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**Selected Reproductive Surgery of the Broodmare**

Angus O. McKinnon

Author’s address: Goulburn Valley Equine Hospital, 905 Goulburn Valley Highway, Congupna, VIC 3633, Australia; aom@iinet.net.au.

**Introduction**

The notes herein are a compilation of some of the techniques that are used at the Goulburn Valley Equine Hospital and are not intended as an exhaustive, heavily referenced treatise of all available techniques. No attempt has been made to discuss all reproductive techniques or conditions requiring intervention. The procedures work very well for us; however, readers should be aware that different methods are employed successfully by others. We would be grateful to those who have different ideas and experiences if they would communicate them. Many of techniques presented are modifications of existing techniques, newer techniques and/or areas we feel warrant special attention. We have assumed that readers are familiar at least with both relevant anatomy and standard documented surgical correction of reproductive related problems.

Topics for discussion have been dictated by our experiences and preference for an individual or alternate technique when many exist. Most problems could be expected to be presented to a busy equine practitioner in any individual breeding season. Most of the techniques relate to restoring or improving fertility and most are elective and require experience to make the correct diagnosis and therapeutic approach.

**Patient Selection**

In consideration of the client, patient and general perception of our abilities and merit of our interference, care should be exercised in selecting only those patients that are likely to respond favorably to surgery.

The probability of a successful outcome i.e. pregnancy, live foal etc. must be evaluated with regard to:

- a) Severity and nature of the problem
- b) Breeding history of the mare
- c) Value of the mare and/or offspring (commercial or sentimental)
- d) Cost of the procedure
- e) Mare age.
- f) Fertility of the stallion
- g) Availability and suitability of sophisticated breeding techniques such as AI, ET etc.
- h) Long term value of interference i.e. temporary or permanent improvement
- i) General health of the candidate
- j) Perpetuation of heritable conditions
- k) Insurance and informed client consent
1) Ethical considerations
m) Experience of the veterinarian
n) Quality of on farm management

It is pointless to perform a sophisticated, expensive surgery i.e. for vesico vaginal reflux, if the mare has sustained chronic uterine damage and fibrosis that will render her infertile despite an excellent surgical outcome. Full reproductive evaluation is necessary prior to surgery in any candidate subjected to physical insults i.e. recto-vaginal lacerations and fistulas for longer than one year.

**Sedation and Anesthesia**

Most procedures are performed with the mare standing utilizing local infiltration or epidural anesthesia. Apart from minor procedures (Caslick’s vulvoplasty) we prefer to have mares tranquilized and restrained in appropriate stocks, i.e. facilities for cross tying and/or tail elevation. Tranquilization and analgesia is provided most commonly with IV Detomidine (mg) butorphanol (mg). Longer surgeries may require the repeated IV use of low doses of Xylazine (100 mg). Cost and length of tranquilization/analgesia are important considerations. In addition some have other physiological effects e.g. increased urinary output with Xylazine. Detomidine provides excellent tranquilization and analgesia; however, effects are often still apparent hours after administration. Epidural anesthesia may be extremely effective, however variation in response, individual susceptibility and time before appropriate anesthesia is obtained, occasionally make it less rewarding than tranquilization and local infiltration for some of the procedures discussed here. Techniques for epidural anesthesia have been discussed elsewhere. However one word of warning - epidural administration more than 7-9 ml of 2% local anesthetic to a 500 Kg mare can be associated with loss of motor control to the hind limbs and recumbency. These mares are difficult to manage and may require support for 2 to 4 hours.

Epidural injection of Xylazine for perineal analgesia has been reported to be very efficacious. A dose of 0.17 mg/kg (around 75-100 mg in an average horse) was as effective as local anesthetic agents for analgesia and had nil or minimal effects on depression of motor nerves in the lumbosacral intumescence. A nother advantage was demarcation of the area of analgesia with an area of sweating (dermatome) that was consistent both temporally and topographically. In our experience the perineal dermatome is not always obvious. In addition it takes around 35-40 minutes for good analgesia to be recognized associated with xylazine epidural anesthesia. Currently we prefer to use a combination of xylazine (70 mg) with lidocaine (60 mg = 3 ml), q.s. saline to 10 ml for most horses. With this regime loss of tail tone has occurred associated with a successful ‘block’ within 5-10 minutes and surgery generally has begun by ~30-45 min post administration. Our most common method of epidural anaesthesia is to begin with the infusion 1 ml of local anesthetic through a 25 gauge needle subcutaneously above the first moveable coccyleal/sacral joint (usually C1 and C2). Next a 38 mm, 18 gauge needle (bevel forward and introduced at 45 degrees) that has a small amount of fluid left to create a meniscus on the needle hub is introduced through the local bleb. Recognition of the fluid being aspirated into the needle infers correct placement and the appropriate amount of solution is injected slowly into the epidural space whilst continually evaluating the ease of administration to ensure the needle tip is still in place.
Occasionally epidural anesthesia is difficult to achieve (infusion outside the spinal cord before proper epidural placement, hemorrhage through the needle and tissues, anatomic abnormalities and fat horses). Provided local anesthesia can be obtained by infiltration without adverse affects on wound healing, we prefer to perform surgery without the epidural and provide incremental IV administration of Xylazine i.e. 50-100 mg to already tranquilized patients when or if minor surgical discomfort is recognized.

