Managing the Cow at Calving Time

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Abstract

Despite increased emphasis in recent years on declining dairy cow reproductive performance, there has been very little focus on the management of the periparturient dairy heifer and cow at calving time. Perhaps as a result, US producers are now reporting increasing perinatal calf losses at calving. A critical determinant in reducing periparturient losses is good calving management. The tenets of good calving management are predicting accurately when calving is due, moving heifers and cows to the maternity unit on time, discrete calving supervision, and critically knowing when and how to intervene during calving. This article deals with each of these topics, outlining where veterinarian-led producer implementation of good calving management can improve perinatal survival and welfare.

The three rules of spring.
If it's in, pull it out,
If it's out, push it in,
And if it's down, give it calcium.
--(Irish veterinary aphorism)

Résumé

En dépit de l'intérêt grandissant ces dernières années pour le déclin de la performance reproductive des vaches laitières, il n'y a pas eu beaucoup d'accent sur la régie des taures laitières en période périnatale et des vaches au vêlage. C'est peut être pour cette raison que les producteurs américains rapportent de plus en plus de pertes de veaux périnataux au vêlage. Une bonne régie du vêlage est un facteur clé dans la diminution des pertes en période périnatale. Les éléments suivants sont la marque de commerce d'une bonne régie du vêlage: prédiction exacte du moment du vêlage, déplacement des taures et des vaches vers les enclos de maternité à temps, surveillance discrète du vêlage, et surtout savoir quand et comment intervenir durant le vêlage. Cet article se concentre sur chacun de ces thèmes mettant en évidence comment l'adoption d'une bonne régie du vêlage par le producteur, sous la tutelle du vétérinaire, peut améliorer la survie périnatale et le bien-être.

Introduction

The objective of successful management of the cow at calving time is to ensure delivery of a viable, live calf and smooth transition of the cow, without complications, from the dry to the milking string. The two major problems encountered at calving time are dystocia and perinatal mortality. The most recent estimates of the prevalence of periparturient problems in dairy cattle in the United States are 14% for dystocia[17] and 8% for perinatal mortality.[35] These values are higher than in beef cow-calf herds and in other species, and tend towards the higher end of the range of figures reported internationally in dairy herds.[30,31] Whereas the prevalence of both perinatal mortality and twinning has increased in recent years in U.S. dairy herds[35], the prevalence of dystocia is stable.[32]

There are substantial economic and welfare costs associated with the high prevalence of these conditions individually in US dairy herds. It has been estimated recently that a serious case of dystocia costs a producer up to $780.[22] Much higher costs may be estimated where the interrelationships between these and other periparturient conditions are also considered, as cows with one condition are at increased risk for other disorders. The economic impact of these conditions is associated with decreased productivity and increased morbidity, culling and mortality. Thus, the periparturient disorder complex (dystocia, perinatal mortality, twinning, milk fever and retained placenta) has variously been associated with reduced milk yield[3], reduced fertility[2], increased culling[1] and increased risk of maternal mortality[12] and postnatal calf morbidity and mortality.[21] These losses can be minimised, but not eliminated, by addressing the important risk factors associated with the periparturient disorder complex.[27] Given that veterinarians attend only approximately 10% of assisted calvings[11], it is critical that veterinarians engage in producer education[16] as part of their role in modern dairy herd fertility management.[28] This article focuses on the modifiable management factors associated with calving dairy heifers and cows.

Moving Heifers and Cows to the Maternity Unit

To avoid calves being born outside of the maternity pen and to prevent associated calving problems and perinatal mortality, producers need to be able to predict the likely date and time of calving. Calving date, and hence when to move cows from the far-off to the close-up pen, can be predicted from service data to within approximately a week. When deciding when to move cows from the close-up to the maternity pen,

more predictive signs are required. Though calving alarm technology is being developed[5], none has been widely adopted by producers. An alternative approach to prediction of time of calving is to alter the timing of calving through nutritional or pharmacological means. Late evening feeding prior to calving has been shown in some, but not all, studies to result in more daytime calvings in dairy herds, but there may be an attendant risk of increased dystocia and stillbirth.[18]

Currently on US dairy farms, pregnant cows are moved from the far-off dry cow group to the close-up dry cow group approximately three weeks before predicted calving date, and from there to a maternity pen some 2 days before expected calving.[6] The pros and cons of alternative maternity facility designs have been recently reviewed.[29] Within 36 hours of calving, cows in freestall barns will attempt to seek isolation by lying in cubicles furthest from other cows, thus early movement to the maternity unit fulfils their natural isolation-seeking behavior. It is recommended that pregnant cows are in the maternity unit at least 24 hours before calving[10,27] and heifers earlier, as this is when calving commences: blood progesterone concentrations decline sharply, coordinated myometrial contractions first appear and cervical opening commences (Figure 1). Cows moved to the maternity unit three days before calving have significantly lower blood glucocorticoid concentrations at calving, indicating less stress, than those moved during calving. Within 12 to 24 hours, signs of imminent calving include increased frequency of rising and lying bouts, urinating and defecating, raising the tail, colostrum leakage, increased vulval relaxation and swelling, teat distension and most reliably, prominent udder distension and pelvic ligament relaxation.[27] More obvious signs of restlessness, such as tail swishing and shifting weight on the hind legs, indicate calving is likely within a few hours. However, some 10 to 20% of animals, particularly heifers, enter stage two of calving with no visible signs of stage one.

