Surgery of the Tubular Portion of the Reproductive Tract of the Mare

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Mares infertile because of an abnormality of the tubular portion of the reproductive tract are candidates for reproductive surgery if the results of a breeding soundness examination indicate that the surgical procedure is likely to restore fertility. Often, this examination includes histological evaluation of the endometrium to determine if the endometrium likely to support pregnancy. Reproductive abnormalities commonly corrected by reconstructive surgery include pneumovagina, caused by a cranially sunken anus and recutm and cranioventral inclination of the vulva; urovagina, caused by cranioventral inclination of the vagina; perineal injury, caused by fetal malposture during foaling; cervical lacerations, caused by insufficient dilation of the cervix during parturition; and ventral inclination of the uterus resulting in delayed uterine clearance.

Pneumovagina

Pneumovagina, or “wind-sucking,” is an abnormality characterized by persistent faecal contamination of the tubular portion of the reproductive tract resulting from conformational faults that cause a mare to aspirate air into the vestibule and vagina.¹ The condition ultimately culminates in infection of the endometrium. Pneumovagina develops when conformation of the vulva prevents the labia from forming a seal. Affected mares typically have a sunken perineal body, characterized by cranial displacement of the anus and cranial inclination of the vulva over the brim of the pelvis (Fig. 1). Aged, underweight, pluriparous mares are most commonly affected. The condition can also occur from tearing or stretching of the vulva or vestibulovaginal sphincter during foaling.

One method of determining if a mare is afflicted with pneumovagina is to part the mare’s labial lips and listen for the sound of air being aspirated into the vagina.² Inrush of air into the vagina indicates that the vestibulovaginal sphincter is dysfunctional and that mare is a “windsucker.” Sometimes this inrush of air can be heard when the affected mare exercises or urinates. Pneumovagina can also be detected during transrectal, ultrasonographic examination of the vagina and uterus.

The surgical procedure used most commonly to resolve pneumovagina is the Caslick’s vulvoplasty, a procedure in which the margins of the labia are apposed with sutures from their dorsal commissure to slightly below the floor of the ischium after a 2- to 3-mm wide strip of tissue is excised from the mucocutaneous margin of each labium using a scissors.³ Excising wider strips results in a dense scar, complicating opening of the labia for vaginal and cervical examination, breeding, or foaling, and complicates performing subsequent vulvoplasties. The right and left cutaneous margins of the labial wounds are apposed with 3- or 3.5-metric, nonabsorbable suture placed in a simple-continuous, continuous interlocking, or continuous horizontal mattress pattern. Sutures are removed at 11 to 14 days. The labia should be apposed to slightly below the ischial arch to prevent aspiration of air that might occur if the vulva bounces dorsally as the mare moves. The ventral aspect of the vulvar cleft should remain spacious enough for the mare to easily expel urine and to allow for insertion of a stallion’s penis or a vaginal speculum. The ventral aspect of the vulva is likely to be sufficiently spacious if four fingers can be inserted into the vestibule.

Fig. 1. Sunken perineal body, typical of mares with pneumovagina and urovagina.
A breeding stitch, can be inserted through the labia at the ventral aspect of the vulvoplasty to allow stretching of the vulvar cleft to permit copulation or vaginal examination without opening the vulvoplasty. The breeding stitch is a heavy, nonabsorbable suture that extends about 1 cm abaxial to ventral aspect of the sutured portion of the mucocutaneous margin of each labium. The deep portion of the simple-interrupted suture should be buried within the labial submucosa to prevent the suture from abrading the stallion's penis during copulation. The suture should be placed loosely enough to allow the ventral aspect of the vulvoplasty to stretch but not so loosely that it allows the vulvoplasty to tear.

A vulvoplasty may be inadequate to prevent pneumovagina if the vulva is deviated dorsal to the ischial arch and cranially so that the vulvar cleft is nearly horizontal. If vulvoplasty by itself is unlikely to prevent pneumovagina, a perineoplasty, or vestibuloplasty, is necessary. This surgery entails excising an equilateral triangle of mucosa and submucosa from the dorsum of the vestibule to expose the vestibular musculature, the right and left aspects of which are sutured together.

