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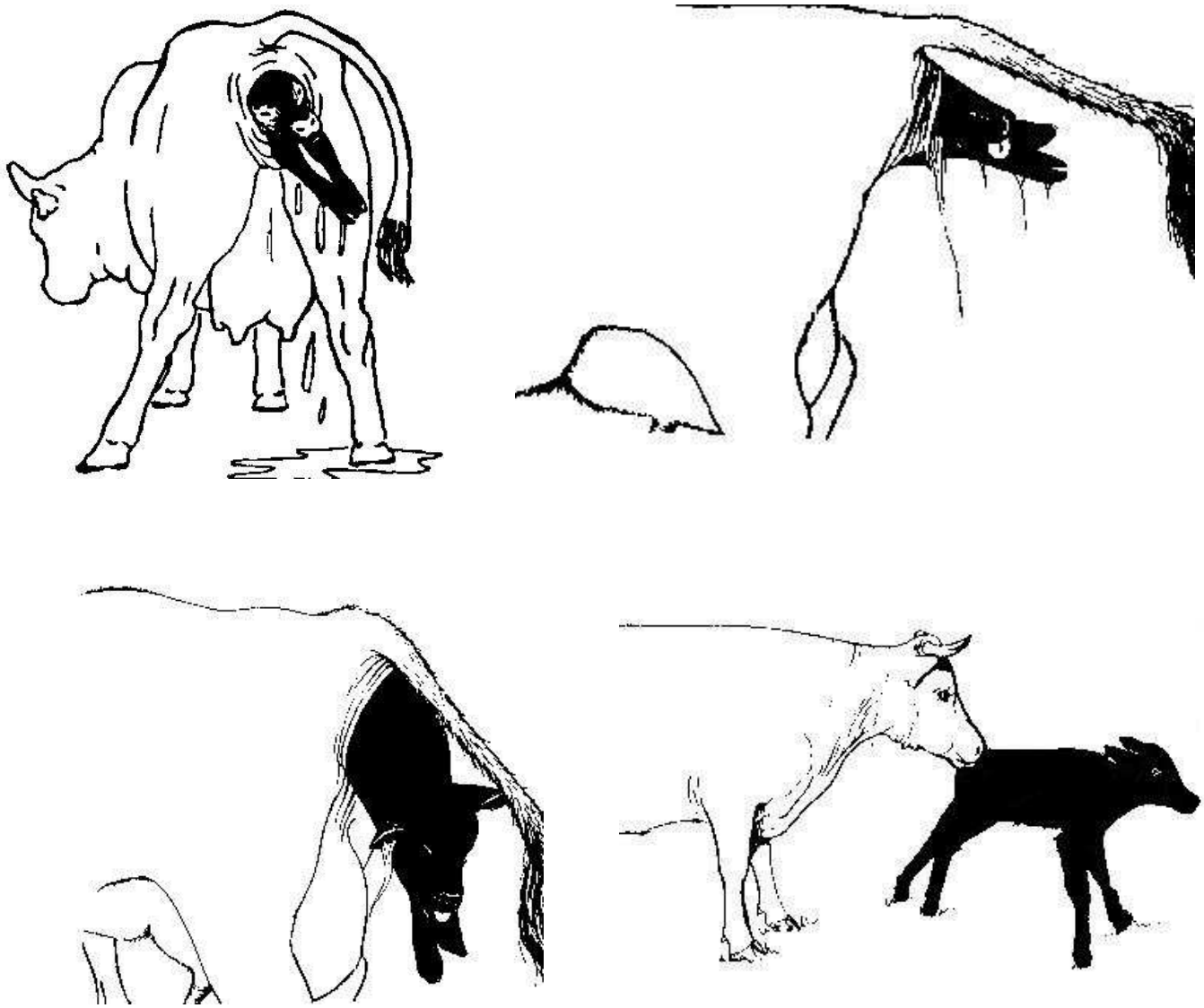
Beef Cattle Sciences

Calving School Handbook



by

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CALVING SCHOOL PROGRAM

TIME	TOPIC
04:00 – 04:10 pm	**Introduction** Dr. Reinaldo Cooke - *Beef Cattle Specialist* Local Extension Faculty
04:10 – 04:40 pm	**The Calving Process** Dr. Aurora Villarroel - *Extension Veterinarian* Dr. Charles Estill - *Extension Veterinarian*
04:40 – 05:00 pm	**Nutritional and Management Strategies to Prevent Calving Problems** Dr. Reinaldo Cooke - *Beef Cattle Specialist*
05:00 – 05:20 pm	**Designing Calving Facilities** Local Extension Faculty
05:20 – 05:40 pm	**Break – Refreshments Provided**
05:40 – 06:25 pm	**Dystocia and Calving Assistance** Dr. Aurora Villarroel - *Extension Veterinarian* Dr. Charles Estill - *Extension Veterinarian*
06:25 – 06:40 pm	**Diseases and Injuries Associated with Calving** Dr. Aurora Villarroel - *Extension Veterinarian* Dr. Charles Estill - *Extension Veterinarian*
06:40 – 07:00 pm	**Managing Newborn Calves** Dr. Aurora Villarroel - *Extension Veterinarian* Dr. Charles Estill - *Extension Veterinarian*

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CHAPTER 1 - Introduction

The major objective of beef cow-calf systems is to produce one live calf per cow annually. Therefore, reproductive performance of the cowherd contributes substantially to the efficiency and profitability of these operations. In support of this fact, it has been estimated that the relative economic value of reproductive performance to cow-calf producers is 10 times greater than the value of production, and 20 times greater than the product. This is not to say that production and product are unimportant, rather it is meant to emphasize the importance that having a live, healthy calf every year plays in a cow-calf operation.

Further, it has been estimated that reproductive issues cost the beef industry, on a yearly basis, up to $500 million. Approximately half of this financial loss can be attributed to calf deaths during a dystocia (difficult calving), which can also lead to many negative outcomes in the cow such as retained placenta, uterine infection, and subsequent cow infertility. Calves that experience dystocia at birth are 13 times more likely to be born dead or die within the first 12 hours of life compared to calves with normal births, 2.5 times more likely to become ill, and 5 times more likely to die during the first 45 days of life. Therefore, beef producers should always pursue management strategies that minimize the incidence of dystocia.

This handbook will focus on the calving process, illustrating and explaining the mechanisms associated with this event, in addition to providing information and management options to alleviate the incidence of calving difficulties. Although infertility problems caused by other factors such as poor nutrition, genetics, management, and diseases highly contribute to the financial losses previously described, these conditions will not be addressed herein. For additional information regarding beef cattle reproductive management, please refer to the Oregon State University – Beef Cattle Library or to the Cow-Calf Management Guide (http://beefcattle.ans.oregonstate.edu/html/publications/).

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CHAPTER 2 – Cow Reproductive Tract

Understanding the anatomy of the cow's reproductive tract and that of the soon-to-be-born calf is essential for good calving management. In this document, we will focus on the cow's structures associated with the calving process. For further information regarding the reproductive anatomy of a non-pregnant cow, please refer to the Oregon State University – Beef Cattle Library or the Cow-Calf Management Guide (http://beefcattle.ans.oregonstate.edu/html/publications/).

The major structures of the cow reproductive tract associated with calving are (from outside of the cow to inside) the vulva, vagina, cervix, and uterus (Figure 2.1). The pelvis, formed by all the bones that protect these structures, also plays a major role in the calving process, and will be discussed in upcoming chapters.

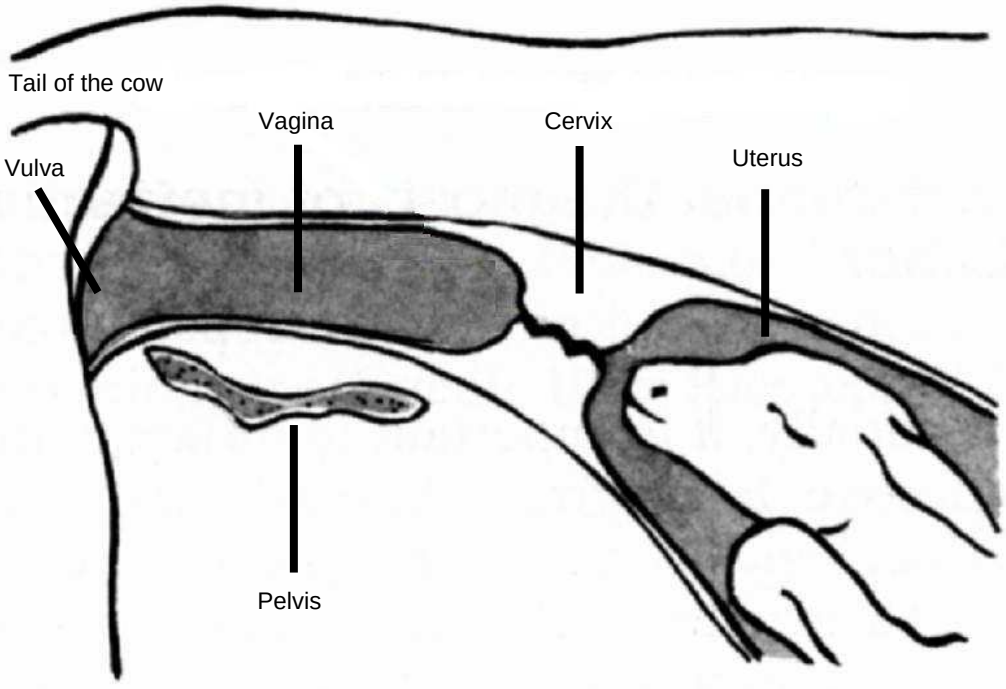

Figure 2.1. Lateral view of a pregnant cow

Vulva

The vulva is the external part of the reproductive tract of the cow. It consists of two labia (left and right), that form a closure to minimize the entrance of foreign material into the vagina (Figure 2.2). Weeks prior to calving, the vulva swells due to hormonal changes that the cow is experiencing to later allow enough stretching during the calving process so the calf can be delivered.

Vagina

The vagina is the birth canal (Figure 2.1 and 2.2). The vagina serves as a line of defense against infections, given that vaginal tissues secrete fluids that inhibit growth of undesirable bacteria. Vaginal tissues also secrete mucus during the calving process to lubricates the birth canal and facilitate the calf delivery process.

