

**CASE REPORT**

Food/farmed animal

# Surgical and medical complications following perineal urethrostomy in a goat

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Email: joseph@wernvets.co.uk**Abstract**

Perineal urethrostomy was carried out in a Golden Guernsey goat to relieve urethral obstruction associated with urethral calculi. The surgery was successful, but post-surgical complications developed, including haemorrhage and failure of the penile stump to heal. Revision surgeries were carried out with a successful surgical resolution. Bacterial cystitis subsequently developed, and *Proteus* spp. and *Trueperella pyogenes* were identified. Treatment of the bacterial cystitis proved challenging, and intense management was required. Survival post-surgery was over 3.5 years.

**BACKGROUND**

Perineal urethrostomy is a surgical option in small ruminants to alleviate urethral obstruction as a result of urolithiasis.<sup>1–4</sup> Partial and complete urethral obstruction is reported in male goats worldwide and is reported as the most common cause of urinary tract disease in small ruminants, although accurate case incidence has not been reported.<sup>1,2,5</sup> Urinary calculi form in the urinary bladder, and then, obstruction usually occurs in the urethra of castrated males, either at the urethral process (vermiform appendage) or the sigmoid flexure.<sup>5,6</sup> Complete obstruction of the urine outflow is a serious veterinary emergency with continual urine build-up within the bladder and increased back pressure on kidney outflow.<sup>6</sup> Urine may leak from the urethra into the subcutaneous tissues and urinary bladder leakage and rupture can occur, with peritonitis consequently developing.<sup>1,6</sup> Kidney damage may also occur, such that even where the obstruction is successfully relieved, the patient may deteriorate and die.

The main predisposing risk factor for the development of urethral calculi resulting in urethral obstruction is the feeding of cereal-based concentrate feed,<sup>7,8</sup> which typically occurs in castrated males due to the narrower urethra resulting from a lack of testosterone.<sup>1,5</sup>

At presentation, the patient is assessed to determine viability, including determining the integrity of the bladder and urethra, and the viability of the kidneys.<sup>1</sup> Subsequently, in viable patients, various surgical techniques are described for relieving obstruction due to calculi within the urethra. For calculi lodged at the urethral process, simple excision

of the urethral process can be enough to allow resumption of normal urinary flow.<sup>4,5</sup> For calculi lodged more proximally, possible surgical solutions include one, or a combination of: penectomy, urethrotomy, perineal urethrostomy, temporary tube cystotomy, modified proximal perineal urethrostomy, vesico-preputial anastomosis, or bladder marsupialisation.<sup>3–5,9–12</sup>

Surgical complications following one of these procedures, including death, are not uncommon. Sickinger and Windhorst<sup>7</sup> carried out a metanalysis of various surgical procedures with wide variation in long-term success. Urinary bladder marsupialization had the greatest success rate (77%), followed by perineal urethrostomy (71%), tube cystotomy (66%) and urethral process amputation (41%). Riedi et al.<sup>1</sup> examined survival post-tube cystotomy and reported an overall survival (to hospital discharge) of 39% and 1-year survival at 17.6%. Oman et al.<sup>2</sup> reported survival post-perineal urethrostomy in 25 goats, with 22 of 25 surviving to discharge (88%) and 13 of 22 surviving to 4 months (59%). Reported complications include haemorrhage, infection of the surgical site, stricture of the surgical stoma, re-obstruction, urine scalding, cystitis, pyelonephritis and renal failure.<sup>1,2</sup>

In the case described here, perineal urethrostomy was carried out to bypass urethral obstruction in a castrated male pet goat. Post-operative complications included haemorrhage, wound breakdown, urine scalding and bacterial cystitis. Case management was challenging, but successful, with survival for more than 3.5 years after initial presentation with minimal observable welfare compromise.

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**TABLE 1** Blood biochemical data for the male Golden Guernsey goat at presentation.

