An update on vaginal and uterine eversions in cattle

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Introduction

Eversion of the vagina or both uterine horns from the vulva are commonly referred to as vaginal and uterine prolapses (from 'prolabi' = to fall out) respectively. It is not unusual to encounter these cases in cattle practice, particularly in the developing world. Vaginal eversions usually occur before calving, and uterine eversions after calving. There is no relationship between the occurrences of these two conditions. A recent review provided an excellent description on the management of these conditions from the perspective of replacing, repairing, and, if need be, amputating the uterus.[1] Noteworthy is a detailed description on manual eversion of the uterus to correct a uterine tear, a technique that involves the use of different pharmaceuticals.[2,3] The purpose of this review is threefold. Primarily, to address these maladies and provide remedies with representative images, both real and created. Secondarily, to provide a summary of information reported in the global literature, including practical solutions provided by practitioners. Finally, a discussion will follow to address these clinical situations from a productive, fertility, and most importantly, from an animal welfare perspective.

Keywords: Eversion, prolapse, vagina, uterus

Vaginal eversion

Eversion of the vagina (Figure 1) is a relatively common occurrence, particularly, in cattle compared to other species.[4] There appears to be a genetic component to its occurrence in beef cows compared to dairy cows. Among the beef breeds, Hereford,[5] heavier breeds such as Charolais and Limousin,[6] and Shorthorns are more affected than others. It has been known that *Bos indicus* breeds are predisposed to this condition along with cervical eversion. Many factors have been suggested to contribute to this condition.[7-10] The list includes increased intra-abdominal pressure in late pregnancy, extreme cold weather, excess peri-vaginal fat, prior injury to the peri-vaginal tissues, intake of large volumes of poorly digestible roughage, poor vaginal conformation, persistence of the medial walls of the Müllerian ducts,[11] and changes in hormonal secretions, particularly, increased estrogen as observed in late pregnancy and in estrus. It has been suggested that the higher concentrations of estrogens found during pregnancy can contribute to excessive relaxation and edema of pelvic ligaments that support the vagina. Besides the above, incompetence of the constrictor vestibule and constrictor vulvae muscles may have a role[7] in the etiology. The condition is observed in embryo donor cows that are exposed to hormonal stimulation of the ovaries. Imbalance in calcium and phosphorus, and hypocalcemia has been considered to be a contributing factor by some workers.[12] It should be pointed out that the association with hypocalcemia was suggested merely based on the response to calcium therapy than on the clinical signs of hypocalcemia. However, as eloquently suggested,[12] it can be tentatively postulated that subclinical hypocalcemia could be derogatory to the internal environment of the physiologically stressed female because of pregnancy and parturition.

The majority of vaginal eversions occur in the last few weeks of pregnancy, however, it may occur several months before calving. In some cows, it may occur during estrus. Vaginal eversions are classified into four grades according to the severity of eversion and the extent of injury.

Grade 1 eversion

A small intermittent protrusion of the vaginal mucosa through the vulval lips is noticed (Figure 1) when the animal lies down. Often this tissue becomes dehydrated and traumatized and leads to a Grade 2. A Grade 1 eversion is readily repaired by applying any one of the retention sutures described later.

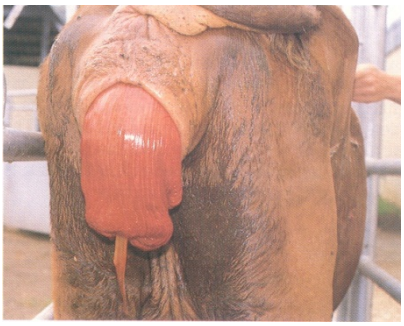

Figure 1: A Grade 1 eversion, vaginal eversion occurs intermittently, particularly, when the animal lies down, reproduced with permission.

Grade 2 eversion

vaginal mucosa protrudes through the vulval lips continuously (Figure 2) with the possibility of the urinary bladder getting trapped in the everted organ. If left untreated, Grade 2 quickly progresses to a Grade 3 eversion.

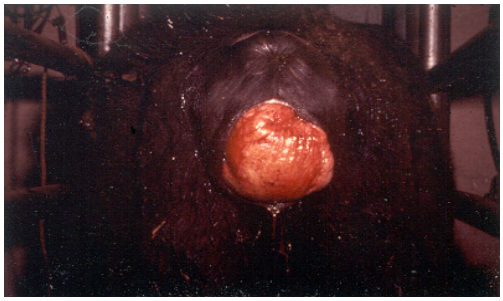

Figure 2: A Grade 2 eversion, floor of the vagina everts and stays everted.

Grade 3 eversion

The entire vaginal mucosa and cervix protrude continuously through the vulval lips (Figure 3) with a trapped urinary bladder and an exposed cervical mucus plug. The cervical seal may liquefy allowing bacterial contamination of the uterus leading to placentitis and fetal death. Often these fetuses become emphysematous and cervical dilation is insufficient for a vaginal delivery. This condition is often referred to as a cervical eversion but more correctly should be referred to as a cervico-vaginal eversion. This distinguishes it from the eversion of the cervix alone as sometimes observed in *Bos indicus* breeds. In the latter case, only the cervix everts as a pedunculated mass through the vulva.

Figure 3: A Grade 3 eversion, floor and cervix evert and they stay everted.

Grade 4 eversion

A grade 4 is of such a duration that the entire vaginal mucosa appears necrotic and fibrosed (Figure 4). Infection is so extensive that the urinary bladder may become involved in it and peritonitis is a possible result.