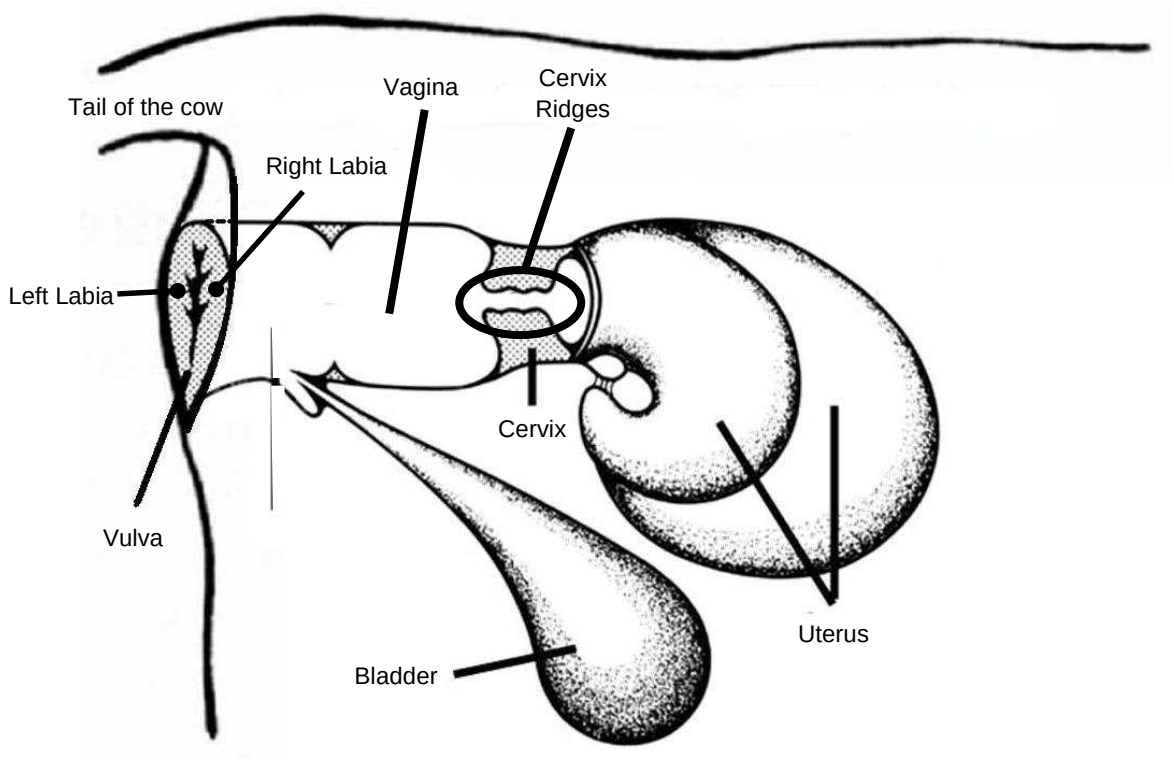

Figure 2.2. Lateral view of the cow reproductive tract

Cervix

The cervix is located between vagina and the uterus. It is a unique cylindrical structure within the reproductive tract, approximately 5 inches long and 2 or more inches in diameter. The body of the cervix typically contains three ridges (also known as cervical rings), which can be appreciated by rectal palpation (Figure 2.1 and 2.2). The main function of the cervix is to isolate the uterus from the external environment. Most of the time it is tightly closed to maintain a sterile environment in the uterus; it only opens during heat (estrus) to allow semen in, and at calving to allow the calf out. The cervix is the most often overlooked structure during an assisted calving because of its internal location

Throughout the pregnancy, the cervix is responsible for isolation of the fetus within the uterus from the external environment aided by viscous cervical mucus. This seal is commonly referred to as the "cervical plug", and if disrupted, could result in abortion if microorganisms gain access to the uterus and kill the fetus.

During the calving process, changes in maternal hormones (which will be explained in Chapter 3) disrupt the cervical plug, and stimulate the cervix to secrete lubricant mucus to facilitate the expulsion of the calf. The cervix needs to dilate until it reaches a diameter that allows the fetus to exit the uterus and enter the vagina **BEFORE** the calf comes through. For this to happen, the hormonal changes that the cow undergoes at calving time should not be interrupted (see Chapter 3).

Uterus

The uterus is considered the "organ of the pregnancy" because it houses, protects, and nourishes the calf throughout the pregnancy. The uterus consists of a "body", which is just forward of the cervix, and two "horns". Cows usually have a single fetus per pregnancy that grows in one of the horns. During pregnancy, the diameter of the uterus expands to allow the growth of the calf and all the fluids that protect it.

The uterus has many functions in the reproductive process. During the pregnancy, it provides an environment conducive to fetal growth and development. The uterine walls are composed of several layers including contractile muscles that will help expel the fetus and fetal membranes during the calving process. The fetal membranes are part of the placenta, an organ that develops only during the pregnancy and is composed of both maternal and fetal components. The major role of the placenta is to contain the fluids in which the fetus swims, produce hormones that regulate pregnancy, and exchange nutrients between the cow and the fetus. More specifically, the nutrient transfer and physical connection between fetal and maternal tissues occurs at the placentomes ("buttons"), which are composed of

cotyledons from the fetal membranes attached to caruncles from the uterus. During normal delivery of a calf, the placenta ruptures and once the calf has been delivered, the cotyledons and caruncles disconnect allowing the placenta to be expelled from the cow (a process called “cleaning”).

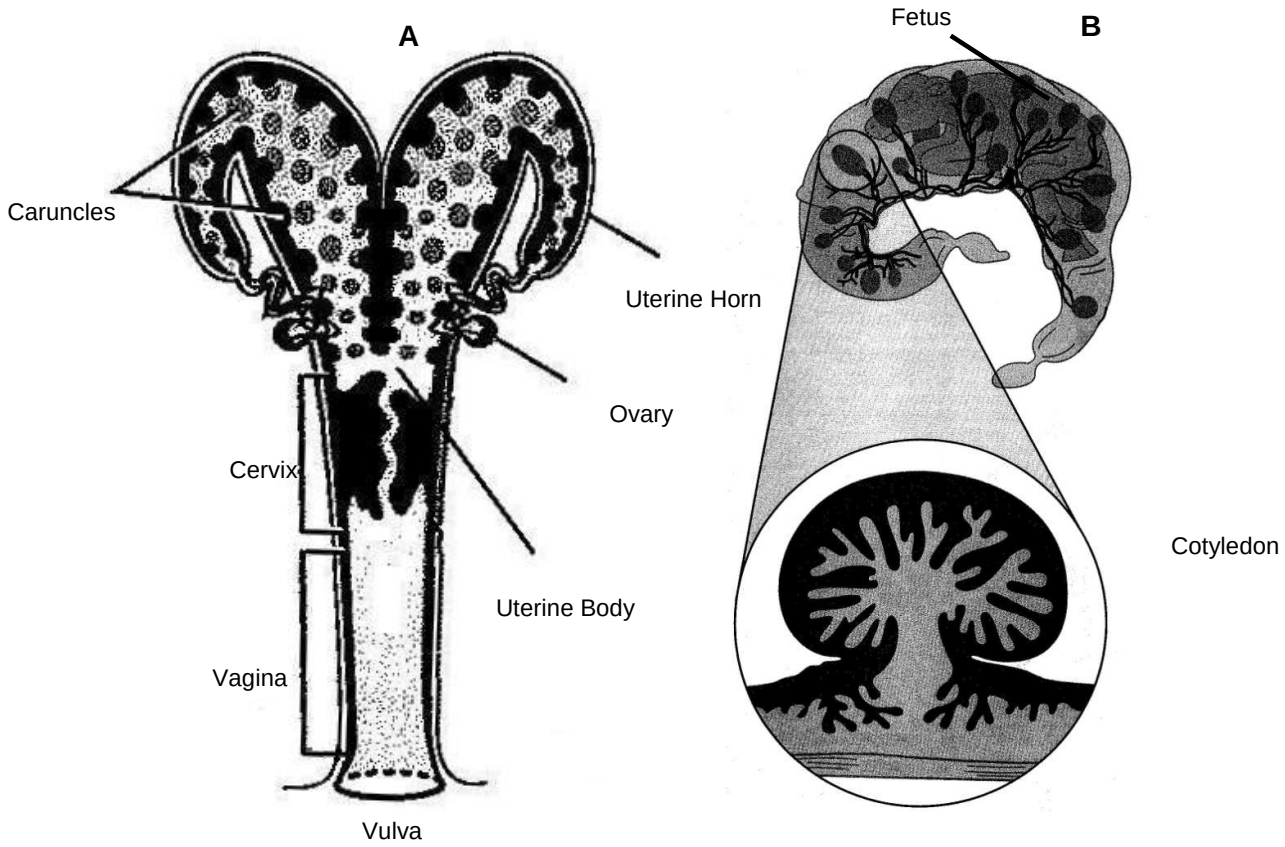

Figure 2.3. Dorsal view of the uterus (A), and the bovine placenta (B).

Pelvis

The pelvis is a group of bones that has many structural, mechanical, and articulation functions within the bovine body. During the calving process, the pelvis forms the rigid frame of the birth canal; therefore the fetus has to be able to move across the pelvis for the calving to be successful. To assist this process, some hormones produced by the dam during the calving process allow the ligaments that connect all the bones in the pelvis to relax so it can expand when the calf comes through, facilitating the birth process.

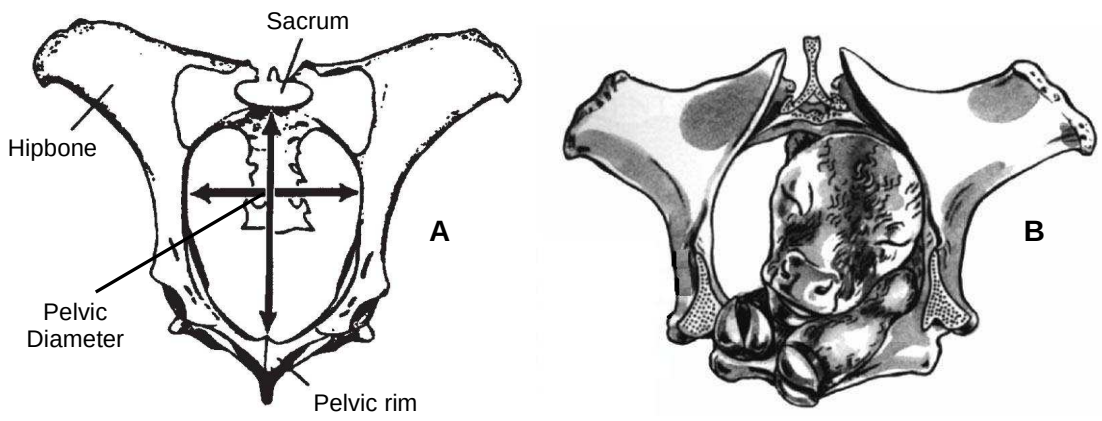

Figure 2.3. Pelvis and pelvic diameters in the bovine female (A), and the view of a small calf coming through the birth canal (B), as viewed from the back of the cow.

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CHAPTER 3 - The Calving Process

The fetus triggers the calving process by initiating a cascade of hormones that result in several biologic events summarized in Figure 3.1. Briefly, when the fetus grows to a stage when uterine space becomes limited, the fetus becomes stressed and produces a hormone called cortisol ("stress hormone") that leads to several hormonal changes in the cow's placenta, stimulating stretching of pelvic ligaments, uterine contraction, cervix dilatation, and consequent delivery. Therefore, the fetus actually determines when it will be born.

