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**Obstetrics** (18-May-2001)

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**Introduction**
The incidence of dystocia varies among breeds, with Thoroughbreds approximating 4% and draft mares approaching 10% [1,2]. Uncommon as it may be, dystocia is recognized as being one of the true emergencies in equine practice, with potentially fatal consequences for both the foal and mare. In a study of over 1,200 fetuses and stillborn foals, fetal asphyxia associated with dystocia was identified as one of the leading causes of reproductive loss in the periparturient period [3]. Inappropriate intervention can easily traumatize the uterus, cervix and vagina such that the mare’s subsequent fertility is markedly reduced [4].

Most of the veterinary literature relating to equine dystocia is based on the work of Vandeplassche [1,2,5-9]. In the past decade several investigators have expanded our knowledge about this important problem. The purpose of this chapter is to review the most recent publications pertaining to equine obstetrics.

**Fetal Orientation**
Fetal rotation within the amniotic cavity, and amniotic sac rotation within the allantoic cavity, results in the characteristic twisting of the equine umbilical cord [5,10]. However, until recently it has been difficult to explain how approximately 99% of foals are delivered in anterior presentation. A complex mechanism involving entrapment of the fetal hindlimbs within the uterine horn appears to be involved. Ultrasonographic studies have demonstrated that between two and five months of gestation the fetus is just as likely to be in caudal presentation as it is to be in cranial presentation [11]. Unlike the situation in ruminants, the equine amnion floats freely within the allantoic fluid. Fetal mobility is maximal during the third and fourth months of gestation, then decreases over the next four months, possibly due to decreased space within the uterine lumen as the fetus grows [5,11,12]. The lumen of both uterine horns becomes closed between five and seven months, and the allantoic fluid along with the fetus is contained within the confines of the uterine body [10-13]. During this time the fetus positions itself so that its head end points towards the mare's cervix. That is, it comes to lie in cranial presentation [11,12,14]. Neurologic signals within the fetal inner ear may respond to the slope of the ventral uterine wall and guide the fetus to lie with its head elevated towards the cervix [13]. The noncord horn remains closed whereas the cord horn gradually permits the entry of the hindlimbs between seven and nine months. The limbs can only enter the horn when the fetus is in dorsal recumbency because there is such an acute angle between the horn and body by this stage of gestation. Thereafter, the hindlimbs remain enclosed within the cord horn and the hooves extend to the horn tip by the tenth month [10-13]. Although the fetus is locked into a dorsopubic position, it is possible for the entire pregnancy (uterus and fetus) to rotate approximately 90° on the lower maternal abdominal wall. This occurs because any rotational movement of the caudal half of the fetus (pelvis and hindlimbs) by necessity will involve the close-fitting uterus. In extreme cases this rotation may progress into a clinical uterine torsion [15,16].

In early pregnancy the mesometrial attachments suspend the uterine horns so that they point cranially and dorsally. By late gestation this horn orientation has changed dramatically. As the pregnancy advances the horns become more perpendicular. Eventually the horn containing the hindlimbs comes to rest on the dorsal surface of the uterine body, with the tip of the horn directed towards the cervix [12,15]. It is possible for the hooves and horn tip to be pushed so far caudally that they actually come to lie over the fetal head. Thus, when performing a *per rectum* evaluation of a mare in late gestation the fetal hooves that are palpable may be attached to the hindlimbs. Vigorous piston-like thrusts of the hindlimbs in association with elevation of the fetal rump can result in the hooves being pushed well past the cervix into the recto-genital pouch [12,13,15]. This observation may explain the acute colic episodes that have been previously attributed to uterine dorsoretroflexion [6]. Although the caudal aspect of the fetus is intimately associated with the uterine wall, the cranial portion has room to rotate within the uterine body itself. Ultrasonographic studies on mares close to term (>330 days gestation) have shown that the cranial half of the fetus was in dorso-pubic position approximately 60% of the time, and in dorso-ilial position during about 40% of observations. The forelimbs and neck were usually flexed (about 80%), but in the remainder the head or limbs were...
extended [13]. These recent ultrasonographic investigations have substantiated the classic radiographic study that demonstrated that the full term equine fetus is initially lying in a dorsopubic position with the head, neck and forelimbs extended [17].

