

Temporary Penile urethral stent placement procedure as a treatment of penile urethral obstruction in Intact Tom Cats

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ABSTRACT

Objective: The treatment of penile urethral obstruction in Tom Cats with no response to catheterization by placing a temporary urethral stent to avoid going through perineal urethrostomy or preputial urethrostomy.

Design: Case Study (April 2015 – June 2021)

Animals: 14 Intact Tom Cats.

Procedures: In the current study, fourteen male cats with obstructed urethras with no response to catheterization were subjected to intervention using a temporary urethral stent. Cases were observed for 10 days postoperative, monitoring blood creatinine level after operations and cases had follow up visits for a year on monthly basis for checkup the subjects' lifestyle.

Results: The procedure was successfully performed, and cats restored their normal lifestyle. Unfortunately, 2/14 cases died at days 9 and 11 after the operation. Both cases show no decrease in blood creatinine levels at day 2 and day 4 after operation as other subjects did.

Conclusion and clinical relevance: Temporary penile Urethral stent provided a fast less complicated solution for intact tom cats from urine retention with subjects going back to their normal lifestyle after 10 days, avoiding going through perineal urethrostomy or preputial urethrostomy. Temporary Urethral stent could be considered as a treatment for penile urethral obstruction before going to perineal urethrostomy or preputial urethrostomy for treatment penile urethral obstruction.

Key words: Urethral stent, cat, Treatment, Urethral obstruction

1. INTRODUCTION

Urological illnesses are commonly seen with cats at veterinary clinics or Hospitals, involving over 7% of the feline case load [1]. A study examining obstructed cats had 59% of cases with urethral plugs and 12% with uroliths. and the other 29 %, with no specific cause [2]. on the other hand, a different study with non-obstructed cats have urolithiasis in approximately 13% of cases and the underlying cause of urinary tract symptoms could not be identified in about 64% of its cases [3]. If causes cannot be identified, idiopathic lower urinary tract disease always considered. Urethral calculi can result in either a complete or partial urethral obstruction which is more frequently diagnosed in male cats more than female cats. mostly at the junction of the intrapelvic and penile urethra in male cats. [4]. Patients could develop post renal uremia and hyperkalemia, depression, and vomiting. also, urinary bladder rupture [4]. Where there is no response to catheterization with penile urethral obstruction, veterinary surgeons normally go to perineal urethrostomy technique in which the urethra was sutured to the perineal skin, with castration and penis amputation [5]. Perineal urethrostomy complication rates vary from 13 to 25% and from 20 to 42% in the short and the long term, respectively, with mortality rates of up to 24% [6].

All over the years it has been reported that (>97%) of stones that are submitted for analysis had been removed from the lower urinary tract specifically the penile urethra, causing

obstruction in male cat, which they were Struvite stones by 48.6% of the cases and Calcium oxalate stones by 40.8% and Urate in 4.9%.[7].

This current study was delineated to demonstrate an alternative technique using urethral stent in order to maintain normal lifestyle and sexual activities of tom cats.

2. MATERIALS AND METHODS

2.1. Subjects

Fourteen male cats with obstructed urethras with no response to catheterization were used in the current study after having an informed written consent from the owners of the animals was taken. All Institutional and National Guidelines for the care and use of animals were followed.

Seven Persian, Fluffy 3 years 3.1 KG Body weight, Snowball 2 years, 4 KG Body weight. Tayeb 3 years 2.5 KG Body weight, Ricko 1 year 2.8 KG Body weight, Meshmesh 5 years 7.2 KG Body weight, Icey 7 years 4.5 KG Body weight and Lilo 3 years, 5.3KG body weight. 3 Egyptian Mao, Gamal 5 years 2.6 KG Body weight, Besbes 2 years 3 KG Body weight, and Sultan 1.5 years 2 KG Body weight. 3 Mix breads, Bondouq 2 years 3.7 KG Body weight, Chixy 4 years 3.7 KG Body weight and Casper 1 year 2 KG Body weight. and 1 Siamese with no name at the age of 1 year at operation time 3 KG Body weight (Table 1).

2.2. Anesthesia

Atropine sulphate at a dose of 1 ml/ 9 kg subcutaneously, followed by i.v. administration of Ketam (ketamine hydrochloride, of Eipico pharmaceuticals, at a dose of 11 mg/kg, using KRUISE Moduflex Coaxial anaesthesia machine. Anesthesia was maintained using Forane (isoflurane, Abbot pharmaceuticals, 1-3 %) with oxygen flow at 20 ml/kg/min.