Figure 4: A Grade 4 eversion, either a Grade 2 or 3 that has become necrotic and/or fibrotic, reproduced with permission.

The objective of treatment in the case of pregnant animals is to replace and retain the vagina within the pelvic canal and to deliver and wean a live offspring. Many management and treatment options are described for vaginal and cervical eversions.[1,4,7, 9-11,13-33] These can be placed in two general categories: those aimed at permanent reduction while others that afford a temporary solution. It should be mentioned that one approach may not fit all grades. The severity of the eversion, the time to expected delivery, the veterinarian's preference, and the owner's ability or willingness to manage the patient after treatment will dictate the treatment option. The elected initial treatment option may need to be changed after the response of the patient has been assessed. This is particularly relevant, if tenesmus becomes an issue. If the patient is close to parturition, induction is recommended to prevent recurrence prior to parturition.

Short-term treatment options

1. Caslick's suture
2. Buhner stitch
3. Bootlace technique
4. Horizontal mattress (Halstead) retention technique
5. Deep vertical mattress technique

Caslick's suture: This technique (Figures 5 and 6) should be reserved only for a non-irritated Grade 1 vaginal eversion that occurs close to parturition and when tenesmus is not expected to be a concern. Unfortunately, a simple Caslick's suture in many cases is insufficient. As the intra-abdominal pressure increases, tenesmus begins and the suture is ripped out or the vagina begins to evert below the sutures. Further, the vulval softening and stretching that occur closer to parturition contributes to this phenomenon. Caslick's suture may suffice in patients that are not pregnant and have a Grade 1 eversion during estrus. This is often the case with embryo donor animals whose ovaries are frequently superstimulated with hormones for the sole purpose of increasing the number of ovulations.

Figure 5. A Caslick's suture being applied to a non-pregnant cow with Grade 1 vaginal eversion.

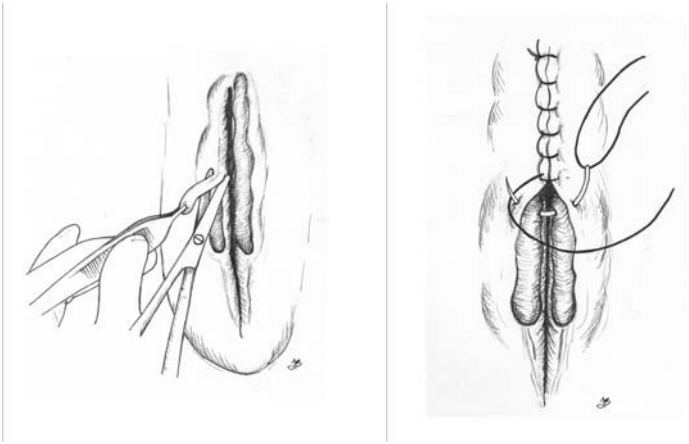

Figure 6: A diagrammatic representation of the Caslick's suture procedure.

Buhner stitch: This is a very effective treatment for more advanced grades and that are chronic in nature.[17,18] To have a successful outcome the stab incisions have to be placed deeply such that the retention line is as cranial to the vulval lips as possible (Figure 7). The disadvantage is that it is unforgiving and if assistance is not available when the patient begins to calve, severe trauma to the vulva may occur or the calf is unable to be delivered and dies in utero or the patient may die as a result of uterine rupture and fatal hemorrhage.

Following epidural anesthesia, the vulva is thoroughly washed with detergent and a 1 cm stab incision on the midline below the vulva and as far forward as practical is made. A second incision is made midway between the anus and dorsal commissure of the vulva (Figure 7). The Buhner needle is then passed deeply from the ventral incision up one side of the vulva and out through the dorsal incision. The Buhner tape (non-wicking) is passed through the eye of the needle and the needle retracted through the ventral incision along with the tape.

The procedure is repeated on the opposite vulval lip and the two ends tied leaving about a two-finger opening in the ventral vulva for urination. The preference is to tie a bow knot and then tie the two loops of the bow in a single square knot. This allows the knot to be loosened but to retain the suture so that if the patient should try to evert again it can be replaced and the knot re-tightened. This can also be done in the evenings, if observation of the patient for parturition is not going to occur overnight.

