Treatment of moderate to severe cases of equine dystocia in a field setting can be intimidating, given the need to perform rapidly, efficiently, and confidently physically demanding procedures with which most veterinarians lack hands-on experience. Compounding the problem are the far less than optimal conditions under which the veterinarian must work, e.g., poor physical circumstances or facilities and little, if any, trained technical support. However, resolving a moderate to severe equine dystocia in a field setting can be a highly rewarding opportunity to exercise creativity when referral is not an option. Not infrequently, the high cost of tertiary care prohibits referral of a dystocia to an expensive veterinary hospital in cases in which the animal is of relatively low value.

Management of the mare while awaiting veterinary attention
Outside of major equine breeding regions, in the majority of dystocia cases attended to by veterinarians on an ambulatory basis, the foal is already deceased at the time of request for treatment or will be deceased prior to the arrival of the veterinarian. Failure to deliver a foal within approximately 70 minutes of the rupture of the chorioallantois usually results in delivery of a deceased foal or a foal of poor viability requiring costly neonatal intensive care.1,2 If it is apparent that the foal is dead, the owner should be instructed to cease all attempts at delivery in order to limit swelling of the birth canal and to reduce the risk of the mare sustaining trauma to the uterus or caudal reproductive tract. The client’s efforts should then be focused upon decreasing the mare’s forceful abdominal contractions by walking the horse until veterinary assistance arrives.

A notable exception is an emergency call involving a “red bag” delivery in which the cervical star fails to rupture, the chorioallantois as a unit separates prematurely from the endometrium, allowing the red velvety surface of the chorion to protrude from the vulva. In most acute “red bag” deliveries, the foal is initially alive; however, progressive chorionic detachment results in fetal hypoxia and rapid death. Thus, recommendations to the attendant must include swift incising of the chorioallantois and application of traction to deliver the foal.

Initial evaluation and stabilization
Initial dystocia evaluation begins with a rapid assessment of whether or not the foal is alive, an accurate diagnosis of the orientation of the foal within the birth canal (fetal presentation, position and posture) and of the condition of the birth canal. The vast majority of equine dystocias result from postural defects of the long fetal extremities and/or neck and head. A retrospective study of 150 mares with dystocia admitted to two equine referral hospitals revealed that 86% were attributable to malposture, with 58% of these cases involving more than one extremity. Abnormal presentation was present in only one quarter of cases and malposition in just under one third of mares affected by dystocia.3 The incidence of these broad categories of fetal maldispositions recorded in a referral population did not differ from those reported by foaling attendants on 8 farms in a survey documenting incidence and nature of dystocia in 517 parturitions.4

If the foal is alive, labor is unlikely to have been protracted to the point that the dam suffers any systemic compromise, and all efforts must be focused upon a rapid delivery of the foal in the absence of any obvious abnormalities in the mare. A comprehensive physical examination of the mare may be conducted following delivery of a live foal or at such time as delivery attempts have failed and the foal has died. If, however, initial evaluation confirms the foal to be deceased and, in particular, if the dam has ceased efforts at delivering the offspring, the mare should be carefully evaluated for overall systemic health, including hydration, cardiovascular status, the presence of septicemia, and gastrointestinal function. Should the mare be systemically compromised in any manner and referral to a tertiary care facility is not an option, supportive care should be initiated prior to commencing obstetrical intervention.

Supportive care of the mare for delivery of a foal that has been dead for longer than an hour should include placement of an indwelling intravenous catheter and administration of a bolus of approximately 12 liters of a balanced, polyionic fluid for a 500 kg horse, as most mares suffering from a protracted dystocia will not drink and will be at least mildly to moderately dehydrated. If possible, intravenous fluid administration is continued at a maintenance rate while delivery is performed. Flunixin meglumine (1.1 mg/kg, IV, q 12 h) is administered as an
In restraining mares for delivery of a dead fetus, the goal is to maintain the mare in the standing position at least during initial evaluation of fetal disposition, but to manage pain and limit the dam’s mobility. A combination of detomidine (4-10 mg total dose per 500 kg mare, IV) and butorphanol (4-10 mg total dose per 500 kg mare, IV) generally provides the most effective pain relief and tranquilization. Ironically, heavy sedation will prevent most parturient mares from lying down. Complicated and prolonged extractions may necessitate administration of a supplemental dose of tranquilizer or general anesthesia. Pain management, in addition to reduction of abdominal straining, is accomplished through caudal epidural anesthesia using lidocaine, or a combination of lidocaine and xylazine to increase duration of action.