To perform vestibuloplasty, the mare is restrained in a stock and sedated, and its perineum is desensitised by administering epidural anaesthesia. The vestibule is exposed by retracting and each labium laterally with a towel clamp inserted at the juncture of the dorsal one-third and ventral two-thirds of the labium (Fig. 2). The labia are retracted laterally so that the margin of the labia form a straight line, parallel to the ground, between the towel clamps, and the towel clamps are fixed to the adjacent skin of the rump. The base of the triangular section of tissue to be removed from the vestibule is the mucocutaneous junction of the horizontally oriented labia and the location of the apex of the triangle is arbitrary. Usually, though, the apex of the triangle is located at a point directly ventral to the anus. The distance between this point and the dorsal commissure of the vulva is determined, and one-half of this distance from the dorsal commissure of the vulva is marked on the margin of each labium. The base of triangle of mucosa and submucosa that is to be excised is the line between these two points on the margin of the labia.

The mucocutaneous margin of the base of the triangle is incised with a scalpel, and using a scissors, the submucosa of the triangle is incised from the base to intended site of the apex of the triangle. This dissection creates a triangular pocket in the submucosa of the dorsum of the vestibule. A triangular section of mucosa and submucosa is removed by incising the right and left sides of this pocket with scissors. The right and left edges of the triangle are apposed with 3.5-metric, monofilament, absorbable sutures using a continuous-horizontal mattress pattern. The right and left sides of the vestibular musculature, exposed by excising the triangle, are sutured to each other with the same suture material using multiple, simple-interrupted sutures or multiple rows of simple-continuous sutures. The skin edges are apposed with 3-
or 3.5-metric, nonabsorbable, monofilament suture using a simple-interrupted suture pattern. Skin sutures are removed in 11 to 14 days.

Vestibulectomy increases the thickness of the perineal body, strengthens the constrictor vestibuli muscle, and returns the vulva to a more vertical position, but the cranial displacement of the anus may persist.\(^4\) The vulvar cleft should remain sufficiently spacious to permit copulation.

**Urovagina**

Urovagina (i.e., vesicovaginal reflux, urine pooling) occurs when the mare’s external urethral orifice is positioned dorsal to the vaginal fornix.\(^4\) The condition is encountered most commonly in thin, aged, pluriparous mares that have poor muscular tone of the vagina and elongated ovarian ligaments, resulting from multiple pregnancies (Fig. 1). Mares that suffer dysfunction of the constrictor vestibuli muscle caused by injury during parturition may also develop urovagina. Urovagina results in vaginitis, cervicitis, and endometritis. Urovagina may decrease viability of sperm by changing the vaginal pH and may cause premature lysis of the corpus luteum. Severely affected mares may constantly dribble urine.

The endometrium should be examined histologically before performing surgery to resolve urovagina because surgery is unlikely to restore the mare’s fertility if the mare has severe, widespread, periglandular, endometrial fibrosis.\(^4\) Surgical techniques described to resolve urine pooling include extending the urethral fold caudally (i.e., the Monin technique) and various techniques to create a tunnel from the external urethral orifice to the vulva (e.g., the McKinnon and Beldon and the Brown techniques of urethral extension).\(^5,6,7\) The Monin technique may be effective only for mares with mild perineal conformational faults that experience mild, transient urovagina. The McKinnon and Beldon technique may be superior to the Brown technique because the McKinnon and Beldon technique provides a more spacious extension and is less likely to decrease the circumference of the vestibule. The incidence of failure in resolving urovagina using the McKinnon or Brown technique of extending the urethra to prevent urovagina is high (15% reported with the McKinnon and Beldon technique and 11% reported with the Brown technique) because a defect often forms in the cranial portion of the extension.\(^5,6\)

A modification of the McKinnon and Beldon technique that reduces the incidence of dehiscence in the cranial portion of the tunnel has recently been reported.\(^8\) The modified McKinnon and Beldon technique of creating a urethral extension is performed with the mare sedated after desensitizing the perineal region by administering caudal epidural anesthesia. The midpoint between the dorsal and ventral commissures of the vulva is marked on each labium, and the vestibule is exposed using a retractor. A stab incision is created in the center of the urethral fold, and the tip of a scissors is inserted into this incision and used to bluntly and sharply separate the urethral fold into a dorsal shelf and a ventral shelf. The transverse incision in the urethral fold is continued caudally along the right and left walls of the vestibule to the midpoint between the dorsal and ventral commissures of the vulva. The incision is then directed ventrally for about 3 cm along the mucocutaneous junction of each labium. The mucosa and submucosa at the ventral margin of the incision is undermined on the right and left aspects of the vestibule to form a U-shaped flap, the cranial aspect of which is formed by the ventral shelf of the divided urethral fold. Right and left sides of the U-shaped mucosal flap are apposed using a continuous Lembert pattern to create a mucosa-lined tunnel that extends from the external urethral orifice to the labia.

