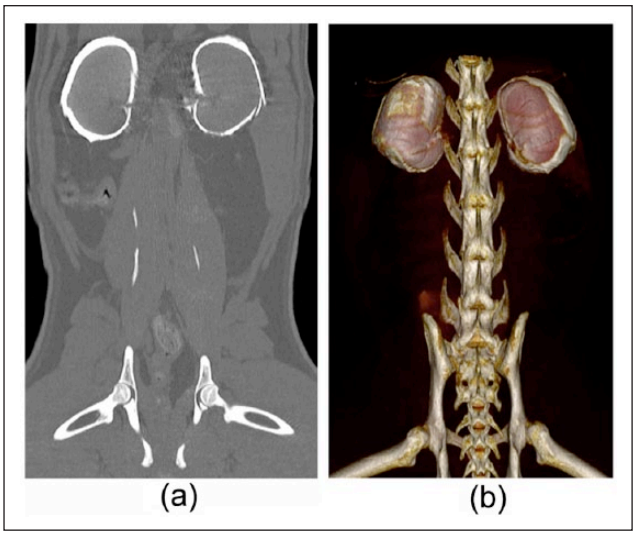

Figure 5 (a) Three-dimensional reconstruction. (b) Dorsal reconstruction of the CT with bone algorithm showing remaining contrast medium in the subcapsular perirenal space

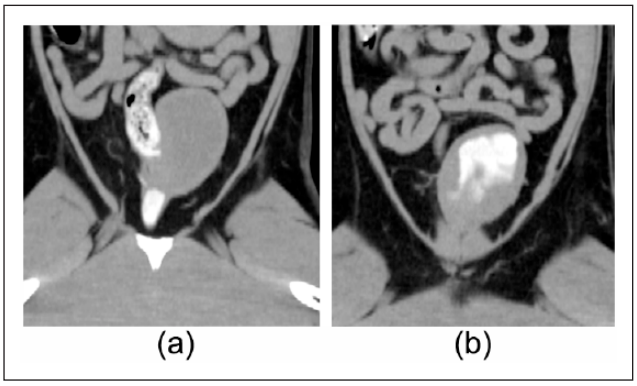

Figure 6 Dorsal reconstruction of the CT in soft tissue algorithm. (a) Contrast medium (CM) ends abruptly at the level of the bladder neck. (b) Some of the CM is also seen in the lumen of the cranial aspect of the urinary bladder, having traversed the partial obstruction in the 11 mins since the radiograph depicted in Figure 4

A CT scan of the abdomen confirmed the radiographic findings (Figures 5 and 6). However, subcapsular accumulation of the CM was also seen around both kidneys but not in the renal parenchyma or in the retroperitoneal space.

The final imaging diagnosis was that a soft- tissue membrane arising from the bladder wall was partially occluding the lumen of the trigone immediately cranial to the ureterovesical junctions.

Surgery was planned to remove the membrane-like structure. A cystotomy was performed on the ventral wall of the urinary bladder and an intraluminal division was identified in the bladder neck. This division was

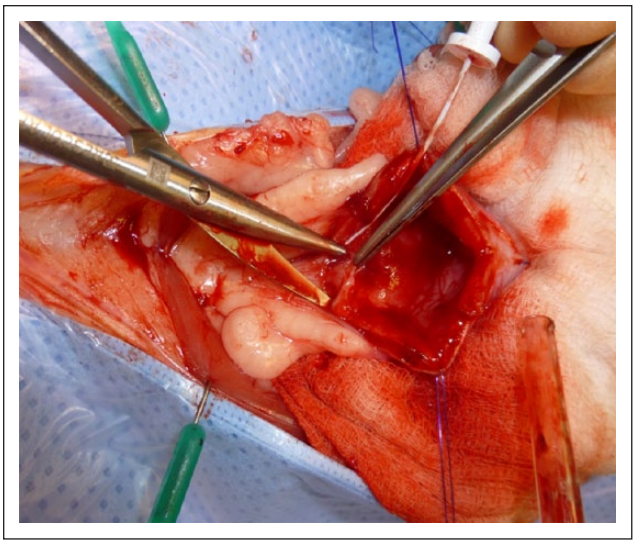

Figure 7 Intraoperative picture. The patient is in a ventrodorsal position. Cranial is to the right of the image. The membrane-like structure localised at the urinary bladder neck is demonstrated with the surgical tweezers. This division was resected en bloc

resected en bloc. The ureters were identified immediately caudal to this membrane (Figure 7).

A urinary catheter was passed in a retrograde fashion into the urinary bladder and remained in place for 4 days. The cystitis was treated with amoxicillin/clavulanic acid (20 mg/kg q12h PO for 7 days); in addition, buprenorphine (Buprecare; Animalcare) 20 µg/kg q8h sublingually and meloxicam (0.05 mg/kg q24h PO) were given for 5 days. After surgery, there was slight improvement of the clinical signs, but the cat remained incontinent.