The early move is designed to allow the cow, and more particularly the heifer, sufficient time to adapt to the stress associated with social isolation and change to

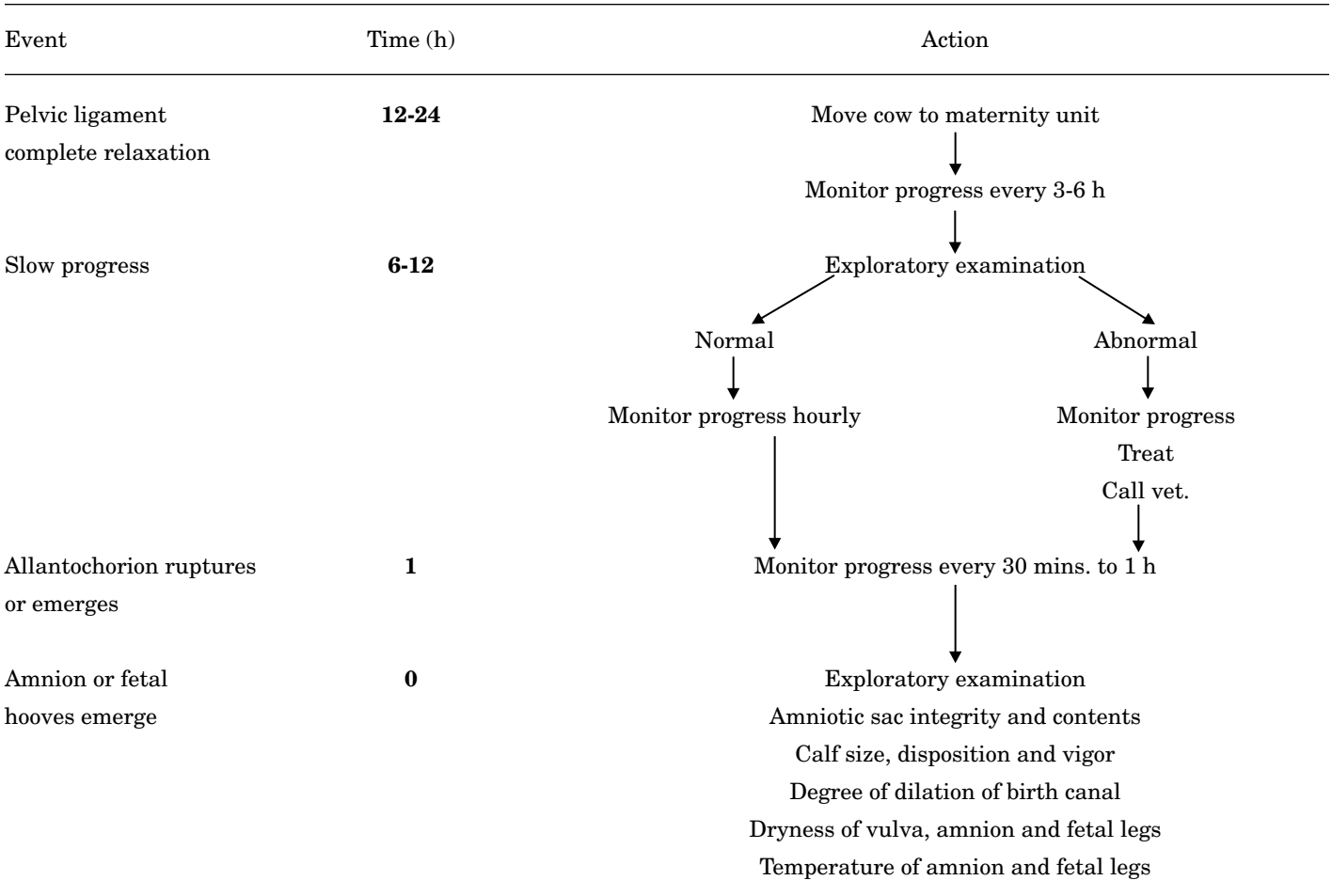

Figure 1. Decision flow diagram for management of the cow in stage one of calving.

