

Case Report

Infertility in a mare with a chronic uterine tear, diagnosis and successful standing hand-assisted laparoscopic repair

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Summary

Uterine rupture is a well recognised and potentially fatal complication in the peripartum broodmare. This case report describes a 16 month history of infertility as the sole clinical sign in a Thoroughbred mare, subsequently diagnosed with a full thickness uterine tear. The clinical course, standing laparoscopically assisted repair and outcome are discussed.

Introduction

Rupture of the uterus may occur for various reasons, most commonly during stage II labour (Blanchard *et al.* 2002). Proposed aetiologies of uterine rupture include hydramnios, uterine torsion, trauma from the fetus and correction of dystocia (Honnas *et al.* 1988; Perkins *et al.* 1992; Dascanio *et al.* 1993). *Post partum* uterine rupture is frequently followed by septic peritonitis (Perkins *et al.* 1992) due to direct seeding of the abdomen from intrauterine bacteria through the tear (Mogg *et al.* 2006). If undiagnosed, peritonitis becomes established and the typical clinical signs ensue. Affected mares become febrile, depressed and anorexic and subsequently display signs of colic (Frazer 2004).

In one report of *post partum* deaths in mares, 11% were attributed to complications with the reproductive tract in general and 6.1% to uterine lacerations alone (Dwyer 1993). Uterine ruptures have historically been thought to occur most frequently in the dorsal uterine body wall (Brooks *et al.* 1985), however, with increasing knowledge, uterine tip lacerations may be more common than previously thought. Another report of 33 mares with uterine lacerations (Sutter *et al.* 2003) showed that 8 were confined to the uterine body, while 22 were found within a uterine horn; interestingly 73% of the uterine horn tears

occurred in the right uterine horn. Definitive diagnosis based solely on clinical signs is therefore difficult due to the nature and position of some uterine tears. Rectal and intrauterine palpation (Mogg *et al.* 2006) in combination with ultrasonography, hysteroscopy and abdominocentesis (Ragle 2006) have been the most common diagnostic tools employed. However, more advanced techniques such as laparoscopy have been used to make a definitive diagnosis (Hassel and Ragle 1994).

Case history

An 8-year-old 550 kg Thoroughbred mare was admitted to Hagyard Equine Medical Institute for investigation of a 16 month history of infertility, spanning the 2007 and 2008 breeding seasons. In 2006 the mare delivered a live foal and an intramural haematoma was subsequently palpated in the wall of the uterus 22 days post foaling, the location of which could not be determined from the records. In 2007 the mare delivered a stillborn fetus with evidence of premature placental separation and she was noted to have haemorrhage from the right uterine artery into the ipsilateral uterine horn wall. Twenty-five days post foaling, a haematoma was palpated in the right broad ligament. During the 2007 and 2008 breeding seasons the mare was confirmed to have normal oestrous cycles by transrectal palpation, transrectal ultrasonographic examination and teasing on the farm. The mare was covered 7 times by natural service to different stallions, 5 of these coverings in the 2008 breeding season and 2 in the previous breeding season. On one occasion the mare was confirmed to be in foal 15 days post breeding via transrectal ultrasonography; however, on Day 19 she was determined to have experienced an early embryonic loss. Prior to each breeding, endometrial swabs for microbial culture were aseptically obtained and were all determined to be negative. Ticarcillin disodium and clavulanate potassium

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was routinely infused into the uterus one day post service. Following the final 3 coverings, the uterus was lavaged using 0.9% sodium chloride.

Clinical signs and diagnosis

On admission, general physical examination revealed the mare to be in good health. Routine haematology and biochemistry were within normal limits. Transrectal palpation and ultrasonography of the uterus revealed a *corpus luteum* on the right ovary and multiple small follicles on the left ovary. The cervix was closed and no uterine fluid, pregnancy or free peritoneal fluid could be imaged at that time. The uterus was infused with 3 l of 0.9% sodium chloride through sterile tubing via the cervix in order to maintain distention and was subsequently examined using a 1 m flexible videoendoscope¹, which was passed aseptically through the cervix (Bracher and Allen 1992). Inspection of the right horn revealed a small hole that appeared to connect with the abdominal cavity (**Fig 1**). Uterine distension was unable to be maintained and transrectal ultrasonography performed after videoendoscopic examination revealed a small amount of anechoic fluid between the uterus and bladder that was not present on the ultrasonographic examination prior to uterine distention and hysteroscopy. It was therefore presumed that this fluid had drained from the uterus into the peritoneal cavity through the hole in the right uterine horn. No further abnormalities of the reproductive tract were detected during the examination. A standing