Analyte (unit of measurement)	Concentration	Reference range
Glucose (mg/dL)	<b>148.0</b>	<b>54.0–93.0</b>
Creatinine (mg/dL)	<b>3.0</b>	<b>0.6–1.4</b>
Urea (mg/dL)	<b>27.0</b>	<b>10.0–21.0</b>
Phosphorus (mg/dL)	2.5	4.2–7.6
Calcium (mg/dL)	9.0	8.2–9.8
Total protein (g/dL)	7.5	6.4–7.8
Albumin (g/dL)	2.8	2.8–3.8
Globulins (g/dL)	<b>4.6</b>	<b>3.6–4.5</b>
Alanine transaminase (U/L)	21.0	23.0–44.0
Alkaline phosphatase (U/L)	224.0	75.0–228.0
Gamma-glutamyl transpeptidase (U/L)	55.0	60.0–101.0
Total bilirubin (mg/dL)	<b>0.4</b>	0.1–0.3
Cholesterol (mg/dL)	61.0	63.0–108.0
Amylase (U/L)	14.0	1.0–30.0

Note: Values in bold are elevated above the reference range, and those in italics are below the reference range.

## CASE PRESENTATION

A pet-castrated male Golden Guernsey goat was presented at a private veterinary practice in the UK, acutely unwell with inappetence, failure to drink or pass urine, reportedly in pain and straining. A history of excessive cereal-based concentrate feeding was reported.

On examination, it was found the goat was passing dry but otherwise normal pelleted faeces, the rectal temperature was 38.0°C, and the heart rate was elevated to 120 beats/min, although respiratory rate was within normal limits at 12 breaths/min; no abnormal heart or lung sounds were detected. The mucous membranes were pink, and the capillary refill time was 1 s. Transabdominal ultrasound revealed an intact bladder 10 cm in diameter; aseptic percutaneous abdominocentesis did not yield any fluid. A small amount of moisture was observed around the urethral orifice, but it was not possible to extrude the penis. Digital rectal palpation revealed a dilated urethra that also pulsed from the obstruction.

## INVESTIGATIONS

Blood haematology revealed a neutrophilia, lymphopenia and eosinopenia. Blood biochemistry revealed elevated globulins, urea, creatinine and glucose, with phosphorus, gamma-glutamyl transpeptidase and cholesterol below the normal range (Table 1).

## DIFFERENTIAL DIAGNOSIS

Urolithiasis resulting in urethral obstruction was by far the most likely differential, given the history of concentrate feeding, presenting signalment and anuria, together with the clinical signs observed at examination.<sup>1,5</sup> Other differentials included urethral obstruction due to a blood clot or purulent

## LEARNING POINTS/TAKE HOME MESSAGES

- Urolithiasis is a known risk in castrated male goats fed a diet rich in cereal-based concentrate foods.
- Surgical treatment of obstructive urolithiasis is possible but post-surgical complications are frequent and require intensive case management.
- With early detection of cases, compromised renal function can be avoided.
- Bacterial cystitis is a potential complication following surgery, and routine culture and sensitivity testing should be carried out to guide appropriate antimicrobial therapy.
- Transabdominal and transrectal ultrasound can be used for investigating bladder and urinary post-surgical complications.

embolus and compression by a soft tissue mass or swelling.<sup>13</sup> Given the acute onset, lack of obvious trauma, lack of any swelling associated with obstructing the urine outflow, and the presenting clinical factors, urolithiasis was considered most likely.

