

Closure of a recurrent bladder rupture in a calf by means of a peritoneal flap: a case report

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ABSTRACT: An 11-month old, Piedmontese bullock was admitted to the Department of Veterinary Science, University of Turin, for urolithiasis and suspected uroperitoneum owing to urinary bladder rupture. A first episode of uroperitoneum had been treated surgically one week previously. On admission, the animal underwent physical and haematological examination, followed by transabdominal ultrasonography and biochemical screening. Clinical and laboratory findings confirmed the recurrence of uroperitoneum, possibly secondary to the previously failed surgical approach. During surgery, urine leakage from the previously treated tear was clearly visible, together with a large necrotic area surrounding the tear. To close the defect, we created a peritoneal flap. For tissue approximation we used a continuous barbed suture material, which obviated the need for knots to secure the leading and terminal ends of the suture. Postoperative monitoring included transabdominal ultrasonography and biochemical profile tests, performed at 10 and 30 days after surgery. Two months after discharge, a telephone follow-up confirmed the positive outcome of the procedure. The creation of a peritoneal flap allows for effective sealing of a bladder tear with necrotic edges. The use of barbed suture greatly simplifies the entire procedure.

Keywords: calf; soft tissue surgery; bladder surgery; peritoneal flap

Case description

An 11-month old, Piedmontese bullock weighing 325 kilograms was referred for suspected uroperitoneum. The bullock had a two-day history of acute abdomen and anuria. On physical examination, the animal showed signs of depression, weakness, bruxism, tail flagging, and bilateral distension of the ventral abdomen with a fluid wave on ballottement. The preputial tuft was dry, with the presence of crystals. Transabdominal ultrasonography excluded hydronephrosis but confirmed the presence of a large amount of free fluid in the peritoneal cavity. Complete blood cell count was within the normal range, whereas biochemical tests revealed severe azotaemia (creatinine = 1376.38 $\mu\text{mol/l}$; urea = 72.11 mmol/l) and a slight increase in serum potassium concentration (5.83 mmol/l). Based on these findings, the case was diagnosed as obstructive urolithiasis with urinary bladder rupture and subsequent uroperitoneum. Because of the high

economic value of the animal, surgical correction was advised.

Ultrasound-guided abdominocentesis was employed to slowly remove about 15 l of urine in approximately 45 min. The procedure was performed using a 5-mm laparoscopic trocar cannula (Covidien, Italy). After sterile skin preparation, the patient received epidural anaesthesia (0.05 mg/kg xylazine and 2% lidocaine (0.2 mg/kg)). The animal was placed in dorsal recumbency and received fluid therapy with 0.9% NaCl (4 ml/kg/h, *i.v.*). The ventral abdomen was clipped and surgically prepared. A local inverted V-block, cranial to the incision site, was also performed using 2% lidocaine. The prepuce and penis were laterally reflected and a ventral midline celiotomy was made. The bladder appeared to be very small in size and thick-walled. A 3-cm-long defect with necrotic edges was found in the ventral aspect, just proximal to the bladder neck. After debridement, the tear was closed with a one-layer, continuous appositional suture, using

USP 0 Glycomer 631 (Byosin suture, Covidien, Italy). The omentum was placed over the suture line and sutured to the bladder using a continuous pattern with USP 2-0 Glycomer 631 (Byosin suture, Covidien, Italy).

At the end of the procedure, the abdominal incision was closed in three layers. The linea alba was closed with USP 2 Lactomer 9-1 (Polysorb™, Covidien, Italy) in a simple continuous pattern. The subcutaneous layer and the skin were closed with a continuous pattern, using USP 0 Polyglactin 910 (Vycril suture, Ethicon, Johnson&Johnson, Germany) and USP 1 nylon (Monosoft™, Covidien, Italy), respectively.

Since the bladder rupture was likely a consequence of urethral obstruction by calculi, a prescrotal urethrostomy was also performed. A catheter was successfully passed to assess for patency of the proximal urethra and no calculi were found in this tract.

Recovery from sedation was uneventful and no postoperative complications or signs of pain were detected. The patient was discharged on the same day, following urine output assessment. The bullock was checked daily by a veterinarian in the following days.

Five days after surgery, and despite some urine output from the urethrostomy site, there was again evidence of abdominal distension. The biomedical profile was consistent with severe azotaemia, as it showed high creatinine (1218.15 µmol/l) and urea (103.53 mmol/l) levels and increased serum phosphorus (2.87 mmol/l) and magnesium (1.73 mmol/l) concentrations. Transabdominal ultrasonography confirmed recurrence of uroperitoneum. Revision surgery was proposed to the owner.

