Review of the Use of Fetotomy To Resolve Dystocia in the Mare

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When the delivery of a live foal is not possible, one or two well-placed fetotomy cuts can dramatically shorten the clinician’s intervention time, as well as salvage the mare’s reproductive future. However, if the obstetrician is not familiar with the correct fetotomy technique, then the best option may be cesarean section. Author’s address: Dept. of Veterinary Clinical Sciences, College of Veterinary Medicine, The Ohio State University, 601 Tharp St., Columbus, OH 43210. © 1997 AAEP.

1. Introduction

Although uncommon, dystocia in the mare is perhaps one of the most challenging conditions faced by the equine practitioner. Long fetal extremities, together with the strong abdominal press and unpredictable behavior of the mare during stage 2 labor, make veterinary intervention difficult and often dangerous for the clinician. Cleanliness and constant lubrication are essential. The obvious goal is not only to deliver a live foal whenever possible, but also to preserve the life and fertility of the mare. Time is not on the obstetrician’s side, as placental separation begins soon after the onset of second stage labor and it is unlikely that the foal will survive unless delivered within 30 to 40 min—either by mutation and vaginal delivery, or by cesarean section.1 Even if the fetus is dead (no limb withdrawal, no ocular reflex, no swallowing reflex, no heart beat, no anal reflex), the time spent manipulating it is still critical. Repeated in-and-out arm movements are contraindicated, as the mucous membranes of the mare’s vagina and cervix are easily abraded. If the surface epithelium of the vagina is destroyed, then exposure of the underlying tissue can result in adhesions that may adversely affect fertility. Cervical adhesions are almost inevitable after prolonged intervention. An irritated equine vagina takes on the texture of sandpaper, and the scar tissue laid down during the healing process results in what can best be described as a stovepipe vagina. One or two well-placed fetotomy cuts can dramatically shorten the intervention time. If the obstetrician is not familiar with the correct fetotomy technique, then the best option for the mare’s reproductive future may well be a cesarean section.

The foremost consideration when assessing an obstetrical case is whether the fetus is still viable. This information, together with knowledge of the economic value of the mare; expertise, equipment, and facilities available to the veterinarian; and owner’s preference will determine whether fetotomy or cesarean section is chosen as the method of resolution for those cases in which mutation alone is unsuccessful.2 Economic considerations should include the future use of the mare (breeding versus performance value), the veterinary fees (anesthesia...
and surgery versus fetotomy), and the extended hospitalization required for postsurgical management.\textsuperscript{2,3} Prominent veterinary obstetricians have made an important point in stating that although some dystocias may be best resolved by surgical intervention, the expense of the procedure and aftercare exceed that of fetotomy.\textsuperscript{4–6} Thus, the value of the mare is a significant factor to be considered prior to resorting to surgery.

In a recent study\textsuperscript{7} of 150 obstetrical cases from two equine referral hospitals, it became apparent that severe dystocia is often multifactorial, with 86\% of cases involving malposition and over half (58\%) of these involving more than one extremity. Head or neck deviation or both were a major reason for referral, as these cases are extremely difficult to correct. In 30\% of the cases malposition was a factor, and abnormal presentation was involved in 24\% of referrals.\textsuperscript{7} Many dystocia cases require only partial dismemberment of the fetus before a safe and rapid delivery is possible.\textsuperscript{1}

The condition of the soft tissues of the birth canal can limit the options available at the referral hospital. If the birth canal is already severely traumatized, then the best option for future fertility may be an immediate decision to perform a cesarean section. In specialist equine hospitals that are located close to well-managed broodmare farms, the fetus is often alive when the mare arrives. A common practice is to immediately anesthetize the mare and then hoist the hindquarters. One clinician then works on the anesthetized mare while preparations are made for surgery. If the foal has not been delivered in the interim, a cesarean section is performed.\textsuperscript{8,9} In the author's hospital environment, over 95\% of the fetuses are determined to be dead on arrival, making this an ideal population for fetotomy procedures. Over 50\% of the mares have been in labor for between 3 and 6 h, and another 25\% have been in labor for between 7 and 12 h. In exceptional cases the mare may have been in labor for 24 h or more.