The dorsal shelf of the urethral fold is retracted caudally for 4 to 5 cm, to cover the submucosa of the dorsal aspect of the cranial half or more of the urethral extension (Fig. 3). Right and left margins of the retracted dorsal shelf are sutured to the exposed submucosa of the extension
using a simple-continuous pattern, and the central, long axis of the dorsal shelf is sutured to the center of the urethral extension using a simple-continuous pattern. Any defect appearing in healed extension is located in the caudal half of the extension where it is relatively easy to repair.

**Perineal laceration or fistula**

A perineal laceration or fistula occurs during parturition when the foal's fore foot becomes caught on the annular fold of the hymen. This injury occurs, with few exceptions, only during the first foaling because the annular fold of primiparous mares is more prominent than that of pluriparous mares. A 1\(^{\text{st}}\)-degree perineal laceration includes only the skin and mucosa of the dorsum of the vestibule, is rarely recognized, and heals without complication. A 2\(^{\text{nd}}\)-degree perineal laceration is characterized by disruption of the constrictor vestibuli muscle, compromising the ability of the vestibule to constrict. Affected mares usually suffer from pneumovagina and urovagina. A 2\(^{\text{nd}}\)-degree perineal laceration is rarely recognized at the time of injury; injury is suspected when the mare develops abnormal perineal conformation and associated pneumovagina and urovagina.

A 3\(^{\text{rd}}\)-degree perineal laceration is characterized by a total disruption of tissue separating the rectum and vestibule resulting in a common rectal and vestibular vault. A rectovestibular fistula occurs when the tissue between the rectum and vestibule is perforated during foaling, but the foal’s malposture is corrected before the foal is delivered, allowing at least a portion of the perineal body to remain undamaged. A 3\(^{\text{rd}}\)-degree perineal injury is termed a rectovaginal, rectovestibular, or R-V laceration or fistula, but nearly all are rectovestibular, rather than rectovaginal (Fig. 4). Rectovestibular lacerations and fistulae allow the mare’s vestibule to become contaminated with faeces, which in turn, usually results in bacterial endometritis and infertility. The vestibulovaginal seal is usually disrupted, but if intact, it prevents contamination of the vagina and endometrium.

Mares with a 1\(^{\text{st}}\)-degree perineal laceration can be treated with a Caslick’s vulvoplasty, but mares with a 2\(^{\text{nd}}\)-degree perineal laceration require a vestibuloplasty to alleviate pneumovagina and urovagina caused by dysfunction of constrictor vestibuli muscle. The technique of vestibuloplasty to repair a 2\(^{\text{nd}}\)-degree perineal laceration is similar to the technique used to treat mares with pneumovagina caused by faulty perineal conformation, but excision of tissue to expose the vestibular musculature is more extensive.

Attempting to repair a rectovestibular laceration or fistula immediately after injury is usually futile because the lacerated tissue soon becomes inflamed and contaminated with faeces and because contraction of the perineal musculature rapidly widens and lengthens the wound. Rectovestibular lacerations and fistulae often can be repaired as soon as 3 weeks after injury. Before a rectovestibular laceration or fistula is repaired, the mare’s reproductive tract should be palpated *per rectum* to determine if the mare has uterine adhesions or pyometra, or is pregnant,
and the cervix should be inspected to ensure that that mare has not also incurred a cervical laceration during parturition. Histologic evaluation of the endometrium may be indicated before the injury is repaired if the injury has been present for more than one reproductive season. The uterus is unlikely to be permanently damaged even though the vagina and uterus are continuously contaminated with faeces, provided that repair was not neglected beyond several reproductive seasons.