In some instances we have been able to identify correct epidural placement by injecting the anesthetic slowly while moving the needle until there is an obvious change in the amount of pressure needed to advance the solution. These situations are usually associated with a mare with abnormal anatomy (i.e. after a traumatic foaling) and lack of movement of fluid in the needle hub.

Vestibule and Vulval Lips

a) Pneumovagina

There are three barriers to aspiration of air and contaminants into the cranial reproductive tract:

1) The vulval/vaginal lips
2) The vestibular sphincter and
3) The cervix

It would appear that the vestibular barrier is more important than previously recognized, however when any of these protective barriers are rendered incompetent, contamination and concomitant vaginitis, cervicitis and metritis may result. Pneumovagina can result from faulty perineal conformation, previous injury to perineal tissues or effects of poor body condition. Pneumovagina can also be iatrogenic i.e. reproductive examination or breeding.

Recognition of potential candidates for pneumovagina are made from anatomical observations\(^3\) i.e. predisposition is associated with a low pelvis, tilted vaginal lips and a sunken anus (Figs 1a and 1b). If possible mares should be examined during estrus when the reproductive tract is relaxed. Parting the vulval lips results in loss of integrity of the vestibular sphincter and an audible ingress of air to the cranial vagina. Recognition of foamy exudates from the vaginal lips may be often noted during rectal examination. In addition ultrasonography has been used to visualize air in the uterus.\(^4\) If in doubt after clinical evaluation about a mares potential to aspirate air into the vagina, we recommend treating by surgery all mares that have been barren one or more breeding seasons, unless other causes of reduced fertility are obvious i.e. stallion, farm management etc.

Caslick's Vulvoplasty

The procedure was first described by Dr. E.A. Caslick in 1937,\(^5\) and involves apposition of the vulval lips. Local anesthesia of vulval lips, removal of a thin portion of mucosa from the mucocutaneous junction and apposition of the cut edges is simple, quick and effective. Length of apposition is determined by height of pelvis relative to vulval lips. In general the join should continue to a point at least 3 to 4cm below level of the pelvis and approximately 3cm should be
left unopposed to allow for urination. If this is not possible other surgical techniques (see below) may be necessary.

Figure 1a. Retraction of vulval lips reveals an intact vestibular sphincter. Figure 1b. Retraction of vulval lips reveals an open vestibular sphincter that is likely associated with pneumo-vagina.

Points for consideration

1) Suture material – We use 0 catgut (Metric 4) on a continuous spool. The benefit of gut is that is gone or degraded by the time of either pregnancy testing (~15 days) or the next breeding cycle (if the mare is empty). Other materials that are non absorbable or delayed absorbable may damage the stallion if the mare is rebred.

2) Suture pattern – Simple continuous is quicker and just as effective as simple interrupted. However failure to appose the deepest layers of the exposed tissues may result in fistula formation. Failure to exit/enter in the middle of the cut tissue caused by taking bites to deep will result in wound breakdown.

3) Method of mucosa removal:
   - Tissue should be removed from the mucosal surface of the vestibule not the skin of the vulva lip.
   - too much will result in fibrosis and difficulty for the next veterinarian (Fig 2a).
   - if multiple procedures are performed in one season, freshening with a scalpel blade is sufficient, providing a careful suture pattern is placed (Fig 2b).
   - incision with a scalpel blade rather than mucosal removal is recommended for maidens (i.e. race mares) (Fig 2c). This results in a thinner join that is easily opened at the breeding farm.