The histopathological study of the excised membrane-like tissue consisted of dense, moderately inflamed, highly vascularised, exuberant fibrous connective tissue. This was discontinuously covered by transitional epithelium. The urinary bladder wall showed severe hypertrophy of the muscle layer and mild atrophy of the submucosal and mucosal layers.

Follow-up ultrasound was performed 4 weeks after surgery. Recurrence of the membrane was evident. A repeat urinalysis, including culture, was unremarkable.

Owing to the postoperative recurrence of the membrane, balloon dilatation was performed (Figure 8). A percutaneous guide wire was placed in a normograde fashion into the bladder and attempts were made to pass the wire down the urethra. Unfortunately, it was not possible to pass the guidewire through the membrane to enter into the trigone and proximal urethra. An introducer and vascular sheath was then placed in the urethra in a retrograde fashion. The guidewire was then inserted through the introducer, across the membrane and into the bladder. An 8.0 mm balloon catheter (40 mm in length; Infinity Medical) was then introduced over the

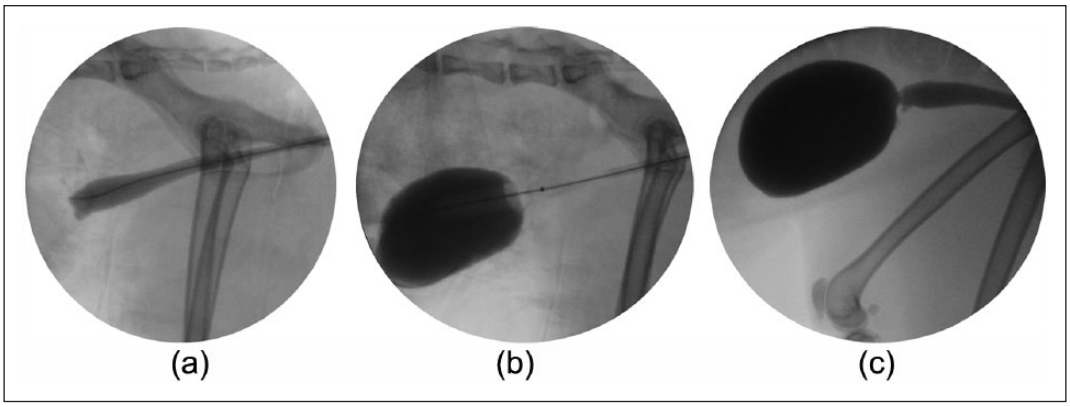

Figure 8 Fluoroscopic-guided balloon dilatation procedure. (a) Retrograde urethrogram with guided wire showing abrupt termination of the contrast medium at the level of the bladder neck. (b) Balloon dilatation procedure: the dilated balloon is seen at the level of the bladder neck. The balloon was dilated and maintained for 30 s before being removed. Contrast medium (CM) is filling the urinary bladder. (c) Retrograde vaginourethrocystogram after balloon dilatation. CM fills the urethra and urinary bladder

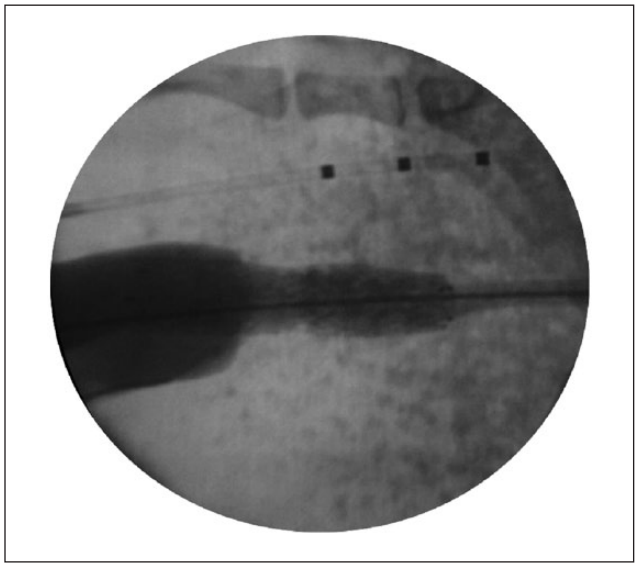

Figure 9 The proximal urethra and trigone stented with a 10 × 40 mm self-expanding nitinol stent. Part of the stent extends into the bladder lumen

guidewire, within the sheath, into the bladder, with the balloon seated across the membrane-like lesion. The balloon was dilated and maintained for 30 s before being removed. A retrograde urethrocystogram was then performed with the aid of the vascular sheath. A small, patent lumen was visible across the lesion. The balloon dilatation treatment was repeated with a 10.0 mm balloon catheter. A repeated urethrocystogram showed satisfactory patency across the trigone. The guidewire and the vascular sheath were removed.

