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Case Report

Perineal Urethrostomy Technique Used for Surgical Management of Recurrent Urethral Obstruction in a Cat

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Abstract

A 6 year old neutered male Domestic Short Hair (DSH) cat weighing 5.1kg presented with an acute history of stranguria, vocalisation and severe discomfort. His inability to urinate and the distended urinary bladder easily palpated in the abdomen were consistent with urethral obstruction (UO). A lateral abdominal radiograph shows an enlarged urinary bladder with no evidence of radiopaque uroliths. Complete blood count (CBC) and serum biochemistry resulted unremarkable. The cat was hospitalised for intravenous fluid therapy (IVFT) and anaesthetised in order to place an indwelling urinary catheter. The two attempts to remove the urinary catheter resulted in reoccurrence of the UO within 24 hours therefore advice was given to manage the case surgically. A perineal urethrostomy (PU) was performed. The predisposing factors for UO in cats are discussed as well as the risk of reoccurrence after medical treatment. Both the medical and surgical approach for the management of the condition are compared to highlight the long-term outcome and any potential complications.

Keywords: *Domestic Short Hair (DSH); Urethral Obstruction (UO); Complete Blood Count (CBC); Intravenous Fluid Therapy (IVFT); Perineal Urethrostomy (PU)*

Introduction

Feline lower urinary tract disease (FLUTD) is a term used to describe a variety of disorders characterised by clinical signs such as periuria, hematuria, pollakiuria, stranguria and/or urinary obstruction [1].

In most cases, the urethral obstructions don't present a specific cause and are idiopathic, they may be induced by matrix-crystalline plugs or urolithiasis and, rarely, are associated with bacterial infections [2]. The UO is reported to occur more commonly in young and, almost exclusively, male cats due to their relatively long and narrow urethra [3]. The diagnosis relies on physical examination findings such as a palpably firm, unexpressable urinary bladder and behavioural demonstrations consistent with the inability to urinate [4]. Therapy consists of emergency measures to correct life-threatening electrolyte abnormalities and perfusion deficits, followed by efforts to re-establish urine flow [5]. Further medical management may include treatment of urinary tract infection (UTI), dietary recommendations for the dissolution of urocystoliths and/or crystals and prevention of their reformation [6].

PU creates a permanent opening between the pelvic urethra and skin in the perineal region [7] and may relieve UO in patients where medical management does not suffice [8].

Case History

A 6 year old neutered male DSH cat presented on the 11th of April 2017 with a 12 hour history of stranguria, vocalisation and excessive grooming of the perineum. The owner reported frequent non-productive visits to the litter tray where the discomfort and the effort to urinate were evident. There had been no previous concerns related to the urinary tract in this otherwise healthy cat.

Clinical examination

On presentation the cat was bright, alert and responsive. It had a body condition score of 6/9 [9] and weighed 5.1 kg. The heart rate was 160 beats per minute in regular sinus rhythm with no audible murmur. Respiratory rate was 32 breaths per minute and the rectal temperature was 38.5°C. These findings were considered to be unremarkable. Following Boag and Hughes' classification [10], dehydration was calculated as 5% of the cat's body weight. On palpation the urinary bladder was turgid and distended and gentle attempt to express it produced no urine flow.

Diagnostic techniques

Blood was collected for CBC, serum biochemistry and total solids. Apart from a very slight raise in the blood glucose level, considered to be clinically irrelevant, the remaining results were within the reference limits (Table 1 and 2).

A plain right lateral abdominal radiograph demonstrated an overdistended urinary bladder with no evidence of radiopaque uroliths within the urinary tract (Figure 1).

During urethral catheterisation a sterile urine sample was collected. The urinalysis supported the presence of struvite crystals and epithelial cells associated with marked hematuria and proteinuria in an alkaline urine. There was no bacterial growth (Table 3).