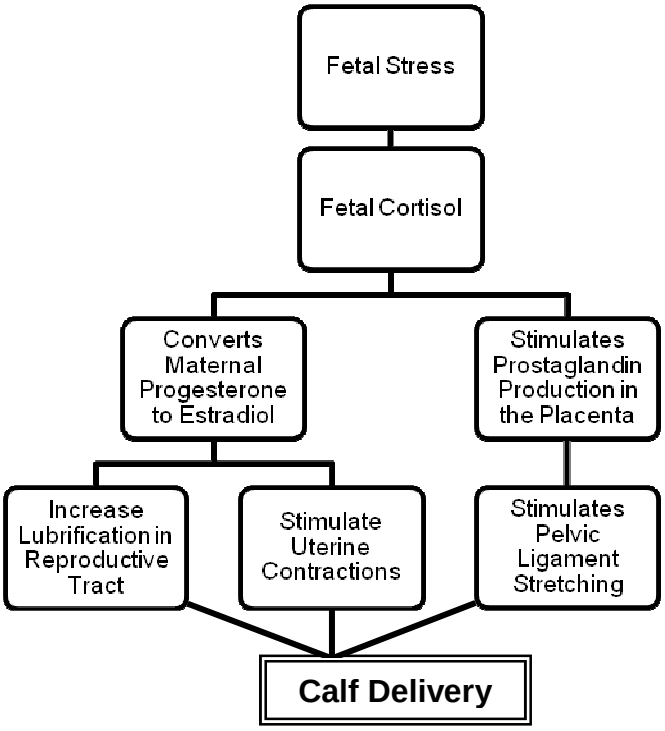

Figure 3.1. Cascade of events stimulated by fetal cortisol secretion

During the last few weeks of pregnancy (up to 6 weeks), the cow's udder starts to develop and fill with colostrum, and the vulva swells. These are the first signs that calving is near. During the last 4 to 6 days of pregnancy, the vulva swells even more and the pelvic ligaments relax causing the area between the tailhead and pin bones to become loose and sunken.

The actual calving process can be divided into 3 stages that last up to 20 hours.

Stage 1 – Preparatory stage (2 to 6 hours of duration). Fetal cortisol stimulates synthesis of maternal estradiol and, consequently, uterine contractions. As pressure inside the uterus increases, the fetus rotates so the front feet and head are positioned to the posterior of the cow (Figure 3.2). If the fetus positions itself incorrectly, dystocia (difficult birth) may occur. Uterine contractions become more frequent and begin to push the fetus toward the cervix, which starts to dilate and allows the fetus to enter the birth canal (Figure 3.2).

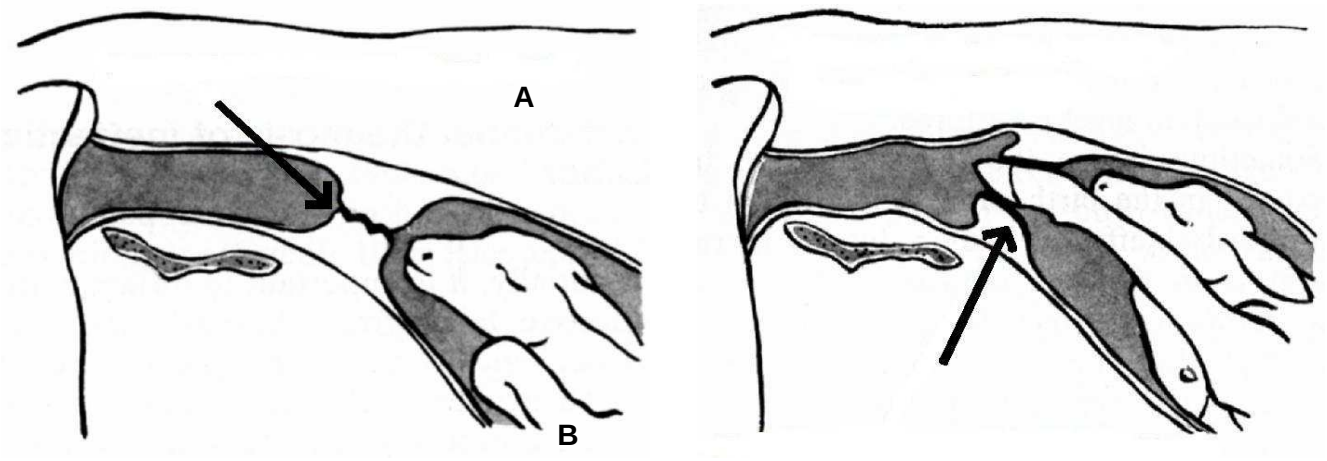

Figure 3.2. The cervix is closed at the beginning of stage 1 (**A**), but begins to dilate throughout this stage, allowing the fetus to enter the birth canal (**B**).

During stage 1, cows typically show signs of discomfort due to the contractions. You may notice restlessness, arching the back, straining slightly and kicking at the belly. Cows may separate themselves from the rest of the herd, and also urinate frequently. However, cows are still alert and fully aware of their surroundings, and may eat, drink, and behave normally. The end of stage 1 is typically marked by expulsion of the water bag (Figure 3.3), which is the most external of the fetal membranes.

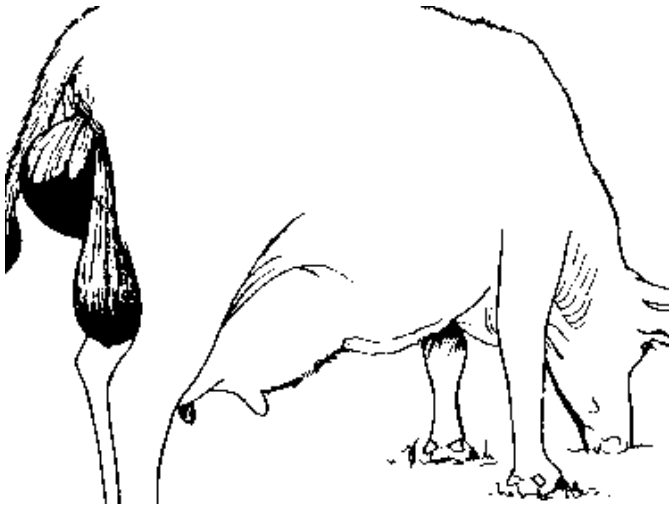

Figure 3.3. Water bag expelled, indicating the end of the stage 1.

Stage 2 – Fetal expulsion (60 to 120 minutes of duration). Maternal estradiol stimulates mucus production by the cervix and vagina, which, together with placental fluids, thoroughly lubricates the birth canal to facilitate the delivery process. As the fetus comes into the birth canal, it puts pressure on the cervix and induces a natural reflex in the cow to push, resulting in visible abdominal contractions that further aid in fetus expulsion. The combined contractions of the uterus and the abdomen stimulate the feet and head of the fetus to progress through the birth canal and put pressure on the placenta, reaching a certain level where it ruptures. Placental fluids are then released and further help in lubricating the birth canal. Contractions continue to strengthen, and cows may lie down to cope with the pain. Cow behavior may also change during this stage, as she may become oblivious of her surroundings, and focused on her contractions. After rupture of the placenta the birth is imminent, with the cow continuing to push and, hopefully, progressing normally through delivery (Figure 3.4).

The first part of the calf (it is not a fetus anymore!) that appears should be the front feet. After that, the abdominal contractions become even more frequent and intense. Sometimes the calving progress may slow down for a minute or two to allow the vulva to stretch. The next visible part of the calf is the nose, followed by the rest of the head, the shoulders, the chest and the rest of the calf. The order in which parts appear is important because it will indicate if there could be a malpositioned calf (see Chapter 4).

When the calf's chest is coming out, mucus may drain from the calf's mouth and nostrils because of labor contractions. This is an important process because it clears the respiratory passages for normal breathing. Within 10 minutes after the calf is born, the cow usually stands up and starts licking the calf.

The calf usually staggers onto its legs within 20 to 30 minutes, and should start nursing within 60 minutes after birth.

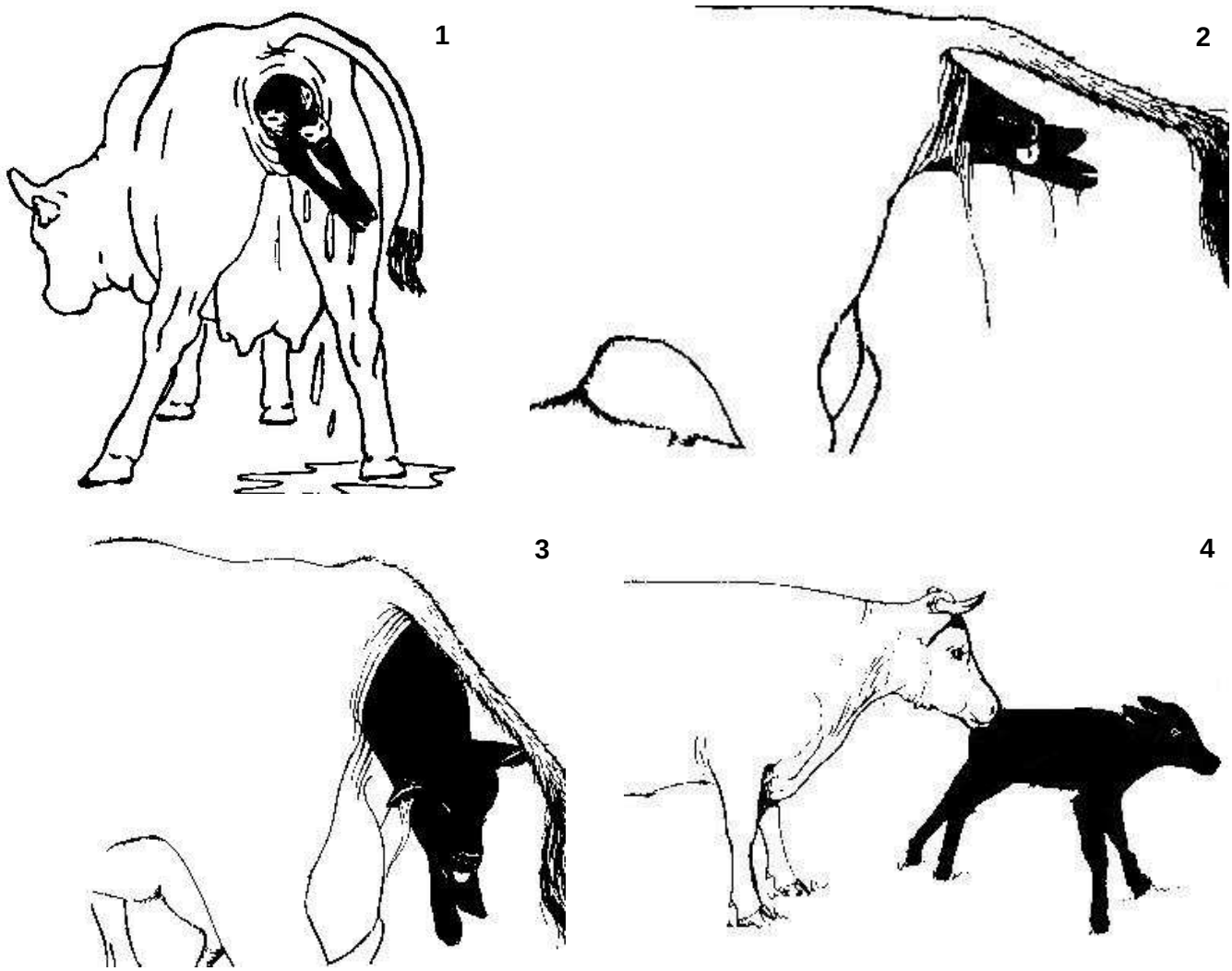

Figure 3.4. Normal calf delivery (in sequence; illustrations 1 to 4), leading to the end of the stage 2.