The mare’s stool should be softened and its bulk reduced in preparation for surgery, but the mare’s ration should allow the mare to maintain weight. Withholding feed places the mare in a catabolic state, hindering healing. The bulk can be decreased by placing the mare on a ration of pellets several days before surgery, and the stool can be softened by administering mineral oil (4 L per os by stomach tube) or raw linseed oil (1 to 2 ounces in the feed) the day before surgery. A mare grazing a lush pasture may require no change in diet or administration of a stool softener. The mare should be administered a broad-spectrum antimicrobial drug before surgery. Although some surgeons prefer to repair a rectovestibular laceration or fistula with the mare anaesthetized and in dorsal recumbency, most are repaired with the mare standing. The repair is composed of 2 stages - rectovestibular reconstruction and anoperineal reconstruction. Both stages can be performed during the same operation, or the anoperineal reconstruction can be delayed for 3 weeks or more after rectovestibular reconstruction. Postponing anoperineal reconstruction until the rectovestibular reconstruction is healed reduces stress imposed on the rectovestibular reconstruction during defaecation, but performing both stages during the same operation minimises the time of hospitalisation and expense and returns the mare to fertility more rapidly.

The mare is restrained in a stock and sedated, and the perineal region is desensitised by administering epidural anaesthesia. The tail is bandaged, elevated, and tied, and faeces are evacuated from the rectum, vestibule, and vagina. Inserting a tampon into the rectum cranial to the defect to prevent faeces from contaminating the surgical site may cause the mare to strain and is not necessary because epidural anaesthesia is effective in preventing movement of faeces into the surgical site. The rectum, vestibule, and vagina are cleaned with cotton soaked in dilute povidone-iodine solution, and the perineal region is scrubbed with an antiseptic soap. The rectovestibular vault is exposed by fixing the dorsal aspect of each labium and the ventral aspect of the right and left sides of the anal defect to adjacent skin with towel clamps. The perineal body lies between the dorsal and ventral towel clamps.

Using long surgical instruments to reconstruct the rectum, vestibule, and perineal body is helpful but not essential. To reconstruct the rectovestibular tissue, regardless of whether or not both stages of reconstruction are to be performed during a single operation, rectal and vaginal submucosa at the cranial border of the laceration is separated cranially, in a frontal plane, with scissors for 5 to 10 cm (Fig. 5). Dissection is continued caudolaterally along the right and left walls of the common vault of the rectum and vestibule, using a scalpel, to the ventral most aspect of each side of the anal defect. This incision along each wall of the rectovestibular vault is deepened ventrolaterally, using scissors, to the form to form a U-shaped flap, the cranial aspect of which is the vaginal shelf formed by dissecting the submucosa separating the rectum and

Fig. 5. To begin reconstruction of the rectum and vestibule, the rectal and vaginal submucosa is separated cranially, in a frontal plane for 5 to 10 cm.
vagina. The incision is then directed ventrally along the mucocutaneous junction of the right and left sides of the rectovestibular vault to the ventral towel clamps, which demarcate the dorsal aspect of the right and left labia. Dissection is deepened until the right and left sides of the U-shaped flap can be apposed on midline without tension. At this point in the surgery, rectovestibular reconstruction can be completed by apposing the right and left vestibular flaps with a continuous-horizontal mattress suture pattern using heavy absorbable or non-absorbable suture. The repair is reinforced by inserting absorbable or non-absorbable suture in a continuous-Lembert or interrupted-Lembert pattern. Anoperineal reconstruction is postponed for 3 or 4 weeks.

To perform anoperineal reconstruction at the same time as rectovestibular reconstruction, the incision in the rectovestibular vault is deepened dorsally and ventrally on each side of the vault to create flaps used to form the dorsal aspect of the vestibule and the ventral aspect of the rectum. Using the Goetz technique of rectovestibular reconstruction, the edges of the rectal and vestibular flaps are apposed simultaneously with 4- or 5-metric, monofilament, absorbable sutures, placed 0.5 to 1 cm apart, using an interrupted, six-bite suture pattern. To relieve tension on the sutured laceration, suturing should begin at the cranial aspect of the cul-de-sac created between the rectum and vagina at the cranial end of the laceration. The dorsal portion of the 6-bite suture resembles a Lembert suture and inverts the rectal mucosa and submucosa into the lumen of the rectum, and the ventral portion of this suture resembles a vertical mattress suture and inverts the vestibular mucosa and submucosa into the vestibular lumen. To enhance apposition of the rectal shelves and reduce the likelihood of leakage of rectal contents into the sutured tissue, one or two, 3- or 3.5-metric, monofilament, absorbable sutures can be inserted in the rectal submucosa between the 6-bite sutures, in an interrupted-Lembert pattern. The rectum and vestibule are reconstructed, using the six-bite suture pattern, until the cranial aspect of the perineal body is reached. The site at which reconstruction of the perineal body begins is arbitrary.