4) Post operative treatment
   - Frequent rectal palpation within two weeks will result in fistula formation.
   - remove (open) 2-3 weeks prior to anticipated foaling
5) Variations
- placement of a breeding stitch (usually doubled heavy gauge suture material or umbilical tape (Fig 2d) will save unnecessary replacement and facilitate breeding and some manual vaginal manipulations for treatment etc. Care is needed with natural service to prevent penile trauma. We routinely treat or bred (AI) mares by passage of an infusion pipette into the vagina (past the vestibular sphincter) and use rectal manipulation of the pipette through the cervix similar to, but with a little more difficulty than cattle.

![Figure 2a](image)

Figure 2a. Careful trimming of the muco-cutaneous junction without removing skin from the vulval lips facilitates many more identical surgeries. Figure 2b. Simple continuous suture is all that is necessary but suture placement will help avoid fistulas. Figure 2c. A scalpel blade is recommended for the first caslick a mare has, especially maidens in work. Figure 2d. A breeding stitch may be useful in preventing the caslick from opening with vaginal examination or natural service.

2) Episioplasty

This procedure is used in cases with more severe anatomic abnormalities where the Caslick vulvoplasty is ineffective and in mares with extensive or repeated second-degree perineal lacerations. Technically the previous surgery is an episioplasty as well, however we use the term to describe the more extensive procedure previously referred to as 1) a deep caslick 2) the Gadd technique or 3) a perineal body reconstruction. The procedure is designed to restore some degree of function to the perineal body. (Figs. 3a and 3b).
Figure 3a. The dotted lines outline the area to be apposed with the formation of a new perineal body. Figure 3b. The ventral layer of the perineal body consists of the vaginal mucosa. The perineal body is created from apposition of the vaginal mucosa where the tissue has been denuded.

The surgery is performed on the standing mare with local anesthesia. Visualization is improved by good retraction and light sources. We prefer to perform all perineal surgeries using as a light source with a centrally mounted beam.

A triangular portion of the dorsal caudal vestibule is removed from both sides. Apposition of the ventral borders of the incision and obliteration of the potential space above result in increase in size of the perineal body and decreased propensity of the vestibule to create negative pressures. The ventral borders are apposed with a continuous absorbable suture (2/0 vicryl) and dead space with single interrupted sutures. The mucocutaneous junction is closed similar to the Caslick procedure.

Points for consideration

- The procedure appears most beneficial when combined with a perineal body transection (see below).
- Failure to "open" the dorsal vestibule and vulval lips prior to foaling (2-3 weeks) may result in severe perineal laceration.
- The surgery usually takes longer (30-40 minutes) than expected (10-15 minutes) and is sometimes associated with significant and annoying obscuring hemorrhage.

b) Urovagina

Pooling of urine in the vagina is a problem for a variety of reasons. In 1985 Jay Belden, then of Fossil Creek Farms, showed me his technique for urovagina. Prior to this both of us had tried the other described techniques and were not particularly happy with the outcome. After around 34 surgeries between us using Jay’s technique, we decided the technique was efficacious and should be presented. The resultant publication has been summarized below.
The midline caudal border of the transverse vaginal fold is grasped with Allis tissue forceps and retracted caudally toward the surgeon. Two to 4 cm cranial from the caudal border of the transverse fold, a horizontal transverse incision to the submucosa is made with a No. 12 Bard Parker blade (Fig 4a). The incision is continued laterad and then slightly dorsad to the vaginal wall. The vaginal retractors are then repositioned, and a No. 20 Bard Parker blade is used to extend the incision from the lateral border of the transverse folds caudad. This incision is made approximately one half to two thirds of the distance between the vaginal floor and roof and is extended to the vulvar labia. The caudal cut edge from the transverse fold incision and the ventral cut edge of the vaginal wall incision are dissected so that the free tissue flaps are reflected caudal and mediad, respectively. This caused vaginal mucous membranes of the free tissue flaps to be reflected ventrally and the underlying cut surface to be exposed dorsally. Next, the retractors are repositioned, and an identical incision is made on the opposite vaginal wall, extending from the lateral extremity of the transverse fold caudally toward the surgeon (Fig 4b).