2.3. Urethrotomy

Midline incision was made 5 mm below the glans using No 15 surgical blade until just before the bulbus glandis including the prepuce. (Figure 1- A). then the pulling of the outer skin layer laterally for better vision of the retractor preputial muscle as it shows in (Figure 1, B), This is followed by releasing the surrounding connective tissue from the urethra. The retractor preputial muscle is retracted laterally to visualize the urethra (Figure 1 -C). The urethra is then incised with a No. 11 blade over the stones (Figure 1- D). The stones are removed, and urinary catheter is placed inside the urethra, (Figure 2 -A) shows holding the tip of the catheter gently with a mosquito forceps and takes it towards the caudal opening of the urethra. While (Figure 2-B) shows the tip of catheter goes inside the caudal opening of the urethra. Then pull another part of the catheter (1 cm) gently and take it towards the caudal opening of the urethra as it shows in (Figure 2-C), at (Figure 2-D) the insertion of another (1cm) of catheter in the caudal opening of the urethra.

The urethrotomy is then closed with 5-0 Vicryl absorbable sutures in a simple continuous pattern using the magnifying loop glasses, to easily identify the edges of the urethra. Figure 3-A identifies the edges of the urethra, and the arrow is pointed at the edge of the urethra. while at (Figure 3-B) start with the first stitch using 5/0 Vicryl from the top of the incision. (Figure 3-C) shows that after 1st stitch, stretching of the penis upward to narrow the edges of the urethra for a better vision of the site. The arrow is pointed at the edges of the urethra. At (Figure 3-D) will carry Continues stitches till the end of the incision.

The corpus spongiosum surrounding the urethra as well as the connective tissue and the Tunica Albuginea were stitched using 5/0 Vicryl (Figure 4 -A) shows the starting to stitch the thin layer of corpus spongiosum surrounding the urethra as well as the connective tissue and the Tunica Albuginea. While (Figure 4-B, C, D) shows the continues pattern that will close the rest of those layers.

Skin and prepuce were sutured with simple continues stitches from caudal towards cranial all the way up using 3/0 Vicryl, as it shows (Figures 5 -A) starting of 1st stitch from right edge of prepuce skin using 3/0 Vicryl. (Figure 5-B) shows the insertion of needle to the left edge for the 1st stitch. At (Figure 5-C) starting 2nd stitch from right edge. While at (Figure 5-D) insertion of needle to the left edge of prepuce.

2.4. Postoperative care

Patients were hospitalized for 10 days; Cefotaxime 125 mg IM injection were administered every 12 hours to all patients for 7 days as well as Gentamycin topical antibiotic cream was applied at the stitches for 10 days after operation. The Patients wore E. collars for the 10 days. Intravenous fluids were administered as well as Halpaperol 0.4 mg tablet twice per day to dissolve stone residues. Monitoring of creatinine within the 1st week was conducted.

At (Figure 6-A) will see the healing after 2 days, while at (Figure 6-B) could see the healing after day 4. Stent was removed and subjects were dismissed from clinic 10 days after operation with normal lifestyle and normal urination.

2.5. Follow up

12 Follow up visits for a year on monthly basis for checkup the subjects' lifestyle, site of the operation and their diet change has been carried out.

2.6. Statistical analysis

Statistical analysis was performed using the International Renal Interest Society (IRIS) staging system for feline chronic kidney disease, the mean creatinine level in the pre operation was significantly high than both at two days PO and four days post operation ($P < 0.001$). Meanwhile, the creatinine level at two days PO differs from that at four days PO ($P < 0.05$) (Table 1, Figure 7). In the current study, 5 cases were in stage 4 at the time of the operation (Table 1, Figure 7). The creatinine levels of the two dead cases did not fall. Three cases showed decrease in the creatinine levels to nearly half (2.9 mg/dl, 3.7 mg/dl, and 2.4 mg/dl) of the pre-operative levels at day 4 after the operation (Table 1, Figure 7). six cases were in stage 3 at the time of the operation, two cats went down to (Stage 2), while four of them went down to stage 1 below 1.58 mg/dl at day 4 PO (Table 1, Figure 7). There were three cases in stage 2 at time of operation, two of them remained in stage 2. While one moved to stage one by going down from 2.8 mg/dl to 1.3 mg/dl. (Table 1, Figure 7).