**Choosing the appropriate method of delivery**

The foal is alive or possibly alive and a Caesarean section is an option: The attending veterinarian should spend no more than 10 min on any attempt to achieve a simple correction and swift delivery of the foal. If this fails it is wise to immediately refer the mare to a tertiary care facility that offers a complete array of obstetric services, including Caesarean section. The resulting delay in the delivery of the foal is, however, likely to result in its death. Additionally, repeated in-and-out movements during this assessment should be avoided as abrasions of the vaginal mucosa may result in subsequent adhesion formation, thus decreasing future fertility despite a successful C-section. Instillation of large volumes of polyethylene polymer (PEP)-based lubricant into the allantoic cavity or uterus during obstetrical manipulation should also be avoided in mares for which C-section is an option given the fatal toxicity associated with intra-peritoneally delivered PEP.

The foal is alive or possibly alive, but a Caesarean section is either impossible or too expensive: Such cases are best kept in the standing position and initially sedated using a combination of xylazine (up to 1.1 mg/kg IV) and butorphanol (0.01 mg/kg IV) if it is deemed possible that the foal is alive. Acepromazine may be added with limited impact upon the fetal heart rate and aortic blood flow. Administration of detomidine should be reserved for cases in which the foal has been confirmed to be deceased or in which the client is not financially committed to providing intensive neonatal care for a poorly viable foal following prolonged dystocia, as detomidine hydrochloride administered at 0.01 mg/kg intravenously results in a 35% decrease in fetal heart rate and a 66% decline in peak velocity of fetal aortic blood flow for 90 minutes. While xylazine acts in a similar manner, the duration of fetal bradycardia lasts only 5-20 minutes.

A caudal epidural anesthetic is usually administered; however, it is important to recognize that epidural anesthesia will not always eliminate all abdominal contractions and full effect may not be realized until 20-30 minutes following administration in some mares. Thus, when attempting to deliver a live foal, epidural anesthesia may be of questionable value. In cases in which the foal is dead and C-section is not an option, provision of efficacious epidural anesthesia is invaluable. A variety of protocols have been suggested including administration into the first caudal intervertebral space of 7-8 mL 2% lidocaine per 500 kg mare, 0.17 mg/kg xylazine diluted in 10 mL sterile saline, or a combination of xylazine (0.17 mg/kg body weight) and carbocaine (2-3 mL) with sterile saline to 8-10 mL total volume. Alternatively, 1.0-1.25 mL of 2% lidocaine per 100 kg body weight may be instilled into the S1-S2 epidural space. Incorporation of xylazine into epidural anesthesia protocols produces analgesia with a lesser degree of ataxia than provision of epidural anesthesia using lidocaine alone. The mare is then placed on a slope facing downhill, allowing the uterus and its contents to fall cranially into the abdomen, thus creating space for manipulation cranial to the birth canal, and every effort is made to correct the fetal disposition and extract the foal.

For correction of a flexed body part the fetus is first repelled into the abdomen to create space in front of the pelvic inlet. Next, the offending leg or body part is rotated so that its bluntest portion (usually a flexed leg joint) presses against the uterine wall and any sharp points (especially hooves) are directed at the foal’s body, i.e., the distal limb is rotated medially with the proximal flexed joint rotated laterally. The flexed body part is then extended into the birth canal. It may be difficult to keep the foal repelled while manipulating a flexed leg or the head at the same time. This problem can be resolved by first attaching an obstetric chain or rope to the fetlock of a flexed leg or to the mandible of a flexed head. While the obstetrician then uses both arms to repel the foal, an assistant can apply traction to the rope or chain in order to extend the flexed body part. Obviously the assistant needs to
receive careful guidance from the veterinarian in order to avoid trauma to the uterine wall through excessive force during the extension process.

If there is still not enough room in front of the pelvis to allow for the extension of a flexed leg, the mare can be anesthetized and the bucket of a tractor or similar hoisting device can be used to hoist her hind quarters to about 1 meter above ground level to provide more room for repulsion and manipulation of the foal. In the field, general anesthesia may be induced using xylazine (1.1 mg/kg IV) followed by ketamine (2.2 mg/kg, IV). Duration of action is relatively brief and produces little, if any, neonatal respiratory depression. Redosing of xylazine and ketamine combination at 0.5 mg/kg IV and 1.1 mg/kg IV, respectively, may be performed for an additional 10 minutes of general anesthesia. For more protracted obstetrical interventions, general anesthesia may then be maintained using “triple drip” containing 5% guifenesin, xylazine and ketamine delivered by continuous infusion. General anesthesia, and guafenesin in particular, provides marked relaxation of the myometrium, thus facilitating controlled vaginal delivery with or without fetotomy. Delivery of oxygen to the anesthetized mare may also be performed.