The perineal body is reconstructed using a technique similar to that described for vestibuloplasty. To repair the perineal body, the caudal, unsutured portion of the right and left flaps created to form the vestibule are apposed with 4- or 5-metric, monofilament, absorbable suture using a continuous, horizontal-mattress pattern. The caudal edge of the sutured flaps forms the dorsal commissure of the labia. The rectal submucosa of the right rectal flap is sutured to that of the left rectal flap with 3-metric, absorbable, monofilament suture using a continuous-Lembert pattern, so that the sutured edges are inverted into the rectal lumen. Tissue between the newly created rectum and the dorsal aspect of the newly created vestibule is apposed with multiple, simple-continuous rows of 3- or 3.5-metric, absorbable, monofilament suture. To ensure a good labial seal, the horse should receive a Caslick’s vulvoplasty.

For ease of repair, a rectovestibular fistula should be converted into a laceration if the fistula is larger than 2 fingers in diameter or is within the caudal portion of the perineal body. Otherwise, the fistula should be repaired using the Forssell technique to spare the intact perineal body. Using the Forssell technique, the skin of the perineum is incised in a frontal plane midway between the anus and the dorsal commissure of the labia. The incision is deepened cranially, separating the rectovestibular hole into a rectal hole and a vestibular hole (Fig. 6). The rectal hole is closed in a transverse plane because the
musculature of the rectum is primarily circular, and sutures placed perpendicular to the muscle fibers are less likely to tear through tissue than are sutures placed parallel to the direction of the muscle fibers. The vestibular hole is closed in a sagittal plane because the musculature of the vestibule is primarily longitudinal. Both holes are closed using 3- or 3.5-metric, absorbable, monofilament suture placed in an interrupted-Lembert pattern. Pre-placing all sutures and then tying the sutures from the center outward may allow the sutures to be placed more uniformly. If necessary, each sutured hole can be reinforced with a second row of Lembert sutures. The frontal plane of dissection is difficult to close and so is usually left unsutured to heal by second intention.

Postoperative treatment of a mare after repair of a 3rd-degree perineal injury usually includes administering an antimicrobial drug and a non-steroidal, anti-inflammatory drug for several days. The mare’s stool should be kept soft and scanty for at least 8 days by feeding a pelleted feed and by administering a stool softener daily. A mare on lush grass may not require a change in diet or administration of a stool softener. A mare that strains after surgery should be treated by periodic administration of epidural anaesthesia and sedation. Causes of straining include faecal impaction of the rectum and bacterial cystitis. Faeces impacting the rectum should be removed manually after administering epidural anaesthesia. Bacterial cystitis and, therefore, straining, usually resolve rapidly when the vestibule is no longer contaminated with faeces. The integrity of the repair can be evaluated after the 8th or 9th day by palpating tissue between fingers of one hand inserted into the rectum and fingers of the other hand inserted into the vestibule. Small defects may close without formation of a permanent fistula. Most mares are capable of resolving bacterial endometritis within 1 estrous cycle. Natural breeding should not be allowed for at least 4 weeks after repair of a rectovestibular laceration, but mares can be bred safely by artificial insemination within 2 weeks after repair.9 Mares can be bred naturally at about 2 weeks after repair of a rectovestibular fistula.

