CASE REPORT

Transurethral removal of a cystic urolith in a mare using a laparoscopic specimen pouch

AJ Williamsona* and AO McKinnonb

Case report Cystic urolithiasis is the most common form of urolithiasis reported in horses. In contrast to the gelding or stallion, clinical disease is less common in the mare and manual removal techniques are possible because of their shorter, wider urethral anatomy. However, these manual removal techniques can be traumatic and are limited by the size of the urolith. This report describes the use of a commercial laparoscopic specimen pouch to remove a cystic urolith in a mare.

Conclusion This approach may allow the extraction of larger uroliths per urethra in the mare, while affording some protection to the mucosa of the bladder neck and urethra.

Keywords bladder; calculi; mares; urethra; uroliths

Urolithiasis has been estimated to cause 7.8% of equine urinary tract disease.1 A lower prevalence of clinical disease has been reported in the mare, as the shorter, more distensible urethra enables natural voiding of larger uroliths than in the stallion or gelding.1,2 Common clinical signs include haematuria, pollakiuria, dysuria and urinary incontinence.1 In symptomatic horses, cystic uroliths are more commonly identified than those that are urethral, renal or ureteral.1

Equine uroliths are formed predominantly from calcium carbonate.3 Other elements include magnesium, sodium, potassium, iron, copper and manganese, with phosphates, sulfates and silica present as minor constituents.3 Uroliths have been divided into two types, both of which are based on hydrated calcium carbonate salts.4 Type I are soft, yellow-green and spiculated, and are more likely to produce traumatic cystitis, whereas type II are less common, admixed with phosphate and magnesium, and are smooth, firm and white.4

The aetiopathogenesis of urolithiasis is yet to be well defined. Risk factors may include the mineral content of drinking water, infection and non-steroidal anti-inflammatory medication.5 Calculus formation may occur secondary to a nidus of precipitated hyperhydrated calcium carbonate crystals, desquamated epithelial cells, mucoproteins or white blood cell aggregations.5 A 63% positive culture rate from samples collected from the centre of equine uroliths has been reported.1 Isolates most commonly cultured from equine cystic calculi are Escherichia coli, Streptococcus spp. and Staphylococcus spp.1,6 It is unclear if bacterial agents initiate urolith formation and their presence in the centre of equine uroliths is of unknown clinical significance.

Because of the naturally distensible urethral sphincter of the mare, surgical techniques often permit manual removal, in addition to those published for cystic urolith removal in the stallion or gelding.7 Manual urolith removal may, however, result in trauma to the bladder neck and urethral sphincter as a result of manipulations and/or abrasion by the spiculated surface of common type I uroliths.1,2,7 Removal of uroliths up to 7 cm in diameter per urethra has been documented.8 Larger uroliths may also require fragmentation by mechanical or laser lithotripsy, or urethrotomy to facilitate removal.1,2,7 More invasive laparocystotomy or laparoscopic/laparoscopic-assisted cystotomy may be required in some cases1,7 and therefore refinement of effective and less traumatic extraction techniques are of clinical benefit.

Case report

An 8-year-old Thoroughbred broodmare, 4 months pregnant and with foal at foot, was referred to Goulburn Valley Equine Hospital for management of cystic urolithiasis. The mare had a history of perineal scalding and pollakiuria. On presentation, ventral perineal scalding with depigmentation, ulceration, necrosis and sloughing of skin was evident. The ventral commissure of the vulva also displayed depigmentation and minor superficial ulceration (Figure 1). Urination was not observed. Rectal palpation revealed a firm, rough ovoid structure at the neck of the bladder. The structure was hyperechoic on examination by transrectal ultrasonography. History and clinical findings were consistent with a cystic urolith.

A novel, minimally invasive technique was devised to remove the urolith using a laparoscopic specimen pouch. The mare was restrained in a crush and sedated intravenously with a combination of 7 mg of detomidine hydrochloride (Calmant®, Ranvet, NSW, Aust) and 3 mg of butorphanol tartrate (Butomidor®, Ausrichter, NSW, Aust). The mare’s tail was wrapped and secured to the side of the crush and the perineum, vulva and vagina were washed. The urethral sphincter was palpated per vaginita. To assist with manual sphincter dilation, 50 mL of a 20-mg/mL solution of lignocaine chloride (Ilium Lignocaine 20 Injection®, Troy Laboratories, NSW, Aust) was applied topically to the urethral sphincter using an artificial insemination pipette. A single application did not provide sufficient local anaesthesia and application was repeated 5 min later. Pressure...
was then applied per vagina to the urinary bladder to stimulate voiding of urine, which appeared purulent. Gradual manual dilation of the urethral sphincter was performed over 10 min following topical application of carboxymethylcellulose gel until the urolith was palpable per urethra at the neck of the bladder. The mare required further sedation with 200 mg of intravenous xylazine hydrochloride (Ilium Xylazil-100®, Troy Laboratories).