3. RESULTS AND DISCUSSION

Fourteen intact male cats with obstructed urethras with no response to catheterization had subjected to bladder rupture, postrenal uremia and hyperkalemia underwent this procedure starting from April 2015 until June 2021. Surgical procedure was successful with all fourteen cases, as urethral stent was successful in treating obstructed penile urethra and maintain urine flow normally and subjects restored their normal lifestyle 10 day after the operation. Figure 8 shows Fluffy, (Persian Cat had his procedure at April 2015) after 6 years with no scar and perform his normal lifestyle

Times of urine retention before operation ranged from one to four times, while blood creatinine levels varied between 2.5 to 10.28 mg/dl (Table 1).

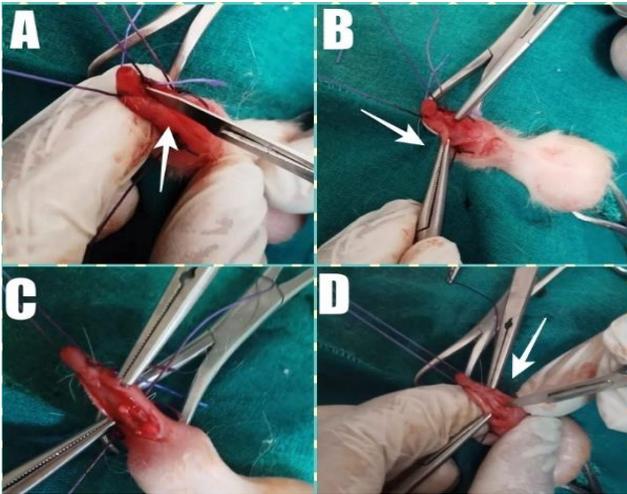


Figure 1. Icey is A 7 years Persian male tomcat with penile urethral obstruction. The incision of the skin, prepuce and urethra. a) incision was made 5 mm below the glans using N_o15 surgical blade until just before the Bulbus Glandis including the prepuce. b) pull outer skin layer laterally for better vision of the retractor preputial muscle. c) The retractor preputial muscle is retracted laterally to visualize the urethra. d) The urethra is then incised with a N_o.11 blade over the stones.

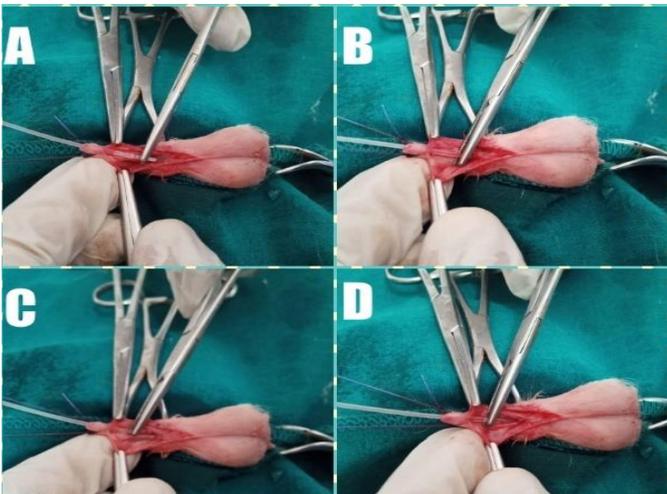


Figure 2. Placing of catheter in the penile urethra: a) holding the tip of the catheter gently with a mosquito forceps and takes it towards the caudal opening of the urethra. b) tip of catheter goes inside the caudal opening of the urethra. c) pull another part of the catheter (1 cm) gently and take it towards the caudal opening of the urethra. d) insertion of another (1cm) of catheter in the caudal opening of the urethra.

Two Persian Cats had died later. Both showed urine retention for the fourth time with Ca Oxalate stones. The first case, a 5-years-old Male Cat, showed a blood creatinine level 7.8 mg/dl at time of operation, had died 9 days after the operation. The second case is a 3-years-old Male Cat with blood creatinine level 10.28 mg/dl had died 11 days after the operation. Both cases show no decrease in blood creatinine levels at day 2 and day 4 after operation (Table 1).