**Cervical Lacerations**

Mares acquire a cervical laceration when the second stage of parturition occurs before the cervix is able to dilate completely, and although some are associated with dystocia or induced parturition, most occur during uncomplicated parturition.10,11 A cervical laceration is often first identified during routine postpartum examination or during examination to determine the cause of infertility, repeated uterine infection, or abortion. Cervical lacerations are best identified by palpating the cervix between an index finger (or thumb) inserted into the cervical lumen and a thumb (or index finger) placed on the vaginal surface of the cervix. Most are longitudinal and solitary, but uncommonly, more than one cervical laceration can be detected. The defect may not extend completely through all layers of the cervix. The lacerated cervix may appear short and persistently dilated when observed through a speculum, and it may be adhered to the vagina.

The cervix must function properly for pregnancy to be maintained, and so, a lacerated cervix should be repaired when the laceration is so extensive that it prevents the cervix from sealing the uterus from bacterial contamination. Opinions differ on how extensive the tear must be to interfere with formation of a seal, but most tears greater than 50% of the length of the vaginal portion of the cervix, prevent the cervix from creating an effective seal against microbial contamination of the uterus.2 Competency is best evaluated when the mare is in diestrus because during this stage of the cycle, a competent cervix must be dilated to allow insertion of a finger into the uterine lumen. The cervix should be repaired if the cervix closes incompletely when the mare is in diestrus.

A cervical tear is repaired most easily when the mare is in diestrus or anestrous because at either of these stages of the cycle, the length of the endometrial folds extending from the uterus into cervix is minimal. Although a ventrally located laceration may be more easily repaired with the mare
anaesthetized and positioned in the Trendelenburg position, most lacerations are repaired with the mare standing. To prepare a mare for repair, the mare is restrained in a stock and sedated, and the perineal area is desensitised and defaecation prevented by administering epidural anaesthesia. The tail is bandaged, elevated, and tied. A two-bladed speculum that expands laterally is inserted into the vestibule and vagina and is anchored to the base of the tail. A heavy retention suture is inserted through the caudal margin of the external cervical os adjacent to each margin of the laceration, and by placing tension on these sutures, the cervix is retracted as far caudally as possible. The sutures are tied to the base of the speculum.

Tissue is excised from each side of the laceration, using long scissors, to expose the fibromuscular layer of the cervix. Endometrial folds that appeared likely to interfere with repair are excised. The internal cervical mucosa is sutured first with 3- or 3.5-metric, absorbable, monofilament or multifilament suture placed in a continuous-horizontal mattress pattern so that the mucosa is inverted into the lumen of the cervix. Suturing begins at the cranial end of the defect and is continued caudally to the external os. The fibromuscular layer is sutured cranially to caudally with 3.5-metric, absorbable, monofilament or multifilament suture inserted in a simple-continuous pattern. The external (i.e., vaginal) mucosal layer is sutured cranially to caudally using 3.5-metric, monofilament or multifilament, absorbable suture material inserted in a continuous-horizontal mattress pattern so that the external cervical mucosa is inverted into the lumen of the vagina.

The retention sutures are removed, and the vagina and cervix are covered with an oily, antimicrobial preparation. The mare should receive a Caslick’s vulvoplasty, if necessary. A broad-spectrum, antimicrobial drug and a non-steroidal anti-inflammatory drug are administered to the mare for 3 to 5 days. Inserting a gloved finger into the cervical lumen every other day for several weeks beginning a week after repair may be worthwhile to prevent formation of intraluminal adhesions. The mare should receive sexual rest for one month, and its cervix should be examined for competency and patency before the mare is bred. The owner should be informed that because of scar tissue at the site of repair, the cervix maybe incapable of dilating sufficiently during the subsequent parturition to prevent a laceration from occurring.

Delayed Uterine Clearance
Many mares, especially pluriparous mares, middle-aged or older, are infertile or subfertile because of post-mating endometritis. The endometrium may become inflamed and filled with fluid in response to bacteria, spermatozoa, and debris deposited into the uterus during natural breeding or artificial insemination, but fluid, spermatozoa, bacteria, and debris are normally eliminated quickly so that inflammation is resolved by the time the embryo reaches the uterus, 5½ to 6 days after fertilization. Most mares are able to rapidly resolve post-mating endometritis, but for some mares, post-mating endometritis persists because they are unable to to eliminate the debris-filled fluid from the uterus. This inability to eliminate fluid is termed delayed uterine clearance. Reproductively healthy mares tend to have a horizontally oriented uterus, and this orientation facilitates flow of uterine contents into the vagina, whereas mares with delayed uterine clearance tend to have a ventrally oriented uterus, and this ventral orientation inhibits escape of uterine contents through the cervix.