It has been proposed that the increasing uterine tone during stage I of parturition somehow stimulates the fetus to extend its head and forelimbs [15]. Once the head and forelimbs are fully extended, they do not return to a flexed posture. Rupture of the chorioallantois and passage of the allantoic fluid does not occur until the fetlocks or knees are at the level of the external cervical opening. As the nose reaches the vulva the cranial half of the torso rotates from a dorso-pubic to a dorso-ilial position [15]. While the cranial aspect of the foal is passing through the birth canal the hindlimbs remain locked within the uterine horn. The foal's rump remains closely apposed to the cranial dome of the uterine body as the contracting uterus and abdominal press combine to expel the foal [15]. The foal's withers continue to rotate into a dorso-sacral position as the head appears through the vulvar lips. The hindlimbs become extended as the fetal abdomen begins to pass through the vulvar lips since at this point the stifles impinge on the pelvic brim [15]. The fetal pelvis rotates through a dorso-ilial position into a dorso-sacral position just as the hips begin to exit the vulva. Thus, at the time of the foal's delivery the cranial aspect of the contracting uterus is only about twelve inches from the cervix [15]. It has been proposed that the gel-like pads on the newborn's hooves may serve to protect the placenta and uterine wall from the vigorous activity of the fetal limbs [15].

In summary, 90° axial-rotations of the cranial aspect of the fetus, together with head-neck postural changes, are common in late gestation. Thus, it is impossible to predict dystocia due to postural or positional complications until the mare is well into first stage labor. However, suspicion of a transverse or caudal presentation would warrant further evaluation.

Types of Dystocia
Although one report noted that the number of previous parturitions was not related to the frequency of on-farm dystocias, two large studies have shown that approximately 30% of referral hospital dystocia cases are in primiparous mares [8,18,19]. Primiparous mares are a major cause of dystocia and neonatal asphyxia in foals in the central Kentucky area [20]. Although fetopelvic disproportion is not common in the mare, obstetrical assistance (traction) is required much more often in primiparous mares [1,2]. Dystocia in these mares is further complicated by a tight vaginovestibular sphincter, which may predispose primiparous mares to lacerations and rectovaginal tears [21]. The terms malpresentation or malposition are often misused to describe a dystocia when in fact the only anomaly present is postural - the most common cause of dystocia in the mare [4]. Thus, in an attempt to avoid confusion, Vandeplassche introduced the term fetal maldisposition to describe the combination of presentational, positional and postural abnormalities that can contribute to dystocia [2]. A comparison of Vandeplassche’s predominantly draft horse population with a light horse population from North America revealed that the types of dystocia were remarkably uniform irrespective of breed [18]. There was a trend for draft mares to experience more transverse presentations. Almost half of the transverse presentations occurred in draft horse mares, and these breeds were twice as likely to be referred with a fetus in transverse presentation as either of the two major light breeds (Thoroughbred, Standardbred; [18]). Dorso-transverse presentations are extremely rare. The vast majority of transverse dystocias are in ventral presentation, meaning that they must be differentiated from twins [8,18]. The incidence of cranial, caudal and transverse presentations in the normal parturient mare population is reported to be 98.9%, 1.0% and 0.1% respectively [2,8]. Two large referral hospital studies have demonstrated that caudal (14 - 16%), and especially transverse (10 - 16%), presentations markedly increase the likelihood of a mare experiencing severe dystocia [8,18]). Oblique ventro-vertical presentation (dog-sitting or hurdling posture) is a variant of cranial presentation where the head and forelimbs protrude through the vulvar lips, but one or both of the hindlimbs is flexed at the hip such that the fetal hoof engages the pelvic canal [6,8,18,21,22]. The incidence in a 739 foaling population was 0.7% [22]. Once again, the difficulty of these cases is evidenced by the fact that this maldisposition accounted for 9% of cranially presented fetuses in one referral hospital population [18]. Bilateral hip flexion ("dog-sitting") is less common than the unilateral ("hurdling") posture [18,22].