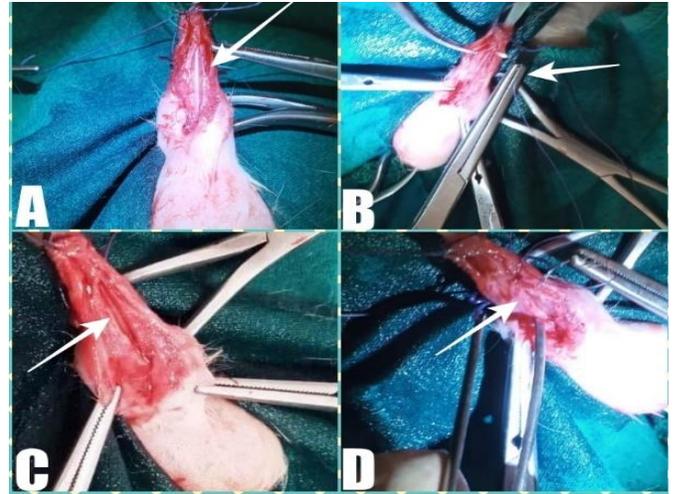


Figure 3. Urethral anastomosis of penile urethra: a) using the magnifying loop glasses with the light on to identify the edges of the urethra, arrow pointed at the edge of the urethra. b) First stitch using 5/0 Vicryl from the top of the incision. c) after 1st stitch stretching of the penis upward to narrow the edges of the urethra for a better vision of the site. The arrow is pointed at the edges of the urethra. d) Continues stitches till the end of the incision.

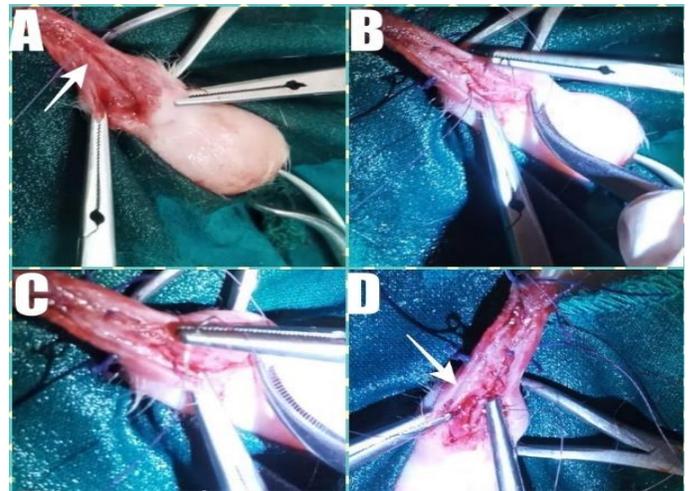


Figure 4. Stitching of corpus spongiosum, connective tissue and Tunica Albuginea. starting to stitch the thin layer of corpus spongiosum surrounding the urethra as well as the connective tissue and the Tunica Albuginea using 5/0 Vicryl. b, c, d) continues pattern will close the rest of those layers.

The Temporary penile urethral stent placement procedure cleared the blockage of penile urethra, relieved urine retention, insured the healing of the urethra normally and blood creatinine levels were noticeably decreased for 12 living cases post-operative.

The site of surgery for Temporary urethral stent placement is different than the most common Perineal urethrostomy and preputial urethrostomy procedures as the corpus spongiosum surrounding the urethra consists of plexus of large caverns tissue surrounded by connective tissue [9], so the incision was made 5 mm after the glans penis, as in (Figure 1-A). while cross section of the penis body showed three distinct layers of

connective tissue, the first layer under the skin is thick tunica albuginea, the second layer is well vascular innervated connective tissue. [9] The third layer of dense irregular connective tissue which sent trabeculae to form the network of cavernous tissue of single corpus cavernosum. In (Figure 1-C) show the releasing of the surrounding connective tissue from the urethra, the corpus cavernosum has cavernous tissue with adipose connective tissue and supported by collagen bundles [9]. The urethra located ventrally to the corpus cavernosum and surrounded by thin distinct layer of corpus spongiosum, that is where the incision made as in (Figure 1-D) Ventrally to the urethra there was a thick bundle of smooth muscle of retractor muscle. Which is retracted laterally to visualize the urethra (Figure 1 -C) the penis skin showed no hair follicles which is clear at (Figure 1-A) during the incision or at (Figure 4-B, C,D). The root of penis was composed of two crura, each has composed of thick bundles of skeletal muscle housed the secretory units of bulbourethral gland [9].