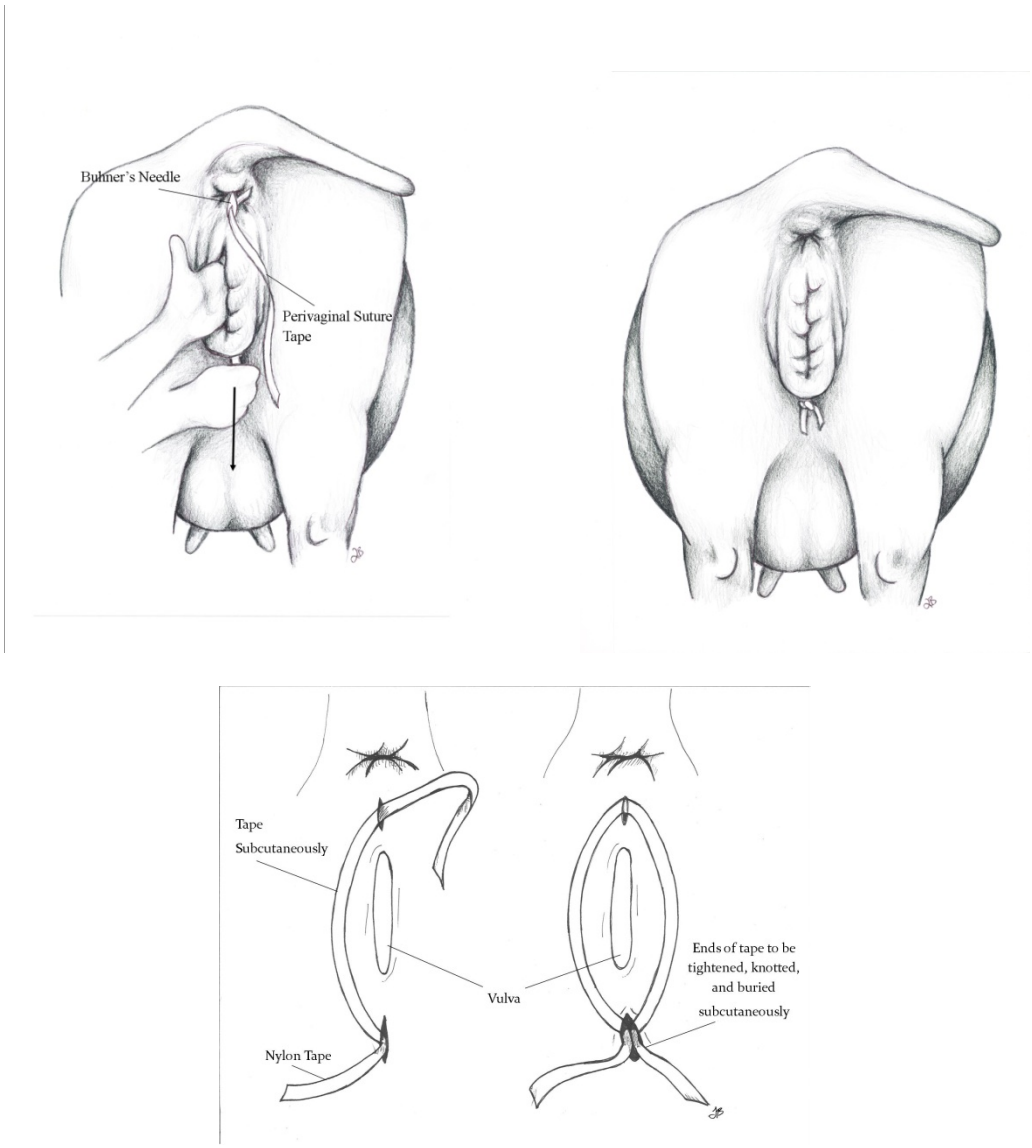

Figure 7: Diagrammatic representations of Buhner stich procedure. Note the locations of dorsal and ventral retention lines.

If the procedure is performed properly, the tape should not be visible at the dorsal incision and this helps to prevent feces tracking down the needle paths. It should be stressed to the caretakers that their presence at the onset of calving is crucial for a successful outcome. If observation is a problem, medium sized catgut can be doubled and used as a suture material. It helps in patients that are within ten days of calving as the gut will break during parturition.

Bootlace technique: This is not a highly preferred technique as the vulval lips are inverted and the suture placement is tedious. However, it is stronger than a Caslick's suture. Following an epidural anesthetic procedure and disinfecting of the vulva and surrounding area, 4-5 small eyelets are made with umbilical tape or hog nose rings[11] on either side of the vulva in a dorsal to ventral line at the hair to hairless junction on the vulval lips. After placing the eyelets, umbilical or Buhner tape is then used to "lace up" the vulva much like a boot (Figure 8). As the pattern is tightened, the vulval lips invert. Again, the bootlace must be loosened prior to calving to avoid serious trauma to the vagina.

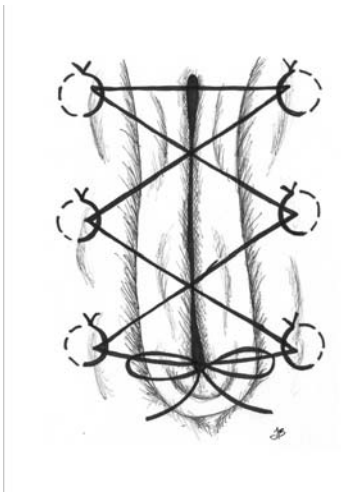

Figure 8. Diagrammatic representation of a bootlace technique.

Horizontal mattress (Halstead) technique: In this technique, a needle is passed through the vulval lip on the right beginning deep at the junction of the labia with the skin of the rump. The needle is continued across the vulval opening and through the left vulval lip at the same depth as the right. The needle is then passed back from left to right at the same plane as the first passage but beginning approximately 2-3 cm ventral to the first passage. This procedure can be done using a Buhner or large cutting needle. Place as many sutures as needed to close the vulva down to about two fingers wide to allow for urination.

The disadvantage of the technique is that even if the sutures are not pulled really tight, vulval edema frequently develops and can be quite severe. This can be lessened if the suture tension is dispersed by "stents". Half inch polyvinyl chloride tubing can be cut the length of the vulva and holes drilled 2-3 cm apart; similarly wooden dowels,[24] or latex tubing can be utilized. A stent is placed either side of the vulva and the horizontal mattress suture passed through the holes and tied (Figure 9). This approach has good deep retention and more evenly disperses the pressure.