The previously discussed ultrasonographic studies suggest that the presence of a weak or dead fetus may be a major contributing factor in many dystocias that involve positional and postural abnormalities. Less vigorous, or absent, fetal righting reflexes early in the parturient process have been suggested by many authors [17,18,21,23]. However, postural abnormalities are often purely accidental occurrences and may, in fact, be complicated by vigorous fetal activity. The hoof or nose of a viable fetus may catch on the pelvic brim, or on a fold of soft tissue, and uterine contractions or abdominal straining at an inopportune time may then force the extremity into an abnormal posture [4,18,23]. Deviation of the head and neck, sometimes in conjunction with limb malposition, appears to be the most common cause of severe dystocia for fetuses presented cranially [8,18]. Lateral deviations may be directly along the fetal thorax or obliquely downward. Occasionally the head itself will be rotated on the neck. Ventral deviation of the head between the forelimbs can result in only the ears being palpable. In extreme cases the head is ventrally displaced such that it lies adjacent to the fetal sternum. The observation that ventral deviation of the head and neck is more likely to be present if the fetus is in dorso-ilial position than in dorso-sacral position further substantiates the hypothesis that the fetal righting reflexes are compromised early in these cases [18]. In referral hospital populations approximately half of the caudally presented fetuses have bilateral hip flexion ("true breech").
Another 25% of these cases have bilateral hock flexion [1,6,8,18]. This high incidence of postural abnormalities in posteriorly presented fetuses suggests that this abnormality is not due to chance. The fact that the delivery is often complicated by concurrent malpositioning (dorso-ilial or dorsopubic) of the fetus further supports the argument that this condition involves some unexplained failure of the normal extension mechanism [8,18]. Foals in caudal presentation are more likely to be in dorso-ilial position than foals in cranial presentation [18].

Assisted or Controlled Vaginal Delivery and Fetotomy
When managing an equine dystocia, time is not on the obstetrician’s side since fetal hypoxia rapidly ensues. Normal stage II of labor is explosive and short - typically lasting less than 20 minutes. Usually the translucent fluid-filled amnion will appear at the vulva lips within 5 minutes of the rupture of the chorioallantois [19]. This rupture should occur at the cervical star, and in a normal delivery the chorioallantois is thought to remain attached to the endometrium until after the foal is delivered. Separation of the fetal membrane will deprive the fetus of oxygen and this is the critical factor that must be considered when assessing an obstetrical case that involves a live foal. Fortunately the vast majority of dystocias can be corrected at the farm fairly quickly by brief manipulation and assisted vaginal delivery. If resolution takes longer than 10 - 15 minutes, the obstetrician should consider the alternatives (controlled vaginal delivery, fetotomy if the foal is dead, or cesarean section). Adoption of hospital approach to the management of these cases may improve foal survival rates and most likely will reduce the complications that are often associated with dystocia [24]. Controlled vaginal delivery entails general anesthesia and hoisting the mare’s hindquarters. The uterine relaxation and effects of gravity greatly assist in fetal repulsion and manipulation [4]. This technique permitted resolution of up to three quarters of cases in one study. The remaining cases were resolved by cesarean section, with a 30% foal survival rate [24]. Although most references suggest that fetal survival rates are very low if the foal is not delivered within 30 to 40 minutes of chorioallantoic rupture, one author reports having delivered live foals by cesarean section up to 90 minutes later [24]. These are cases that were promptly presented to the hospital and that had minimal - if any - vaginal intervention at the farm. Perhaps this minimal vaginal intervention is less disruptive to the placental attachment, and thus these foals are not deprived of their oxygen supply.