## TREATMENT

The goat was hospitalised, and general anaesthesia was induced with xylazine (0.1 mg/kg) and ketamine (1 mg/kg) and maintained with isoflurane. Perioperative intravenous fluids were administered (Aqupharm II; Animalcare) at a rate of 4 mL/kg/h in order to hydrate the patient, maintain renal perfusion and assist in renal excretion of the elevated blood biochemistry parameters. During the surgery, meloxicam (Metacam; Boehringer) was administered subcutaneously (0.5 mg/kg) to reduce inflammation and for analgesia.<sup>6</sup>

The penis was extruded under general anaesthesia, but no obstruction was evident at the urethral process. The goat was then placed in dorsal recumbency and a penectomy and perineal urethrostomy were carried out at a location 5 cm distal to the anus at the distal curvature of the perineum (the high position) using a technique described in Turner and McIlwraith<sup>3</sup> and Fubini and Ducharme.<sup>4</sup> The penis was located by blunt dissection and transected, and the proximal section was brought to the skin surface. The penile stump was left exposed and sutured to the skin. The transection of the penis was successful in releasing a profuse stream of urine. Spatulation of the urethra was then carried out, and the urethral opening was sutured to the skin. All sutures were with 3-0 polydioxanone suture (PDS; Ethicon). After a 24-h period of recovery in the practice where urine was observed to pass freely from the urethrostomy, the goat was returned home to convalesce.

Antibiosis was instigated for 7 days with intramuscular injection of 8 mg/kg procaine penicillin and 10 mg/kg dihydrostreptomycin sulphate (Pen & Strep; Norbrook); a non-steroidal anti-inflammatory drug (NSAID), meloxicam (Metacam; Boehringer), was prescribed at a dose of 0.5 mg/kg given orally for 3 days. All medicines were prescribed under

the cascade due to the lack of medicines licensed for use in goats in the UK. The owner was advised to cease all cereal-based concentrate feed administration, to offer free access to water and good quality forage in the form of hay or haylage and to administer ammonium chloride at a dose of 100 mg/kg orally for 2 months to acidify the urine in order to assist calculi dissolution and prevent the risk of further urethral obstruction.<sup>14</sup>

A review of all feeding was carried out for the rest of the herd. Good quality forage was available for all herd members; however, daily concentrate feeding was carried out for all animals. Advice was given to phase this out over the following week, with concentrate feeding only carried out for short periods of time in animals unable to meet their energy, protein and metabolic needs via forage feeds, for example, in late pregnancy. The human–animal interaction centred around feeding was recognised as important, and to facilitate this safely, the use of grass pellets was encouraged as an alternative to the concentrate feed.

## OUTCOME AND FOLLOW-UP

The goat was re-examined 24 h post-surgery and was reported to be bright and active, having eaten a small amount of hay and was observed to be drinking. On clinical examination, some urine was noted to be dribbling from the surgical urethral orifice and a small amount of haemorrhage was evident from the penile stump but this had clotted. The owner had been cleaning the blood from the perineum with cooled boiled water and cotton wool. During the examination, the bladder was easily expressed by firm pressure on the abdomen and vital signs were within normal limits.

Four days post-surgery, re-examination revealed similar findings; the cut surface of the penile stump had begun to granulate and minimal haemorrhage was observed. Blood was drawn for biochemical analysis with creatinine noted to have returned to a concentration within the normal range (1.1 mg/dL; range 0.6–1.4 mg/dL) and urea still remaining elevated at 33.0 mg/dL (range 10.0–21.0 mg/dL).

Repeated post-surgical examination was carried out at the owner's request and at intervals of approximately 1–2 weeks. At each examination, a small amount of haemorrhage was noted from the penile stump, which had granulated but was failing to heal. In addition, urine frequently splashed onto the hindlimbs, resulting in hair loss and scalding. This was managed by the owner with the daily application of petroleum jelly (Vaseline) to the affected areas.

Forty-eight days post-surgery, it was decided to carry out a revision surgery to debride the granulation tissue from the penile stump, undermine the skin and re-suture this to cover over the penile stump. General anaesthesia was carried out as before. During this surgery, the urethra was noted to have healed well, and a good surgical closure of the skin over the penile stump was managed. Antibiosis and NSAID treatment were instigated as before. For 48 h, the surgery appeared to have been successful, and following self-trauma of the surgical site through rubbing, some haemorrhage was observed with further wound breakdown over the next few days, despite mitigation attempts. A second revision surgery was carried out 17

days after the first. This time, healing was uneventful, and no further surgery was necessary.