Figure 9: An example of a horizontal mattress technique, note the location of the stents in the illustration for reduction of vulval edema and for dispersion of pressure.

Deep vertical mattress technique: This is similar to the horizontal mattress pattern described above. The difference is that a vertical mattress suture pattern is used and stents are recommended to disperse tension on the vulval lips (Figure 10). This replacement method can also have serious consequences if

assistance is not available at the onset of parturition.

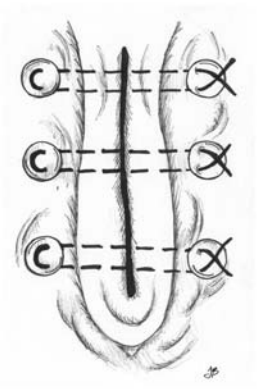

Figure 10 An example of a deep vertical mattress technique applied and buttons are used as stents.

Permanent treatment options:

1. Minchev vaginopexy
2. Modified Minchev vaginopexy
3. Winkler cervicopexy

Minchev vaginopexy: There are two Minchev techniques described that differ only in location of needle insertion. In the original Minchev technique the needle is passed through the lesser sciatic foramen. The technique is an excellent prepartum method that aims to retain the vagina in the correct pelvic location by adhesion formation between the sub-mucosa of the vagina and surrounding fascia.

An epidural is given and the gluteal area shaved and disinfected. In the original Minchev technique, a large S-shaped needle is threaded with ⅜inch umbilical tape and a gauze bandage or large plastic or metal plate is attached at the end of the tape, the needle is then taken in vaginally and the lesser sciatic foramen is located on the dorso-lateral wall of the vagina. The needle is then pushed through the dorsal area of the foramen in order to avoid the pudendal nerve. The needle is pushed through the skin in the gluteal area and the suture pulled up snug (do not tie too tightly) and another button, plate or gauze is tied into the suture. This is repeated on the other side.

Modified Minchev vaginopexy: This technique is similar except the stay sutures are placed anterior to the lesser sciatic foramen 5 cm lateral to the midline and just posterior to the shaft of the ilium, providing more cranial fixation of the vaginal wall (Figure 11). Care must be taken to avoid the sciatic nerve, pudendal artery and rectum when placing the needle. These structures can be identified cranial and slightly dorsal to the lesser sciatic foramen. The needle is passed through the sacrosciatic ligament approximately 4-5 cm lateral to the sacrum and just posterior to the shaft of the ileum. There are advantages to this technique, including the fact that cows rarely show tenesmus when the vagina is replaced and the cow can calve unassisted. It is however recommended that the sutures are removed in two to four weeks.

A commercial prolapsed repair kit is available (Figure 12; Pro-Button Prolapse, Jorgensen Laboratories, Loveland, CO). Assembled kit is soaked in a disinfectant. The stainless steel pin with the six inch plastic trocar passed through the three inch plastic button is carried vaginally. The trocar is pushed dorsal or anterior to the lesser sciatic foramen pointing dorso-laterally to avoid the rectum, and then through the sacrosciatic ligament and the biceps femoris to the skin outside. The stainless steel pin is removed, and the 2.5 inch plastic button is placed on the protruding trocar. Pushing down on the 2.5 inch button, enables the three inch button to be held firmly between the vaginal wall and the sacrosciatic ligament. The cotter pin is inserted through the hole in the protruding trocar. The plastic trocar is cut about an inch above the cotter pin. In severe cases, it may be necessary to place buttons on both sides of the anterior vagina.

However, it should be recognized that recurrence of eversion is possible since only the dorsum of the vagina is held. Further, when the internal placement is too far caudal, a partial eversion may occur eliciting straining resulting in total eversion.