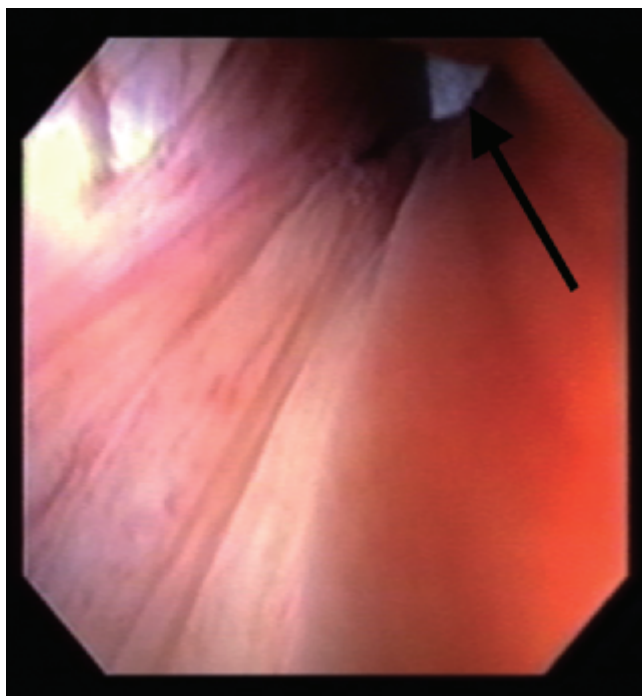


Fig 1: Videoendoscopic image taken from inside the right uterine horn demonstrating a full thickness tear. The black arrow indicates peritoneum visible through the uterine defect.

exploratory laparoscopic procedure was scheduled for the following day.

Surgical technique and treatment

All feed with the exception of water was withheld for 24 h prior to surgery. Broad-spectrum antimicrobial (gentamicin 6.6 mg/kg bwt i.v. q. 24 h and ampicillin 20 mg/kg bwt i.v. q. 8 h) and nonsteroidal anti-inflammatory drug (flunixin meglumine 1.1 mg/kg bwt i.v. q. 24 h) were given beginning 24 h preoperatively. The mare was placed in standing stocks and sedated using a combination of detomidine hydrochloride (0.01 mg/kg bwt i.v.) and butorphanol tartrate (0.02 mg/kg bwt i.v.) with repeat doses being administered to effect. The right paralumbar fossa was then clipped, and a line block performed using 2% mepivacaine hydrochloric infiltrated subcutaneously and intramuscularly, beginning at a point located half way between an imaginary line drawn between the *tuber coxa* and the 18th rib, and extending 15 cm ventrally. The surgical site was then aseptically prepared and draped. The abdomen was entered in a similar manner to that previously described (Rodgerson *et al.* 2002; Janicek *et al.* 2004). Briefly, an incision was made in the anaesthetised region beginning 4–6 cm ventral to the dorsal border of the internal oblique muscle. The incision was continued in a vertical plane for 12–15 cm. The external abdominal oblique muscle was transected sharply in the direction of its fibres and the internal abdominal oblique and transverse abdominus muscles bluntly dissected, also in the direction of their fibres. A surgeon's hand was placed in the wound and with blunt force the peritoneum was breached. Following this, a 1.5 cm skin incision was made just dorsal to the most proximal aspect of the larger incision. With one hand in the abdomen to protect abdominal viscera, the free hand was used to insert a 10 mm conical tipped laparoscopic trocar and cannula. The trocar was removed and a 10 mm × 30 cm, 0° laparoscope² passed through the cannula. The cranial reproductive tract was examined and a uterine tear visualised in the abaxial wall of the right horn located approximately 15 cm from the uterine tip. The right uterine horn was exteriorised and a 2 cm diameter full thickness tear was confirmed (**Fig 2**). Excess bulging endometrium was sharply dissected away and the defect was closed in 2 layers using No. 3-0 polyglecaprone 25. The first layer was closed using a simple continuous pattern and the second layer using a Lembert suture pattern (**Fig 3**). The site was thoroughly lavaged and the exteriorised portion of the uterus returned to the abdomen. The transverse abdominus, internal and external abdominal oblique muscles and subcutaneous tissues were apposed individually using No. 0 polydioxanone in a simple continuous pattern. Following this, the skin was closed using No. 0 poliglecaprone 25 in a Ford interlocking pattern. The laparoscopic portal was closed using No. 0



Fig 2: Full thickness 2 cm uterine tear in the right uterine horn held by the surgeon's left hand. Note endometrium protruding from the tear.



