

A non-invasive technique for standing surgical repair of urinary bladder rupture in a post-partum mare: a case report

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ABSTRACT

An 11-year-old mare presented 36 hours after foaling with a ruptured bladder. Uroperitoneum was diagnosed on ultrasound and from the creatinine concentration of the peritoneal fluid. Bladder endoscopy demonstrated tissue necrosis and a rent in the dorsocranial aspect of the bladder. Following stabilisation, including abdominal drainage and lavage, the mare was taken to standing surgery. Under continuous sedation and epidural anaesthesia, and after surgical preparation, a Balfour retractor was placed in the vagina. Using sterile lubricant and moderate force, it was possible to insert a hand into the bladder. The tear was easily palpable on the dorsal portion of the bladder. Two fingers were inserted through the tear and used to provide traction to evert the bladder completely into the vagina where it could be grasped with the surgeon's other hand to prevent further trauma. A second surgeon could then visualise the entire tear and repaired this using a single layer of size zero PDS suture in a single continuous pattern. As soon as the bladder was repaired, it was replaced via the urethra. The mare did well after surgery and was discharged after 48 hours, apparently normal.

This report is the first describing repair of the bladder without an abdominal incision or incision into the urethral sphincter. This greatly reduces the chance of possible complications such as urine pooling after surgery with the previously described standing technique or bladder trauma due to traction with abdominal surgery.

KEYWORDS: bladder tear, cystorrhexis, sphincterotomy, urethrotomy

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Urinary bladder rupture in the adult mare is rare, but has been reported to occur associated with parturition (Rodgers 1999, Higuchi 2002). Higuchi (2002) estimated the occurrence of this condition at approximately one in 10,000 births. Repair via celiotomy has been described, but it can be difficult to exteriorise the bladder sufficiently, particularly in the case of caudal or dorsal tears. Previous standing techniques have involved approaching the bladder via urethrotomy (Rodgers 1999) or using a urethral sphincterotomy to place a hand into the bladder (Higuchi 2002). Here, we describe a non-invasive urethral approach that was successfully used to repair a 10 cm tear in a post-parturient mare.

CASE HISTORY

An 11-year-old thoroughbred mare was referred with suspected peritonitis or ruptured bladder. The mare had foaled uneventfully 36 hours previously and since then had been depressed, had experienced mild colic and had developed a swollen abdomen. On arrival, the mare was mildly uncomfortable with a heart rate of 72 beats/min, respiratory rate 12 breaths/min and rectal temperature

38.1°C. Mucous membranes were pink and CRT was less than two seconds. Gastrointestinal borborygmi were reduced in all quadrants. On examination per rectum, thickened small intestine could be palpated. Vaginal examination was normal. Trans-abdominal ultrasonography demonstrated free fluid in the peritoneal cavity and some thickened loops of small intestine. Analysis of the peritoneal fluid showed: a nucleated cell count of $23.8 \times 10^9/L$; 76.9% neutrophils; 16.8% lymphocytes; 8.3% monocytes; a total protein concentration of 16g/L; and, a creatinine concentration of 1600 $\mu\text{mol/L}$. The plasma creatinine concentration was 395 $\mu\text{mol/L}$. The ratio of peritoneal to plasma creatinine concentrations of just over 4:1 was indicative of uroperitoneum (Corley and Stephen 2008). Haematology revealed a leukopaenia (peripheral white cell count $4.8 \times 10^9/L$) with an increased neutrophil percentage (82%). In addition to increased creatinine concentration, plasma biochemistry revealed increased urea (14 mmol/L) and lactate (2.4 mmol/L) concentrations. Plasma sodium (133.8 mmol/L), potassium (3.64 mmol/L) and chloride (97.6 mmol/L) concentrations were normal.

Endoscopy of the bladder showed a large rent in the dorsal-cranial part of the bladder (**Figure 1**). A 28F chest drain was placed midline in the most ventral part of the abdomen and 15 L of proteinaceous fluid was drained off. The abdomen was then lavaged with 12 L of warm sterile Hartman's solution through the chest drain (**Figure 2**). The mare was treated with flunixin meglumine (1.1 mg/kg IV BID), cefquinome (2 mg/kg IV SID) and intravenous fluids (Hartmann's solution at 1.7 L/hr). A 30 ml Foley catheter was placed into the bladder and secured to the perineum with a urine collection bag to monitor urine production (**Figure 3**).