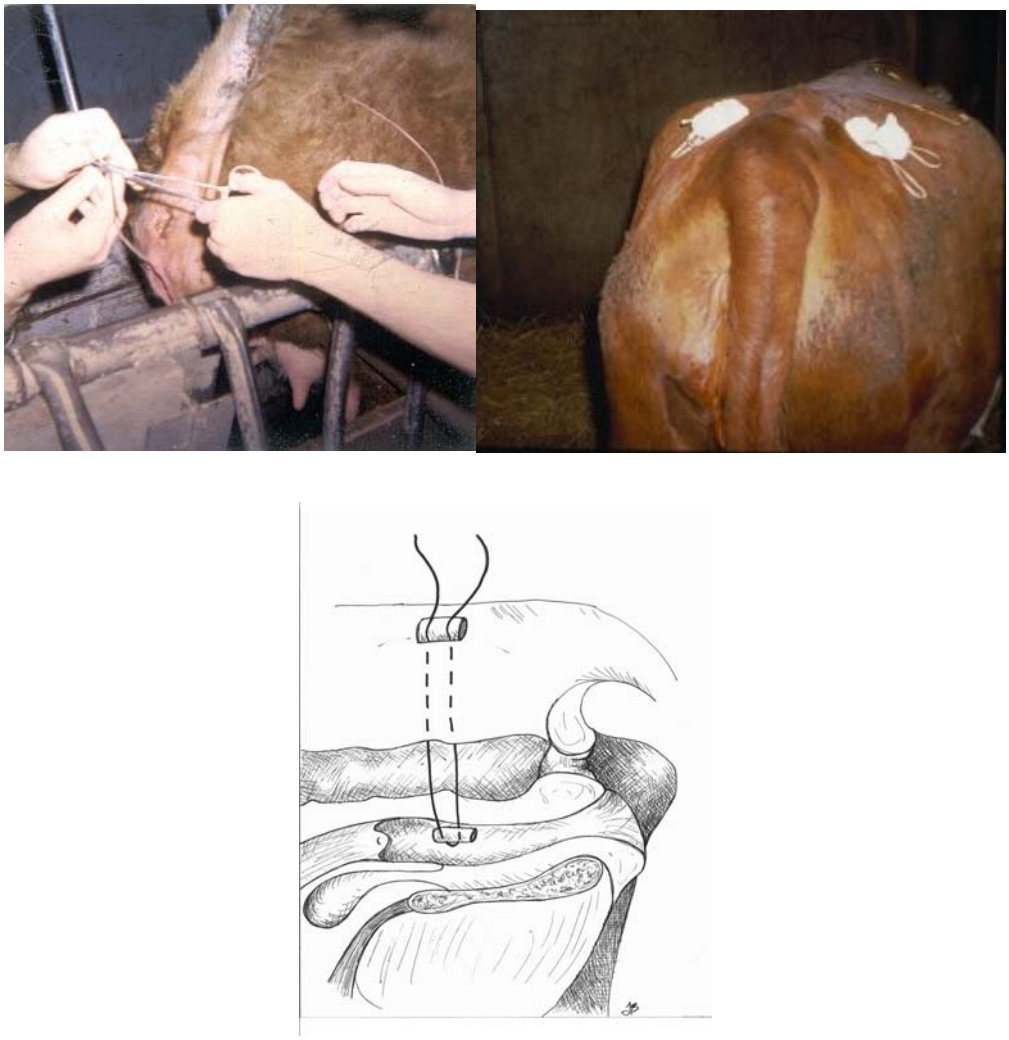

Figure 11: An example of a modified Michev technique (top) with a schematic illustration.

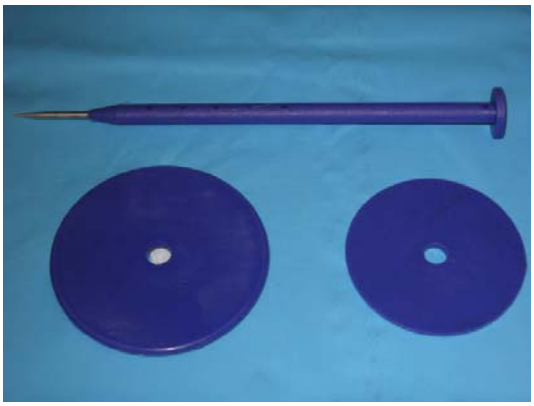

Figure 12: Trocar and plastic buttons used for a modified Minchev technique.

Winkler technique cervicopexy: This technique[33] is a very effective method of vaginal retention because it fixes the cervix in place making it difficult for the vagina to prolapse. The basic procedure is aimed at suturing the cervix to the prepubic tendon.

There are numerous descriptions of placing the suture in the cervix and how to suture through the tendon. The two approaches to suture placement are either through a left-paralumbar approach[26] or through the vagina. The former is more time-consuming but is safer while the vaginal approach is quicker but can result in broken needles if one is not careful. The vaginal approach could be done in two ways by either including the lower half of the cervix or by just including the external os of the cervix on one side (Figure 13).

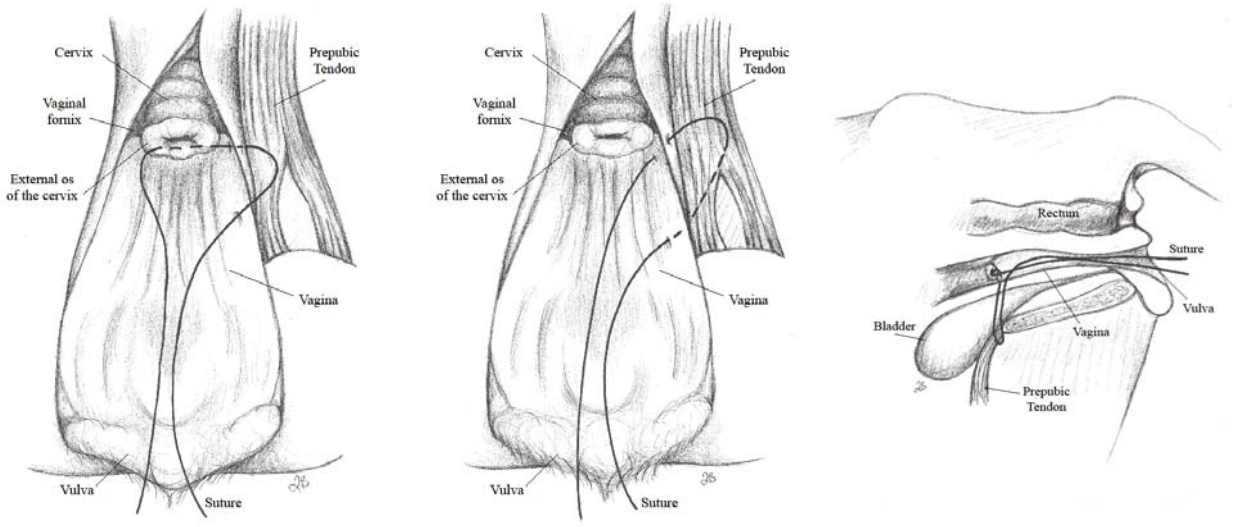

Figure 13: Schematic representation of a Winkler technique for cervicopexy, redrawn with permission.