Dissection of the tissue flap from the transverse fold is continued until the caudal cut edge could be reflected approximately 3 to 6 cm toward the surgeon. The dissection of both vaginal wall flaps is continued ventrally until the cut edges could be reflected without tension past the midline (Fig 4c). The suture pattern (Fig 4d) used to appose the submucosal tissue layer is a continuous modified Connell's, using 2-0 gut. The final configuration is in the shape of a Y, with the apex pointing caudally. The first suture line begins cranially and laterally at the junction of the transverse fold and vaginal wall incisions and is ended at the midpoint of the transverse fold reflection. Cut edges of the transverse fold and vaginal wall are inverted so that denuded tissues are in apposition. The second suture line began on the opposite side, at the junction of the transverse fold and vaginal wall incisions, and is continued to the end point of the first suture pattern and then on the midline, toward the surgeon, to the caudal end of the vaginal wall reflections. The result is an extended tunnel from the urethral orifice (under the transverse fold) to the caudal vaginal vault. It is important to have minimal tension associated with the suture line and have all apposed edges inverted so that dissected or denuded tissues are in apposition (Fig 4e).
The denuded tissues created dorsally by the dissection of the transverse and vaginal folds are allowed to heal by second intention. If necessary, an episioplasty is performed after surgery.

- Additional points

- The technique described is our technique of choice for treatment of all mares with urovagina. Other treatments such as perineal body transection or caudal relocation of the transverse fold are often only temporarily effective.
- Episioplasty performed at the same time may result in excessive ablation of vestibule.
- In some mares urine will pool in the caudal relocation of the urethral tunnel and it will be voided during exercise, commonly resulting in urine staining of the perineum. While this does not affect fertility, it is unsightly and may be treated by incision into the new urethral tunnel to a point 2-4 cm cranial to the vulval lips but not far enough to allow urovagina to reoccur.

**Perineal Body**

Surgeries of the perineal body are necessary to correct severe anatomic defects (perineal body transection - PBT) or injuries due to foaling (perineal lacerations and fistulae).

**a) Perineal Body Transection**

Perineal body transection has been described to be beneficial for both pneumovagina and urovagina. Our experiences would suggest definitely the former but only occasionally the later.

The primary indication for PBT is mares with such external reproductive conformation that we are not able to prevent pneumovagina after either Caslick's vulvoplasty or episioplasty i.e. mares with a severely sunken anus and most or all of the vulval lips positioned above the brim of the pelvis (Fig 5a and 5b).
The procedure is performed with local anesthesia with or without tranquilization. Local anesthesia (40-70ml) is liberally infused into the perineal body and laterally to include the vaginal walls to a depth of 8-14 cm.

Towel clamps positioned just ventral to the anal sphincter and dorsal to the dorsal commissure of the vulva are used to provide retraction and tension while a 4-6 cm-horizontal incision is made midway between the anus and dorsal vulva. The incision is continued for a short distance (2-5cm) along either side of the vulva. Sharp and blunt dissection are used to completely transect the muscular and ligamentous supporting tissues between the rectum and vestibule (Figs 5c-e). Depending on the individual mare, the dissection proceeds cranially for 8-14cm and finishes before entering the peritoneal cavity. The aim of the surgery is to allow the vulval lips to assume a more horizontal position by freeing them from attachments to the rectum. Generally the surgery is finished when the desired external conformation is achieved after allowing for wound contraction.

Figure 5a. The ageing process of the mare and her conformation has allowed the vestibule and vagina to be positioned mostly above the pelvic brim. Figure 5b. This conformation results in pneumo-vagina and occasionally urine pooling. Figure 5c. The musculature associated with the rectum and vestibule/vagina must be transected to allow the vulval lips to relax caudal. Figure 5d. The surgery often results in the tip of the vulva relaxing to create a shelf if the incision is left not sutured. Figure 5e. The final result about 48 hours after surgery.
Closure of the skin incision was originally recommended; however, we commonly leave the incision open. Closing the skin occasionally results in dehiscence and also seems to influence the result after wound contracture occurs. The wound heals by second intention and is surprisingly rapid (2-3 weeks).

Points for consideration

placing a hand in the vestibule enables accurate dissection. Penetration of the vagina or rectum should be avoided.

The wound is unsightly while healing and we recommend careful client communication and/or hospitalization for 1-2 weeks.

The benefits from corrective surgery are immediate and mares can be bred at the first opportunity providing qualified personal are available. Natural service is generally delayed 2-3 weeks to allow strengthening of the dorsal vestibule and vagina. Despite the surgery causing moderate hemorrhage we have not had to take any special precautions or protective measures.

b) Perineal lacerations

Most perineal injuries occur at the time of foaling and are associated with:
1) a mal-presented or oversized fetus or
2) extensive, vigorous, inappropriate or sometimes unavoidable manual manipulation during parturition and
3) violent expulsive efforts of the mare
4) maiden mares are by far the most commonly injured with 3rd degree perineal lacerations.