Fig 3: Repaired uterine tear prior to return to the abdomen.

poliglecaprone 25 in a simple interrupted pattern. Finally, the incision was covered with an aluminium spray³.

Post operative care

Post operatively the mare received broad-spectrum antimicrobial drugs (procaine penicillin G, 22,000 iu/kg bwt i.m. q. 24 h and gentamicin 6.6 mg/kg bwt i.v. q 24 h) for 5 days and flunixin meglumine (1.1 mg/kg bwt i.v. q. 24 h) for 3 days. The referring veterinarian was instructed to manipulate the uterus and uterine horn *per rectum* post operatively every 2 days for 2 weeks.

Outcome

The mare was successfully bred 8 months following surgical repair and subsequently produced a healthy foal.

Discussion

This case report describes the diagnosis and surgical treatment of a full thickness uterine tear that is thought to have occurred at a previous foaling, 16 months previously. To the authors' knowledge, the diagnosis of such a chronic tear has not previously been reported in the literature. The mare in this report was presented for a detailed investigation of an apparent history of infertility spanning a 16 month period. Detailed fertility records had been maintained by the farm and referring veterinarian, which confirmed her to have had normal oestrous cycles, ovarian activity and 7 serial negative prebreeding endometrial swabs. The mare was also recorded as having conceived and carried 2 live foals to term previously. Following rectal palpation and ultrasonographic examination of the reproductive tract, no abnormalities were detected and it was decided to perform hysteroscopy. Upon infusing 3 l of sterile saline into the uterus it was quickly evident that distension was unable to be maintained and, on further examination, a defect was noted in the right uterine horn, through which peritoneum was visible. It was therefore postulated with reasonable certainty that a full thickness uterine tear existed and it was decided to perform a standing hand-assisted laparoscopic surgical repair. We propose that the uterine rupture occurred after the latter foaling due to the external evidence of uterine haemorrhage and premature placental separation at that time, which may have resulted in fetal stress and subsequent blunt force trauma to the uterus from fetal movement (Frazer 2011). With increasing knowledge it seems that uterine tip lacerations may be more common than previously thought (Sutter *et al.* 2003). The mare in this case report had a full thickness uterine tear at the tip of the right uterine horn.

Laparoscopy was chosen as the method of choice, as it has been described as one of the least invasive surgical procedures (Hanson and Galuppo 1999; Yanmaz *et al.* 2007; Lee and Hendrickson 2008), and standing surgery avoids the risk of general anaesthesia and associated complications (Lee and Hendrickson 2008). Minimally invasive techniques in general, are associated with decreased post operative morbidity and mortality and hence a shorter time to return to work (Hanson and Galuppo 1999; Lee and Hendrickson 2008).

Intraoperatively, the greatest complication to be avoided is inadvertent trauma to abdominal viscera on cannula insertion. One study documented complications with cannula insertion using a 'blind' approach in 11/26 (42%) of horses (Desmaizieres *et al.* 2003). In our surgical technique, the surgeon first places one hand in the abdomen while the trocar and cannula are inserted with the free hand, thus guarding the tip of the instrument as it passes through the peritoneum.

The technique used was chosen due to surgeon preference and familiarity with the procedure. The possibility exists that surgery may have been performed

using a solely laparoscopic approach and employing intra-abdominal suturing techniques. Although this may have been possible, this surgical technique was not elected and would certainly require considerably greater surgeon skill and an increase in surgery time. The utilisation of a small laparotomy incision to allow passage of the surgeon's hand and exteriorisation of the uterine horn negates some of the benefits of a minimally invasive technique. As the location of the tear was determined preoperatively, the use of a laparoscope may not have been necessary; however, laparoscopy affords excellent visualisation of both the surgical site (Lee and Hendrickson 2008) and areas of the uterus that are not easily exteriorised. With a hand-assisted technique, the surgeon's hand within the operative field may also be used as a retractor (Janicek *et al.* 2004). The uterine tear was readily identifiable by its shiny protruding mucosa. The affected horn could be quickly exteriorised, repaired and returned to the abdomen thus affording a short surgery time of approximately 30 min.