Before placing the suture vaginally, an epidural is given and a mild antiseptic douching of the vagina performed. The prepubic tendon is then palpated at its attachment to the pelvic brim. As one moves their fingers laterally about 5 cm on both sides of midline, a small triangular shaped area free of tendon is felt. This is formed by a short band of tendon extending posterolateral to the iliopectineal eminence of the pelvis. A large curved cutting needle is bent into a "U"-shape and 60 inches of non-absorbable suture material is attached. The needle is then carried into the vagina and passed from the inner lumen of the external cervical ring out peripherally. The needle is grasped again and passed down in a medial to lateral direction through the prepubic tendon and carefully curved around to come up through the triangular area. The needle is grasped again, passed through the external cervical ring from the periphery to the center and bought on out of the vagina. Some clinicians prefer to pass the "U"-shaped needle (Figure 14) through the vaginal wall initially, then pass the needle through the prepubic tendon medial to lateral direction, then pull the needle back through towards the intravaginal part of the cervix, then the needle is directed across the lower half of the cervix and brought out side to tie the knot. This latter procedure may prevent breaking of the "U"-shaped needle. A catheter is then passed through the urethra so that as the suture is tied the urethra and not trapped in the suture.

Figure 14: A special needle used for Winkler technique for cervicopexy.

To tie the suture, the knots are started on the outside of the vulva and slid forward. The suture is tied tight enough to prevent the posterior movement of the cervix. To assist in placing the cervical sutures, Knowles' cervical forceps can be used to either fix the cervix cranially making passing of the needle through the cervix easier or in some cows the cervix can be retracted sufficiently to be presented at the vulva again making placing of the cervical sutures easier.

Other descriptions of this procedure do not advocate passing the needle through the cervical opening but rather through the side of the cervix without penetrating the lumen. This approach is greatly aided by fixation of the cervix with forceps.[3,26] The advantages of this approach are that the cow can calve on its own, post-repair tenesmus is rare and the cow can still be examined per vaginum. Occasionally the suture in the cervix can break resulting in recurrence of eversion. This procedure is recommended for chronic cases which the owner wishes to keep, especially embryo donor cows in which the problem is likely hormonally induced rather then there being any genetic predisposition. However, if the condition is likely to occur again or if it is probably of hereditary in nature, the affected animal should be culled.

Uterine eversion

Uterine eversion occurs mostly within 24 hours after fetal delivery with the majority of cases occurring shortly after parturition. While relatively uncommon (less than 1% of parturitions[34]), it is nevertheless one of the true emergency situations one encounters in practice. In many instances the everted organ is readily contaminated (Figure 15), traumatized physically or by extreme weather (heat/cold), becomes edematous, may hemorrhage and evert severely enough to rupture the uterine vessels leading to rapid shock and death.

Figure 15: An everted uterus with evidence of contamination.

Owners should be instructed not to transport the animal and to put the everted organ inside a plastic bag to reduce contamination. Fortunately, many of these cows are unable to get up and run due to hypocalcaemia, partial paralysis or exhaustion. However, on occasions, the cow is capable of getting up and may become fractious as she attempts to outrun the uterus or knocks the uterus between her hocks (Figure 16). Since these cases often result in rupture of the uterine vessels and rapid death due to internal hemorrhage, one should approach them very cautiously.

Figure 16: Uterus is further traumatized by knocking between the hocks.

Many factors[8,35] are believed to contribute to uterine eversion including reduced uterine contractility due to decreased uterine activity following primary or secondary uterine inertia. Hypocalcemia and reduced prostaglandin and oxytocin receptors and myometrial defects due to overstretching contribute to primary uterine inertia. Among others, mere physical exhaustion and dystocia are responsible for secondary uterine inertia. Apart from uterine inertia, situations wherein continuing tenesmus as noted in dystocia, manual extraction of calf, retained fetal membrane, delayed cervical involution, and laceration of the reproductive tract can lead to eversions. Prolonged recumbency that follows paralysis or hypocalcemia can lead to increases in intra-abdominal pressure, a potential factor for eversion. Hypocalcemia is also believed to make the uterus atonic delaying the involution of cervix, a predisposing factor for uterine eversion.[36] However, it has been suggested that hypocalcemia can be the result of an uterine eversion rather than a cause of it.[37] The role of parity[38] and hypocalcemia still remain an enigma in the etiology of uterine eversions.[39,40] Over-conditioned animals may be more prone to increased intra-abdominal pressure due to increased fat reserves in the abdomen. Other non-animal factors can contribute to this condition. For example, outbreaks can occasionally occur due to extreme weather conditions and pasture composition. Further it has been suggested that alterations in the availability of dietary calcium, phosphorus, and magnesium may have a role in creating uterine inertia and predisposing animals to this condition. The uterine eversion outbreak noticed in animals kept on a cool-season grass pasture supports this hypothesis. It has also been suggested that high estrogen concentrations in pasture may play a role. The foregoing undoubtedly attests to the multi-factorial nature of this condition.

Many methods of reduction and practical tips have been described.[1,35,36,41-59] Replacing the uterus can be done in either the standing or recumbent position depending on circumstances and clinician preference. The animal may have to be cast, rolled, and pushed to lie on its abdomen to facilitate pulling hind legs straight behind to facilitate reduction.[35] Obviously, if the cow is in the pasture with partial paralysis, the recumbent position is dictated. Replacing the uterus in the recumbent position is greatly facilitated by positioning the cow in the sternal position with both hind legs extended out behind (Figure 17) with the head end facing downhill ("Okie position"). This position tilts the pelvis forward and allows the clinician to get behind the cow and cradle the uterus in their lap as they feed it back into the cow.