The mare was placed in stocks for surgery. A continuous infusion of detomidine (decreasing dose from 0.6 to 0.1 $\mu\text{g}/\text{kg}/\text{min}$) was given for sedation. A mixture of 9 ml of 2% mepivacaine and 4 ml of 2% xylazine were placed into the epidural space after sterile preparation of the skin. A rectal examination was performed to evacuate all faeces and the tail was tied dorsally. The vagina and perineum were aseptically prepared. The back door of the stocks was draped. A Balfour retractor was placed in the dorsal vagina to provide exposure.

On examination, the tissues of the vagina were severely bruised and swollen. Three fingers could be easily inserted into the urethral orifice. Using sterile lubricant and moderate force it was possible to insert a hand into the bladder. The tear was easily palpable on the dorsal portion of the bladder. Two fingers were inserted through the tear and used to provide traction to evert the bladder completely into the vagina where it could be grasped with the surgeon's other hand to prevent further trauma. A second surgeon could then visualise the entire tear. The tear was located in the dorsal bladder and was 10 cm long. This was repaired using a single layer of size zero PDS (polydioxanone) suture in a simple continuous pattern

(**Figure 4**). As soon as the bladder was repaired, it was replaced via the urethra. During surgery the mare experienced discomfort and began to strain. Three vials (180 mg) of morphine sulphate were administered intramuscularly and topical 2% mepivacaine was placed into the urethra. This allowed successful completion of the surgery.

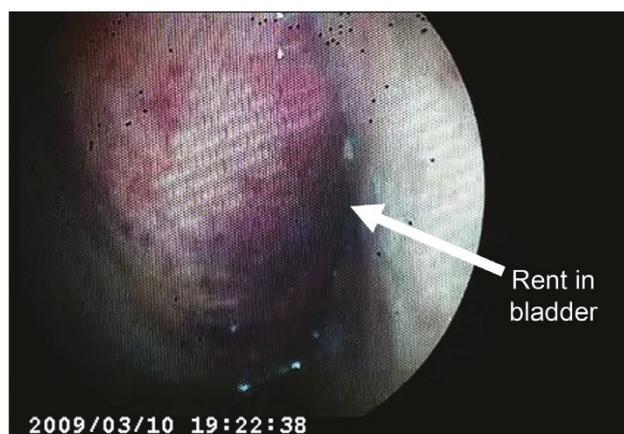


Figure 1: Endoscopic view of the dorsal cranial bladder. There is an area of intraluminal purple discolouration leading to a rent in the bladder wall.

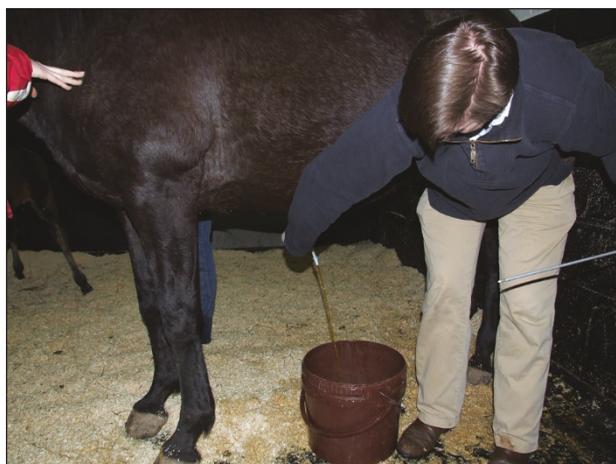


Figure 2: Abdominal lavage of the mare.

After surgery, a Foley catheter was maintained in the bladder for 24 hours, urine output was measured and urine specific gravity was monitored. The mare was maintained on intravenous fluids. Urine production and specific gravity were appropriate for the fluid rate. The mare was maintained on cefquinome. Flunixin meglumine was administered as an analgesic and the mare received one further abdominal lavage. Trans-abdominal ultrasound 24 hours after surgery showed no excess fluid in the peritoneal space, and that the thickening of the small intestine had resolved. After the surgery, the mare was administered domperidone (1.1 mg/kg PO q24h) to maintain lactation. This was also the rationale for continuing the fluid therapy for 24 hours. After the procedure, the foal was nursing well, and appeared to be receiving enough milk. The mare was discharged after 48 hours with instructions to administer oral potentiated sulphonamides for five days and was urinating normally at this time.