Test	Result	Reference value
RBC	8.25	6.54 - 12.20 x 10^12/L
Haematocrit	0.347	0.303 - 0.523 L/L
Haemoglobin	119	98 - 162 g/L
MCV	42.1	35.9 - 53.1 fL
MCH	14.4	11.8 - 17.3 pg
MHCH	343	281 - 358 g/L
Reticulocyte	27.2	3 - 50 K/µL
WBC	12.72	2.87 - 17.02 x 10^9/L
% Neutrophil	74.4	%
% Lymphocyte	15.2	%
% Monocyte	2.9	%
% Eosinophil	6.9	%
% Basophil	0.6	%
Neutrophil	9.47	1.48 - 10.29 x 10^9/L
Lymphocyte	1.93	0.92 - 6.88 x 10^9/L
Monocyte	0.37	0.05 - 0.67 x 10^9/L
Eosinophil	0.88	0.17 - 1.57 x 10^9/L
Basophil	0.07	0.01 - 0.26 x 10^9/L
Platelet	261	151- 600 x 10^9/L
MPV	18.8	11.4 - 21.6 fL

Table 1: *Complete blood count (CBC).*

Test	Result	Reference value
Glucose	8.96	4.11 - 8.84 mmol/L
Creatinine	118	71 - 212 µmol/L
Urea	9.6	5.7 - 12.9 mmol/L
Phosphorus	1.44	1.00 - 2.42 mmol/L
Calcium	2.43	1.95 - 2.83 mmol/L
Sodium	161	150-165 mmol/L
Potassium	3.8	3.5 - 5.8 mmol/L
Na:K Ratio	43	-
Chloride	113	112 - 129 mmol/L
Total protein	78	57 - 89 g/L
Albumin	29	22 - 40 g/L
Globulin	49	28 - 51 g/L
Albumin:Globulin Ratio	0.6	-
ALT	21	12- 130 U/L
ALP	40	14 - 111 U/L
GGT	1	0 - 4 U/L
Bilirubin - total	4	0 - 15 µmol/L
Cholesterol	4.03	1.68 - 5.81 mmol/L
Amylase	572	500 - 1500 U/L
Lipase	216	100 - 1400 U/L
Osmolality	326	mmol/kg
Total solids	65	65 - 80 g/L

Table 2: *Serum biochemistry.*

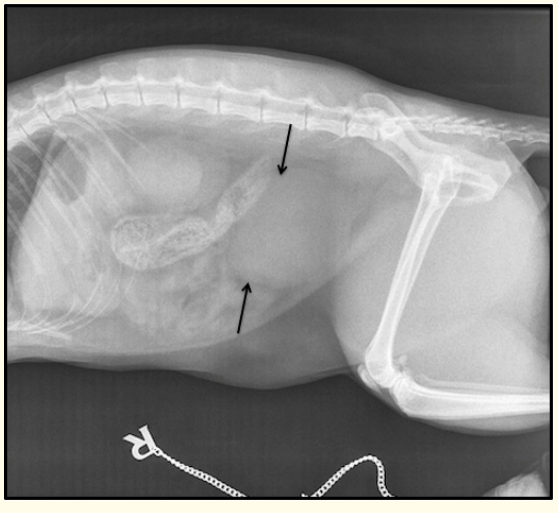

Figure 1: *Right lateral plain abdominal radiograph.*

The arrows point at the dorsal and ventral wall of an overdistended urinary bladder. There is no evidence of radiopaque uroliths within the urinary tract.

Physical properties	Chemical properties	Sediment analysis	Culture
Colour - red Transparency - clear Odour - slight odour of ammonia Specific gravity - 1.040	pH - 8 Protein - positive (+++) Glucose – negative Ketones – negative Bilirubin - negative Nitrites - negative Blood - positive (++++)	Leukocytes - 1 (0 - 5 high-power field (hpf)) Erythrocytes - > 200 (0 - 5 hpf) Casts - Not seen Crystals - 10 hpf STRUVITE Epithelial cells - 5 (0 - 5 hpf)	No growth

Table 3: *Urinalysis.*

Urinalysis consisted of physicochemical assessment with reagent strips (Dirui A10 reagent strips; Dirui), urine density by refractometry, analysis of urine sediment by optical microscopy and external culture and antibiogram.
For the sediment analysis an unstained and a stained (Sedi-stain®; Becton-Dickinson; Maryland) slides were examined.

Diagnosis

Based on the history, clinical signs and physical examination a diagnosis of UO had been made. Further evaluation was considered necessary in order to identify the cause of the obstruction and to acknowledge the presence of eventual metabolic derangements.

A list of possible causes of UO was taken into consideration (Table 4).