After balloon dilatation, abdominal ultrasonography was performed. The membrane-like lesion was not visualised and from this point, treatment with prednisolone (Prednisolone; Actavis) 1.4 mg/kg q24h PO was started.

Two weeks later, abdominal ultrasonography was repeated and again revealed the presence of a membrane. Recurrence was apparent after each of five ballooning treatments performed at weekly intervals. At that time, the decision was made to place a nitinol stent (Infinity Medical) in the bladder trigone and proximal urethra (Figures 9 and 10).

For the procedure, the membrane was dilated with a balloon to 8 mm before a 10 × 40 mm self-expanding nitinol stent was deployed across the proximal urethra and the trigone.

There was no evidence of incontinence overnight and urination was normal. However, multiple episodes of stranguria were observed. These were probably explained by mechanical cystitis secondary to stent placement and surgery. Follow-up ultrasonography performed the next day showed no signs of renal pyelectasia. Urine culture at that time showed growth of *Enterococcus* species that was sensitive to amoxicillin/clavulanic acid. The cat was discharged with prednisolone (1.4 mg/kg q24h PO for 5 days) and amoxicillin/clavulanic acid (20 mg/kg q12h PO for 4 weeks).

Six weeks after surgical stent placement, the cat showed no signs of urinary incontinence. On abdominal ultrasonography irregular, hypoechoic tissue was seen encircling the stent and protruding into its lumen, narrowing it (Figure 10). Urine culture, taken at this time, was negative.

Follow-up information was obtained by telephone interview of the owner. Neither urinary incontinence nor other abnormalities were reported 5 months post-treatment.

Discussion

This case report describes the diagnosis and treatment of a membrane-like structure in the bladder neck of a

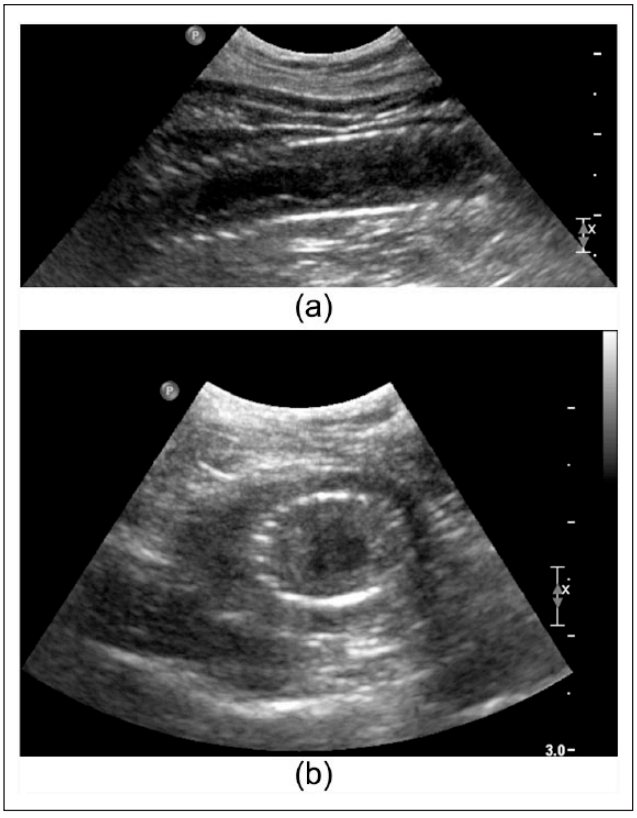

Figure 10 (a) Sagittal ultrasonographic image of the bladder neck and proximal urethra 8 days after placement of a metallic intravesical stent. Irregular soft tissue is seen encircling the stent and protruding slightly into its lumen. (b) Transverse ultrasonographic image of the bladder neck and proximal urethra 6 weeks after placement of a metallic intravesical stent. Irregular soft tissue is still seen encircling the stent and protruding slightly into its lumen

young adult female cat, which caused partial obstruction of the urinary bladder.

Unfortunately, the final histopathological study of the membrane was not able to differentiate whether the lesion was congenital or acquired.

Benign obstructions of the trigone and urethra are most typically associated with urethral strictures from either urethral tears, vehicular trauma or chronic obstructions by uroliths.[1] Mechanical obstructions secondary to calculi, strictures and neoplasia often require intervention to re-establish urine outflow.[2]

It has also been described that exuberant fibrous connective tissue can form secondary to chronic cystitis. Pseudomembranous cystitis associated with feline urinary outflow obstruction has been previously described.[3] In that case series, ultrasonography showed numerous hyperechoic stripes, resembling membranes, and histopathology revealed major and unusual inflammatory changes.