Figure 17: "Okie position", note the extension and elevation of hind legs.

Others prefer the standing position (Figure 18) if the cow can be adequately restrained and help is available to place a towel or bedsheet (or something similar) under the uterus and lift it up as the clinician replaces the uterus (Figure 19) it back into the cow.

Figure 18: Cow is placed in a chute for the standing reduction, a squeeze chute is preferred.

Figure 19: Elevation of the uterus by a sheet helps in reduction.

Replacement guidelines

- Give epidural anesthesia
- Remove as much fetal membrane as possible

- Clean the endometrium
- Apply chlorexidine ointment over the entire uterus and massage
- Apply a pressure bandage for 10-15 minutes tightened from the tip of the horn. Sugar may be applied sparingly. However, care needs to be taken, because sugar will dry the endometrial layer quickly causing the tissue to become friable. This may lead to tears when applying pressure to push in the horns.
- Depending on dryness the operator may have to apply an ointment that has lubricant and emollient properties
- Identify the non-gravid horn (strong intercorunal ligament prevents its eversion) by observing for the presence of an oval or slit-like opening bordered by a ring of small cotyledons and reduce it first
- Begin applying steady pressure at the cervix/uterine body area using both hands with a clenched fist to reduce the everted uterus into the vagina. Once the uterine body is reduced into the vagina, the uterine horns are gradually massaged into the birth canal or vagina.
- Fully invert the horns. If the operator's arms are not long enough, the rounded bottom of a one liter soda bottle or probang can be used to completely invert the uterus
- Give non-steroidal anti-inflammatory drugs and parenteral antibiotics
- Oxytocin should not be given until the uterus has been reduced or replaced
- Apply a retention suture

A probang (Figure 20) is commonly used to make sure that the tip of the uterine horn is fully inverted. The rounded edges of probang prevent possible tears that may occur to the friable uterine wall during the procedure.

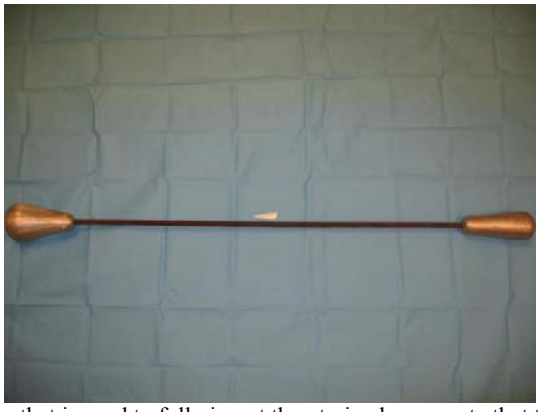

Figure 20. A probang that is used to fully invert the uterine horns, note that the ends are rounded.

Failure to fully straighten the horns can result in re-eversion or ischemic necrosis of a portion of the uterine horn. Placement of a suture in the vulva after uterine replacement is controversial. If the uterus responds to oxytocin and the cow is able to stand, then re-eversion is highly unlikely and a vulval stitch is not needed. On the other hand, if the cow is going to be unable to rise and tenesmus recommences, a vulval stitch may be indicated for 24-48 hrs. After reduction, 20 to 30 IU oxytocin should be injected and repeated two more times at 30 minute intervals and calcium therapy instituted if necessary. Intra-uterine antibiotics are probably warranted in the case of a severely injured and contaminated uterus but are controversial in the case of a relatively fresh and cleanly reduced eversion.

Uterine amputation

There are two approaches to uterine amputation, open and closed.[1,2,60,61] The open approach involves incising the uterine body and location and ligation of major uterine vessels in the stretched broad ligament prior to amputation of the uterus. The advantage of this approach is that any viscera contained within the prolapse can be returned to the abdomen before the uterus is actually removed. With the surgical

approach, the wall of the uterine body is opened from the cranial cervix to the bifurcation of the uterine horns to expose the contents within the everted uterus and the major vessels in the broad ligament (mesometrium). The latter are identified by "fanning out" the mesometrium and the vessels double ligated, preferably when they are not under tension. The vessels are severed between ligatures and the mesometrium incised and allowed to retract into the abdominal cavity. A series of adjacent slightly overlapping mattress sutures are then placed across the uterine body just proximal to the cervix. The uterus is then amputated 2-3 cm below this line of sutures. The stump may then be sutured with a simple continuous pattern. Postoperative treatment should include administration of tetanus toxoid, non-steroidal anti-inflammatory drugs, and appropriate antibiotics.

In the closed approach (Figure 21) the entire organ is ligated and left to slough in 10-14 days. This is a salvage operation applied in cases of severe ischemic necrosis and or lacerations. With this approach, viscera could be unintentionally trapped in the everted uterus with fatal consequences, Ligatures for this latter approach can be made of surgical tubing, bungee cord or the bloodless castrating unit used for castrating large bulls works well.