The goat rapidly returned to normal behaviour and was returned to the herd. Urine scalding occurred from time to time but was managed successfully by the owner as before. Five months after the initial presentation, the goat was re-examined and found to be straining slightly, although it was passing urine and faeces. Urinalysis at this point revealed haematuria, proteinuria and bilirubinuria, with leukocytes and bacteria observed in the sediment by direct light microscopy. These findings were consistent with a bacterial cystitis. Medical management was instigated with antibiotics: intramuscular injection of 8 mg/kg procaine penicillin and 10 mg/kg dihydrostreptomycin sulphate (Pen & Strep; Norbrook) and NSAID, meloxicam (Metacam; Boehringer), at 0.5 mg/kg given orally for 3 days. Urethral spasm was suspected, and therefore, 0.2 mg/kg butylscopolamine and 25 mg/kg metamizole were administered as a single dose. Again, all medicines were prescribed under the cascade.

Over the next 2 years, bacterial urinary tract infections were repeatedly diagnosed with occasional obstruction of the urethra with debris and purulent material. These obstructions were usually easily cleared using a 4FG urinary catheter inserted gently into the urethral orifice, with the goat in a standing position. On occasion, an indwelling urinary catheter was retained for a few days with parenteral fluids administered concurrently. The infections usually resolved with antibiotics (procaine penicillin and dihydrostreptomycin sulphate), NSAID (meloxicam) to manage the inflammation and butylscopolamine/metamizole to manage urethral spasm.

Twenty-nine months post-surgery, urine culture was carried out with *Proteus* spp. isolated in pure culture. This was resistant to most of the antimicrobials tested, with sensitivity only to ceftiofur and enrofloxacin. Antimicrobial treatment was changed to enrofloxacin at this point. Transrectal ultrasound examination clearly revealed extensive thickening of the bladder wall and mobile thread-like hyperechoic material within the urine.

The patient continued to be managed as before with intermittent urethral obstruction relieved by urinary catheter insertion. Further ultrasound examination of the bladder revealed a very thickened bladder wall with deep crypt formation containing irregularly dense hyperechoic material. Further bacterial culture, 3 months after the first, revealed an absence of *Proteus* spp. but the presence of *Trueperella pyogenes* with a wide antibiotic sensitivity profile. Antibiosis with amoxicillin and clavulanic acid (Combiclav; Norbrook) administered parenterally daily was instigated for 1 month duration.

Remarkably, despite the chronic bacterial cystitis, the patient behaved normally, apart from when urethral obstruction occurred. He interacted well with the herd and did not demonstrate any pain response even when handled and his bladder palpated. He continued to eat and drink normally. At the time of publication, survival had been more than 3.5 years. It is expected that a bacterial cystitis may recur with likely intermittent obstruction of the urethra, but the owner is able to detect signs of this early and seek veterinary assistance with management.

**TABLE 2** Summary of post-surgical complications as reported by Oman et al.<sup>2</sup> from a population of 25 surgical cases.

Complication	n (%) of cases (total n = 25)	Presence (Y)/absence (N) in this clinical case
Haemorrhage	8 (32)	Y
Surgical site infection	0 (-)	N
Proximal re-obstruction	2 (8)	Y—with pus
Stricture of urethral stoma	3 (12)	N
Wet rear limbs	4 (16)	Y
Urine scald	1 (4)	Y
Cystitis	0 (-)	Y
Renal failure	0 (-)	N
Death related to urolithiasis	1 (4)	N

Note: The right-hand column indicates the presence or absence of each complication in this clinical case.

## DISCUSSION

In the goat, surgical and medical complications following perineal urethrostomy are common. In this case, we report a successful surgical outcome with a long duration of survival (>3.5 years), although several post-surgical complications occurred that required intervention and management.