The uterus of middle-aged and aged, pluriparous mares is often oriented vertically because the broad ligament has become stretched by the weight of numerous foals. A uterus suspended more than 15 cm below the brim of the pelvis is more likely to accumulate and retain fluid after breeding than is a uterus positionned horizontally because vertical orientation inhibits the expulsion of debris-filled fluid. Returning a ventrally oriented uterus of mares infertile because of chronic endometritis caused by delayed uterine clearance to a horizontal position may restore fertility by improving uterine clearance. The mesometria of the uterus can be imbricated laparoscopically to restore a pendulous uterus to a horizontal position.
The mare is prepared for surgery by withholding its feed (not water) for about 36 hours. The mare is restrained in stocks, and its tail is bandaged to prevent it from contaminating the surgical fields. Faeces are evacuated from the rectum, and the bladder is drained with a catheter. Pre-surgical administration of an analgesic agent, such as flunixin meglumine, may prevent post-operative abdominal discomfort. Administration of an antimicrobial drug is not necessary. The flank and the last 3 intercostal spaces on each side of the mare are prepared for aseptic surgery, and the skin and musculature are desensitised with local anaesthetic solution instilled into the subcutaneous tissue and musculature at each of the 3 sites of incision in each flank for insertion of laparoscopic cannulas. Sedation is administered by continuous-rate, intravenous infusion of a sedative.

Laparoscopic portals are first created in the left flank to allow the cecum to fall from the right body wall as negative pressure within the abdominal cavity is relieved with the portals placed through the left flank. This makes inadvertent puncture of the cecum less likely when portals are created in the right flank. The laparoscope is inserted through a cannula introduced into the abdomen at the 17th intercostal space slightly ventral to an imagined line drawn horizontally through the ventral border of the tuber coxae. Instruments used to elevate the uterus are inserted through a cannula placed midway between the cranial ventral aspect of the tuber coxae and the last rib at the dorsal crus of the internal abdominal oblique muscle and through a cannula placed about 6 cm ventral and 2 cm caudal to the central portal. Surgery can usually be performed without insufflating the abdominal cavity.

The mesometrium and uterus are desensitised by infiltrating the length of the dorsal aspect of the mesometrium with 30 to 50 mL of local anaesthetic solution using a laparoscopic injection needle. The left side of the uterine body and the left uterine horn are sutured to the dorsal aspect of the mesometrium using a laparoscopic needle holder or by using a 15-inch, Endo Stitch Automatic Endoscopic Suturing Device (Endo Stitch Automatic Endoscopic Suturing Device, Auto Suture Company, Division of Covidien Surgical, Norwalk, Conn 06850) inserted through the caudoventral portal (Fig. 7 and 8). The needle is inserted through the seromuscular layer of the dorsolateral aspect of the body of the uterus, at the reflection of the mesometrium onto the uterus, and then through a site on the mesometrium sufficiently dorsal to the uterus to elevate the uterus to a horizontal position when the suture is tightened. After passing the suture through the uterus and mesometrium, the suture is anchored, rather than tied, by passing the needle through a small loop created on the end of the suture strand.

Suturing begins close to the cervix and extends cranially to end near the tip of the uterine horn, being careful to avoid obstructing the oviduct with the suture. Sutures are spaced about 1.5 cm apart, using a simple-continuous pattern, and about 10-15 suture bites through the uterus and mesometrium are required to suspend one side of the uterus. The length of the mesometrium imbricated increases as suturing advances cranially because the abnormal conformation of the uterus causes the mesometrium to be much longer cranially than caudally. The cranial end of the continuous suture line is tied intra-corporeally if the procedure was performed using the Endo Stitch Automatic Endoscopic Suturing device. The skin incisions are closed with staples or sutures, and the same approach and technique are used to imbricate the right mesometrium. An anti-inflammatory
drug is administered for several days for analgesia, and the mare is confined to a small area for 1 month after surgery. Although the results of this procedure have not been subjected to scientific scrutiny, preliminary results indicate that the procedure is effective in restoring fertility to many mares.

References