a new environment, and possibly a new diet, before the time of calving. Heifers are particularly susceptible to environmental stress-induced vulva constriction and dystocia.[14] The impact of these additional stressors at calving, when periparturient immune suppression is already present, has been shown to increase susceptibility to infectious diseases like mastitis. However, it can be difficult to predict calving and to time this pre-calving movement accurately, which can be a problem in large herds with limited maternity pens. This often results in cows being moved too early and spending a week or more in the maternity pen. Movement too early to the maternity unit will affect the cleanliness of the calving environment. Field observations suggest that if cows spend three or more days in the maternity pen they are at greater risk of elevated blood non-esterified fatty acid concentrations, ketosis and displaced abomasums.[10] The movement of animals, particularly nervous cows and heifers, will suspend their calving behavior possibly for hours, so they should be left without further disturbance to adapt to the maternity unit and resume calving progress. Environmental stress can be further reduced in heifers by calving them separate from older cows, maintaining visual contact with herdmates to prevent social isolation, not tethering them at calving and avoiding disturbances from routine farm tasks, such as calf feeding and cleaning out pens.

Alternative movement strategies currently finding favor in medium- to large-size US dairies include no movement pre-calving or only moving cows once stage one or stage two of calving is detected. Dry cows can be maintained in a large group-bedded pack right up to calving, and freshen there. The advantage of this system is a reduction in the number of pen moves, with the associated behavioral and metabolic sequelae, and a reduction in disturbance at calving. However, the risk of cross-suckling is increased and pack hygiene needs to be well managed with an all-in, all-out policy.[10] Moving cows once stage one has been detected, by behavioral cues or by relaxation of the sacrosciatic ligaments, has been recommended to reduce the time cows spend in the maternity pen. However, it is difficult to monitor close-up dry cows closely enough to detect the presence of stage one, which may result in cows being moved too early. An alternative strategy is to move cows once stage two has been detected. The advantages of this approach are that cows spend hours, not days, in the maternity pen, thus reducing the magnitude of the change in dry matter intake and freeing up maternity pens for other cows, particularly in large herds. A recent field observational study which compared moving heifers and cows in stage one (mucus or blood present) or stage two (fetal membranes or the fetal legs or head present) to a maternity pen found that moving animals in stage two was associated with reduced time to first lie down, duration of calving from entry and reduced assistance, dystocia and stillbirth rates.[7,8] It was preliminarily concluded that calving duration is a potential risk factor for dystocia and stillbirth.[9] These results suggest that it is less detrimental to move animals which have already commenced calving (stage two) than it is to move animals which are about to start calving (stage one). It is likely that environmental disturbance, such as moving an animal, may cause psychogenic uterine atony if initiated in stage one of calving, but may only cause a temporary decrease in uterine motility if initiated in stage two. However, this strategy requires 24-hour monitoring of the close-up group with approximately hourly checks, and it is not clear whether this policy may interrupt the calving process and lead to more calving problems than if these animals were not moved or were moved before stage one commenced.

Currently, moving cows before calving commences, as is widely practised, appears prudent to optimise newborn calf care. However, the potential management benefits of alternative strategies, particularly in large dairies, need to be examined in controlled research studies.

Calving Supervision

Good supervision is dependent upon monitoring calving, particularly stage two, and intervening if and where necessary, while avoiding excessive direct supervision. The continuous presence of an observer during stage two of calving has been associated with an increase in calving problems and assisted deliveries.[14] Monitoring approximately every three to six hours from the first detection of the onset of stage one is advisable to detect the onset of stage two of normal calving and to detect abnormal calvings early.

The duration of stage one of calving is highly variable between animals and the onset and changes occurring, such as myometrial contractions, cervical dilation, and fetal repositioning, are largely undetectable. Hence, six to 12 hours of restlessness, box walking, tail raising and increased frequency of rising and lying down may occur. If after approximately six to 12 hours (cows and heifers, respectively) of this behavior, without undue disturbance, abdominal contractions have not commenced, an exploratory examination should be conducted. If cervical dilation has commenced and no abnormalities are detectable, monitoring should continue approximately hourly. The allantochorion ruptures approximately an hour before the amnion appears. Undue delay between the rupture of the allantochorion and the appearance of the amnion or fetal hooves may indicate a problem, such as fetal oversize or malposition.