Stage 3 – Expulsion of the placenta (6 to 12 hours of duration). The placenta should detach from the uterus almost immediately after the calf is delivered. More specifically, the cotyledons on the placenta separate from the caruncles on the uterus (Figure 2.1) and contractions expel the placenta from the cow. Sometimes the placenta expulsion is delayed because the cow is fatigued. However, if the placenta is retained for more that 12 hours, special precautions may have to be taken (see attached articles for more information).

CHAPTER 4 - Dystocia

The number of calves produced each year within a cow-calf operation depends on two main factors: 1) success of cows and/or heifers to conceive and maintain the pregnancy, and 2) birth of viable and healthy calves. Within the many factors affecting calf survival, the most important is dystocia, which is the technical term for a difficult birth that needs assistance. Depending on the degree and type of dystocia, it can result in a weakened/dead calf and injury/death to the dam. Supporting this statement, calf death during or shortly after calving results in losses of over 3.5 million calves every year in the United States, wherein 45% of these losses are caused by dystocia. Along with decreased calf crop, dystocia is also associated with increased cow mortality, veterinary and labor costs, and impaired subsequent reproductive performance.

Causes of Dystocia

Although there are many management and genetic factors that affect the incidence of dystocia in the cowherd, the most significant cause of dystocia is maternal/fetal disproportion. This occurs when the calf is too large for the size of the birth canal of the cow. Therefore, size of calf and also age and size of the dam at calving highly determines the incidence of dystocia. In more detail, the most common factors associated with dystocia include:

Calf birth weight: It has been shown that the incidence of dystocia increases as birth weight increases (Table 4.1 and Figure 4.1). Although weight of the animals may be distributed differently in various breeds, it is a good approximation for calf size. Therefore, special attention should be given to the factors that influence birth weight to prevent dystocia. Breed of the sire and the dam, along with genetic traits of both parents play the most important role in determining calf birth weight. Thus, selecting replacement heifers for low birth weight in addition to choosing sires according to actual birth

weight, body shape, and EPDs for birth weight and calving ease will likely alleviate calving problems within a herd.

Table 4.1. Effect of birth weight on calving ease.

	Calving Ease			
	Normal Birth	**Hand Pull**	**Mechanical Pull**	**C-section**
N^{o} of cows	68	34	16	2
% of total births	56.7	28.3	13.3	1.7
Avg birth weight (lbs)	81.1	88.3	100.3	121.0

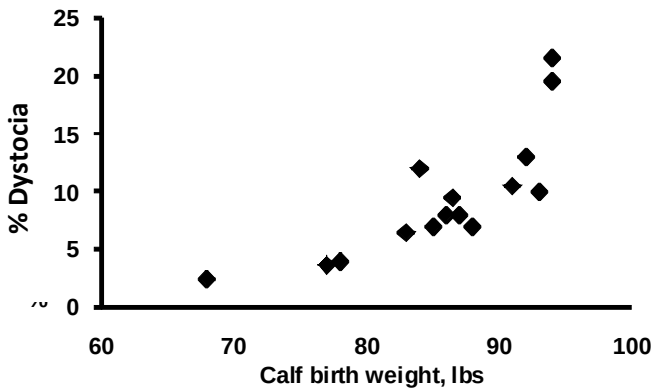

Figure 4.1. Relationship of dystocia and average calf birth on Hereford and Angus females calving at 4 years of age and older.

Pelvic area: The pelvic diameter determines the maximum birth size that can be accommodated by an individual cow before calving difficulty is experienced. Heritability estimates for pelvic dimensions are moderate, ranging from 0.40 to 0.53. There are conflicting reports relating pelvic area to dystocia, which puts the usefulness of pelvic measurements in question. In general, culling the 10% of the heifers with the smallest pelvic size will only result in a reduction in dystocia of 2 to 3% in the herd. This could be explained by the fact that pelvic dimension appears to be highly correlated with dam size. By selecting for large pelvic dimensions, producers are also indirectly selecting for large heifers, which typically have greater nutritional requirements and also produce large calves. Consequently, the use of pelvic measurement has not been shown to be a reliable and efficient selection criterion to reduce incidence of dystocia in beef herds.

Gestation length: Gestation length can have an indirect influence on calving difficulty. As gestation length increases, birth weight increases from 0.3 to 0.8 pound per day. Gestation length is a trait that can be selected for; therefore cattle can be selected for shorter gestation length and

subsequently lighter birth weights. However, selecting cattle for birth weight independent of gestation length has the same effect and is a more effective approach to reduce incidence of dystocia compared to selection for shorter gestation.

Sex of calf: Typically, bull calves outweigh heifer calves at parturition by up to 10 pounds. This can partly be explained by the fact that bull calves generally have longer gestation length compared to females. Because of heavier birth weights, many reports indicate that bull calves require from 10 to 40% higher assistance rate compared to heifer calves during birth. Additionally, it has been shown that dystocia rates in mature cows carrying male calves are twice that of cows carrying female calves.

Age and parity of dam: The incidence of dystocia decreases as dam parity increases. Table 4.2 summarizes calving data from University of Nebraska and Colorado State University relating calving difficulty to age of dam at calving. Although first- and second-calf dams experience more calving difficulty, they typically have lighter birth weight calves (by 2.5 to 5.0 pounds) than mature cows. This is probably because mature cows have greater body size and pelvic area compared to heifers; therefore adult cows are capable of developing and giving birth to heavier calves.

Table 4.2. Effect of dam's age on calving difficulty.

	% of difficult calvings	
Dam's age	**Ranch 1**	**Ranch 2**
2 years	54	30
3 years	16	11
4 years	7	7
5 or more years	5	3

Size and breed of dam: Body size is highly correlated with pelvic area, and pelvic dimensions determine limitations to the size of the calf that can go through the birth canal. Typically, larger breeds of cattle have larger pelvic areas and produce calves with heavier birth weights than smaller breeds. Therefore, dystocia rates do not differ significantly between dams of various beef breeds that also vary in size. Data from University of Nebraska show very little difference in incidence of dystocia when 15 breeds were compared. Exceptions to this theory include Jersey-crosses and two Zebu-crosses breeds (Brahman and Sahiwal) which experienced an average of 3.7 % incidence of dystocia compared to an average of 14.1 % for the other breeds in the study.

Sire breed: Most producers are well aware of the impact that the bull has on the incidence of calving difficulty and subsequent calf death loss. Traditionally, commercial beef cattle producers have

predominantly used British breed sires on first-calf heifers due to their small calf size at birth. Unfortunately, as beef and seedstock producers emphasized sire selection according to adult body size and growth rate, many British breed bulls are now producing large birth weight calves. However, with proper bull selection and heifer development, producers can still breed cows with British breeds and even some Continental breeds. Emphasis on multiple trait sires (bulls with acceptable birth weight, calving ease and growth EPDs) can minimize the degree of calving difficulty, while still maintaining performance traits. Further, selecting replacement heifers out of bulls with low EPDs for birth weight should help reduce birth weight and calving difficulty. Selecting heifers out of low birth weight sires tends to result in females with a lower mature size, which may, or may not, be desirable. Therefore, producers should evaluate important sire EPDs (birth weight, calving ease and daughter's first-calf calving ease) when selecting replacement heifers.

Nutritional program: Supplemental energy fed for 90-100 days prior to calving has been shown to increase birth weight, but does not have an adverse effect on calving ease. Further, the incidence of calving difficulty is actually reduced when cows consume moderate and high amounts of energy compared to low energy intake (Table 4.3). Inadequate protein intake during gestation also results in decreased calf vigor, delayed uterine involution, increased interval to estrus, and decreased conception rates following calving. These problems appear to be increased when energy is also deficient, illustrating the need for a properly balanced diet of cows during pregnancy. These data clearly demonstrate that "you cannot starve calving difficulty out of cows and heifers."

Body condition of the dam has also been implicated as a factor that contributes to calving difficulty and is closely related to nutritional status during gestation. Underfeeding cows to the point where they are emaciated will result in calving difficulty probably due to lack of strength during the delivery process, and these cows typically have weak, non-vigorous calves. However, overfeeding cows to the point of obesity will also result in dystocia, probably due to a fat-filled birth canal and increased abnormal presentations. Therefore, it becomes extremely important that cows are not over- or under-fed during pregnancy, but are provided adequate feed to meet their nutritional requirements and those of the fetus.

Hormonal implants: Implanting heifer calves with Ralgro® or Synovex-C® increases pelvic area in young heifers, but has little effects on calving difficulty because by calving time, the pelvic size is similar to non-implanted heifers. Further, these implants do not improve age or weight at puberty and can decrease fertility.

Table 4.3. Effect of pre-calving energy level on birth weight and dystocia in 2-year-old heifers.

Energy intake	Birth weight, lbs	% of dystocia
Low intake (10.8 lbs of TDN)	58.0	26
Medium intake (13.7 lbs of TDN)	61.5	17
High intake (17.0 lbs of TDN)	63.9	18

Feed additives: Ionophores such as Rumensin® or Bovatec® decrease age at puberty but have no effect on gestation length, calf birth weight, pelvic area, or dystocia. Therefore, ionophores have positive effects on heifer development and can be used as long as the diet is adequate for growth and development of the heifer and the fetus.

Geographical location: Calf birth weight is greater in colder environments compared with warmer, southern climates. Because of that, northern states tend to experience a higher rate of calving difficulty than their southern neighbors. The exact reason for this phenomenon is unknown. A research study evaluated genetically similar Hereford cattle calved part in Montana and part in Florida. Each group was then moved to the other location and 10 years later, birth weight data were compared. Results of this study are shown in Table 4.4 and clearly show the effect of colder environments on increased birth weights.

Table 4.4. Genetic x environmental interaction: Effects on birth weight in Hereford cattle.

Herd origin	Herd location	N° of calves	Birth weight, lbs
Montana	Montana	727	81
	Florida	677	64
Florida	Montana	405	77
	Florida	363	66

Exercise: Increased muscle tone in heifers and cows can lead to easier calving. Forced exercise consisting on walking 1 mile per day for 4 weeks prior to calving has been shown to improve the calving ease of closely confined dairy heifers (Table 4.5). These heifers showed improved calving ease score, reduced placenta retention time and less days open following calving. Many beef heifers are grown and developed in semi-confinement drylot conditions similar to dairy operations. Where this is the management system, it is possible that heifers could benefit from increased exercise prior to calving. This could be accomplished simply by placing water and feed supplies at a distance from each other to force movement and exercise.

Table 4.5. Effects of exercise during gestation on calving ease and retained placenta of dairy heifers.