DISCUSSION

Bladder rupture during parturition is an uncommon problem in mares. It has not necessarily been associated with dystocia. One theory is that bladder rupture or trauma occurs as a result of impingement of the bladder between the pelvic rim and the foal during labour (Nyrop 1984). The



Figure 3: Indwelling urinary catheter.

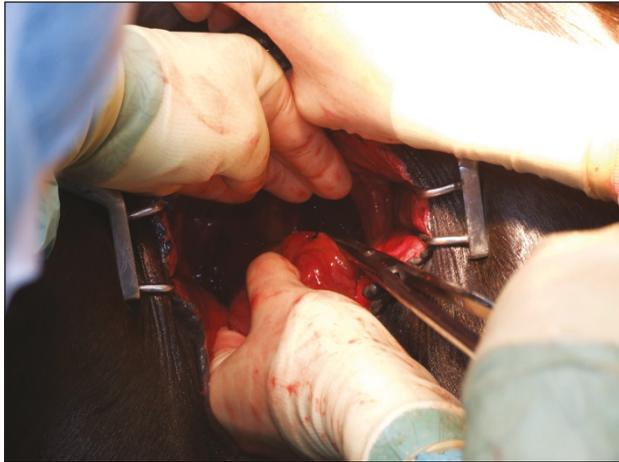


Figure 4: Stitching the bladder tear within the vaginal vault.

bladder may rupture at parturition, or later, due to necrosis of the bladder wall. Mares have been presented with this problem immediately after parturition to six days later (Higuchi 2002). After parturition, the symptoms that have been described include depression, anorexia, anuria, fever and abdominal distension (Divers 2009). Diagnosis can be made by detection of the bladder defect with endoscopy, trans-abdominal ultrasonography demonstrating free fluid in the abdomen, evaluation of serum biochemical variables and comparison of serum and abdominal fluid creatinine concentrations (Divers 2009).

A number of different surgical approaches have been described for repair of the bladder in the adult horse. A ventral median abdominal approach requires full traction on the bladder to observe the defect. In some cases (Rodgerson 1999), this has not been possible or has caused severe trauma to the bladder (Nyrop 1984). This approach would be especially unsuitable for dorsal bladder tears such as the one described here. Several successful standing techniques have been described for repair of the urinary bladder. The urethral sphincterotomy approach has been associated by some authors with post operative urine dribbling and urine pooling (White 1977), although other authors have performed this successfully without long term complications (Higuchi 2002). Rodgerson (1999) described two techniques to preserve the urethral sphincter. In one, the vaginal floor was incised 5-10 cm caudal to the cervix to retract the bladder. The second technique was to incise the vaginal floor and dorsal urethra 5 cm cranial to the urethral orifice. Obviously, both these approaches require careful repair of the incisions made to close the abdomen. In the mare examined in this case report, there was marked bruising and swelling in the vagina, particularly at the urethral orifice. This bruising would have certainly have complicated both performing the procedures described by Rodgerson (1999) and potentially healing in the post-surgical period. We were able to exteriorise the bladder by inserting a hand directly through the urethral orifice. The small size of the author's hand (9 cm x 17 cm) might have been favourable in performing this. While the technique described sounds simple, having two experienced surgeons

greatly facilitated the success of this procedure. Gentle, yet firm tissue handling was essential to prevent tearing of the damaged tissue. Eversion of the bladder required very careful tissue handling in order to exert enough force to bring the bladder out without causing further damage or tearing. Having one surgeon concentrating on bladder exposure allowed repair without stay sutures or surgical retraction which may have caused further trauma. Suturing the defect had to be done rapidly, yet extremely accurately. As this was a dorsal tear, care had to be taken not to suture dorsal to ventral bladder. Suture ends were kept as short as possible to avoid leaving a future nidus for urinary calculi formation. The technique used here meant there was no need to open the abdominal cavity, it also minimised potential complications and preserved the integrity of the vaginal structures.

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