From the clinical history and diagnostic findings, it cannot be concluded accurately whether the lesion described here had a congenital or acquired origin, and whether cystitis was the cause or the consequence of the obstruction. However, owing to the age of the cat, the early clinical presentation (since 9 months of age) and the ultrasonographic appearance of the membrane (single and smooth), in our opinion, congenital disease is more likely than an acquired process.

The recommended treatment for urethral strictures depends on the location and cause of the stricture. Surgery is the most common treatment, and its most frequent complication is re-stricture.[4] In this case, 2 weeks postoperatively, re-stricture of the bladder neck was observed in the same location.

Fluoroscopic-guided balloon dilatation of the bladder neck was then chosen as a treatment option. Balloon dilatation is a relatively safe and simple therapy for the management of strictures. It has been successfully used in veterinary patients with oesophageal strictures and for pulmonic valve dilatation.[5,6] It has also been described for the treatment of urethral strictures in three canine case reports.[5,7,8] Potential complications of this technique include the inability to dilate the stricture, recurrence of the lesion, trauma to ureteral–vesical junctions, and tearing or rupture of the bladder. In this case, fluoroscopic guidance allowed visualisation of the passage of the balloon catheter and correct placement in the stricture site, which minimised the risk of urethral trauma during the procedure and confirmed correct balloon placement.[5]

The total time for balloon dilatation used in this case (30 s) was previously described in a female dog using cystoscopic-guided balloon dilatation.[7] Variable dilatation times have been previously reported for urethral strictures, ranging from 15 s in a female dog[7] to 5 mins in a male dog[5] and in humans. A balloon dilatation times of 1–1.5 mins have been described in endoscopic balloon dilatation of benign oesophageal strictures in dogs and cats. The short dilatation period was performed in the present case to minimise the possible trauma of the wall and ureterovesical junction.

In this case, after five sessions of fluoroscopic-guided balloon dilatation of the bladder neck, recurrence of the stricture was observed. The reason for this could be the formation of scar tissue secondary to trauma (previous surgery and/or ballooning procedure). As previously described, prednisolone was used during ballooning treatment to minimise scarring following balloon trauma.

Finally, placement of a self-expanding metallic stent into the urinary bladder neck was performed. Urethral stents are used for the relief of benign or malignant obstructions in the trigone or urethra in dogs and cats.[1,2,9,10] Potential complications of this treatment include soft tissue growth through the stent, obstruction of the ureterovesical junctions with secondary hydronephrosis, urinary incontinence, infection, dysuria, stent migration and breakage.

A gradual soft- tissue growth was observed encircling the stent and slightly protruding into its lumen. This tissue was not causing clinical signs 5 months after placement of the metallic stent but might cause complications in the future. Owing to the limited follow-up period, the longer-term outcome remains uncertain.

In a previous case report in which a metallic stent was used to relieve malignant urethral obstruction in a male cat, urinary incontinence was evident immediately after stent placement, but continence was regained within 10 days of stent placement.[11] The difference could be due to the different gender of the patients, because in the previous reported case the stent was placed across the preprostatic and prostatic portions of the urethra, which may have contributed to initial incontinence.[11] In another previously study describing stent placement in 12 dogs with malignant urethral obstruction, not all of the dogs developed urinary incontinence after stent placement.[9] In a further study of stent placement for benign urethral obstruction in dogs, 12.5% of dogs were severely incontinent after the procedure.[10] In a case series evaluating nine cats for benign and malignant urethral obstruction, 100% of obstruction relief was described, but 25% of these cats developed severe urinary incontinence after stent placement.[2]

One unexpected finding was the presence of subcapsular CM in the first retrograde urethrocystogram and on the CT. The reason for this remains unknown, as it has not been previously described. However, it was considered likely that the presence of subcapsular contrast was due to high renal intrapelvic pressure secondary to retrograde vaginourethrocystography against the obstructing bladder membrane.

Conclusions

This case report describes the presence of a membrane-like structure causing partial obstruction of the bladder neck–urethra in a young adult female cat, and different therapeutic options. The outcome suggests that stent placement can be a viable palliative treatment in cats with benign urinary obstruction. Further studies are required to assess the suitability of fluoroscopic-guided balloon dilatation of the bladder neck for the treatment of non-neoplastic urethral/bladder neck strictures in cats.

Acknowledgements The authors would like to acknowledge the help and support provided by Kelly L Bowlt Blacklock of the Animal Health Trust during the treatment and diagnosis of the cat described in this report.

Conflict of interest The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding The authors received no financial support for the research, authorship, and/or publication of this article.

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