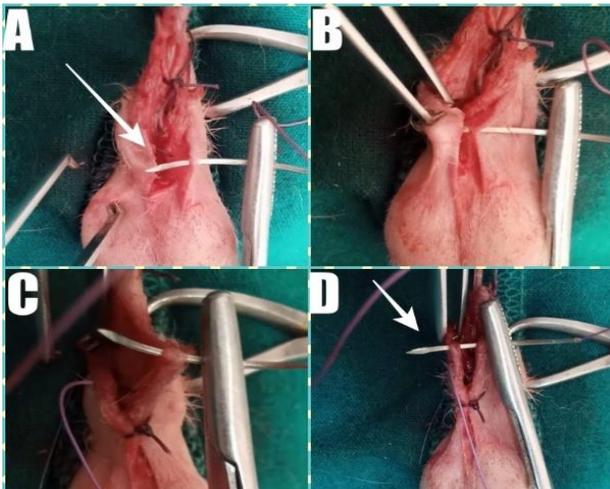


Figure 5. Stitching penile skin and prepuce: a) starting of 1st stitch from right edge of prepuce skin using 3/0 Vicryl. b) insertion of needle to the left edge for the 1st stitch. c) starting 2nd stitch from right edge. d) insertion of needle to the left edge of prepuce.

On the other hand, Perineal urethrostomy create permanent urethral opening between the pelvic urethra and the perineal skin, indicated in cases with no response to catheterization [8] which has reports of complication rates 13–25% and 20–42% in the short and long term respectively. as urinary tract infection, subcutaneous urine leakage, urinary incontinence, and perineal hernia. [10-14] also bacterial cystitis [12, 15-16]. and the risk of the urethral branches of the pudendal nerve could be injured during surgery [17-19]. None of these complications were reported in the current Temporary urethral stent placement procedure. Also, Perineal urethrostomy mortality rate was reported to be up to 24% [8]. while, in the current study 2 out of 14 cats (entering the study with stage 4 renal failure) died after the operation in the current study (14%). on the other hand, prepubic urethrostomy

is a technique deals with a failed perineal urethrostomy, irreparable injury of the intrapelvic urethra or congenital narrowing of the intrapelvic urethra,[8]. is associated with significant complications as urine scalding, skin necrosis and urinary incontinence [20-23]. No records of any of such side effects with any of the current study subjects. The possible cause of death for the two tom cats died at this study at day 9 and day 11 after the operation is renal failure as both were in stage 4 renal failure and their creatinine failed to decrease after operation and both cases had experienced the 4th time of urine retention before operation.

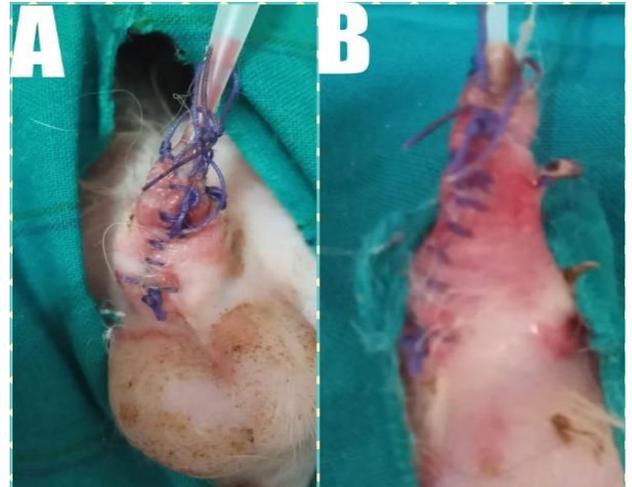


Figure 6. The healing of the outer skin layer after the operation. a) shows the healing after 2 days of the operation. b) shows the healing after 4 days.

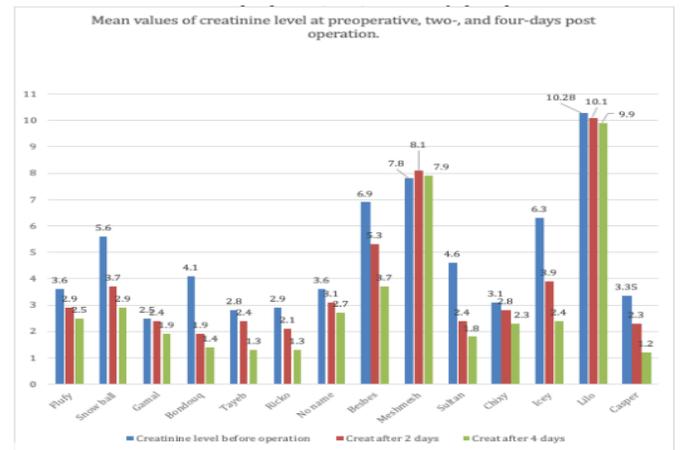


Figure 7. Mean values of creatinine level at preoperative, two-, and four-days post operation. Notice The creatinine levels of the two cases did not fall. And 12 cases went down.