The injuries are commonly referred to as 1st, 2nd or 3rd degree perineal lacerations (PL).
1) 1st degree PL involves only the mucosa of vestibule and skin of the dorsal commisure of the vulva.
2) 2nd degree PL involve both the mucosa and submucosa of the dorsal vulva, and some of the musculature of the perineal body, in particular the constrictor vulvae muscle. There is no damage to rectal mucosa.

Minor 1st degree PL may require no treatment. Extensive lacerations may require episioplasty or perineal body reconstruction. If tissue damage results in significant edema, inflammation and infection, then surgical correction is often delayed for 2-3 weeks.

3) 3rd degree PL results in tearing of the vestibular and sometimes vaginal wall and disruption of the perineal body, anal sphincter and rectal wall. This results in a common opening between the rectum and the vestibule. The constant presence of feces in the vestibule and occasional unpleasant sound from air movement make repair imperative for breeding and recommended for future riding horses.

Immediate care for the mare at foaling involves antibiotics, anti-inflammatories and protection against tetanus. The surgical correction is delayed at least 4 weeks to allow initial second
intention wound healing to occur. Heroic repair at the time of foaling is almost never successful.\textsuperscript{8} The longer the injury is left untreated the more opportunities for continual contamination of the reproductive tract, however this is related to functional capabilities of vestibular sphincter and many people will wait until weaning if a live foal was delivered. The cervix must be examined prior to surgical correction of PL and if a prolonged time between foaling and repair has occurred a full reproductive evaluation including biopsy is warranted.

**Surgical Technique**

There are many methods described. Most importantly the procedures are modifications of either a single or two-stage repair. A modification of the single stage repair\textsuperscript{9} is the technique we prefer.

Prior to surgery vigorous efforts are made to modify the consistency of the feces. Mares are held off feed for at least 24 hours and given a mineral oil drench (2-3 liters) before beginning surgery. After surgery mares are placed on pasture if available and mineral oil is administered by stomach tube daily for 3 days as necessary to maintain a soft fecal consistency. Mares are restrained standing, tranquilized and epidural anesthesia is employed. Fecal material from the rectum is removed as far cranial as possible. Large wads of cotton are inserted into the cranial rectum to absorb fecal fluid and prevent fecal contamination of the surgical site. Tissues are cleansed and prepared for aseptic surgery. Towel clamps are inserted into the ventral anal sphincter in a configuration that when apposed represent the ideal surgical apposition point. In addition towel clamps are placed on the dorsal vulval commisure and then retracted to provide visualization for surgical access or alternatively stay sutures are used to retract the vulvae. An incision is made along the scar tissue line marking the junction between the vestibule/vagina and rectum. Tissues ventral to the incision are dissected to create mobilized vestibular mucosa and submucosa that when apposed from side to side will form the ventral border of the perineal body. Tissues dorsal of the incision are debrided and rectal submucosa is undermined to allow sufficient mobilization to form by side to side apposition the ventral border of the terminal rectum. All tissues are then sutured concurrently and incrementally from cranial to caudal. The rectal and vaginal reflections are apposed by a continuous modified inverting Connell suture. Suture material preferred is a No. 1 delayed absorbable i.e. PDS for the fibrous layer, 0 PDS for the vagina and 2/0 for the rectal mucosa. When the suture pattern of the rectal submucosa has proceeded 2-3cm the suture material is retracted and then the vaginal or vestibular submucosa is similarly apposed. The resulting dead space in between that will be the recreated perineal body, is obliterated by multiple interrupted or continuous apposition sutures. The three areas of apposition are then alternatively progressed caudally, 2 - 4cm each time, diverging at the perineal body, until the ventral vestibular submucosa stitch can be tied and vulval lips closed by a Caslick. The apposing suture of the rectal submucosa is terminated at the dorsal perineal body at the level of the defect in the anal sphincter. The anal sphincter may or may not be apposed at all. A dequate dissection of vestibular and rectal submucosa is necessary to prevent undue tension on the continuous suture patterns (Fig. 6).

Post operatively apart from antibiotics anti-inflammatory and protection against tetanus, the management of fecal consistency is most important.
Figure 6a. Towel forceps are used to identify the ideal position of the rectum at the end of the surgery. Figure 6b. After dissection of the scar tissue the tissues are sutured according to their origin (rectal mucosa, perineal body and vaginal wall). Figure 6c. The three suture patterns are incrementally increased to ablate dead space in the perineal body and provide integrity of the rectal and vaginal layers.