2. Materials and Methods

Most of the unsatisfactory results that are attributed to fetotomy are actually a result of a lack of experience and poor technique. Correctly designed instruments must be available, and the procedure should not be resorted to after prolonged attempts at mutation.\textsuperscript{3}

A. Restraint

The author prefers to perform partial fetotomy procedures on a tranquilized, standing mare in a large stall bedded with nonslip material, preferably clean straw.\textsuperscript{2,3,10–14} Parturient mares are unpredictable and the clinician should take what ever precautions are necessary to permit a safe examination—both for the mare and the veterinarian. The presence of a dead fetus means that only the mare need be considered when administering chemical restraint. The author routinely uses low doses of xylazine (0.3–0.5 mg/kg IV) and butorphanol (0.01–0.02 mg/kg IV) in conjunction with a twitch or lip chain. Epidural anesthesia may not eliminate the abdominal contractions of mares, but it does provide analgesia to the perineal region.\textsuperscript{15} It is useful to reduce the reflex straining initiated by manipulations within the birth canal.\textsuperscript{10,12,13} The author prefers a xylazine–carbo-caine combination to reduce the likelihood of hind-limb weakness. Tranquilization, with or without an epidural, was the means of restraint used for almost three quarters of the fetotomies (51/70) in a recent dystocia study.\textsuperscript{7} The remaining cases required either short-term or prolonged general anesthesia. General anesthesia provides excellent muscle relaxation, and hoisting of the hindquarters provides additional free space within the uterus such that the fetus may be repelled and obstetrical manipulations performed.\textsuperscript{13,16,17}

In those mares subjected to a prolonged fetotomy procedure, the use of general anesthesia and hoisting of the hindquarters is recommended.\textsuperscript{2,3,6,10} It should be remembered, however, that a complete fetotomy can generally be expected to result in severe trauma to the genital tract, even if performed by a skillful and experienced operator.\textsuperscript{3,6,10,12}

B. Equipment

Apart from having the technical knowledge and expertise, a veterinarian must have the correct equipment to optimize the chances for a successful fetotomy.\textsuperscript{5} All equipment is readily available through veterinary supply catalogs.

1. Utrecht model fetotome and threader: this is a double-barreled instrument with a hand grip and notched oval plate for anchoring obstetrical chains.
2. Wire saw handles: the author prefers the fold-over type, which grips the fetotomy wire between the two arms. The wire can be quickly attached and securely held.
3. Fetotome saw wire: this is available in spools. Approximately 15 ft (~13.7 m) are required to double thread the fetotome, pass around the fetus, and still provide the assistant with sufficient length to saw.
4. Krey hook: this expandable, two-armed hook comes with a stop that prevents overclosure of the instrument should it become disengaged.
5. Wire introducer: this is a curved instrument for passing the wire over or around a fetal part.
6. Fetotomy (palm) knife: this is used to seat the wire for some cuts. It is useful for removing bone fragments prior to fetal extraction.
7. Fetotomy wire and sterile wire cutters are needed.
8. Lubricant\textsuperscript{9} is needed.
9. A sterile stomach pump and stomach tube are required.
10. Obstetrical ropes, chains, and handles are also required.

C. Procedure

After the mare's tail is wrapped and tied to one side, the perineal region is thoroughly cleansed. The author routinely wears a sterile rubber sleeve on each arm. A well-lubricated arm is inserted to determine the condition of the genital tract (lacerations, presence of a pelvic mass, degree of cervical relaxation, presence of uterine muscular spasm). Careful thought should be given prior to all manipulations. Repeated vaginal entry and internal maneuvers only serve to traumatize the birth canal and increase the level of bacterial contamination. The application of copious volumes of lubricant is essential because the mare's genital tract is very sensitive to trauma, and the uterus is easily ruptured.

The author uses a polyethylene polymer powder (J-Lube) mixed with clean water. This product is extremely slippery, and good footing is essential. A sterile stomach tube and pump are used to gently instill the mixture into the uterine lumen as often as necessary during the procedure to keep the tract coated with lubricant. If the uterus is contracted, the lubricant tends to induce some uterine relaxation and thus create additional room between the uterus and fetus. Most referred cases have been subjected to variable attempts at mutation; therefore, if manual repositioning can't be readily achieved an alternate approach is chosen, namely a partial fetotomy or a cesarean section. Once the wire is seated securely during the cutting procedure, an assistant is instructed to start the cut by slow, short to-and-fro arm movements. Once the wire is seated the length of the arm movements is increased, as is the amount of pressure. Long strokes spread the wear on the wire and prevent it from overheating, thereby reducing the likelihood that the wire will break. A correctly performed cut can be completed in a short time. The most frequently employed cuts are discussed below.