Once the foal is ready for extraction, usually when the head and distal fore limbs have been delivered, the mare’s hind end is lowered to the ground, she is positioned in lateral recumbency, and the delivery is completed. If vaginal delivery is either impossible or likely to cause excessive trauma to the birth canal, the anesthetized foal needs to be destroyed by exsanguination in utero and a fetotomy be performed while the mare is anesthetized (the rules of the AVMA clearly state that the destruction of a conscious animal by exsanguination is illegal!). Mares should not be maintained with hind limbs hoisted for prolonged periods of time, i.e., not longer than 20 minutes, as respiration is impaired by the weight of the abdominal organs, including the gravid uterus, pressing on the diaphragm.

The foal is dead and can be delivered by any method: In the authors’ opinion, the proportion of dead foals that cannot be delivered vaginally by a skilled obstetrician is very, very small. Since the foal is already dead, much more time can be allowed for the delivery of the foal while the mare remains standing. General anesthesia, while very safe in most cases, is never entirely risk-free. The authors share the opinion of those who state that a fetotomy is best performed on the standing mare, but others prefer general anesthesia for the procedure. Nimmo et al proposed that resolution of dystocia by fetotomy with the mare under general anesthesia affords safer working conditions for both the mare and the clinician and, due to decreased time of manipulation secondary to reduced muscle contraction, shorter intervention time, and improved outcomes for future fertility. It is the authors’ firm opinion that fetotomy is an elegant and enormously successful technique for the resolution of equine dystocia. The vast majority of abnormal fetal dispositions can be resolved using only one or two transections and, if pursued expeditiously by a skilled operator, fetotomy can decrease duration of obstetrical manipulations as well as actually reduce the likelihood of trauma to the birth canal from continued efforts to correct a malposture or application of excessive force to perform the extraction. Results in even complicated cases that required complete fetotomies have been very rewarding. While mare mortality after fetotomy has been reported to be 5 - 45%, the author (Volkmann) has not ever lost a mare on which a fetotomy was performed by himself or under his immediate supervision. The inadvertent trauma to the mare’s birth canal, a commonly cited consequence of fetotomy, can be limited to a large extent by the skillful and appropriate use of the fetotomy equipment to minimize duration of intervention. When a partial fetotomy is used to remove the offending extremity of the foal, but the foal can still not be extracted easily, further dismemberment of the foal by fetotomy is preferred over the excessively forceful extraction of the foal.

While a detailed account of the techniques for fetotomy falls well beyond the scope of this presentation, a few general guidelines are:

1. Without thorough training and at least some experience, equine fetotomy is very challenging and is likely to result in excessive trauma to the mare’s reproductive tract. However, in cases in which future fertility is secondary to survival of the mare, fetotomy should always be considered.
2. Fetotomy should be initiated promptly, prior to excessive manipulations that may traumatize the birth canal.
3. Ample lubrication is necessary to prevent trauma to and irritation of the birth canal during the removal of even small transected fetal body parts.
4. For fetotomies on foals of large mares it is helpful to have long, slender arms.
5. Fetomal manipulations should be performed inside the allantoic cavity so that endometrial damage is minimized.
6. The allantoic cavity can be distended by the infusion of large volumes of dilute lubricant or even water. This increases the weight and volume of the uterine contents, stretching the uterine wall cranio-ventrally and making it easier to repel the fetus back into the mare’s abdomen.

7. Resolution of dystocia by fetotomy is more readily accomplished in anteriorly presented fetuses with postural abnormalities than in posteriorly or transversely presented fetuses.

While rarely encountered, some dead foal cases are best resolved by cesarean section, e.g., the presence of pre-existing lacerations to the birth canal or uterus; the failure to accurately diagnose the exact disposition of the foal (removing any fetal body part by fetotomy just because it could be done is an irrational and often counter-productive approach); inadequate space in the birth canal; severe fetal deformities, often with severely malformed and/or contracted joints; and the inability to reach deep enough into the uterus to place the fetotomy wire around the targeted body part (most often encountered in transversely presented fetuses). In contrast, emphysematous fetuses should be delivered exclusively per vaginum.

The foal is dead and the mare is suffering from some concurrent disease: In the rare event that a mare presents in dystocia while she is also suffering from some other disease, careful deliberation is required in order to choose an approach that is most likely to provide a satisfactory result to the client. Examples include uterine torsion in the term mare (extremely rare), gastrointestinal colic in a near-term or term mare, prolapse of the rectum or urinary bladder, herniation or rupture of the abdominal body wall, hemorrhage from one or more of the large uterine vessels, chronic laminitis, recurrent myopathy (HYPP, polysaccharide storage myopathies), and a pre-existing cardiovascular or respiratory disorder that would increase the anesthetic risk to the mare.