Calving Intervention

The vast majority of cows will happily calve unattended and unassisted, and where possible should be allowed to do so. However, a small proportion of cows and a greater proportion of heifers may require assistance. Phenotypic dystocia rates are increasing internationally,[30] with currently 40% of heifers and 20% of cows assisted on US dairies.[17] Three simple questions need to be addressed by herd personnel to ensure successful calving intervention: whether or when to intervene, how to intervene and when to solicit veterinary assistance. For the veterinarian, these queries often come down to whether to pursue traction or surgery. Potential dystocia may be differentiated from eutocia by the presence of risk factors for the various types of dystocia. These risk factors may be assessed from the calf sire, breed and size and body condition and size of the dam, previous calving history, exploratory examination, calving conditions and most importantly, calving progress. Addressing the question of whether to intervene during calving, intervention is recommended in cases of feto-pelvic incompatibility (FPI), maldisposition, twinning, uterine inertia and vulval or cervical stenosis. Addressing the question of when to intervene, early intervention is recommended during stage one for uterine inertia, and during stage two for maldisposition and twinning. Delayed intervention is recommended during stage two for FPI and cases of vulval or cervical stenosis. FPI with a live, full-term normal calf in anterior presentation is the primary reason for intervention during calving, particularly by herd personnel. The importance of progress, rather than clock-watching, during stage two is emphasised, as the onset of stage two is usually unknown. When the dam is first detected in stage two, an exploratory examination should be conducted (Figure 2). This includes cow health (milk fever, mastitis), the integrity and contents of the amniotic sac, the disposition, vigor and size of the calf, the degree of dilation of the vagina and vulva and an assessment of how long the cow has been in stage two of calving. The amniotic sac may be ruptured or intact and normally contains milky white fluid, while mustard/brown fluid indicates meconium staining, red fluid indicates placental haemorrhage or late fetal death, foetid fluid indicates early fetal death and cotyledons indicate premature placental separation. A vital calf will have strong interdigital, bulbar, lingual, swallowing and anal reflexes. With increasing degree of acidosis, failure to show the interdigital reflex will precede failure to show the bulbar and swallowing reflexes. If the amnion or fetal legs are dry and cold, the cow has been calving at least 30 to 60 minutes. If indentations from the calf's incisors are visible on the lower surface of a swollen upturned purple tongue, the calf has been stuck at the vulva for at least three hours. Signs of progress during stage two include a recumbent dam straining intermittently but strongly, with occasional breaks while she stands up and lies down again, and progressive emergence of the fetal legs and head through the vulva. It is normal for the greatest delay in delivery of the fetus to occur once the muzzle and forehead have emerged, but the eyes are not yet visible. Once progress is normal, discrete monitoring without disturbance every 30 minutes, or continuously if patience can be assured, is recommended.

Intervention should not be carried out before the calf's muzzle has emerged and not before the calf's fetlocks are visible. As a general rule, if ropes have to be placed on the calf's legs in the vagina, intervention is too early. When progress ceases over 30 minutes or the calf begins to exhibit signs of reduced vigor (such as capital or lingual edema, buccal or lingual cyanosis, scleral haemorrhages or reduced responsiveness to stimulation) intervention should be conducted. In approximately 5% of calves it will not be possible to elicit any reflex though they are alive, possibly because they are wedged tightly in the birth canal. When severe acidosis can be traced back to stage two of relatively short duration, rapid improvement can be achieved by resuscitative care. When acidosis exists over a longer period, as in delayed assistance, the efficacy of supportive care is lower as hypoxic lesions such as meningeal, subepicardial and subpleural haemorrhages may develop.[23] It has been suggested that the stress of a prolonged delivery, rather than the type of assistance, may ultimately be responsible for reduced calf vigor following dystocia.

Calving Assistance

Basic principles

Adequate restraint, with a quick release facility in case the dam chokes, preferably in the maternity unit, is a prerequisite for safe obstetrical assistance. Cows should not be calved in a crush, race or chute. Adequate help in the form of at least two people or a calf puller should be available in case a severe dystocia develops. Limited manipulation of the birth canal and good hygiene will reduce the risk of subsequent endometritis. Before applying traction, attempts should be made to dilate the vulva and lubricate the vagina, particularly where the calf and vagina are dry or the calf is dead. Sustained vulval dilation using a forearm wedge or mechanically, and vaginal lubrication (with a proprietory product) are easier to achieve in the standing animal. A dorso-lateral episiotomy may be performed more easily while the dam is recumbent.

The principle of obstetrical assistance is to augment the natural calving process. Where possible, the