1. Carpus–Tarsus

One channel of the fetotome is threaded and the free end attached to a curved wire introducer. This is passed around the joint of the flexed limb and the wire returned to the outside. The second channel of the fetotome is then threaded and the head of the instrument held firmly against the distal carpal–tarsal joint. Cutting through the intercarpal joint ensures that the increased diameter of the distal radius in the area of the growth plate remains as an anchor point for the chain when traction is applied. Similarly, the hock joint is sectioned through the distal row of tarsal bones so that a point of traction remains above the large tuberosity of the os calcis. Once the distal portion of the limb has been removed from the uterus, an obstetrical chain is attached to the proximal stump. Before any traction is applied the anteriorly presented fetus should be retropulsed to facilitate extension of the elbow and shoulder.

2. Deviation of the Head and Neck

Two options are possible, i.e., either direct amputation of the flexed head and neck, or removal of the opposite forelimb first, which then provides access for amputation of the head and neck. With a direct cut, one channel of the fetotome is threaded, and the wire introducer attached to the free end is passed between the neck and chest wall. The head of the fetotome is held as close to the thoracic cavity as possible so that amputation is near the base of the neck. Once the head and neck have been removed, a Krey hook is attached to the exposed vertebra. It is essential that a hand is placed over the neck stump while traction is applied to the Krey hook chain and forelimbs. This ensures that the uterine wall, cervix, and vagina are not traumatized by bone fragments. If the neck can't be reached, removal of the opposite forelimb often provides sufficient room to facilitate passage of a curved wire introducer around the fetal neck. A second cut then removes the retained head and neck, thereby permitting delivery of the remainder of the torso.

3. Extended Forelimb

After both channels of the fetotome are threaded, the wire loop is moved up the limb until the head of the fetotome is positioned dorsocaudal to the cartilaginous part of the fetal scapula. It is essential that the wire is not dragged over the vaginal and cervical mucous membranes. Once traction is applied to the wires, the loop should be seated in the axilla such that the ventral part passes between the fetal elbow joint and chest, and the dorsal part rests medial to the humeroscapular joint. A chain attached to the fetlock is then anchored to the fetotome such that the limb is held in extension. The veterinarian must ensure that the head of the fetotome remains dorsocaudal to the scapula during the sawing process. A correctly placed cut will remove the entire forelimb by dissecting through the muscular attachments between the scapula and chest wall. The obstetrician should endeavor to remove the scapula in its entirety. It is common, however, to have a remnant of the scapula remaining that is attached to the fetal trunk after removal of the limb. It is critical that this portion be removed by hand (palm knife) before any further manipulations are performed. Failure to remove this remnant prior...
to fetal extraction may result in lacerations of the uterus, cervix, and vagina.1,5

4. Retained Forelimb

Prior to introduction of the saw wire, a palm knife is used to make an incision along the dorsal border of the scapula. One channel of the fetotome is threaded and the free end is then attached to a curved wire introducer. The introducer is passed over the scapula and then pushed down between the limb and chest wall until it can be picked up ventrally and withdrawn under the humeroscapular joint. The second channel of the fetotome is threaded and the head of the instrument is advanced until it rests medial to the humeroscapular joint. The head should be held here and the wire loop seated in the dorsal incision. The sawing action will then cut through the muscular attachments that hold the scapula to the body wall.5