Two Stage Repair

1st Stage - the aim is to recreate the rectovestibular shelf i.e. close the vestibular cavity and recreate a portion of the ventral perineal body. Because the rectal mucosa is not apposed and anal sphincter not repaired, there is less tension on the sutures, minimal straining and potentially less dehiscence.

The surgical technique is described elsewhere, however, it is very similar to the single stage repair except the rectal mucosa and dorsal perineal body are not apposed until 3-4 weeks later (2nd Stage).

Points for consideration

1) Techniques are largely dictated by experience. We believe inexperienced surgeons will have less difficulty with the 2 stage repair.

2) The better the surgeon’s anatomical and functional understanding of the perineal body the more likely a favorable outcome will follow.

3) If a two stage repair is attempted economic consideration for the client appears warranted as single stage repair is just as successful with experienced surgeons.

Fertility is good after successful repair. A slightly higher incidence of perineal trauma is expected with these mares.
c) Rectovestibular Fistula (RVF)

Most commonly RVF result from foaling injuries although they can occur from breeding, sadism or other accidents. Some will heal without surgical intervention, so surgical correction is attempted at least one month or more after the injury. In the last five years we have been breeding the mares on an induced (prostaglandin) second post partum estrous period and then immediately (within 2 days) performing the fistula repair. The fertility of mares undergoing this technique has been excellent (~75% per cycle). For this to be successful as much fecal material as possible is removed immediately before breeding (either natural or AI). After breeding the uterus is lavaged at least daily until repair is performed.

Most surgeons treat RVF by converting them to 3rd degree PL and repairing as previously described either standing or under general anesthesia.\textsuperscript{11} For deep (cranial) RVF’s a perineal body transection has been utilized.\textsuperscript{8}

During the last 17 years we have repaired RVF with a trans-rectal approach, which we first described in 1991.\textsuperscript{12} A similar technique was described in the 1996 AAEP proceedings by Dr. Stephen Adams.\textsuperscript{13} In our hospital, modified Finochetto (Aanes) retractors (Scanlan Instruments, Englewood, Co USA) are inserted into the rectum through the anal sphincter. These retractors make the surgery quite simple. The fistula is debrided and closed in three layers, with continuous suture patterns and without conversion into a 3rd degree PL. The vestibular portion may be closed through the vagina or rectum and is inverted into the vestibule. The middle layer (perineal body) is closed from the rectum and the rectal portion inverted into the rectum. When we previously described the surgical correction\textsuperscript{12} it was recommended to alternate the orientation of the closure. Now we recommend that all three layers are closed transversely not longitudinally. The fistula middle layer is closed with 0 or 1 PDS, the vagina with PDS and the rectum with 0 or 2/0 PDS (Fig. 7).

![Figure 7. The fistula is easily approached per rectum if good retractors are available.](image)

Restraint and postoperative care is similar to mares with perineal lacerations; however, not as much attention is given to fecal softening.

Points for consideration
The caudal border of the fistula may be difficult to debride and is most commonly rotated towards the surgeon by grasping it with forceps (from the rectum) and everting it caudally. On occasion it may be helpful to have the surgeon's hand in the vagina while working on this part of the fistula.

The use of a No 12 blade greatly facilitates dissection of the fistula ring.

3) Cervix

- Cervical lacerations

Injuries to the cervix most commonly occur at foaling. Many are not associated with a recognized dystocia. Assessing degree of compromise to the cervix as a barrier to intrauterine infection may be difficult. In general examination immediately after foaling will reveal only the most major defects. Most cervical lacerations are identified later and are best evaluated in diestrus because increased tone facilitates assessment of degree of apposition of cervical folds and damage to the muscular layer. Manual palpation is essential for accurate diagnosis. Many mares with major cervical defects are still able to conceive and carry a foal to term.

In general only those mares with a cervical defect that progresses cranially to involve the junction of the external Os with the vagina are candidates for surgery at our practice. In addition only mares with obvious subfertility are usually considered i.e. uterine infection, barren one or more years etc.

Surgical Technique

Mares are restrained, standing and tranquilized. Local anesthesia is preferred with 40-60 ml of 2% lidocaine infused dorsally and laterally deep in the vaginal tissues around the cervix. The most difficult aspect of cervix surgery in the mare is adequate exposure. Modified Finochietto (Aanes) retractors are preferred and the cervix is drawn caudally by Knowles forceps. The forceps used must have large teeth that facilitate retraction with vigorous caudal pressure without tearing out of the cervix. With this technique it is generally not necessary to use specially extended cervical instruments (Fig 8a and 8b).