A laparoscopic single-use polyurethane specimen pouch (Endo Catch II (Autosuture) single use specimen pouch®, Covidien, Dublin, Ireland) was used to capture and extract the urolith; pouch dimensions were 20 × 25 cm, with a mouth dimension of 10 × 16 cm.9 The pouch was pre-protected inside a long rigid cylindrical tube that was passed per urethra into the bladder. The non-dominant hand was maintained within the vagina for guidance while the shaft of the device was passed with the opposite hand. The pouch was extended from within the lumen of the tube, opening a continuous deformable metallic ring supporting the mouth of the pouch and giving a mouth diameter of 12.7 cm.9 The apparatus was rotated 180° to capture the urolith through the ring aperture into the pouch. The pouch was separated from the ring and closed using a draw-string mechanism, and the ring was retracted back within the lumen of the shaft. The shaft of the device was slowly withdrawn; with mild difficulty the pouch containing the urolith was retracted through the urethra (Figure 2A).

Palpation of the urethra post extraction showed no obvious tearing of the urethra or caudal bladder. The calculus was a firm and spiculated type I urolith, 93 × 59 × 40 mm in dimensions, and 285 g in weight (Figure 2B). The mare was treated with procaine penicillin G (22 mg/kg IM q12h; Ilium Propercillin®, Troy Laboratories), gentamicin sulfate (6.6 mg/kg IV q24h; Ilium Gentam 100®, Troy Laboratories) and phenylbutazone (4.4 mg/kg PO q24h; Equine Bute Paste®, Randlab, NSW, Aust) for 3 days. Broad-spectrum antibiotic therapy was initiated because of the potential for any urinary bladder or urethral trauma to lead to bacterial cellulitis. This was combined with non-steroidal anti-inflammatory medication to reduce post-procedural inflammation and oedema.

At 24 h after urolith removal, the mare was sedated intravenously with 200 mg xylazine hydrochloride (Ilium Xylazil-100®, Troy Laboratories) and 10 mg ketamine hydrochloride (Ilium Ketamine 100 mg/mL, Troy Laboratories) to reduce post-procedural inflammatory response. The pouch was removed and the urethra was washed with 100 mL warm saline followed by 100 mL 1% povidone-iodine. The urethra was observed to have a normal appearance with no obvious tears or trauma.
Laboratories) and 3 mg butorphanol tartrate (Butomidor®, Ausrich-
ter) to facilitate re-examination. On examination, no urethral dam-
age was palpable. A 7-mm endoscope was passed per vagina into the
urethra, assisted by topical carboxymethylcellulose gel. Cystitis was
observed secondary to trauma from the urolith; no mucosal tears
were visualised in the bladder or urethra. On follow-up contact
2 months later the mare was reported to be urinating normally. The
mare aborted the pregnancy 4 months after the procedure was
performed.

Discussion

There are multiple reported techniques for cystic urolith removal in
the mare, including manual removal.1,2 Manual removal via the ure-
tha can be enhanced with the use of a laparoscopic specimen pouch
as described here. We found this technique to be a convenient, more
reliable and reproducible method of larger urolith removal in the
standing mare. It negates the need for the clinician’s hand to be
within the urethra at the same time as extracting the urolith, which
in this case permitted removal of a large (93 × 59 × 40 mm) urolith
without sphincterotomy. The polyurethane pouch also provided lim-
ited protection to the bladder and urethral mucosa from traumatic
abrasion associated with the irregular surface of spiculated type I
uroliths.

The size of the urolith able to be removed manually in the mare is
limited by the possible extent of urethral dilation. In the case
described here, dilation of the urethral sphincter was assisted by top-
cical local anaesthesia with lignocaine chloride. Epidural anaesthesia
could also be considered in order to provide alternative regional
analgesia.1 It was not performed in this case because mild abdominal
pressure from the mare was considered adjunctive to urolith extrac-
tion; however, it would have been utilised if adverse straining was
encountered. The combination of intravenous sedation and topical
local anaesthesia provided adequate local analgesia to perform the
procedure.

The use of sterile plastic bags or a surgical glove to exteriorise uro-
liths and reduce trauma has been noted elsewhere, although the

techinque is not described.7 Use of similar laparoscopic devices to
remove uroliths in two geldings via perineal urethrotomy has been
recently reported.10 Although not necessary in this case, similar use
of videoendoscopic guidance for visualisation of urolith capture
would be useful in the mare if blind entrapment of the urolith within
the pouch proved difficult.10

Larger or spiculated type 1 uroliths removed manually may cause
complications, including tearing or trauma to the urinary bladder or
urethra. Sphincterotomy may prevent urethral lacerations in such
cases, but additional complications include urine pooling, small ure-
thro vaginal fistulas and pollakiuria.1 Use of the specimen pouch
reduces the extent of urethral dilation required in contrast to manual
hand removal and may prevent the requirement for sphincterotomy
in some cases.