3. Results

Vandeplassche has reported on a series of partial and complete fetotomies.3,6,11 Partial fetotomy (one, two, or, exceptionally, three cuts) permits repositioning of the fetus such that controlled vaginal delivery is possible.3,11 A series of 132 severe dystocias that were resolved by partial fetotomy included reflection of the head and neck (54.5%), hydrocephalus–dicephalicus (4.5%), breech presentation with deformity or ankylosis of the hindlimbs (12.9%), partial transverse presentation (18.9%), and deformity, ankylosis, or reflection of the forelimbs (9.0%). On the basis of these 132 cases, Vandeplassche stated that partial fetotomy was the method of choice to rapidly and safely resolve over 80% of cases that were not amenable to mutation alone.6 The only alternative in such cases is a cesarean section. In another dystocia study,7 almost half of the cases were resolved by fetotomy, and 73% (51/70) of these were performed on a standing tranquilized (with or without an epidural) mare. A one- to three-cut fetotomy was performed in cases in which the head and neck, or limbs were abnormally placed. One or two cuts were sufficient to correct 57% (40/70) of the cases, and another 15 required three cuts. More than three cuts (15/70) were performed when economics of the case precluded the expense of cesarean section or where, in the opinion of the clinician, the autolyzed state of the fetus presented too great a surgical risk. Of the cases not resolved by mutation alone, 66% were corrected by fetotomy and 34% by cesarean section.7

A. Wry Neck

It is important to be able to differentiate this condition from a mere lateral deviation of the head and neck. Wry neck is not amenable to correction by mutation.9,14 Although the author generally removes the entire neck at the level of the thorax, in severely kinked cases it may be preferable to make the cut behind the greater curvature of the bend in the neck. This ensures that the amputated head and neck portion can be readily extracted.

B. Hydrocephalus

The condition is not uncommon in equine fetuses, especially those of the pony breeds.13 A single fetotomy cut from behind the ears down into the mouth removes the dorsal half of the fetal head, thereby permitting assisted vaginal delivery of the fetus.3,10 The trunk of a hydrocephalic fetus is generally smaller than normal and thus seldom interferes with delivery.14 In the author's referral hospital caseload, approximately 5% of dystocias involve a hydrocephalic fetus.

C. Contracted Tendons

This condition is considered to be congenital rather than hereditary and has no sex predilection.18 In a survey of 668 foals that died because of complications at birth, the contracted foal syndrome was the most common congenital anomaly diagnosed.19,20 This rigid deformity generally means that the fetus must be extracted by cesarean section. Less severe cases may be managed by fetotomy. The condition occurs with various combinations of torticollis, scoliosis (49%), maxillofacial deformities (18%), and varying degrees of flexion of the carpus, tarsus, and fetlock. Limb contractures are generally bilateral and more common in the forelimbs (87%) than in the hindlimbs (74%).18,19 Contracted fetlocks are more common than contractures of either the carpus or tarsus.

D. Anterior Presentation

1. Hip Lock

A two-cut fetotomy may occasionally become necessary if a normally presented foal becomes hip locked. If the fetus is dead and attempts at traction are unsuccessful, the first fetotomy cut should section the lower lumbar region, and the second bisect the pelvis such that delivery by traction can proceed.11,13

2. Hurdling-Dog Sitting

Another reason for traction on the head and forelimbs to be unsuccessful is with oblique ventrovertical presentations.7,21 In this variant of anterior presentation, the head and forelimbs protrude through the vulvar lips, but one (hurdling) or both (dog sitting) hindlimbs are flexed at the hip. The hooves may be caught at the pelvic brim such that the long axis of the fetus is angled up out of the uterus, or the entire hindlimb may lie in the vagina under the fetus.7 The unilateral malposture is more common.7,21 Although the hindlimb may be successfully repelled if the fetus is alive, this should not be attempted in the standing mare if the fetus is dead. In these cases the hindlimb may not always return to its normal position and uterine rupture can result when the fetus is being extracted.21 For this reason experienced practitioners recommend anesthetizing...
the mare and elevating the hindquarters before attempting mutation.21

Partial fetotomy is an alternative, with a transverse cut being made through the fetal trunk. After the front end is delivered, the fetus is eviscerated and skinned back to permit removal of the lumbar vertebrae as close to the pelvis as possible. The skin flaps are tied together to cover the vertebral stump. Chains are then attached to the hindlimbs and the pelvis reflected into the uterus. The caudal portion of the fetus is then delivered in posterior presentation.1,5,9–11,14,21 An alternate approach in the anesthetized mare has been described.21 A forelimb is removed, the costochondral junctions are incised, and the fetus is eviscerated. The curved fetotomy wire introducer is then passed far back over the fetal tailhead and retrieved by passing an arm underneath into the inguinal region of the fetus. The malpostured hindlimb is sectioned in the coxofemoral area, and the fetus is delivered by applying traction on the remaining forelimb.21 This method eliminates the possibility of uterine rupture if the offending hindlimb remains flexed within the uterus after manual repulsion.21