In the study by Oman et al.,<sup>2</sup> the percentage of animals with each of the various post-operative complications is listed and summarised in Table 2, together with the presence or absence of each complication in this clinical case.

In the clinical case presented here, the initial surgery was successful in relieving the urethral obstruction and in the resolution of the elevated blood creatinine detected at presentation. Indeed, the early presentation of the case likely facilitated the lack of detectable compromise to renal function.<sup>5</sup> With regards to the clinical investigative process, radiography and urinalysis by cystocentesis could also be useful in investigating the integrity, and the size and condition of the bladder and its contents, which could have helped with surgical planning and post-operative care. In this case, the use of trans-abdominal ultrasound and blood biochemistry were employed to assess bladder integrity and renal function, with repeat biochemical analyses used for post-surgical monitoring. However, two revision surgeries were required to affect a satisfactory surgical outcome, namely, to manage an initial failure of the penile stump to heal and ongoing haemorrhage.

Medically, bacterial cystitis was a challenging long-standing post-surgical complication, together with consequent intermittent urethral obstruction with pus (as opposed to further uroliths) requiring catheterisation to relieve the obstruction. Catheterisation was successful in relieving the obstruction and could easily be carried out with minimal restraint. It could also be used to irrigate the bladder in order to facilitate dilution of the bacterial population.

Ultrasound examination of the bladder revealed the deep-seated chronic nature of the bacterial infection, as evidenced by gross thickening of the bladder wall and deep crypt formation. As such, a full bacterial cure appeared unlikely, with expectation that recurrent episodes of discomfort and urethral obstruction due to pus formation could result. Throughout this case, consideration of the welfare of the animal was paramount with regard to managing the case forward med-

ically or surgically, with euthanasia considered as an option where welfare could not be managed satisfactorily. A possible further surgical solution would have been marsupialisation of the bladder to the ventral abdominal wall. However, given the context of this animal as a pet and this procedure being considered a short-term salvage procedure, it was likely to result in a reduced welfare outcome for the patient and increased frequency and severity of bacterial cystitis episodes due to increased environmental contamination.<sup>5,6</sup>

Medical management with long courses of antibiotics was considered to be practical in the context of the goat as a pet, but with concerns for the development of antibiotic-resistant bacteria through prolonged use. Antimicrobial choice was prioritised based on the European Medical Agency antimicrobial classification.<sup>15</sup> As such, repeated cultures were taken to monitor the bacterial population and adjust antibiotic accordingly, where possible selecting the lowest category antimicrobials based on these results. In the UK and Europe, category B antimicrobials are restricted to use in veterinary cases where category D or C antimicrobials are considered likely to be ineffective, based on antimicrobial sensitivity testing wherever possible.<sup>15</sup> Encouragingly, the *Proteus* spp. isolate with initial sensitivity only to ceftiofur and enrofloxacin (both category B antimicrobials<sup>15</sup>) was later not detectable following treatment with enrofloxacin. As such, cessation of treatment with this antibiotic could occur and subsequent treatment for the *T. pyogenes* isolate with a category C antibiotic could be instigated instead.<sup>15</sup>

Urine splashing on the rear limbs and urine scalding occurred in this case but could be successfully managed by the owner using a daily application of petroleum jelly. As time progressed, the goat adjusted his stance when urinating to minimise contamination of his skin with a reduced need for daily application of petroleum jelly.

## AUTHOR CONTRIBUTIONS

Joseph W. Angell carried out the work and wrote the manuscript. Jennifer S. Duncan and Kim Hamer reviewed the manuscript and edited it.

## CONFLICT OF INTEREST STATEMENT

The authors declare they have no conflicts of interest.

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## ETHICS STATEMENT

This work was carried out as part of the normal veterinary duties of the lead author as part of the employment. Permission to write this report was sought from and granted by the owner.

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