Other potential complications of the manual procedure described
here include pouch rupture. Although no damage to the pouch
occurred with this case, there is potential for the polyurethane speci-
men pouch to rupture secondary to abrasion from the spiculated
surface of type 1 uroliths. An in vitro comparison of bursting
strength for laparoscopic organ retrieval pouches revealed that the
device used here is more resistant to bursting than Ziploc bags
(SC Johnson, USA), which may be considered as a cheaper alterna-
tive.9 Because of the large aperture of the device described here,
retrieval times are also faster than with other systems.9

This technique is considered low risk in pregnant mares because the
vagina is not entered beyond the cranial extent of the urethral
sphincter, although the importance of gentle manipulations is
emphasised. The mare in this case did not carry the concurrent preg-
nancy to term; however, given the significant time lapse of 4 months
between treatment and abortion, we consider that the intervention
was unlikely to be related.

Alternative techniques for removal of larger uroliths in the mare
include per-urethral extraction using forceps, lithotripsy and cystot-
omy. Use of a variety of extraction forceps and snare to remove
uroliths has been described in male horses undergoing perineal ure-
throtomy and are similarly applicable to the mare, although their use
does carry a small risk of bladder/urethral perforation and rectal tear
subsequent to urolith manipulation per rectum.1,11–13 Lithotripsy

techiniques include mechanical or laser-based methods. Uroliths may
be crushed using Lane bone-holding or Liston bone-cutting forceps;
however, sphincterotomy may still be required and a 47% recurrence
rate because of incomplete fragmentation and 19% morbidity rate
because of urethral trauma have been reported.1,2 In contrast to
mechanical techniques, laser lithotripsy performed endoscopically
under sedation and epidural anaesthesia is associated with lower
morbidity.7,14 Holmium:yttrium–aluminium–garnet (holmium:YAG)
laser utilising a photothermal mechanism is more readily available
and less expensive than pulsed-dye laser, but variable success has
been reported.7,13–17

The requirement for fragmentation is dictated by the size of the
urolith. Lithotripsy techniques require longer operative times in
contrast to efficient use of a laparoscopic specimen pouch, and with
potential for greater trauma and incomplete removal of fragmented
uroliths. The technique described here likely allows slightly larger
uroliths to be removed manually without fragmentation, as the
need to also accomodate the surgeon’s hand within the urethra is
eliminated.

Large uroliths may require cystotomy, via laparotomy, laparoscopy
or a pararectal (Gökel’s) approach.7 However, surgical complications
associated with cystotomy techniques can include poor exposure,
uroabdomen, peritonitis and incisional complications.6,18 Require-
ment for general anaesthesia generates complications including
myopathy, limb fracture and sudden death.19 Although the pararec-
tal approach is usually performed standing, less invasive approaches
are often successful and there can be additional complications such
as pelvic abscesses and orchitis in the stallion.7,20 The pararectal
approach has not been described in the mare to our knowledge and
the cervix, uterine body and broad ligament in the mare would
impede surgical access to the bladder.

Laparoscopic and laparoscopic-assisted cystotomy techniques are
less invasive than laparocystotomy and allow better visualisation and
smaller surgical incisions than laparotomy.6,21 Laparoscopy allows
tension-free bladder manipulation and can be performed under either general anaesthesia or standing sedation to avoid associated anaesthesia risks, but does require experience with laparoscopic suturing.18,21 Laparoscopic-assisted cystotomy with extra-abdominal extraction and bladder closure techniques under general anaesthesia has been described and does not require experience in laparoscopic suturing and reduces the risk of uroabdomen.6,18 Other factors to consider include surgical theatre requirements, staffing and consumables associated with anaesthesia, surgery and recovery. The postoperative recovery period required for incisional healing is also a significant consideration for mares in work and those with a foal at foot.

Factors including urolith size and number, clinician and/or surgeon preference, equipment and facilities, economic considerations and temperament of the horse may influence the technique used for urolith removal in the mare in the clinical setting. Manual removal via urethral dilation and use of the laparoscopic specimen pouch enables removal of larger stones in contrast to manual hand removal. Potential complications include bladder and urethral trauma. Use of the specimen pouch reduces the need for sphincterotomy, lithotripsy, general anaesthesia, laparotomy and cystotomy. It is a comparatively cost-effective technique with a minimal recovery period, making it a viable, minimally invasive, relatively atraumatic and time-efficient treatment alternative for cystic urolith removal in the mare.

Conflicts of interest and sources of funding

The authors have no commercial interest in the specimen pouch capture system used in the management of this case. Treatment of this case was not supported by a grant or external funding.

References


(Accepted for publication 24 July 2016)