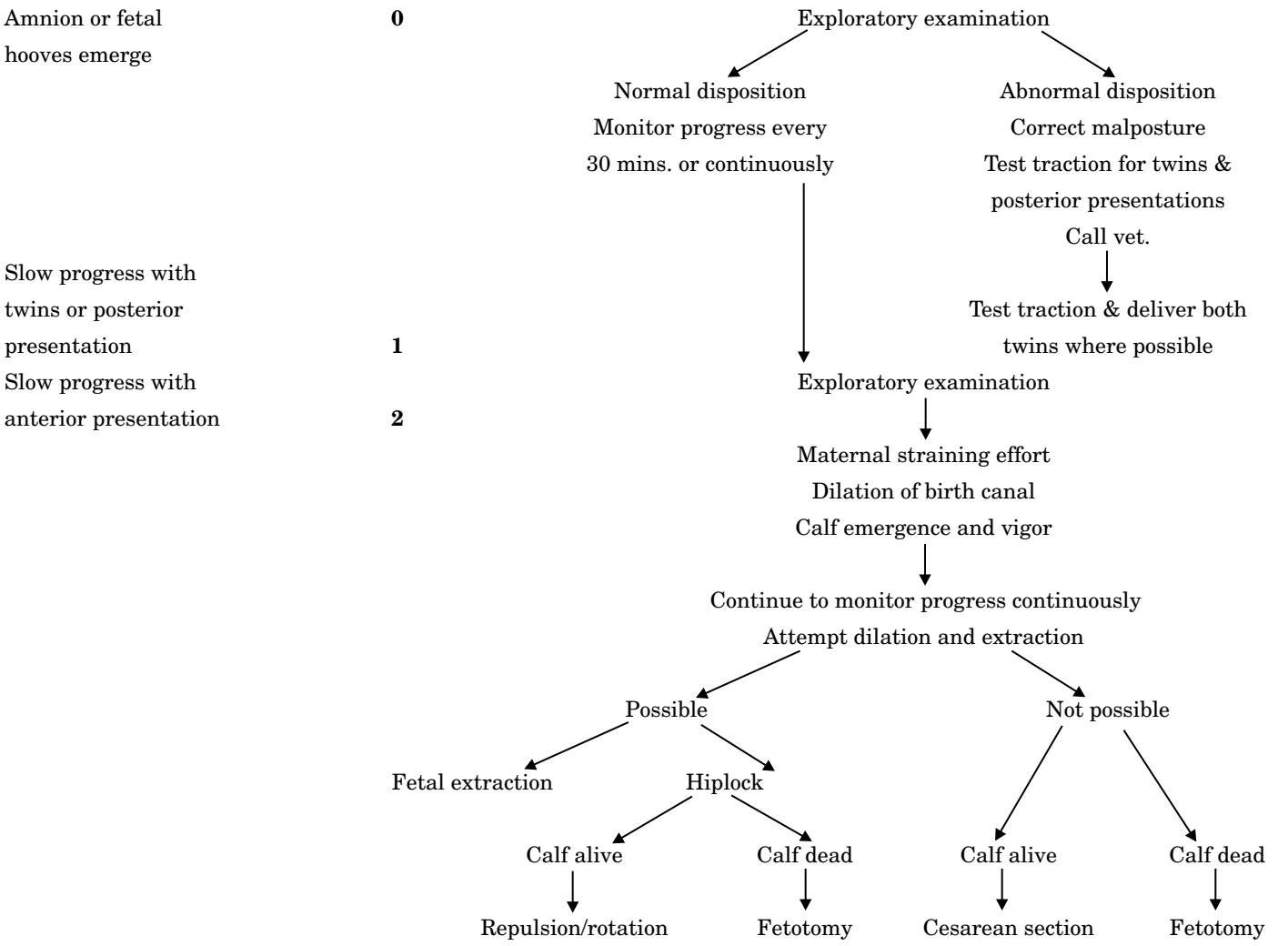

Figure 2. Decision flow diagram for management of the cow in stage two of calving.

dam should be cast or left in recumbence during assistance as this both maximises the efficiency of abdominal contractions and increases the effective pelvic area.[34] Ropes or chains should be placed above both fetlocks, with or without a half-hitch on the pastern and around the back of the head below the ears, where possible. Greater tractive force is required to fracture the calf's leg when the ropes are placed above the fetlock than below where joint dislocation and removal of the hooves occurs. The knots may be placed above or below the bone, although above the bone allows better alignment of the leg and rope. The direction and amount of leverage and intermittent restrained traction critically influence the outcome of assistance. Leverage or traction should only be applied when the dam strains, and traction should be relaxed when she relaxes to allow optimal fetal circulation and oxygenation.[38] This can be achieved by continuously watching the dam's thorax to see the buildup to each bout of abdominal contractions and to lever in synchrony. Thus sustained traction should not be applied as sustained forcing never occurs in a natural calving. If a calf puller is used, the shaft should be directed upwards initially above the spine of the dam to allow leverage during maternal straining. The breeching piece or head of the calf puller should be at least a hand's breadth below the vulva to allow expansion during delivery. Throughout the assistance, the calf puller is used primarily as a lever while the dam forces, and the handle is used to take up the slack on the ropes once she relaxes. A rhythm of lever, ratch-

et and relax in concert with the dam is established. When the dam relaxes, the slack is taken up on the ropes and the shaft of the calf puller is lifted upwards to release the tractive pressure on the calf. Leaving your free hand in the birth passage beside the calf's head will allow rapid assessment of how tight the birth canal is becoming during assistance. Initially, leverage and traction should be applied to both legs.[4] Most time should be taken to extract the calf to the point where its eyes are visible. This is the slowest part of the delivery and progress is measured in half-inch increments of fetal emergence, primarily due to leverage, not traction. Once the head emerges, traction should continue parallel to the dam's spine until the shoulders emerge.