The importance of avoiding prolonged vaginal manipulations cannot be emphasized enough. The obstetrician must be able to differentiate mere carpal flexures or neck deviations from contracted tendons and congenital curvature of the cervical vertebrae (“wry neck”). These latter conditions are best corrected by fetotomy or by cesarean section [25]. In a survey of 668 foals that died due to obstetrical complications, flexure deformities were the most commonly diagnosed congenital anomaly [3,20]. The deformities are generally bilateral and more common in the forelimbs than the hindlimbs [3]. The high incidence of head and neck malpostures in referral hospital populations speaks to the fact that they are very difficult to correct [8,18]. Fetotomy is an alternative to cesarean section in the management of selected equine dystocias, irrespective of the value of the mare [26]. In experienced hands one or two well-placed fetotomy cuts can markedly shorten the intervention time [7-9,26,27]. Although some cases may be best resolved by surgical intervention, the expense of the procedure and aftercare exceed that of fetotomy. Thus, the value of the mare is a significant factor to be considered [26]. The condition of the soft tissues of the birth canal can limit the options available at the referral hospital. If manipulations have already inflicted severe trauma, the best option for future fertility may be an immediate cesarean section. Most of the unsatisfactory results that are attributed to fetotomy are actually a result of a lack of experience and poor technique [26]. Dystocia due to reflection of the head and neck is especially amenable to correction by a single fetotomy cut [7,26]. In a review of 132 dystocia cases, partial fetotomy was the method of choice to rapidly and safely resolve over 80% of cases that were not amenable to mutation alone [7]. In another large study almost half of the cases were resolved by fetotomy, and three quarters of these were performed on a standing, tranquilized mare [26]. One or two cuts were sufficient to correct 57% of the cases, and another 21% required a third cut. A correctly performed fetotomy does not cause changes in the composition of the peritoneal fluid in post-dystocia mares [28].

Abdominal discomfort in a postpartum mare poses a diagnostic dilemma. A prompt and accurate diagnosis followed by aggressive medical and/or surgical therapy may prevent an otherwise fatal outcome. Abdominocentesis is helpful in diagnosing the cause of abdominal discomfort because peritoneal fluid composition reflects the pathophysiologic state of the visceral and parietal mesothelial surfaces. However, until recently the peritoneal fluid changes in the normal postpartum mare, yet alone in mares recovering from dystocia were unknown. Two studies have confirmed that the normal parturient process does not cause the composition of the peritoneal fluid to change from within the normal range [28,29]. Even after prolonged obstetrical manipulations in dystocias that are serious enough to warrant referral to a veterinary hospital, the peritoneal fluid profile is generally not altered from that of the normal range [28]. Elevation of one peritoneal fluid value does not mean that the mare will become clinically ill. Repeated abdominocentesis is indicated in cases where clinical signs suggest that an abdominal lesion related to parturition may be present because the peritoneal fluid constituents may change within hours. In those cases that do become clinically ill, at least 2 of the total protein, total nucleated cell count and percentage of neutrophils values will be significantly elevated above the normal reference range. Suggested clinical guides to
the presence of a potentially life-threatening lesion are total protein >3.0 g/dl in conjunction with a total nucleated cell count of >15,000 cells/ul and a differential cell count of >80% neutrophils, especially if degenerate changes are present [28]. Peritoneal fluid values should not be viewed in isolation, and must be considered in light of all the signs exhibited by the mare.

Cesarean Section

The option for a cesarean section will be governed by the economics of the case and the proximity of a suitable surgical facility. The surgical technique has been recently reviewed [30]. A poor prognosis for future fertility can be expected if the surgery is attempted after the mare has been subjected to prolonged vaginal manipulations [1,2,23]. The reduced fertility that has been reported in mares after cesarean section may have more to do with the cause and initial management of the dystocia rather than the actual surgery [9,31,32]. Fertility studies on dystocia cases that have been resolved by cesarean section after minimal prior vaginal manipulation are needed. The pregnancy rate after elective cesarean sections appears to be higher than those reported for mares that have had surgery to correct a dystocia [28]. There is some controversy about whether mare mortality rates are higher following controlled vaginal delivery versus cesarean section [24,33,34]. Certainly as the duration of dystocia increases, the morbidity and mortality rates for both the mare and foal increase. If the dystocia is protracted and the birth canal is severely traumatized then cesarean section is probably preferable to attempts at a controlled vaginal delivery [34].

In conclusion, there is no one procedure that is better than any other. The viability of the fetus, economics of the case, clinical skills of the obstetrician, and proximity to a referral hospital are all major considerations that the attending farm veterinarian must weigh before choosing the most appropriate course of action.

References


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