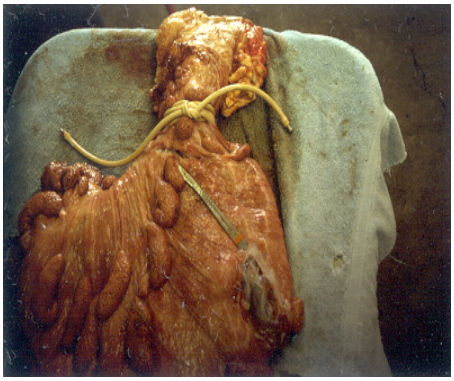

Figure 20. A closed approach of uterine amputation, note the location of the ligation.

Discussion

Vaginal Eversion

Prepartum vaginal and cervical eversions can be perplexing and disturbing problems both to the producer and veterinarian. The expense and effort can be costly at times. These everted structures should be promptly replaced within the vaginal vault and secured such that contamination, laceration, sepsis, fibrosis or necrosis does not occur. This approach will prevent compromise of cervical and vaginal relaxation at the time of parturition and most importantly will enhance the animal well-being by preventing unnecessary injury at the time of parturition.[62] Some attempts made by producers to correct the situation can have many unintended consequences and can inflict unnecessary pain and injury to the animal. In this regard, client education is paramount. Although there may be temporary relief the animal may evert again at the next parturition if the primary cause for an eversion is not corrected.[11] It is very important to realize that satisfactory reduction and retention alone are not sufficient since the recurrence rate is high if the primary or inciting cause is not removed. This not only forces subsequent repair but more importantly, in some instances, can result in mutilation of vulval and perivulval tissue, and become an important animal-welfare issue. Many techniques have been developed and stood the test of time. Each one is unique and the technique chosen depends on the condition and expertise of the clinician. What has been said a few decades ago still stand true, better techniques for handling chronic vaginal eversions are needed.[28] New knowledge in this area by developing alternate techniques and improving current techniques will keep our discipline vibrant.

Not many studies have characterized the future fertility of affected animals. However, we ought to consider the possibility of future occurrence of the condition in light of animal well-being rather than fertility. In this regard, it is pertinent to consider some of the treatments administered. These are aimed in

preventing recurrence by narrowing the birth canal[6,21] by creating adhesions between retroperitoneal surfaces of the vaginal and adjacent or subjacent structures. These methods can prevent recurrence but may result in injury to the animal at the time of parturition. Further, should these animals conceive, subsequent pregnancies are frequently complicated by recurrence. Hence, consideration should be given to culling affected animals after their calves are weaned.[9] Animal health advisors have an important role to play to help the producers to make a decision to eliminate these animals from the breeding herd. Considering the injury the animal may endure at the present reduction and subsequent reductions, it behooves us to strongly suggest removing such animals from the herd.[62]

Uterine eversion

The appearance of a heavy mass of tissue outside the body of an animal can be intimidating and at times the process of reduction can be overwhelming. Truly the prospect of performing a successful reduction and the thought of recurrence can place one in mental anguish. We always look for ease of the operation and reduced physical effort on our part to reduce the eversion. In an attempt to facilitate the process of reduction mechanical aids have been used successfully.[48,50,56,57] However, raising the rear end of a live cow may appear inhumane.[46] Next, the application of agents such as sugar[45,58] or salt[52] to the everted tissue to reduce the edema spectacularly before reduction is not supported uniformly. Although the authors prefer a careful application as supported by others in practice,[45] it remains controversial[8] since it can amplify endometrial trauma. This technique may have certain academic skepticism despite its benefits.

The chance of immediate recurrence can be eliminated if the reposition is done completely without allowing invagination of the uterine horn to occur at the ovarian pole. Overall, the mortality rate ranges from 18-20 %.[8,36] The prognosis for survival and future reproductive performance depends on several factors, but time from the occurrence to treatment is critical for a positive outcome. Despite the extensive trauma that may occur before replacement, those that are replaced correctly and survive, have an acceptable prognosis for future fertility.[36,63] Occasional bladder eversion and intestinal entrapment that follow into the everted uterus may result in a poor prognosis. Timely intervention by a professional can minimize animal discomfort and economic loss to the producer. Treatment given by the uninitiated nonprofessional has to be discouraged since severe damage can be inflicted to the animal.[44] A unique retention technique developed to prevent recurrence[59] should be considered to obviate situations such as necrosis, gangrene, severe trauma, necessitating amputation.

The chance of recurrence at the next parturition has been discussed [2,64] and the heritability or additive susceptibility with subsequent pregnancies for this condition is not apparent.[1] Since no known heritable component is recorded there is no increased probability of occurrence at subsequent parturition. Therefore one should not be too hasty in recommending salvage of affected cows. The chance of recurrence is minimal and this has to be discussed with the producer. It should be remembered that in the developing world, cattle are an economic asset and the cost of therapy must be balanced against the value of the animal. Besides the value of the animal, decisions to keep the animals in the herd is based on their future fertility. The major factor that can influence in this decision is the degree of trauma caused to the uterus and the time it has taken to repair.[36] Future fertility of cows is reduced and there is a slight increase in risk at the subsequent calving, but the increased risk is not sufficient to justify culling.[2]

As the profession is emphasizing more and more into animal health and production than restorative therapy, it is incumbent on us to prevent the occurrence of these conditions by careful selection of breeding stock, observing quality animal husbandry methods, providing adequate care to periparturient animals, and finally eliminating potential recurring cases. All the above will enhance the animal well-being and place the profession as animal welfare contributors.

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(Editor's note: Many of the photographs in this manuscript are available in color in the online edition of Clinical Theriogenology.)