As abdominal contractions often cease once the calf's thorax emerges, traction should also cease temporarily. This also allows the calf to commence breathing and transfer of blood from the placenta to the calf prior to umbilical rupture.[19] Premature cord rupture is associated with reduced perinate vigor (time to start breathing, achieve sternal recumbence and stand).[27] Sustained traction when the dam is not forcing will result in the calf's hips entering the dam's pelvis while the latter is not being dilated by abdominal contraction.[34] Once the thorax has emerged, traction should be directed at 45 degrees towards the dam's hocks, simulating the natural arc of delivery. An excessive early acute angle of traction will result in dislocation of fetal costochondral junctions and possible rib fracture.

Correcting hiplock

If hiplock is probable based on the relative size of the calf and the dam, early rotation of the calf during this phase of traction is recommended. Even in normal assisted calvings, rotation of the calf once the thorax has emerged, and before its hips engage the dam's pelvis, facilitates delivery of the hips. This may be achieved by twisting unilateral traction of the lower leg in an upward direction towards the dam's flank. Excessive force should not be used as unilateral traction increases the risk of limb fracture. Where this is ineffective, rotation can be effected by an assistant clasping the calf between the forelegs and around the neck, and rotating the calf while traction is applied. If hiplock occurs, traction should cease and calf stimulation should commence as correction may be prolonged, with 15 to 30 minutes not unusual. Palpation of the relationship of the calf's to the dam's pelvis can reveal which calf's hip is locked, and the necessary direction of rotation and traction. This examination is best conducted in the standing animal, and the process of standing may in itself alter the relationship between the two pelvises, thus facilitating delivery. Extra lubrication should also be introduced into the vagina as far forward as possible and the calving ropes moved up above the carpus. Repulsion of the calf may also be attempted while the dam is standing. As a result of findings of the internal examination, it may be necessary to roll the dam to her other side to facilitate twisting unilateral traction of the lower leg as described above to relieve the hiplock. The rolling process in itself may relieve the impaction. Surgical options should be considered at the initial examination when stage two is first detected and when the hiplock cannot be corrected. These include partial fetotomy, fetal or maternal pubic symphysiotomy and caesarean section.

How much force to apply?

During calving, a cow can apply approximately 165lb (75 kg) of force on the calf.[20] A loss of tractive efficiency of up to 30% occurs when a cow remains standing during calving.[20] To avoid calving jack fractures, both legs should be pulled simultaneously where possible as this substantially reduces the force required to extract the head and shoulders.[4] It has been recommended that the force of traction should not exceed 154 lb (70 kg) in Holsteins and 77 lb (35 kg) in Jerseys,[37] or two men.[38] However, the maximum tractive force applied by a calf puller is approximately 880 lb (400 kg) and that of a pulley block 990 lb (450 kg).[20] Thus, a calf puller can apply a force approximately five times greater than that of one man pulling. Herd personnel and veterinarians are generally not fully aware of how easily or how quickly traumatic injuries can be caused with a calf puller using tractive force that would be regarded as common in bovine obstetrics.[25] More extreme tractive force can be applied with calf pullers of a non-slip design. To reduce the risks associated with excess force during calving, calf pullers have been designed with quick release devices, slip breeching pieces, traction indicators and traction control. In order to distribute evenly the force of traction over the lower leg, calving ropes can be double knotted above and below the fetlock and a leg mesh can be utilised instead of ropes or chains. With labor scarce on many farms, calf pullers are increasingly used--on over 80% of dairy farms in one survey.[15] If they are used to apply the principles of forced extraction outlined above, they are of substantial assistance to the herd personnel and veterinarian as long as the risks of abuse are understood. Personnel who use a fetal extractor should either be trained or experienced, or else directly supervised by someone who is.

What about malpresentations and malpostures?

Although only approximately 3% of calves are born in posterior presentation, these calves have a five-time greater risk of dystocia and perinatal mortality than calves born in anterior presentation.[26] Detection and correction of fetal maldisposition is best achieved while the dam is standing, as the fetus can be repelled,

and mutation carried out. Early detection of fetal maldisposition, before the extremities have emerged, assists greatly in mutation, rather than attempting to do so once the extremities have emerged. With severe malpresentation, such as a full breech (hip flexion), as opposed to a hock breech, an epidural anaesthetic (5-10ml of 2% lidocaine or other anaesthetic) should be administered to prevent straining and uterine tearing during repulsion and retrieval of the hind legs. A relatively thick, long head rope that can be easily felt in the uterus is essential in ensnaring fetal extremities. Once a malposture has been corrected through repulsion and extension, the dam may be left to calve if the fetus is vigorous and there is incomplete cervical and vulva dilation, likely to lead to severe dystocia. However, if it is likely that the malposture will recur or the fetus is weak or the birth canal is sufficiently dilated, delivery should be attempted immediately.