The forceps are placed about 1-2 cm on either side of the defect or laceration. Slight rotational movement provides excellent access to the fibrous scar of the defect. The scar is debrided to level of the cervical musculature and the external vaginal mucosa of the cervix slightly undermined. The internal cervical mucosa is undermined and trimmed. Original reports of cervical closure describe a three layer closure. We prefer two. The internal layer is closed with a 1 PDS with a cutting needle by a continuous pattern through the internal mucosa and muscular layer. The external layer is closed with a simple continuous layer using 2/0 or 0 PDS. Occasionally it is necessary to trim excessive cervical folds that prolapse into the suture pattern and result in fistula formation, however, care in not removing too much is recommended to avoid creating a cervix with major orientation deviations. In addition it is easy to inadvertently include cervical mucosa on the wrong side of the lumen if the cervical forceps are not positioned well. Patency of the cervical Os is continually confirmed during placement of sutures.
Post operative treatments for the mare are antibiotics and protection against tetanus. After 21 days, patency of the lumen is assessed by careful manual examination. Frequently mild adhesions have attempted to form. Their occurrence is of no major concern and gentle manipulation and daily application of a corticosteriod, antibiotic, oil based cream, after the surgical site has healed, results in return to normal function.

Figure 8a. Knowles forceps applied either side of the laceration facilitate the retraction and identification of the best place to debride and suture. Figure 8b. Suture pattern recommended for cervix surgery.

Points for consideration

- The most craniad portions of the external cervical Os appear to be the most important barriers to infection. Overzealous surgical apposition of the caudad cervix results in a very small external Os that broadens cranially and does not create a good enough seal in diestrus or relax enough during estrus to allow adequate drainage of uterine contents.

- Previously repaired cervix problems often are injured again at breeding and/or foaling. AI is recommended, or a breeding roll at the very least, if natural service is necessary.

4) Ovaries

Ovariectomy- some indications for ovariectomy include: a) mares displaying continual annoying nymphomania b) ovarian neoplasia c) use of ovariectomized steroid treated mares as recipients for embryo transfer or d) mares to be used as tease/jump mares (with or without exogenous hormone administration).
Most techniques describe ovariectomy by a ventral midline approach with ovarian pedicle ligature prior to excision. However, this is expensive and in our experience occasionally unnecessary. Ovariectomy by colpotomy (vaginal approach) with hemostasis and excision performed with an ecraseur ("crusher") is an approach not often utilized, despite being described centuries before advent of powerful restraining pharmaceuticals. Of course there are many occasions when flank or ventral midline approaches will be necessary, particularly for mares with ovarian neoplasia.

**Colpotomy**

Mares are not fed for 24 hours prior to surgery; they are restrained standing and tranquilized. The tail is secured dorsally. The external perineum is cleansed and vaginal cavity lavaged with sterile saline (1 liter). No epidural anesthesia is necessary. Blunt/Blunt scissors (Metzenbaum) are used to puncture the cranial vaginal wall in a position between 4 and 5 o'clock relative to the external Os of the cervix and near the border of the pelvic canal. The scissors are advanced 4-6 cm then opened and withdrawn through the vaginal wall in the opened position. The resultant hole enables a single finger to bluntly enlarge the opening to admit a hand. The peritoneum is punctured with a single digit and ovaries and uterus identified and palpated. Swabs that have been previously sewn together and then sterilized are soaked with 50ml of local anesthetic and applied circumferentially to each ovarian pedicle for at least one minute each. A ‘Hauptner’ ecraseur is used to remove each ovary individually. Frequently the ovarian attachments to the ovary have to be manually stretched to allow ovarian removal. The vaginal incision is not closed, however we recommend a Caslick be performed.

Mares are treated with anti-inflammatory medication i.e. phenylbutazone (2gm IV) approximately 10-20 minutes prior to beginning surgery. Delaying phenylbutazone administration or use of oral preparations may result in moderate abdominal discomfort manifested by sternal recumbency. Other prophylactic administrations are antibiotics and protection against tetanus. Mares are not cross tied but usually are boxed overnight and then turned out onto pasture the next day.

We have used this technique in many mares, including mares with small granulosa theca cell tumors up to approximately 10 cm without complication. Reported complications are evisceration, hemorrhage, removal or penetration of bowel, fatal peritonitis and local infection. The incidence of these problems is likely related to experience of surgeon and speed of the surgery. Clearly the technique has potential drawbacks i.e. size of ovary or structure is limited to less than approximately 10cm. However the procedure is safe and efficacious in many instances and able to be performed expeditiously by personnel experienced with examination of female reproductive tract.