Group	N° of heifers	Calving Ease Score*	Placenta release time, h
Control	14	2.1	4.2
Exercise**	26	1.4	2.5

* 1 = easy calving; 5 = dystocia
** Walk of 1 mile daily at 3.5 mph for 4 weeks prior to calving

Season of the year: Fall-born calves usually are lighter and born with less assistance than spring-born calves. This can be partially explained by nutrition and environmental conditions. Hot summer temperatures tend to reduce birth weights, whereas cold temperatures increase birth weights.

Fetal position: About 5% of the calves at birth are in abnormal positions, such as forelegs or head turned back, breech, rear end position, sideways or rotated, etc. (Figure 4.2). This requires the assistance of a veterinarian or an experienced herdsman to reposition the fetus correctly prior to delivery. If fetal position cannot be corrected, the veterinarian may have to perform a caesarean section or fetotomy.

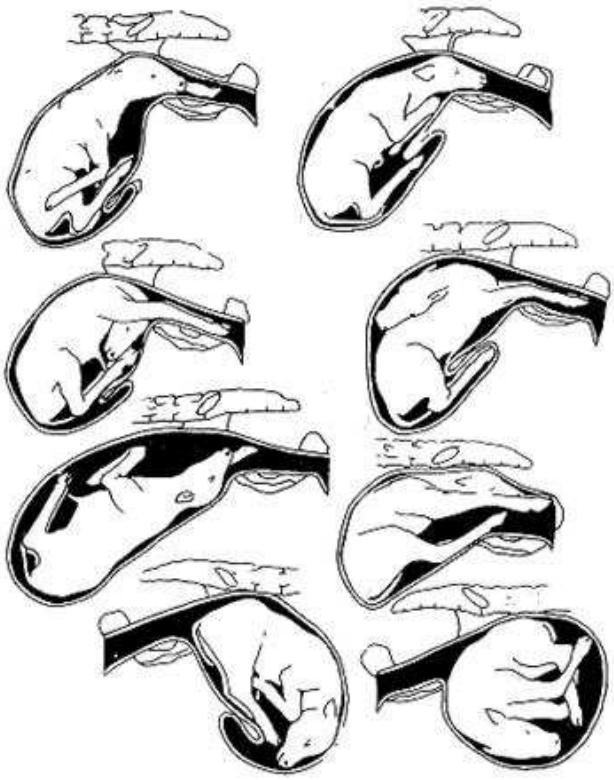

Figure 4.2. Some of the abnormal birth positions that may be seen in cows

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CHAPTER 5 – Calving Assistance

The first step to a successful calving assistance is recognizing a normal calving. As long as the calf is normally presented (Figure 5.1), the vast majority of animals will give birth without assistance. Most calves lost at birth are anatomically normal but die because of injuries or suffocation resulting from difficult or delayed calving. Therefore, knowing when and how to provide assistance highly determines the number of viable calves produced within cattle operations. Special attention should be provided to first-calf heifers, given that less than 2% of calving difficulties occur in mature cows. Please refer to Chapter 3 for information regarding all the processes and stages within a normal calving.

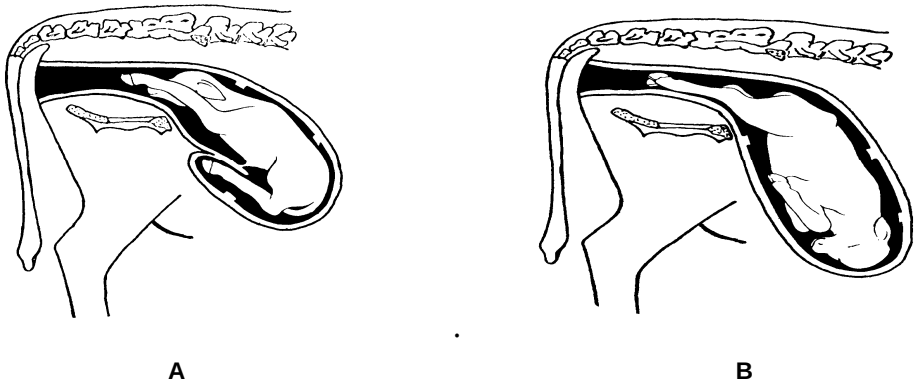

Figure 5.1. Normal anterior or “head” presentation (A) and posterior or “butt” presentation (B).

Preparation for Calving

The dam should be placed into a clean, well-lighted pen. Having the correct facilities and equipment available at calving time can mean the difference between a dead or a live calf. Always make sure all the equipment is clean and sanitized between cows. Remember, everything past the cervix is sterile and you don’t want to contaminate it. The following equipment should always be available at calving time:

- OB chains, 30 or 60 inch, and OB handles.
- Plastic sleeves.
- Commercial OB lubricant.
- Common disinfectant - chlorhexidine (Novalsan®) or iodine (Betadine®).

In addition to the equipment, some pharmaceuticals should also be available to aid the calf and/or the cow **after** the calving process. Some of the pharmaceuticals will require a prescription.

For the calf:

- Dopram® - 1 cc squirted into the nose to stimulate breathing.
- Tincture of iodine 7% - to dip the navel (desiccant and disinfectant).

For the cow:

- Oxytocin® – 2-5 cc (20-100 IU) **after calving only** to stimulate uterine contraction and avoid prolapse. It is **very important** not to administer while the calf is inside the uterus, or the uterus will clamp around the calf and make delivery even more difficult.
- Antibiotic – follow your veterinarian's advice on which antibiotic to use.

Correct Chain Placement

When attaching the stainless steel OB chains, it is important that there is proper placement on the calf's legs to reduce the chance of a broken leg or injured foot (Figure 5.2). To attach the chain, loop it above the fetlock and then make a half hitch on the fetlock. Make certain that the chain is positioned in such a manner that it goes over the top of the toes so the pressure applied pulls the sharp points of the calf's hooves away from the soft tissue of the vaginal wall.

Figure 5.2. Proper placement of obstetrical chains on the calf's legs

Try always if possible to place the chains on legs that are already outside of the cow.

When and How to Examine a Cow

Regular observations are required to determine the progress of labor, and when and how to provide assistance or seek for help from a veterinarian. As a rule of thumb, normal delivery should be completed within 2 hours after the water bag appears. If not, the calf may be born dead or in a weakened condition. Observing cows in labor at 30-minute intervals will provide information about whether the calving is progressing normally or not. Cows should be provided assistance if they have not delivered the calf within 2 hours from the time the water bag appears, or if more than 30 minutes elapse without progress. First-calf heifers can be allowed an extra hour for a normal delivery, but examination should still be provided if there is no progress within 30 minutes.

If no progress is observed within a 30-minute interval the dam should be examined to determine if calf presentation is normal (Figure 5.1) and if it will fit through the birth canal. All interventions should be performed in a clean environment:

- Tie the tail to the cow, or have someone hold it away from the vulva.
- Wash the vulva and anus area of the dam using soap and warm water.
- After washing your hands and arms, put on a new disposable plastic OB sleeve and apply copious commercial obstetric lubricant (soap will irritate the vaginal walls and potentially cause temporary infertility).
- Insert your hand slowly into the vagina cupping your fingers .

To determine if the presentation is anterior or posterior (Figure 5.1 A and B), find out whether the limbs near the birth canal are forelimbs or hindlimbs. This can be done by feeling the fetlock and moving the hand up the limb. All four legs have two joints that bend. In the front legs both joints will bend in the same direction, i.e. fetlock joint bends downward and knee joint bends downward. In the hind limbs, leg joints/fetlock and hock bend in opposite directions. If only the toes can be reached, it is most probable that the front legs are presenting if the toes point down (Figure 5.1). If the toes point up, it is most probable that the calf is presenting backwards. For an anterior presentation to show with the toes pointing up, the calf would have to be on its back, and this occurs very rarely.

To determine if there is enough space in the birth canal for the calf, check if you can put your hand flat against the calf and go all around it (from about 7 o’clock to about 4 o’clock).

If the calf's presentation is abnormal, or if the calf is too large to pass through the birth canal, a veterinarian should be contacted.

Assisting the Calving Process

Deliveries should be assisted with proper preparation of facilities and equipment (see Chapter 6). Four rules to keep in mind:

- **Patience.** The reproductive tract of the cow needs to dilate to allow the calf through and this requires time for the hormones to work. The normal position of the calf acts like a funnel to dilate the cervix and the vulva, inch by inch.
- **Use as much lube as necessary.** Trying to deliver a dry calf makes things much more difficult and can harm the reproductive tract of the cow.
- **Pull when the cow is pushing**. Pulling "against" the cow can damage the reproductive tract, which gets swollen and makes delivery more difficult.
- **Do not use excessive force**. Avoid the use of the calf-jack unless you are by yourself, because it can put too much force on the cow and you will not notice it, so the cow can get damaged in the process. Use "flexible" traction, meaning that when you stop pulling all tension on the cow stops (as opposed to the calf –jack which would keep the tension).
- **Steady traction** is easier on the cow and the calf, avoid jerky and irregular pulls.

Most of the time, movement can be detected in a live calf by placing the fingers in the mouth, seizing the tongue, pinching the toes or touching the eyelids, but not always. Some calves may not show any signs of movement and still be alive.

Ensure adherence to the timings previously described. Cows that are in labor too long give up pushing, and then it will be more difficult to assist the delivery. In addition, delayed assistance also has detrimental effects on the subsequent calf performance and fertility of the dam (Table 5.1).

Table 5.1. Effect of time of calving assistance on performance of heifers experiencing dystocia and their calves.

	Time of assistance	
Item	**Early**	**Late**
Postpartum interval *(days)*	49	51
In heat at beginning of breeding season *(%)*	91	82
Services/conception	1.15	1.24
Fall pregnancy *(%)*	92	78
Calf average daily gain *(lb)*	1.74	1.63
Calf weaning weight *(lb)*	422	387

Assisting calves with a normal anterior presentation: The normal anterior presentation position is forefeet first, head resting on the forelegs, and the eyes level with the knees (Figure 5.1). The most common problem with normal anterior presentations is the delivery of large calves. If the space is tight, alternate by pulling one limb at a time to decrease the diameter of the shoulders. One elbow and shoulder of that limb will enter the pelvis first (Figure 5.3). Now apply traction on both limbs and guide the head until it protrudes from the vulva.

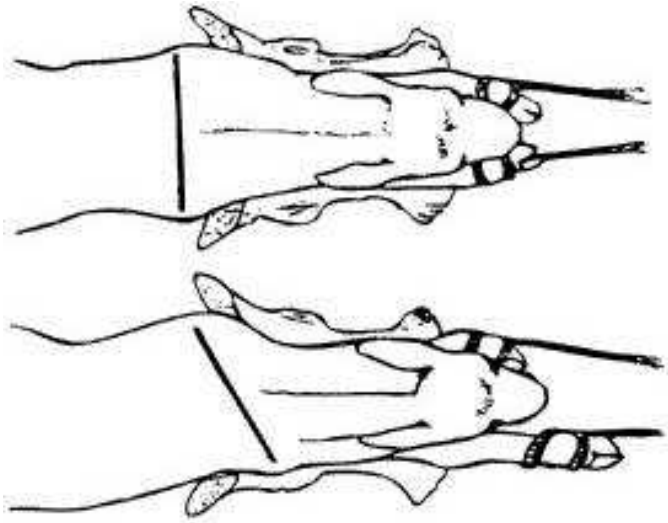

Figure 5.3. Pulling a calf “one limb at a time”.