Anatomic	Functional
Urolithiasis Urethral plugs Neoplasia Urethral stricture (primary/iatrogenic) Post surgical/trauma Prostatic disease	Idiopathic FLUTD (urethral spasm and oedema) Reflex dyssynergia

Table 4: *Causes of urethral obstruction.*

The presence of a urethral plug occluding the urethral lumen was considered to be the most likely cause of obstruction based on the information collected from the history, radiograph and urinalysis, although it wasn't possible to quantify the degree of contribution of urethral spasm and oedema to this problem.

Treatment

The nature of the problem was discussed with the client. Medical management was advised and - in the absence of significant systemic imbalances - its goals were identified: to relieve the UO, defining afterwards a long-term plan to prevent reoccurrence. The prognosis was classified as good.

IVFT was initiated using a compound sodium lactate solution (Vetivex®11;Dechra; IV) at a rate of 4 mL/kg/hour in order to correct the dehydration over 24 hours, meeting the maintenance requirements. Meloxicam 2 mg/mL (Metacam®; Boehringer Ingelheim; 0.2 mg/kg IV) was administered.

An indwelling urinary catheter was placed under sedation (Diagram 1) and left in situ for 24 hours in order to flush the urethra and bladder hourly. The urine output was recorded (Table 5); post-obstructive diuresis, as described by Francis., *et al.* [11], wasn't documented.

Urine production (mL)	Time of collection (h)	Urine output (mL/kg/hour)
19	2	1.86
20	4	1.96
60	10	1.96
58	16	1.89
70	24	1.71

Table 5: *Urine output obtained during 24 hours of hospitalisation with indwelling urethral catheter and IVFT 4 mL/kg/hour. T0 (h) - placement of indwelling urinary catheter.*