Points to be considered

- Occasionally some mares strain during the procedure. Allowing more time for improved analgesia or additional analgesia appears effective.
- Many of the complications such as evisceration and infection appear to be minimized by pre-surgical administration of IV phenylbutazone to prevent post surgical recumbency, a Caslick and prophylactic antibiotics.
- The procedure is safe, expedient and efficacious and complication rate is similar to or less male castration.
- Mares with uterine infection or urovagina are not considered for the technique.

5) Uterus

Uterine Torsion

Uterine torsion is an infrequent but serious complication of the late gestation mare. Most occur in the last two months of gestation and are recognized by mild to moderate colic that responds temporarily to analgesics. Unlike cattle most uterine torsions of the mare are pre-term and not associated with parturition. Definitive diagnosis is based on careful rectal examination. Identification of the ovarian pedicle and uterine ligaments should suggest whether the rotation is clockwise (to the right and downwards when viewed from behind) or counter clockwise. The uterine ligament on the side to which the rotation has occurred is pulled directly downwards and under the uterine body. The other uterine ligament is displaced medially and runs over the uterine body towards the side of rotation and then downwards. The greatest tension is on the ligament that the rotation is turned towards. Occasionally diagnosis of direction of torsion is difficult per rectum.

Technique for correction depends on stage of gestation and value of the animal. At term, manual rotation of the fetus through the cervix is often possible. Prior to imminent parturition, non-surgical repositioning (rolling) is possible but may occasionally result in uterine rupture. The mare is positioned in lateral recumbency on the side to which the uterus has rotated to i.e. clockwise torsions result in the mare being placed in right lateral recumbency. The mare is quickly flipped over to her other side and hopefully uterine weight allows the mares body to pivot about the fetus and reposition the problem. Degree of success can be ascertained by repeated rectal palpation. Another approach is to place a board with weight (i.e. a person) on the upper flank and turn the mare slowly. In this case the board maintains the fetal position during mare rotation.

Alternative techniques for correction include standing flank laparotomy and ventral midline approach. Standing flank laparotomy has been our preferred method for correction if the mare and/or foal are valuable and there is no evidence of uterine rupture. This technique has a lower probability of creating uterine rupture and avoids the stress of anesthesia.

Standing Flank Laparotomy

The mare is moderately sedated and the paralumbar fossa on the side towards which the rotation is directed is clipped and prepared for aseptic surgery. Local anesthetic (40-80 ml) infused in a vertical line is administered at or slightly cranial to the anticipated incision in the middle of the paralumbar fossa. The skin and paniculus (cutaneous) muscle are incised vertically and external and internal abdominal oblique muscles are separated along their direction of orientation (grid
approach). The transverse adominus is bluntly dissected and the peritoneum punctured with a single finger. The direction of the torsion is confirmed and a prominent part of the foal under the uterus is grasped and used to gently rock and lift the uterus towards the surgeon. Resolution of the torsion is usually immediately obvious, however on occasion lengthening the incision to allow two hands to enter the abdomen or a bilateral flank incision with two surgeons is sometimes necessary. The external and internal abdominal oblique muscles and subcutaneous tissues are apposed by a simple continuous suture pattern with a No. 1 or 2 absorbable material. The skin is closed with a continuous simple or interlocking pattern of non-absorbable material.

Points for consideration

- Abdominal ultrasonography should be used to verify that the foetus is still alive and if possible asses uterine integrity.
- Survival of the mare and/or foal may be influenced by degree of uterine torsion, ease of correction, elapsed time prior to correction and stage of pregnancy.
- Regardless of the stage of gestation, if the cervix is open at the time of recognition of uterine torsion, delivery after standing intravaginal/intrauterine manipulation or ventral midline access for reposition and caesarian section is preferable to standing flank laparotomy or rolling of the mare.
- Occasionally a standing flank laparotomy will not have a successful surgical outcome due to the degree of rotation. If a more severe rotation (>360 degrees) is suspected or an excessively elevated heart rate (>70 bpm) are identified it may be better to perform a ventral midline laparotomy to better asses uterine health and gain the best physical advantage for uterine positioning. In addition the foetus can be removed.

References

7. Pouret E. J. M.: Surgical technique for the correction of pneumo and urovagina Eq V et J. 14:
249, 1982.


Additional Reading