Traction should be straight backward until the chest clears the vulva and then traction should be directed downward toward the cow's hocks. The calf, thus, passes through the birth canal in the form of an arc.

If the passage of the hind end of the calf presents any difficulty (hip lock), the body of the calf can be twisted to an angle of about 45 degrees to decrease the diameter across the pelvis of the cow (Figure 5.4). Delivery is then made with the calf half-turned on its side.

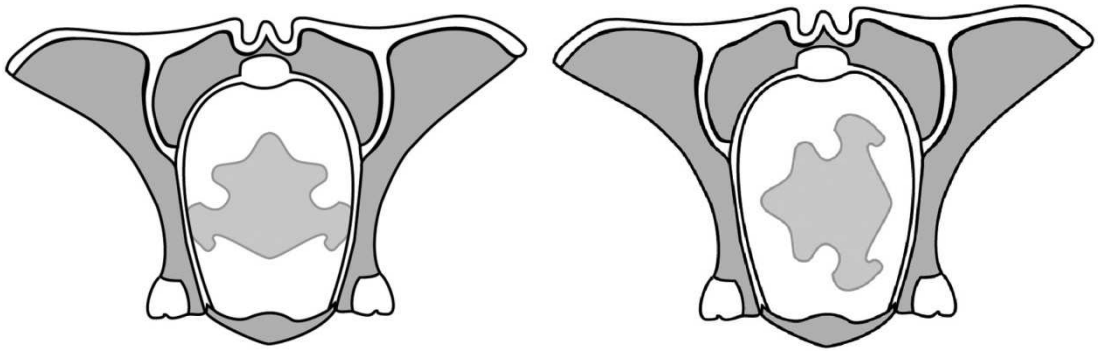

Figure 5.4. Rotating the calf on its side allows matching the widest opening of the pelvis.

Assisting calves with a normal posterior presentation (backwards): In a normal posterior or backwards presentation, both hindfeet are presented with the hooves facing upwards. Do no attempt turning the calf around to get the front feet first; you can damage the uterus of the cow.

In a posterior presentation, the head is the last part to be expelled and there is a risk of drowning of the calf in the fluids contained in the uterus. Therefore, delivery should be as quick as possible, especially once the pelvis of the calf is outside of the cow, but still allowing good dilation of the cow's reproductive tract while the calf's pelvis is inside of the cow.

As with the anterior presentation, if the space is tight, traction should be exerted on one limb to decrease the diameter of the calf's pelvis. It may be necessary to push the other limb partly back into the uterus to accomplish this. Once the legs are offset, traction should be applied to both limbs simultaneously. If this does not succeed, cross one limb over the other and pull on the lower limb. This will make the calf rotate slightly to one side and delivery should proceed more smoothly. The calf's tail may have a tendency to protrude upward and damage the top of the vagina. Be sure the tail is down between the legs by placing your hand on the tail until it is out of the vulva.

Assisting calves with an abnormal presentation: It is generally easier to correct any abnormal presentation if the dam is standing than lying down. If a cow or heifer won't get up, she should not lie directly on the part of the calf which has to be adjusted. Thus, if the calf's head is turned back toward the cow's right flank, the cow should lie on her left flank. Once the calf is in a normal position, delivery will be easier if the cow is lying down.

If you don't have immediate access to a veterinarian, you can try to reposition a calf in an abnormal presentation. However, take into account that some of these abnormal positions may in fact be due to monster calves (malformations) and may require a cesarean section or a fetotomy. A C-section can save the life of the calf and the cow. Although some cows may end up having reproductive problems after a C-section, most recover without problems.

Remember, attempts to reposition the calf should be made between contractions!

One of the most common calving problems occurs when one or both of the forefeet are back and the head is presented in a normal position (Figure 5.5). To correct this problem, push the calf back into the cow a little and carefully reach for the foreleg/s guarding the hooves into your hand to avoid

perforating the uterus. You will probably need both arms for this maneuver, one to keep pushing the calf back, and the other one to pull the foreleg/s up.

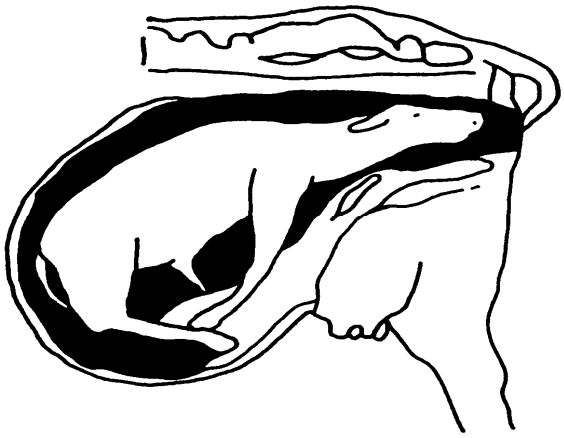

Figure 5.5. Abnormal presentation**:** Calf presented with its head in the birth canal but one or both forelegs retained.

A calf that has its nose down underneath the brim of the cow's pelvis (Figure 5.6) can be repositioned by grasping the calf's mouth or nostrils and pulling the head up into the normal position in the pelvis. If the calf's head is positioned to the side of its body, the same procedure can be used to correct it. If excessive force is used to pull the head into the canal, there is a good chance of breaking the jaw of the calf.

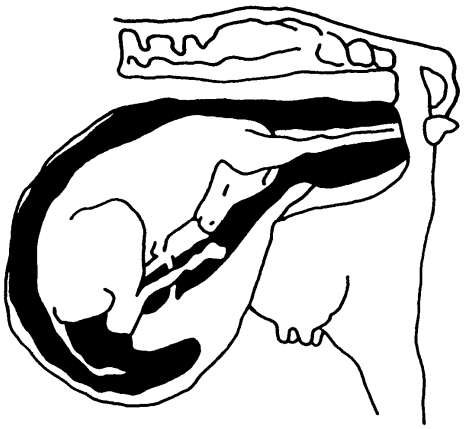

Figure 5.6. Abnormal presentation**:** Front legs presented with calf's head down between legs.

The breech presentation is a backwards presentation where the hind legs are stretched forward into the uterus (Figure 5.7). Therefore; the only body part palpable during examination is the tail or the pelvis of the calf ("butt"). This type of presentation is very difficult to correct. An attempt can be made

to push the calf deep into the cow with one arm, while reaching for one of the hindlegs with the other arm. Extreme care is needed to prevent damaging the uterus with the calf's hooves. The calf's best chance with this type of presentation may be a C-section, and therefore a veterinarian should be called promptly.

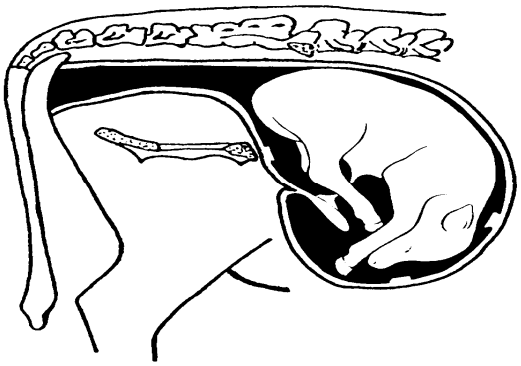

Figure 5.7. Abnormal presentation**:** Calf presented in a breech position.

Sometimes, the calf can be presented upside-down, both forward and backward presentations (Figure 5.8). In this situation, the best option may be a C-section. An attempt can be made to rotate the calf to an upright position. This usually means rolling the cow over while keeping the calf in position.

Figure 5.8. Abnormal presentation**:** Calf presented in an anterior upside-down position.

Calves can be presented in very abnormal positions. The goal is to attempt to reposition them to a normal position without damaging the reproductive tract of the cow, and if possible delivering a live calf. If a sudden obstruction occurs, stop and examine the birth canal and calf to find out what is wrong before proceeding.

Twins can cause calving difficulties if they try to enter the birth canal at the same time or by trying to adapt to the limited space available in the uterus by adopting abnormal positions. Make sure

both limbs you are working with belong to the same calf. To do this, feel along each limb to where it joins the body and feel along the body to the opposite limb.

Other Ideas on Pulling Calves: When the head tends to turn backwards, use a head snare or chain behind the poll, under the ears and through the mouth on top of the tongue, causing the mouth to gape (be careful that the sharp incisors don't cut the birth canal).

A calf puller (as known as calf-jack) can easily exert too much force on a calf and cause injury and/or death. Therefore, it is recommended not to use the calf-jack if possible.

Post-Natal and Pos-Partum Care

Helping the calf after it is on the ground is important, especially if the cow does not get up to clean the calf. There are three major things to take care in the calf:

Make sure the calf can breathe. Clear the nostrils of mucus and stimulate breathing by tickling the inside of a nostril with a piece of straw: the calf will sneeze, which helps to clear out the mucus. It is not recommended to hang the calf upside-down to drain fluids from the lungs, as most of the fluids are in fact from the stomach and the position puts too much pressure on the lungs and makes breathing difficult. If the calf does not breathe on its own, it may be necessary to use a respirator. There are several types of respirators available commercially. An inexpensive option is to place a hand around the mouth and nose clamping it together, closing off one nostril, and blowing into the other nostril at about six or seven second intervals. Rubbing the calf’s body rhythmically can also help and stimulates circulation.

The navel needs to be treated to prevent infection (“navel ill”). The best option is a strong iodine solution, especially in calves born in a muddy or wet environment, because it will desiccate the navel. This product is only available by veterinary prescription. Another option is using chlorhexidine solution.

Make sure the calf gets colostrum within the first three hours after birth. Colostrum is the calf's only source of protection from many infectious agents. Because newborn calves are only able to absorb the immunoglobulin in colostrum within the first 24 hours of life, it is recommended that a calf should receive 10% of its body weight in colostrum within that period. This is about a gallon of colostrum for an 85 lbs calf. Colostrum may be frozen and stored when excess is available so it can be thawed and used when none is available for another calf. Consider using a colostrometer to test the quality of colostrum obtained from dairy farms.

As a precaution against infections, any cow that needs assistance should be given antibiotics, especially when the calving was difficult and hands had to reach inside the uterus. Uterine boluses and

lavages are not indicated, unless recommended by your veterinarian (follow his/her specific protocol to avoid damage to the uterus). Leave the cow with the calf in a clean, small pen to bond.