Post-resolution complications and supportive care
Dystocia increases the risk of fetal membrane retention, metritis and laminitis as well as uterine laceration, peritonitis, vaginal necrosis and perineal trauma. The management of these complications is discussed elsewhere in these Proceedings. Mares suffering from prolonged dystocia resolved by vaginal delivery with or without fetotomy often develop gastrointestinal impactions. Therefore, mares suffering from protracted dystocia should be administered intravenous fluids during obstetrical intervention and 4 L of mineral oil and 2-3 L of warm water via nasogastric tube following delivery of the foal. Crushing or stretching injuries to the sciatic, obturator or peroneal nerves is uncommon and usually results in temporary, reversible gait abnormalities. Affected mares should be kept in small enclosures with good footing and, in cases of peroneal nerve damage, the distal limb should be splinted until they can move again without risk of injury.

Pain is common in mares that suffered dystocia and should be managed as a distinct entity. Systemic treatment with non-steroidal anti-inflammatory drugs (e.g. flunixin meglumine or phenylbutazone), long-acting epidural analgesia and/or intra-vaginal icepacks can provide relief from various degrees of pain originating in the birth canal. Vaginal or cervical trauma, while not life threatening, can seriously affect the mare’s ability to conceive and carry another foal to term. Cervical lacerations are best assessed and repaired after the tissues have healed (after foal heat), but vaginal trauma needs to be addressed immediately to prevent transluminal adhesions from developing. Daily application of an oily ointment or dry-cow intra-mammary preparation onto the walls of the vagina by means of a gloved hand may prevent adhesions between abraded areas of vaginal mucosa. Pneumovagina and/or urovagina are both more frequently encountered during the postpartum period of mares that have suffered dystocia. Exercise, when possible, and the repair of any Caslick’s sutures as soon as the vulvar tissues have healed and the vaginal therapy for the prevention of adhesions is completed are helpful in controlling these problems.

Mastitis, although rare, can develop in mares that have lost their foals during dystocia and have engorged udders. It is suggested that mares only be milked out if they develop mastitis (fever and a hot, painful udder). Milking out of distended udders in post-dystocia mares not suffering from mastitis is contraindicated, as this practice serves only to delay involution of the mammary glands.

Prognosis for Life and Future Fertility
Outcome measures in cases of equine dystocia include delivery of a live foal, the incidence and severity of complications, survival of the dam, and preservation of the mare’s fertility. Most data has been derived from records of mares treated for dystocia at tertiary care centers and, therefore, all conclusions drawn may not be strictly applicable to those resolved under field conditions. Furthermore, across seven published studies, not all methods of resolution were compared uniformly in each investigation and results varied widely due, in large part,
to the range in duration of dystocia prior to presentation. An early examination of mortality and subsequent fertility of mares that underwent fetotomy (80% partial, 20% complete) or C-section to resolve dystocia revealed that 90% of mares with dead foals subjected to fetotomy survived the standing procedure and 38% (20/52) of mares for which follow-up information was available subsequently produced a live foal. In this same study, 20% of mares in which dystocia was resolved by C-section (n=63) died and 32% subsequently delivered a live foal. In another study on a group of dystocic mares treated by C-section 89% of mares survived and 50% produced a live foal one year post-surgery. In a more recent study published by Byron et al in which 247 cases of dystocia were resolved utilizing controlled vaginal delivery (71%), C-section (25%), and fetotomy (4%), 94%, 89%, and 56% of mares, respectively, survived to discharge. Of the mares that underwent a controlled vaginal delivery, 66% subsequently produced at least one foal, with 58% delivering a live foal after being bred during the same season as the dystocia occurred. Figures for mares having dystocia resolved by C-section were similar at 72% and 60%, respectively. Live foals surviving to discharge were delivered in approximately one third of mares that underwent either controlled vaginal delivery or C-section. These higher success rates were likely attributable to the relatively short duration of dystocia prior to presentation as well as the application of an extremely efficient protocol for case management.

Reported outcomes for populations of mares treated exclusively with fetotomy for dystocia resolution are highly variable. A 1983 retrospective analysis of 21 cases of dystocia resolved by fetotomy revealed an overall mortality rate of 29%, with mortality rate increasing commensurate with increasing duration of dystocia prior to presentation, i.e., 15% for mares treated within 12 hours of onset of labor, 40% for dystocias addressed within 12-24 hours, and 67% for mares suffering from dystocia for longer than 24 hours. Additionally, the mortality rate for mares subjected to complete fetotomy was 50%, while the percentage was much lower (15%) for mares whose dystocias were resolved by partial fetotomy. An unspecified number of fetotomies included in this retrospective analysis were performed by “inexperienced residents in training”. More recent reports have been more encouraging with regard to the use of fetotomy, particularly that of Carluccio and co-workers. In analyzing the records of 72 dystocic mares treated on the farm by standing fetotomy 6-18 hours after rupture of the chorioallantois, a 95.8% survival rate was achieved. Future fertility was evaluated in terms of the 45-day pregnancy rate in 68 of 72 mares that were bred 2-3 months post-fetotomy. The pregnancy rate attained, 79.4%, did not differ significantly from that of control mares (82.3%).
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