3. Head and Neck Flexion

The single most common abnormality resulting in dystocia is a reflected head and neck.7,11 If the fetus is dead, a partial fetotomy is indicated.11 This cut is relatively easy to perform and the author believes it to be preferable to prolonged attempts at manual correction of a head and neck deviation. In Vandeplassche’s dystocia population, 89% (154/173) of the anteriorly presented cases (head and neck reflection) that were not amenable to correction by mutation were subsequently resolved by predominately one-cut (40%) or two-cut (30%) fetotomies.11–13

4. Forelimb Malpostures

These are more easily corrected than hindlimb malpostures, provided that there is no tendon contracture.14

A unilateral or bilateral carpal flexion alone is usually not a cause of severe dystocia.13 If complicated by flexion of the elbow or shoulder, then mutation becomes more difficult, and if the fetus is dead, a fetotomy cut through the distal row of carpal bones is preferable to prolonged attempts at manual correction.5,13 This is especially true if contracted tendons are suspected. A unilateral or bilateral shoulder flexion will inevitably cause dystocia.7,13 Correction by mutation alone is possible but may take some time to achieve because of the long limbs of the equine fetus.1,13 Here again, dead fetuses are best delivered by a one- or two-cut fetotomy.1 If a dead fetus is presented with bilateral shoulder flexion and only the head protrudes through the vulvar lips, sectioning the neck may permit repulsion of the fetus and correction of the abnormal posture by mutation. If not, further fetotomy cuts to remove the retained forelimbs may be indicated.10

E. Posterior Presentation

In Vandeplassche’s dystocia population, 78.6% (44/56) of posterior presentations that were not amenable to correction by mutation were subsequently resolved by fetotomy (mean of 2.8 cuts).11–13

1. Hip Flexion

Correction of bilateral hip flexion (true breech presentation) by mutation is seldom successful. It must first be converted into hock flexion. This is best attempted by anesthetizing the mare, hoisting the hindquarters, and instilling copious amounts of lubricant. This eliminates straining and increases the abdominal space.11 However, the uterine body is easily ruptured at its dorsal aspect as the hock is straightened. If the foal is dead then a fetotomy may be considered, but this is not readily performed on a bilateral hip flexion.1,5,12,22 The curved wire introducer must be passed dorsally between the trunk and most accessible flexed hindlimb, then retrieved from underneath—a rather difficult maneuver. The only alternative is a cesarean section.10–12

2. Hock Flexion

Correction of a flexed hock posture by fetotomy may be safer in some instances than attempting to straighten the retained limb of a dead foal.5,11,13 The limb is sectioned through the distal row of tarsal bones and the amputated portion is removed. An obstetrical rope or chain can then be fixed above the large tuberosity of the os calcis and used as a point of traction.5

F. Transverse Presentation

Mutation of most transverse cases is impossible. In Vandeplassche’s dystocia population, only 50.5% (47/93) of the transverse presentations that were not amenable to correction by mutation were subsequently resolved by fetotomy (mean of 3.3 cuts).11–13 Some ventrotansverse cases may be managed by a two-cut fetotomy if they are only partially bicorneal.2 After one forelimb is removed, the head and neck are sectioned. It may then be possible to convert the fetus into a posterior presentation.2,10,11,13,14 However, in Vandeplassche’s studies,11,12 transverse presentation of the fetus was the predominant reason for surgery and it was emphasized that this might have been higher, as several cases that were corrected by mutation would have been better managed by cesarean section.13 In a study of 202 mares delivered by fetotomy (69 total; 133 partial), transversely presented and oversized fetuses posed the poorest prognosis for recovery of the mare, being 81% and 75%, respectively.2,12 They required too many cuts, especially if there was an oversized or malformed fetus, an elongated narrow birth canal, or advanced uter-
The author has extracted several transversely presented fetuses by means of fetotomy. These are extremely difficult cases, and the procedure in this instance should be viewed as a last resort to save the mare’s life when cesarean section has been declined by the owner.