Calving Assistance Summary

1. When labor begins, watch regularly for progress (every 30 minutes).
2. The cow should be examined if:
    a. If calf is not delivered within 2 hours, or if more than 30 minutes elapse without progress.
3. Make sure calf is in correct position (normal presentation).
4. If you cannot see/feel both front legs and the head of the calf, assistance will be needed.
5. If it is necessary to go inside the birth canal:
    a. Use clean sleeves and disinfected equipment.
    b. Always use plenty of commercial OB lubricant.
6. **If the calf is in an abnormal position or is too large, call your veterinarian.**
7. If you need to assist the cow yourself, attach the OB chains above and below the fetlock area of the calf to prevent broken bones.
    a. Only pull when the cow is pushing.
    b. PATIENCE is a virtue; the birth canal needs to dilate to prevent tears.
    c. If the calf is coming backwards, proceed with assistance rapidly once the calf's hips enter the pelvic canal to prevent oxygen deprivation to the calf.
    d. If the calf becomes hip locked, rotate the calf 45 degrees to decrease the diameter.
8. Once the calf is out:
    a. Remove mucus and membranes from nose and mouth of the calf.
    b. Stimulate breathing and apply artificial respiration if needed.
    c. Dip navel with disinfectant solution.
    d. Give the cow antibiotics.
9. The cow should be left alone with the calf in a clean, small stall until she accepts the calf.
10. Make sure that the calf starts nursing. Provide a minimum of 1 gallon of colostrum to the calf within the first 24 hours if it cannot nurse off the dam (as much as it will nurse within 3 hours).

CHAPTER 6 – Calving Facilities

As previously discussed in this handbook, providing proper assistance and care to cows during calving is extremely important to the productivity of cattle operations. However, calving assistance cannot be completed without proper equipment and facilities that provide safety for personnel and animals. Therefore, cattle producers should always ensure that laboring cows and the assisting crew have access to well-designed calving areas containing all the tools required for assisted or unassisted births.

Proper facilities can affect the motivation of the crew to bring the cow or heifer into the calving area, and also allow assistance without unnecessary stress on the animal or the assistant. The animal should move to the area easily and be constrained without fright. Therefore, it should be located in an area familiar to the animals. Feeding the animals in the calving facilities will allow them to be familiar with the surroundings and move into the area with ease.

A concrete pad is helpful to avoid mud by allowing the area to be swept clean. A floor drain can be built to remove birth liquids and placenta. However, non-bedded concrete areas can be slippery especially to a newborn calf soaked in birth fluids. Therefore, to provide sure footing for both the dam and the calf, concrete areas should be adequately bedded. A flood light above and behind the animal is also helpful to see what is needed. A light may not heat the entire area; however, it does 'feel' warmer than working in the dark.

Calving Area

Hinged, swing away or interchangeable gates or panels allow flexibility in designing and assisting in cattle movement to the calving area (Figure 6-1). A head catch should be installed in this area to allow access to the calving dams that need assistance. Panels or gates should flank both sides of the head gate to facilitate moving the heifer into the catch and aid in holding the heifer quiet as assistance is given. Additionally, a chain, a panel or a gate should be placed behind the cow as she enters

the head catch. Once assistance begins, the panels need to be able to swing away from the animal so that it can lie down during the birth process if necessary. These panels can also be used to form a small pen (10 or 12 square feet) to hold cow and calf after birth to encourage the bonding process, help graft calves, or doctor sick cows and calves.

To accommodate an occasional C-section, the gate to the left of the cow can be modified by being cut in half horizontally, thus allowing the top section to swing out of the way. The bottom section will stay in place to avoid personnel injuries due to kicking of the cow, but it is important that this bottom section allows complete access to the left flank of the smallest cow in the herd. This section design also allows assistance during nursing; the lower portion can be opened while the top restrains the cow.

A squeeze chute can be an acceptable alternative as long as there is a way to prevent the cow from going down in the chute; such as using a board or belts inside the chute to hold the animal up. However, it is difficult to calmly release the dam from the squeeze chute after calving and mimic the natural “mothering up” instincts.

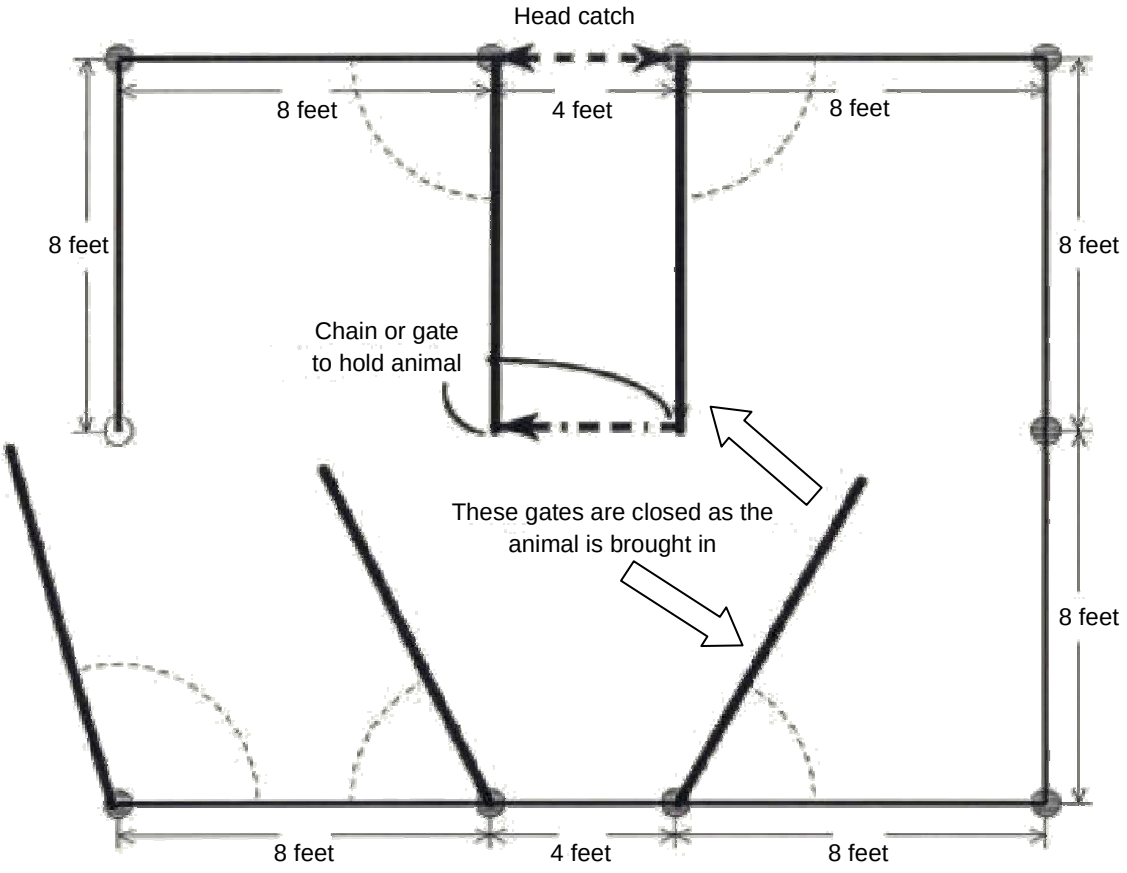

Figure 6-1. Example calving area floor plan.

Head Catch

There are several commercially available head gates which are acceptable for a calving stall. It is essential that they open all the way to the floor and have straight side bars that constrain the animal's head. These design peculiarities allow the animal to lie down during the process if necessary without the danger of choking. A curved head catch gate can be adjusted by welding a straight pipe into the curved section. A wooden head catch may be less expensive (Figure 6-1) but should open all the way to the floor. The gate can be equipped with a rope to lock the head from the rear or side of the animal when desired.

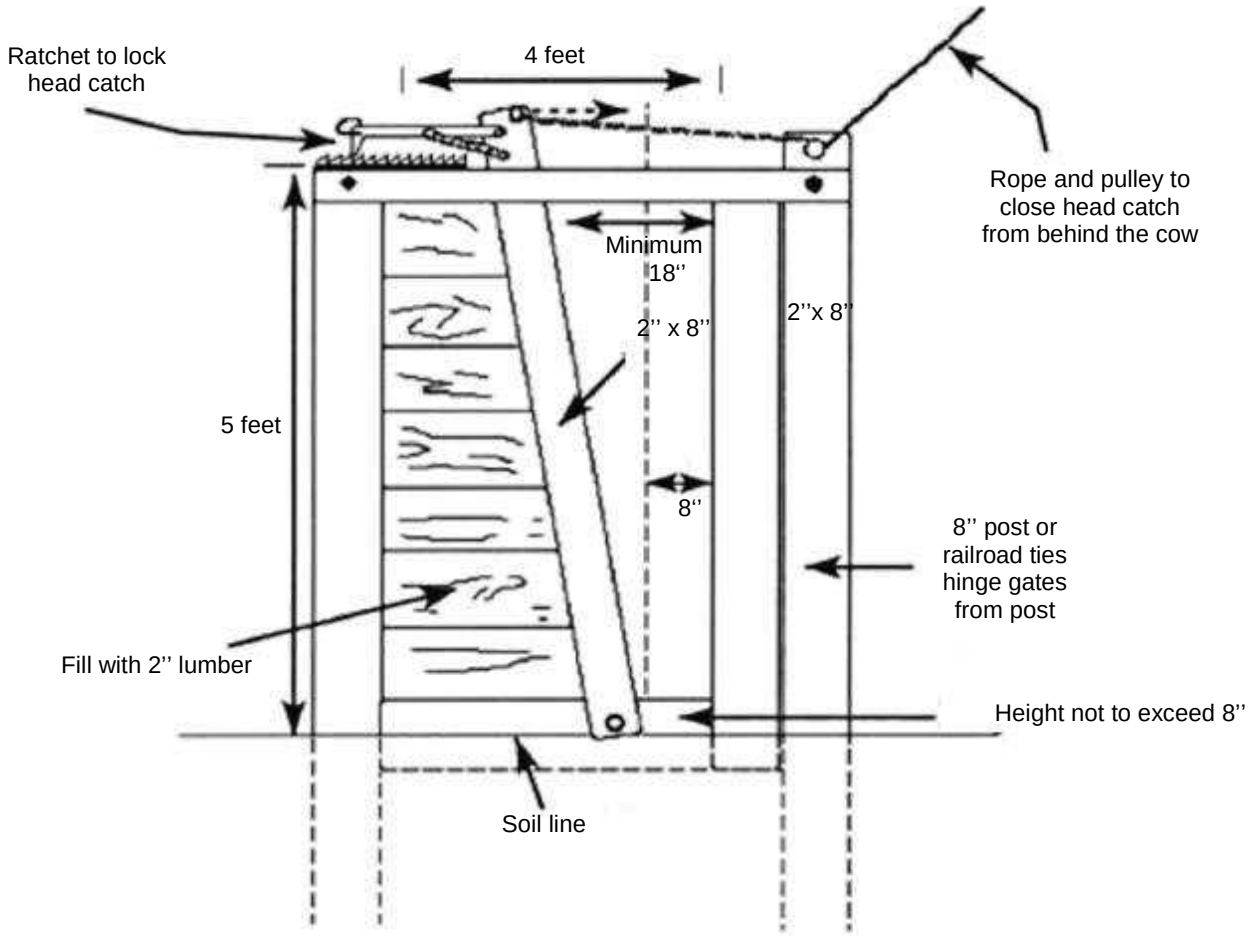

Figure 6-2. Front vertical view of a simple head catch for the calving barn.