Post operatively, anticipated complications included surgical wound dehiscence and adhesion formation between the sutured site on the right uterine horn and other intra-abdominal structures. Both the flank incision and uterus healed without complication. The uterus and uterine horn were manipulated *per rectum* every 2 days post operatively for 2 weeks to decrease the risk of adhesion formation.

Possibly the most interesting aspect of this case is the unusual presentation of a post parturient full thickness uterine tear as a history of infertility. Typically, affected mares become febrile, depressed and anorexic and subsequently display signs of colic with the onset of peritonitis (Frazer 2004). However, this mare did not show any external signs or illness that was noted by either the referring veterinarian or farm manager. One may speculate that there may have been haematological or biochemical abnormalities present during the early post parturient period, but due to the absence of clinical signs, blood tests were not performed. A study of *post partum* emergencies showed that 7/9 mares diagnosed with an acute uterine tear had a leucopenia at the time of diagnosis (Dolente *et al.* 2005). The presence of a full thickness uterine tear provides a direct portal of entry from the cranial reproductive tract into the abdominal cavity for bacteria. In addition to the normal uterine flora, many additional opportunities existed for the introduction of bacteria into the abdominal cavity via the reproductive tract. The mare in this report had been naturally bred on 7 separate occasions and additionally had 3 uterine lavages with each event affording the entry of bacteria, nevertheless, the mare did not develop a clinically identifiable peritonitis or signs of systemic illness. The possibility does exist that a low grade localised septic peritonitis may have developed that the mare's immune system was able to eliminate, which explains the absence of observable clinical signs. Seven serial negative uterine

cultures were obtained suggesting that this particular mare was not susceptible to post breeding endometritis and was readily able to clear any uterine infection present. On the day following each breeding, the mare routinely had uterine lavage performed. This procedure, along with the aid of the mare's immune response may have further reduced the pathogenic load. Other factors postulated to have helped prevent the development of a diffuse septic peritonitis include contraction of uterine smooth muscle surrounding the tear thus decreasing the size of the portal of entry for bacteria to the abdominal cavity. Oxytocin (10 iu) was routinely administered post foaling on the farm. During the surgical repair, the endometrium was noted to bulge from the uterine lumen into the abdominal cavity (**Fig 2**) and so partially plugged the tear. Similarly this was thought to have decreased the luminal diameter of the tear with reduced influx of bacteria and fluid into the abdominal cavity.

Post foaling uterine tears may not be readily detected. If the uterus is palpated in the period immediately following parturition before uterine involution has begun, a large proportion of the uterus may be out of reach, particularly the gravid horn (Dolente *et al.* 2005; Lofstedt 2005). As the uterus undergoes involution, the uterine wall begins to take up a corrugated feeling on palpation (Lofstedt 2005) and thus small tears may not be palpable. Following small full thickness uterine tears, smooth muscle surrounding the tear contracts and thus makes any communication between the uterine lumen and abdominal cavity difficult to detect, particularly if transrectal palpation is performed over intrauterine examination. However, more experienced examiners may be alerted to a uterine tear by the presence of a localised spasmodic portion of uterine wall. Due to the nature and position of some uterine tears, they may not all be diagnosed with the use of ultrasonography (Mogg *et al.* 2006), as was evident in our case, where the mare had transrectal ultrasonography performed multiple times by an experienced operator, yet uterine wall pathology was not visualised on any occasion. The lesion was first identified by hysteroscopy and confirmed with the use of laparoscopy. This confirms that when endoscopy, ultrasonography and laparoscopy are used in conjunction, they afford the clinician a comprehensive set of images to make an accurate diagnosis (Ragle 2006).

Conclusion

This report highlights the need for a thorough examination of the *post partum* mare's reproductive tract, so as to ensure future productivity. It confirms that transrectal ultrasonographic examination alone may not detect all uterine pathologies and digital uterine examination is a valuable adjunct to a comprehensive examination. Additionally, it demonstrates that full thickness uterine tears should be considered as a differential for chronic apparent infertility in the mare and the advantages of hand-assisted

laparoscopy in the diagnosis and repair of such defects over older surgical techniques.

Authors' declaration of interests

No conflicts of interest have been declared.

Manufacturers' addresses

¹Olympus, Center Valley, Pennsylvania, USA.

²Karl Storz Veterinary Endoscopy, Goleta, California, USA.

³Neogen Corporation, Lexington, Kentucky, USA.

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