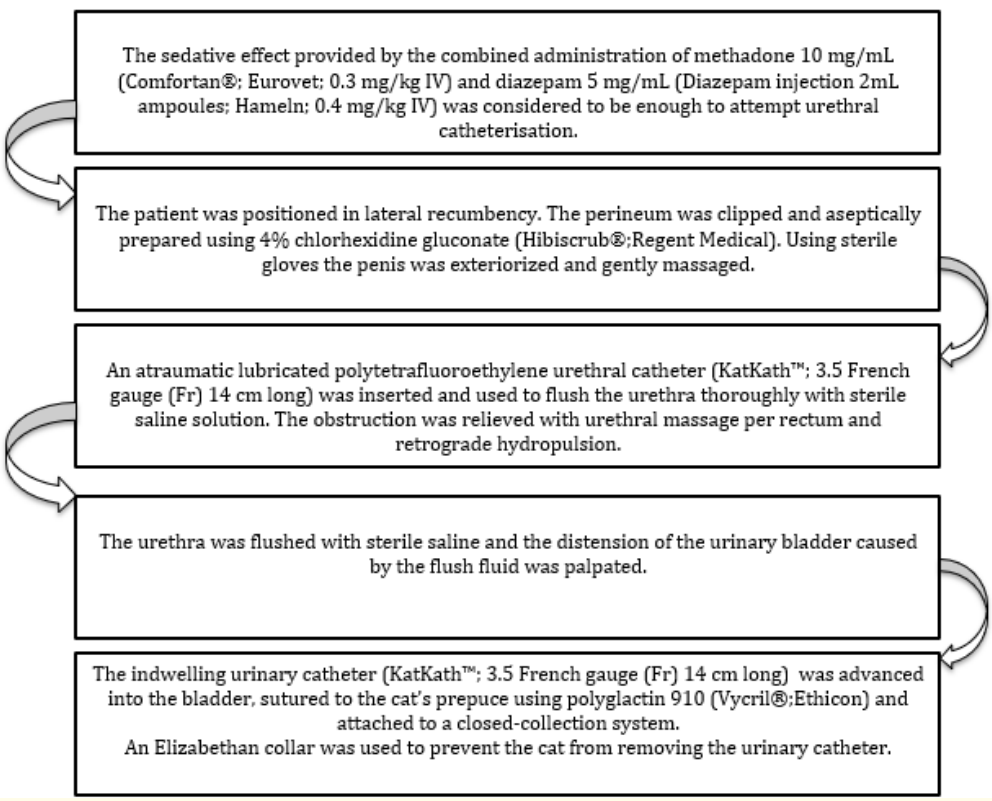

Diagram 1: *Urinary catheter placement procedure.*

The cat was maintained and discharged on buprenorphine 0.3 mg/mL (Vetergesic®; Alstoe; 0.02 mg/kg three times daily per os (PO)), meloxicam 0.5 mg/mL (Metacam®; Boehringer Ingelheim; 0.1 mg/kg once daily PO) and prasozin 1 mg (Hypovase®; Pfizer; 1 mg/cat twice daily for 7 days PO). As recommended by DePorter [12], a synthetic version of the naturally occurring feline facial pheromones (Feliway® Diffuser; Ceva) was used in the practice and was recommended at the time of discharge aiming to reduce underlying anxiety potentially contributing to the urinary signs.

One week later the cat was booked for an elective PU as the UO reoccurred twice despite extension of the urinary catheterisation period to 60 hours - (the protocol of treatment previously described was applied with no other modifications).

Euthanasia was discussed due to financial concerns but following informed consent the client decided to proceed with surgical treatment.

The perineal area and proximal tail were clipped and prepared for aseptic surgery using 4% chlorhexidine gluconate (Hibiscrub®; Regent Medical). The cat was positioned in sternal recumbency (Figure 2), a purse-string suture was placed in the anus and a urinary catheter (KatKath™; 3.5 French gauge (Fr) 14 cm long) was aseptically inserted in the urethra.

Figure 2: *Position of the patient for perineal urethrostomy.*

Perineal position with the legs hanging over the padded edge of the surgery table and the tail pulled forward.

An elliptical skin incision was made from just below the anus to include penis and prepuce (Figure 3). Blunt and sharp dissection were combined to separate the penis from its ventral attachments within the pelvic canal. The ventral penile ligament was transected with Metzenbaum scissors and digital pressure was gently applied to disrupt possible remnants of the ligament. The penile body was then reflected dorsally allowing identification of the paired ischiocavernous muscles. The ischial attachments of these muscles were bilaterally transected with tenotomy scissors.

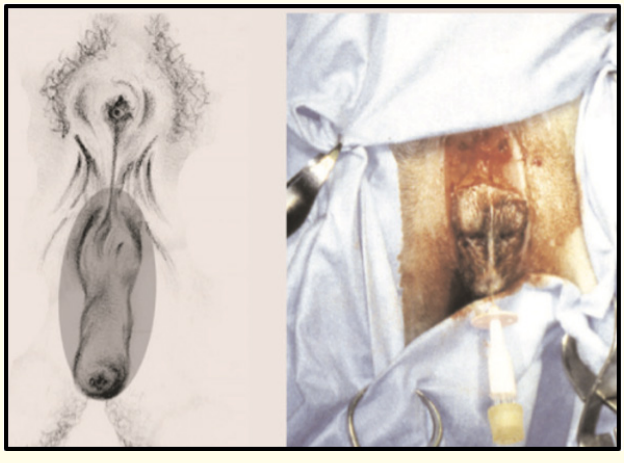

Figure 3: *Elliptical skin incision around the prepuce and scrotum.*

Illustration reproduced Williams J [13].

On the dorsal aspect of the penile body, the retractor penis muscle was identified and carefully dissected from the length of the dorsum of the urethra. The dissection was prolonged proximally until visualisation of the bulbourethral glands located on the dorsolateral aspect of the urethra. Digital examination of the ventral and dorsal dissection was performed ensuring the whole length of the penile urethra had been separated from surrounding tissues.

A longitudinal incision on the dorsal midline aspect of the urethra was then made using a scalpel blade number 11. This incision was extended with tenotomy scissors from the tip of the urethra up to the level of the bulbourethral glands. The urinary catheter was removed. The urethral diameter was tested by inserting a closed Halsted mosquito forceps into the opening. The hemostat tips were accomodated to the level of the boxlocks revealing an adequate width of the new stoma.

The urethral mucosa and skin were apposed in a simple interrupted pattern using 1.5 metric poliglecaprone 25 (Monocryl®; Ethicon) (Figure 4). The distal penis was ligated with a transfixing suture and amputated before completing the skin closure using the same suture material and an intradermal pattern.