Attempts to deliver a calf in posterior presentation before the hocks are visible will result in cervical and vulval tearing. This is because the allantochorion and amnion usually rupture earlier than in anterior presentation and the head and legs wedge is not present to dilate the vulva. Test traction to see if the hocks can be delivered is a good way of judging whether extraction or surgery should be considered. Where test traction reveals that the calf is likely to be delivered without excessive traction, it should be delivered immediately. However, where the calf is oversized or the birth canal is not dilated, delivery should be delayed while assisted dilation is carried out. If following dilation, test traction reveals delivery is still likely to be excessively traumatic, veterinary assistance should be sought. The ideal angle of initial traction is parallel to the dam's spine or upward, where possible. This can only be achieved with manual traction or a non-slip, frame breeching piece, calf puller. If this type of calf puller is used, the shaft should be placed over your shoulder initially to achieve this upward angle of traction. Once the hocks have emerged, with the dam in recumbence, pull only on the lower leg in a twisting upward direction towards the dam's flank. It is important not to attempt to pull the calf in a downward angle towards the dam's hocks until the stifles have emerged as this may result in spinal fracture.

Unnecessary delay during assistance is unwarranted in cases of posterior presentation, as fetal hypoxia may be exacerbated due to umbilical cord occlusion or rupture due to stretching rather than compression. This occurs more frequently when the cord is wrapped around one of the hind legs, or another limb in the case of twins, a feature that can be detected on exploratory examination. However, the fetus can withstand approximately five minutes of cord occlusion, depending on myocardial glycogen reserves,[36] without suffering fatal anoxia.[13] Overenthusiastic traction or traction at a very acute angle should also be discouraged as it is more likely to result in rib or spinal fractures or diaphragmatic herniation.[25] The latter lesions go grossly under-diagnosed in cattle practice.

Dealing with twin calvings

The prevalence of posterior presentation is four times greater, and perinatal mortality is twice as high, for twin compared to singleton calves.[24] Spontaneous twin calvings require more assistance, primarily for fetal malposition, simultaneous presentation and uterine inertia, and hence suffer greater perinatal mortality.[24,35] Induction of twin pregnancies by embryo transfer has allowed prediction of twin calvings and development of a protocol to deal with the associated problems. Early exploratory examination as soon as stage two is first observed is recommended to detect such problems. Often these problems can be corrected easily, as twins are 20 to 30% lighter than singletons,[37] but the rare possibility of conjoined twins should be recognised. Following exploratory examination, malpostures should be corrected and both twins delivered if possible. With simultaneous presentation, either twin in posterior presentation should be delivered first. Once one twin is delivered, the second fetus should be delivered immediately as delay may result in failure to detect malpresentation, malposture or anoxia due to undetected umbilical cord rupture caused by the first twin or uterine inertia. It may take between five minutes and an hour for the second twin to be delivered naturally after the first twin.[37] If test traction indicates that the birth canal is not dilated enough, the dam should be left for an hour before attempting delivery again. After delivery of any calf, always check for another one.

When should producers call the veterinarian?

It is impossible to be prescriptive given the huge variation in the experience and level of skills of herd personnel and the individuality of each calving. However, it is recommended that herd personnel call the veterinarian:

- Any time exploratory examination reveals a severe abnormality unlikely to be dealt with by simple traction, such as uterine torsion, abnormal fetus, simultaneous fetal presentation or severe malpresentation or malposture.
- Ten to 15 minutes after attempts to deliver a normally presented calf further than its eyes have failed, or after 15 to 30 minutes of attempting to correct fetal malposition have failed.

The wealth of experience and superior skills of a veterinarian should be utilized as a routine practice in good calving management rather than occasionally in emergency calvings.

When to perform surgery?

Relative fetal oversize is the primary indication for obstetrical surgery. Waiting for full cervical dilation, even in elective cesarean section, is recommended before performing surgery as it promotes postnatal respiratory and metabolic adaptation. If, following at least two hours of maternal straining, one person unaided cannot pull the fetal muzzle through the vulva or the fetlocks further than approximately one hand's breadth beyond the vulva after 10 to 15 minutes, then it is probable that severe dystocia will ensue and surgery should be considered immediately. If after 15 to 30 minutes, depending on experience, a fetal maldisposition cannot be corrected, cesarean surgery should be considered. The time veterinary practitioners spend deciding to operate is quite variable (0-60 minutes), but is, on average, 10 to 15 minutes. Breech presentations, particularly with large calves in heifers, if detected early and alive should be candidates for early elective cesarean section. Irreducible uterine torsion following rolling, unresponsive uterine inertia, absence of cervical dilation, abnormal fetuses, and transverse presentations will also require cesarean surgery. As the prognosis for the dam following surgery is primarily influenced by the condition of the calf, emphysematous fetuses should generally not be considered for cesarean section unless fetotomy is impossible. Anytime an unusually valuable calf is presented for delivery, elective cesarean surgery should be considered. Fetotomy, following generous lubrication and an epidural anaesthetic, is indicated in cases of fetal mortality, particularly emphysematous calves, abnormal calves, and where fetal maldisposition or hiplock cannot be corrected. The indications for, and management of, bovine cesarean sections have been reviewed recently.[33]

Conclusions

Managing the dairy cow at calving, unlike artificial insemination or transrectal ultrasonography, is often perceived as an unskilled task, not requiring specialist training. This paper presents the argument for the financial and welfare costs associated with poor periparturient management, and how to address them by veterinarian-led education and upskilling of herd personnel. Successful management of the dairy cow at calving will result in the birth of a healthy calf and a smooth transition of the cow into the milking string with minimal calving problems and their sequelae. The tenets of good management of the cow at calving are predicting accurately when calving is due, moving cows to the maternity unit on time, discrete calving supervision and, critically, knowing when and how to intervene during calving.