The Temporary penile urethral stent placement procedure treated the obstruction in all cases, and they did not have to go through perineal urethrostomy nor prepubic urethrostomy to relieve the urine retention, as this procedure succeeded in keeping all males intact and no short term nor long term complications was noticed with 12 living subjects. Although

dietary change is very important to prevent the formation of stones once again.



Figure 8. Flufy after 6 years of the operation: Flufy is a Persian male had his operation at April 2015, at this photo showing no scar at the site of the procedure.

Table 1. Demographic data of cats with information type of stones, creatinine level as well as Details.

| Ref No | Name | Date of Operation | Breed | Age at Operation | Times of urine retention | Creatinine level before operation (mg/dl) | Type of Stone | Creat after 2 days mg/dl | Creat after 4 days (mg/dl) | Out come |
|--------|----------|-------------------|---------|------------------|--------------------------|---|---------------|--------------------------|----------------------------|----------------|
| 494 | Flufy | 04/2015 | Persian | 3 years | 1st | 3.6 | Ca oxlt | 2.9 | 2.5 | A live |
| 2805 | Snowball | 06/2015 | Persian | 2 years | 3rd | 5.6 | Ca oxlt | 3.7 | 2.9 | A live |
| 2428 | Gamal | 12/2015 | Mao | 5 years | 1st | 2.5 | Ca oxlt | 2.4 | 1.9 | A live |
| 2986 | Bondouq | 05/2016 | Mix | 2 years | 1st | 4.1 | Ca oxlt | 1.9 | 1.4 | A live |
| 2795 | Tayeb | 12/2016 | Persian | 3 years | 2nd | 2.8 | Ca oxlt | 2.4 | 1.3 | A live |
| 1849 | Ricko | 08/2017 | Persian | 1 year | 1st | 2.9 | Struvite | 2.1 | 1.3 | A live |
| 3435 | No name | 10/2018 | Siamese | 1 year | 1st | 3.6 | Ca oxlt | 3.1 | 2.7 | A live |
| 3840 | Besbes | 04/2019 | Mao | 2 years | 3rd | 6.9 | Struvite | 5.3 | 3.7 | A live |
| 2898 | Meshmesh | 12/2019 | Persian | 5 years | 4th | 7.8 | Ca oxlt | 8.1 | 7.9 | Died at day 9 |
| 2517 | Sultan | 06/2020 | Mao | 1.5 years | 2nd | 4.6 | Struvite | 2.4 | 1.8 | A live |
| 3558 | Chixy | 12/2020 | Mix | 4 years | 2nd | 3.1 | Ca oxlt | 2.8 | 2.3 | A live |
| 4883 | Icey | 04/2021 | Persian | 7 years | 2nd | 6.3 | Ca Oxlt | 3.9 | 2.4 | A live |
| 2854 | Lilo | 06/2021 | Persian | 3 years | 4th | 10.28 | Ca oxlt | 10.1 | 9.9 | Died at day 11 |
| 4907 | Casper | 06/2021 | Mix | 1 year | 1st | 3.35 | Ca oxlt | 2.3 | 1.2 | a live |

Conclusion

The Temporary penile urethral stent placement procedure should be considered as a promising approach for the treatment of penile urethral obstruction with no response to catheterization avoiding going through perineal urethrostomy or preputial urethrostomy, saving tom cats all complications reported with the two procedures.

The Temporary urethral stent placement procedure provided a fast less complicated solution for intact tom cats from urine retention with subjects going back to their normal lifestyle after 10 days.

Tom cats with penile urethral obstruction has a good chance to experience normal life after The Temporary penile urethral stent placement procedure specially with diet change.

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Conflict of interest statement

The authors declare no conflict of interest.

Animal ethics committee permission

Fourteen male cats with obstructed urethras with no response to catheterization were used in the current study after having an informed written consent from the owners of the animals was taken. All Institutional and National Guidelines for the care and use of animals were followed.

Authors' contribution

Houssam H. Abdelrehim had planned for the case study carried out the surgical procedures, follow up over postoperative care and lab analysis; Reham N. Alsamanody had assisted in all surgical procedures, carried out postoperative care for all cases; Asmaa A. Abdelmoteleb assisted in all surgical procedures carried out all lab analysis.

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