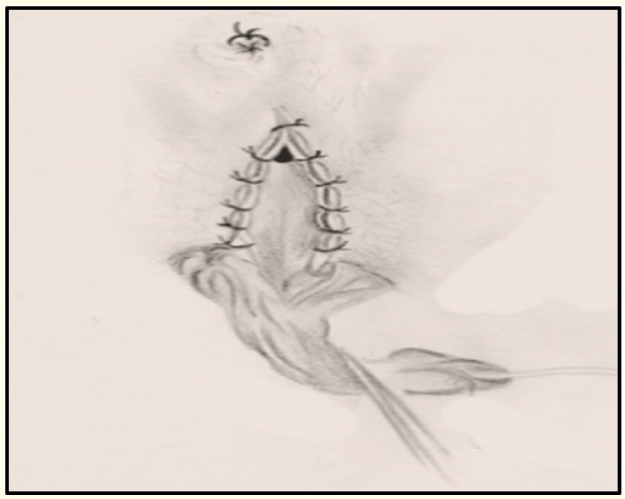

Figure 4: *Simple interrupted pattern used to appose urethral mucosa and skin.*

The dorsal aspect of the urethra was sutured to the dorsal edge of the skin incision preplacing the first two sutures at the 10 and 2 o'clock position. After placing the dorsalmost suture (12 o'clock position) the preplaced sutures were tied and alternate bites on each side were taken apposing urethral mucosa to skin in a simple interrupted pattern.

Illustration reproduced from: Williams J [13].

The purse string suture was removed from the anus. An Elizabethan collar was placed to prevent self mutilation.

The cat was maintained on 2 mL/kg/hour IVFT and discharged 8 hours after the surgery with meloxicam 0.5 mg/mL (Metacam®; Boehringer Ingelheim; 0.1 mg/kg once daily PO) and buprenorphine 0.3 mg/mL (Vetergesic®; Alstoe; 0.02 mg/kg three times daily for 5 days PO).

Progress and outcome

A first postoperative re-evaluation took place 5 days post surgery. The clinical examination was considered to be unremarkable and the wound appeared dry and clean. The owners reported no signs of discomfort when urinating and the bladder was easily expressed

in consult, therefore the medication was discontinued. A prescription urinary diet was recommended (Hill's® Prescription diet c/d® Multicare feline stress) for lifelong feeding.

Five days later the cat was re-examined and the Elizabethan collar was removed. No further examinations were booked but the owners were instructed to monitor the cat routinely allowing early detection of possible complications, such as urethral stricture formation and reobstruction. The increased risk of UTI after PU was also discussed.

The cat was administered a 5 day course of non-steroidal anti inflammatories to treat an episode of sterile cystitis 20 months post operatively. No other concerns were communicated to the author since the surgical procedure.

Discussion

The term FLUTD describes a clinical syndrome produced by many conditions that may affect the feline lower urinary tract [14]. Some risk factors associated with FLUTD have been identified such as excessive body weight [15], inactivity [16] and stress [17]. UO can occur in up to 58% of male cats with FLUTD [18]. The cat discussed in the case report was mainly kept *indoors* and its owners described it as a *"lazy"* and "*nervy"* pet. Additionally, it exhibited a high body condition score, which may have contributed to the primary episode of urethral obstruction.

Clinical signs of UO at presentation can be categorised to local lower urinary tract signs, resulting from the obstruction, and systemic signs associated with the accumulation of uraemic toxins and with the acid-base and electrolyte imbalances [3].

Hyperkalemia and uraemia are major causes of death in male cats with urethral obstruction; however some cats with recurrent FLUTD are euthanised because their owners are unwilling to incur the expense of repeated treatment, diagnostics, or hospitalisation necessary to relieve the UO [19]. It is therefore vital to optimise the management of obstructive cases in order to reduce reoccurrence.

In this case, the cat was bright, alert and responsive on presentation; the clinical exam and the blood work-up reassured the clinicians that it would be safe to anaesthetise the patient.

Surgical management of the cat with UO has changed over the years from being a first line of treatment to generally being reserved for cases where medical management techniques are no longer achieving their aim [13]. Irrespective of the cause of obstruction, medical treatment must focus on the restoration of urethral patency and urine flow [6], reversing life-threatening electrolyte disturbances, maintaining adequate tissue perfusion and minimising visceral pain [4]. Studies have shown that the UO is most likely to reoccur within the first 7 days following emergency treatment [20] and the author established the same correlation.