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American Association of Bovine Practitioners

Prudent Drug Usage Guidelines

The production of safe and wholesome animal products for human consumption is a primary goal of members of the AABP. In reaching that goal, the AABP is committed to the practice of preventive immune system management through the use of vaccines, parasiticides, stress reduction and proper nutritional management. The AABP recognizes that proper and timely management practices can reduce the incidence of disease and therefore reduce the need for antimicrobials; however, antimicrobials remain a necessary tool to manage infectious disease in beef and dairy herds. In order to reduce animal pain and suffering, to protect the economic livelihood of beef and dairy producers, to ensure the continued production of foods of animal origin, and to minimize the shedding of zoonotic bacteria into the environment and potentially the food chain, prudent use of antimicrobials is encouraged. Following are general guidelines for the prudent therapeutic use of antimicrobials in beef and dairy cattle.

1. The veterinarian's primary responsibility to the client is to help design management, immunization, housing and nutritional programs that will reduce the incidence of disease and the need for antimicrobials.

2. Antimicrobials should be used only within the confines of a valid veterinarian-client-patient relationship; this includes both dispensing and issuance of prescriptions.

3. Veterinarians should properly select and use antimicrobial drugs.
   a. Veterinarians should participate in continuing education programs that include therapeutics and emerging and/or development of antimicrobial resistance.
   b. The veterinarian should have strong clinical evidence of the identity of the pathogen causing the disease, based upon clinical signs, history, necropsy examination, laboratory data and past experience.
   c. The antimicrobial selected should be appropriate for the target organism and should be administered at a dosage and route that are likely to achieve effective levels in the target organ.
   d. Product choices and regimens should be based on available laboratory and package insert information, additional data in the literature, and consideration of the pharmacokinetics and pharmacodynamics of the drug.
   e. Antimicrobials should be used with specific clinical outcome(s) in mind, such as fever reduction, return of mastitic milk to normal, or to reduce shedding, contagion and recurrence of disease.
   f. Periodically monitor herd pathogen susceptibility and therapeutic response, especially for routine therapy such as dry cow intramammary antibiotics, to detect changes in microbial susceptibility and to evaluate antimicrobial selections.
   g. Use products that have the narrowest spectrum of activity and known efficacy *in vivo* against the pathogen causing the disease problem.
   h. Antimicrobials should be used at a dosage appropriate for the condition treated for as short a period of time as reasonable, i.e., therapy should be discontinued when it is apparent that the immune system can manage the disease, reduce pathogen shedding and minimize recurrence of clinical disease or development of the carrier state.
   i. Antimicrobials of lesser importance in human medicine should be used in preference to newer generation drugs that may be in the same class as drugs currently used in humans if this can be achieved while protecting the health and safety of the animals.
   j. Antimicrobials labeled for use for treating the condition diagnosed should be used whenever possible. The label, dose, route, frequency and duration should be followed whenever possible.
   k. Antimicrobials should be used extra-label only within the provisions contained within AMDUCA regulations.
   l. Compounding of antimicrobial formulations should be avoided.
   m. When appropriate, local therapy is preferred over systemic therapy.
   n. Treatment of chronic cases or those with a poor chance of recovery should be avoided. Chronic cases should be removed or isolated from the remainder of the herd.
   o. Combination antimicrobial therapy should be discouraged unless there is information to show an increase in efficacy or suppression of resistance development for the target organism.
   p. Prophylactic or metaphylactic use of antimicrobials should be based on a group, source or production unit evaluation rather than being utilized as standard practice.
   q. Drug integrity should be protected through proper handling, storage and observation of the expiration date.

4. Veterinarians should endeavor to ensure proper on-farm drug use.
   a. Prescription or dispensed drug quantities should be appropriate to the production-unit size and expected need so that stockpiling of antimicrobials on the farm is avoided.
   b. The veterinarian should train farm personnel who use antimicrobials on indications, dosages, withdrawal times, route of administration, injection site precautions, storage, handling, record keeping and accurate diagnosis of common diseases. The veterinarian should ensure that labels are accurate to instruct farm personnel on the correct use of antimicrobials.
   c. Veterinarians are encouraged to provide written guidelines to clients whenever possible to describe conditions and instructions for antimicrobial use on the farm or unit.

Presented by the Bacterial Resistance and Prudent Therapeutic Antimicrobial Use Committee. Board approved March 1999.