4. Discussion

Results from fetotomy can vary tremendously, because to a large extent they depend on the level of expertise offered by the obstetrician and the facilities available. A common fault is to choose fetotomy only after the birth canal has already been traumatized by unproductive attempts at mutation. Although many experienced veterinarians have reservations about the use of a fetotome in the mare, others consider a dead fetus to be an indication for fetotomy to avoid the additional risks inherent in performing a cesarean section. The aim of a fetotomy is to rapidly decrease the size of a fetus such that safe extraction can proceed. This avoids the stress and injury that follows from prolonged manipulations and excessive traction.

Vandeplassche has stated that an experienced obstetrician should be able to resolve over 90% of equine dystocias by mutation and traction, coupled with the judicious use of the fetotome when indicated. Thus, in this renowned obstetrician’s opinion, cesarean section may only be indicated as the primary approach in fewer than 10% of the cases in which a dead fetus is present. Fetotomy should not, however, be considered as a substitute for cesarean section even though veterinarians unfamiliar with fetotomy techniques may be more inclined to perform surgery. The good obstetrician should be skilled in the former, have recourse to the latter, and should use both techniques at the appropriate time.

A poor prognosis for future fertility can be expected if the surgery is attempted after the mare has been subjected to prolonged vaginal manipulations or attempts at fetotomy. The reduced fertility that has been reported in mares after a cesarean section may have more to do with the cause and initial management of the dystocia rather than the actual surgery. In one study of 17 mares admitted for treatment of dystocia, all had been subjected to mutation attempts prior to referral, and then additional attempts at vaginal delivery were made before the surgery was performed. In the year of the surgery, 4/8 of these mares became pregnant, but only one subsequently delivered a live foal. In mares bred in the seasons subsequent to the surgery, there was a 50% foaling rate. Vandeplassche reported a 50% pregnancy rate for mares after cesarean section, but there was an increased likelihood of subsequent abortion. Fertility studies on dystocia cases that have been resolved by cesarean section after minimal prior vaginal manipulation are needed. The author and others have noted that the pregnancy rate after elective cesarean sections is higher than that reported for mares that have had surgery to correct a dystocia. Variable management practices can make it difficult to obtain reliable data. Unfortunately, the owners of valuable mares on well-managed farms are reluctant to discuss their mare’s cesarean section for fear that this information will substantially deflate the animal’s market value.

One may ask why the use of the fetotome is far more common in the management of equine obstetric cases in Europe. Perhaps this is a reflection on the level of species specialization in the North American veterinary profession. Fetotomy in the mare is not as easy as in the cow because of the longer equine birth canal, longer fetal extremities, and the impediment posed by the rapidly detaching fetal membranes. Thus, veterinarians who have the opportunity to develop their obstetrical skills in bovine dystocia cases are at a distinct advantage when it comes to managing such cases in the mare. The author had performed many fetotomies on cows before attempting to use the procedure in a mare. Extensive bovine fetotomy experience facilitates the acquisition of the technical expertise necessary to manipulate the equipment and to perform the cut(s) required without traumatizing the dam’s reproductive tract. This paper has discussed when the procedure may be indicated in the mare, and where the cut(s) should be made. For those veterinarians who work exclusively on horses, the cases that provide an ideal learning opportunity are those in which cesarean section is not an option, and the alternative to an attempted fetotomy would be euthanasia.

5. Conclusions

The author believes that fetotomy definitely has its place as a viable alternative to cesarean section in the management of selected equine dystocia cases, irrespective of the value of the mare. In one report, an experienced obstetrician performed a prolonged (65 min) two-cut fetotomy procedure on a mare that was subsequently inseminated at the foal heat. The uterine involution was sufficient to maintain the embryo and the mare delivered a live foal the next spring. The alternative would have been a cesarean section followed by routine postoperative care. Obviously, the obstetrical skill of the veterinarian is a major deciding factor in determining whether a fetotomy or cesarean section is the best option. Owners should be advised that postpartum metritis and laminitis are potential complications following either procedure.

References and Footnotes

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