A longer duration of urinary catheterisation may decrease the risk of short-term recurrent UO in cats treated medically [21]. Further studies may focus on identifying an ideal duration of catheterisation to better clarify the role this variable has on the outcome [21]. The author found no improvement when increasing the hospitalisation and urethral catheterisation periods from 24 to 60 hours. Additionally, regardless of the type, the use of a 3.5Fr indwelling urinary catheter has been associated with lower rate of reoccurrence when compared to the use of a 5Fr catheter [20]. Neither the volume of IV fluids delivered nor the continuation of IVFT after removal of the urinary catheter was associated with the risk of recurrent UO [21]. Other variables, such as administration of the α1-adrenergic receptor antagonist prasozin instead of phenoxybenzamine have been recognised to reduce the risk of reoccurrence [20]. The cat in this report received oral prazosin through the hospitalisation period and post-discharge; the author concluded it didn't influence significatively the outcome. On the other hand, according to Dorsch., *et al.* [22], the use of the anti-inflammatory and analgesic drug meloxicam didn't influence the incidence of reoccurrence early after catheter removal and the author confirmed this fact.

The implementation of environmental modifications reduced the risk of recurrent UO, but increasing water consumption was the only independent factor associated with a lower reoccurrence rate [21]. Despite decades of research, Gerber., *et al.* [18] affirm there has been

no decrease in the reoccurrence rate with medical management. Currently the PU technique is indicated in cases of recurrent UO despite appropriate medical management, for occlusions that cannot be relieved by catheterisation, cases of urethral stricture, urethral trauma and neoplasia [7]. In the case it seemed likely for the reoccurrence of the obstructive episode to be associated with a urethral stricture caused by repeated urinary catheterisation. Positive contrast urethrocystogram would have been necessary to identify and locate the stricture as described by Osborne., *et al* [23]. In the absence of reoccurrence, it would have been adequate to maintain the cat on a calculolytic diet to prevent reobstruction by struvite-containing urethral precipitates as demonstrated by Osborne., *et al* [24]. Bacterial UTI is rarely the initial cause of FLUTD [25], therefore obtaining a urine culture only at the time of catheter removal and dispensing antimicrobials accordingly seems to be appropriate [17]. In the case, the culture was unnecessarily performed at the time of urinary catheter placement and later empirical use of cefovecin was required due to financial constraints and impossibility to run further tests.

The choice of surgical technique will be determined by the cause of the obstruction and its location in the urinary tract [13]. The PU technique used was described by Wilson and Harrison and is reserved to relieve distal urethral obstruction. Modifications to the PU technique have been developed although they haven't been widely adopted to date [26]. Their common goal is to take advantage of the wider pelvic urethra to produce a widened tube for urine flow [27]. If a cystotomy is required, PU is performed in dorsal recumbency, allowing simultaneous acess to the urinary bladder [26]. In the case the radiograph eliminated the suspicion of urolithiasis therefore surgical opening of the bladder was unnecessary. It was the author's preference to perform the procedure positioning the patient in ventral recumbency.

Short-term complications of the PU include haemorrhage, stricture formation, wound dehiscence, urine extravasation, perineal hernia and urinary incontinence [23]. These can be reduced by using good surgical technique, including appropriate intra-pelvic dissection and careful apposition of the urethral mucosa to the skin [28]. There has been no difference shown in complication rates following the use of absorbable or non-absorbable suture materials [29].

The prepubic urethrostomy technique must be seen as a salvage procedure although it may be indicated if the pelvic urethra is severely traumatised or the PU has strictured [26].

In the long term, the commonest complication of PU is recurrent UTI [13] as a consequence of urethral shortening and direct exposure of the urethral orifice [26].

Reoccurrence of UO is uncommon when PU is performed properly [30] and 88% of the owners assessed their cat's quality of life as good following PU [8].

Conclusion

In conclusion, financial or management issues precluding long-term medical management of UO must be seen as a valid reason to perform a PU. However the owner should be made aware the surgical treatment won't eliminate reoccurrence of FLUTD or UTI [8] and it should be clear that the surgery deals only with the obstruction but not with the underlying disease [13]. It is vital to provide a realistic prognosis to avoid disappointment after the treatment of this costly disease [18].

Additionally, client education is critical in ensuring early recognition of urethral reobstruction particularly in the cases selected for medical management [19].

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