The anaesthesia and sedation protocol was the same as in the previous surgery. Because no adhesions were visible on ultrasonography, a ventral midline coeliotomy was performed through the same incision. After abdominal exploration, and drainage of urine from the abdominal cavity, the bladder was examined. The omentum had not adhered to the ventral bladder wall and was easily removed. To help locate the tear, a fluorescein and saline (NaCl 0.9%) mixture was injected into the bladder with a 50 ml syringe. Leakage of dye fluid showed a tear on the ventral aspect of the bladder neck, approximately 1.5 cm in length. The bladder still appeared to be very small in size, with a wide, necrotic area surrounding the tear. Since the pres-

ence of large necrotic edges and a difficult access to the site of the defect were likely to have caused the failure of the previous surgery, a peritoneal flap was used to cover the defect (Close et al. 2001). A 6 × 6 cm, U-shaped peritoneal flap was made in the caudal right abdominal wall, just ventral to the level of the bladder neck. A dorsally directed, U-shaped incision was made in the peritoneum and through the retroperitoneal fat, down to the internal abdominal muscle. The flap was then inverted with its peritoneal side towards the bladder and sutured along its edges to the ventral wall of the bladder, using a one-layer, simple continuous pattern with USP 0, absorbable polyglactone, barbed suture material (Vloc 180, Covidien, Italy). To prevent other organs from adhering to the peritoneal defect, the ventral aspect of the flap and the defect in the abdominal wall were covered with the omentum, which was held in place with single sutures. Subsequently, the abdomen was closed as described above.

Clinical findings

The patient recovered uneventfully and was discharged on the same day. Over the following 10 days, the bullock was checked daily. Transabdominal ultrasonography and jugular blood sampling were carried out at 10 and 30 days after surgery, respectively. The biochemical profile was normal and no fluids were detected. The urethrostomy wound granulated and the bullock did not have any extension issues. Telephone follow-up was performed six months after discharge. No complications were noted and a normal increase in weight was reported.

DISCUSSION AND CONCLUSIONS

Urinary calculi, or uroliths, are a common cause of disease in ruminants and obstruction typically develops in the distal urethra of male animals (Fubini and Ducharme 2004). Common sequelae of urethral obstruction include urethral or bladder ruptures. This in turn leads to uroperitoneum and azotaemia, the latter excluding the animal from human consumption (Fubini and Ducharme 2004).

The most common location of these defects is in the dorsal wall of the apex of the bladder but,

doi: 10.17221/8825-VETMED

while a dorsal tear can be managed conservatively, a tear located on the ventral aspect of the bladder requires surgical treatment. A number of surgical options have been proposed for the treatment of urethral and/or bladder defects. In our case, we anticipated that cystotomy and marsupialisation would not be feasible. Some authors recommend suturing the bladder wall in two layers, using a simple continuous pattern oversewn by an inverting pattern. Boure et al. (2005), however, reported comparable results for one-layer and two-layer closure techniques in terms of strength. They also found that a one-layer appositional pattern resulted in better healing, and therefore better sealing, than an inverting pattern (Boure et al. 2005). For these reasons, and because of the deep surgical field and small bladder, that made the surgical site difficult to access, we initially chose a single-layer appositional pattern to close the tear, and used the omentum to cover the area.

This first attempt failed, probably owing to the edges of the debrided tear being too weak, something which had previously escaped notice. In fact, at second surgery, the suture material used to close the tear was found on one side of the defect, where leakage occurred. Continuous urine leakage also caused a failure in the fibrin seal (Fubini and Ducharme 2004), which may have prevented adherence of the omentum to the bladder wall as initially planned.

For revision surgery, we used a peritoneal flap and barbed suture material. This approach was successful and no recurrence of uroperitoneum was detected. The barbed suture was particularly suited to the procedure. Its main advantages were ease of placement and maintenance of tissue apposition while suturing, which translated into shorter operative times. We also note that this material is completely self-retaining and therefore may provide adequate anchorage at each bite, eschewing excessive tension and tissue laceration (Boure et al. 2005). Further, although its strength is reduced by 20% one week after surgery and by 35% three weeks after surgery (Boure et al. 2005), it maintains adequate strength for the time required to allow bladder healing (Nemecek et al. 2013).

At follow-up, transrectal ultrasonography showed the peritoneal flap incorporated into the ventro-caudal aspect of the bladder wall. A transabdominal scan also confirmed the absence of free fluid in the abdominal cavity, which indicated that adequate

sealing of the bladder tear had been achieved. This is in accordance with previous studies on both sheep and humans, which demonstrated that a peritoneal flap can help promote complete urothelium (Elbahnasy et al. 1998; Close et al. 2001) and detrusor muscle (Elbahnasy et al. 1998) regeneration in bladder augmentation procedures.

A peritoneal flap was used for the first time in human medicine for bladder wall replacement, and subsequently for bladder augmentation procedures in sheep (Close et al. 2001). Although it failed to produce any significant bladder augmentation, this technique was nonetheless highly effective in terms of sealing performance, with no leakage detected (Close et al. 2004). In several cases, Close et al. (2001) reported flap atrophy with scarring and contraction at necropsy. In a few animals the flaps failed, but the authors did not investigate the underlying causes. Furthermore, in a large number of cases adhesions involved both the flap and other organs. We did not seek to confirm whether this also occurred in our case, but we cannot exclude the possibility. For this reason we made the flap considerably larger than the defect, bearing in mind that omentalisation of the flap itself could provide further blood supply, thereby avoiding failure and limiting adhesion formation (Close et al. 2001; Close et al. 2004). Further studies are needed to investigate the process of flap healing and to assess the above possibilities. Also, we cannot exclude that the combined effect of suture type, peritoneal flap and omentalisation was instrumental in providing effective bladder sealing. To the best of our knowledge, this is the first report regarding the successful use of a peritoneal flap for bladder rupture closure in a calf. Our method proved well-suited to the purpose and may be a useful adjunct for repair of bladder defects where large necrotic margins or difficult locations make suturing difficult or impossible.

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Received: 2015–03–18

Accepted after corrections: 2016–02–18

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