The area in front of the head gate should be open and well lit so the animal will readily enter. A dark hole will discourage most cattle from putting their head through the opening. An example of a custom-made head catch is presented in Figure 6.2. The head catch can be placed between two posts inside a barn, or also in the fence line. These posts can also be used as hinge holders for the panels (Figure 6-1).

The natural behavior of cattle after an unassisted birth is to stand, turn around, and begin to mother the calf (licking). This action not only dries the calf but stimulates it to move, breath, get up and bond with the mother. To simulate this action, the dam should be allowed to back out of the head catch and turn around with her head down. If the pair is moved to a new location before bonding has taken place, this process can be threatened.

Conclusions

The calving facilities should be user-friendly for both the producer, assistance crew, and the animal. They should provide a safe, comfortable, and clean environment for the entire birthing process, which will result in more live and healthier calves, easier rebreeding cows, and increased profits to the operation.

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Western Beef Resource Committee

Cattle Producer's Library

Animal Health Section CL661

Diseases of Beef Cattle Associated with Post-calving and Breeding

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Once a cow has delivered her calf, the groundwork for the next year's calf crop must be laid. This publication will examine some of the more common problems that occur during the post-calving interval and at the time of breeding. Often these problems are subtle, and a producer may not realize there is a problem until the cows are examined for pregnancy or until the next calving season. Once a problem has progressed to this point, the individual animal is often culled from the herd or an entire calf crop can be significantly reduced.

Problems Post-calving

Metritis (Uterine Infection)

Cows will normally have a discharge from their birth canal for 8 to 14 days post-calving. This discharge is often thick and reddish in color and has no odor. If the uterus has become infected from calving, the cow has developed a metritis.

Causes—Infection of the uterus by bacteria after calving. Often cows that have had a difficult birth, a retained placenta, or have calved in a dirty environment will become infected.

Clinical Signs—They include discharge from the birth canal that is thin, watery, red to gray in color, and has a foul smell. Other symptoms may include sickness, increased temperature, depression, off feed, diarrhea, and stop milking.

Treatment—Administer drugs to evacuate the uterus of infected contents. Usually oxytocin will only work in the first 48 hours after calving. Prostaglandins may be more effective in increasing uterine tone and opening the cervix to drain the uterus.

Antibiotics should be infused into the uterus. Systemic antibiotics are useful, especially oxytetracycline.

If the cow is sick, supportive treatment is necessary; fluids, steroids, glucose, and antihistamines. Cattle may develop tetanus or other clostridial infections from a metritis, so vaccination or use of tetanus anti-toxin may be indicated.

After Effects—These may include chronic uterine infection and a problem breeder.

Endometritis

This is chronic low-grade infection of the uterus. The cow very seldom shows any outward signs.

Causes—This condition often follows metritis or retained placenta, and often follows difficult calving, twins, abortions, or C-sections. Physical damage to the birth canal during calving or during breeding can also be a cause.

Clinical Signs \—No signs are evident other than some flecks of pus in the mucus discharged during the heat periods. Affected cattle will cycle normally but will not conceive. Uterus may feel abnormal during rectal palpation.

Treatment—Evacuate the uterus using prostaglandins. Treat uterus with antibiotic flushes. It is best to treat the uterus during a heat to improve drainage. Often no treatment is done because the problem is not discovered until pregnancy examination, and the cow is culled for being open.

Prevention—Identify all cows with calving problems and watch for abnormal discharges. Consider having a pre-breeding examination done on cattle with potential problems so they can be treated before breeding starts or identified to be culled.

Delayed Uterine Involution

This condition is often associated with difficult births, twins, abortions, C-sections, or retained placentas. Cattle that have had metritis or endometritis often have a sub-involuted uterus.

Clinical Signs—None. It is found only by rectal palpation.

Treatment—Treatment is similar to endometritis.

Pneumovagina (Windsucker)

In older cows the cervix and uterus extend forward over the brim of the pelvis. This pulls the vulva forward into the pelvis and allows air to be trapped in the birth canal. Tears or laceration from calving can also allow air to be trapped.

Clinical Signs—Air in the vagina after urination or defecation, or after the animal stands up are signs of pneumovagina. Urine is retained in the floor of the vagina. Fecal material may also be present. Because of contamination, this cow is often a problem breeder.

Treatment—Correct tears and lacerations with surgery, and treat the uterus for infection.

Pyometra (Pus in the Uterus)

With pyometra the cow has developed a uterine infection, and the cervix has closed to prevent the accumulated pus from draining out. The uterus becomes enlarged, and the cow will not show heat cycles.

Causes—Pyometra can result from any contamination of the uterus; problem calving, retained placenta, or contamination during breeding. In some cases, cows are pregnant and the fetus dies and becomes macerated.

Clinical Signs—The cow fails to show heat, and fluid-filled uterus is found on rectal palpation. Discharged pus may be seen around the tail and vulva.

Treatment—Prostaglandins to drain the uterus, as well as antibiotic flushes and manual massage, are treatments.

Problems at Breeding

No Heat

Beef cattle will respond to environmental and nutritional stress by stopping normal heat cycle activity. Before the breeding season begins, observe the cow herd for signs of estrus activity. You should expect about 5 percent of the herd to be in heat on any given day. By watching for signs of estrus and getting a rough estimate of the percentage of cows showing heat, you have a fair idea of the level of estrous cycle activity in the herd. If you find that the level of activity is lower than expected, consider having a number of animals examined to determine if they are cycling or not.

The lack of cycling by individual cows may be the result of uterine problems, pregnancy, or stress. Rectal palpation can quickly determine the cause.

Treatment—In most cases, prostaglandins will bring a cow into heat if she is cycling normally already. If normal cyclic activity has stopped because of stress, that pre-existing condition must be resolved.

Weak/Silent Heats

The condition often occurs 30 to 60 days postpartum. This is when the cow is having difficulty in establishing normal cyclic activity after calving.

Animals that are stressed will have a more difficult time in starting normal cyclic activity. Cattle that are at greatest risk are first-calf heifers that are being bred for the second calf and older cows with poor teeth or chronic health problems.

Marginal deficiencies in copper may cause weak heats. If a high percentage of cows show decreased heat activity, have several cows examined and check for serum copper levels. Short term (48 hours) removal of calves may help herds where the cows are showing weak or absent heats.

Persistent Heat

In a small percentage of cattle, the follicle that brings the animal into heat does not rupture and release the egg. In these cases the animal will show heats constantly or every few days.

Treatment—Cattle with persistent heats should be examined rectally and, if a cystic ovary is found, they should be treated to induce ovulation. Cystic ovaries can also cause a lack of heat.

Prolonged Time Between Heats

A prolonged period between heat cycles will occur in a small percentage of cattle. The primary cause is the early death of the fetus, rarely because of congenital problems. A beef producer must be alert to two common diseases that will cause early embryonic death and therefore prolonged intervals between heats. These diseases are trichomoniasis and vibriosis. Both are veneral diseases carried by the bull. The cow becomes infected during breeding. The resulting infection kills the embryo after 4 to 6 weeks, and the cow will then return to heat. These diseases are a particular problem in range operations because infected bulls may be introduced without the owner's knowledge.

If you observe an unusual number of cows returning to heat after 45 to 60 days of breeding, have several cows examined immediately.

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Cattle Producer's Library

Animal Health Section CL660

Injuries and Diseases of Beef Cattle Associated with Calving

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The pay-off for cow-calf producers is being able to sell a weaned calf. To get this calf to market you must first get your cow pregnant and have her deliver a live calf. Several common problems affect cows from late pregnancy through calving. Many problems that occur during calving have a rapid onset and require a rapid response. The good news is that if they are attended to early they often have no permanent effect on subsequent breeding.

This publication presents common reproductive problems affecting beef cattle, a short description, underlying causes, possible prevention, and common treatment. These problems are presented generally in chronological order, from conditions seen before calving starts through the immediate post-calving interval.

Problems Pre-calving

Vaginal/Rectal Prolapse

Causes — The tissue around the birth canal becomes relaxed as the cow starts the last third of gestation. Increased pressure in the abdominal cavity will push the vagina or the rectum out. If the tissue is trapped outside the birth canal it will swell and may become infected. In some cases the bladder is also trapped, and the animal is unable to urinate.

This condition is more common in older cows but may occur in first-calf heifers. There may be a genetic link. Overly fat cattle and cattle on pasture with a high legume concentration are at higher risk.

Treatment — Epidural anesthetic is usually necessary. Replace the tissue and suture in place. Vaginal sutures must be removed before calving.

Prevention — Remove animals from the herd once they develop this condition. Don't keep animals that have pre-calving prolapses.

Don't allow cows to gain too much weight during the last trimester of pregnancy.

Ketosis/Pregnancy Toxemia

Causes — Cows are exposed to low nutrition during the last 2 months of pregnancy. Cows that are overly fat or are carrying twins are at a higher risk.

Signs — Affected animals become depressed, stop eating, and will often stand off away from the herd. Some animals will have the odor of acetone on their breath. As the condition gets worse, the cow will develop muscle tremors (trembles) and then go down.

Treatment — IV glucose, B vitamins, or propylene glycol given by oral drench. Any animal that is down should be lifted by a hip hoist 2 or 3 times a day for 15 to 20 minutes. In cattle that are in late pregnancy, consider inducing calving or a C section.

Problems at Calving

Dystocia

Any time a cow is unable to deliver her calf normally, a dystocia has occurred. Many management practices can be used to reduce the incidence of dystocia. Not all

of them may be suitable to every ranching system. Heifers have many special requirements, so they will be discussed first.

Breeding Management — Cull heifers with small pelvic areas before breeding starts. Select bulls to use on heifers based on the birth weight of the bull, not on his relative size. Use bulls on first-calf heifers that will produce small birth weight calves.

Expose heifers to the bull so they will start calving 30 to 45 days before the adult cows. Watch body condition during gestation; heifers must not get overly fat or lose weight.

Calving Management — Develop calving grounds. These should be separate from wintering areas, should be dry, and should have some shelter from weather if possible (anything from a shelter to trees for a wind break will help).

Separate first-calf heifers from the cows. In large herds, the heifer group may need to be divided into subgroups of 40 to 50 animals.

Provide surveillance and calving assistance on a 24-hour basis if possible. Restricting the breeding season to 42 to 60 days will allow personnel to focus their attention to assist in calving for a short, but intense, period.

Feeding at night (between 9 and 11 p.m.) will cause more animals to start calving during daylight hours.

The dam and calf should be moved from the calving area to a separate nursery pasture after the calf has nursed, is up and moving about, and has bonded onto the dam. This generally takes 24 to 36 hours.

General Indications for Calving Assistance — The start of calving is indicated by the animal laying down and starting abdominal contractions. The water bag (part of the placenta) appears in the birth canal. The water bag will normally break after 30 to 60 minutes. This is often followed by a period of restlessness and several position changes. Abdominal contractions become more forceful and the feet appear in the birth canal. Birth is usually completed after 30 to 60 minutes of hard labor. If the animal has not made any progress after 60 to 90 minutes, assistance should be given.

The appearance of the head alone, the head and one leg, one leg alone, or the tail are all indications of an abnormal calf presentation and indicate the need for assistance.

Guidelines for Calving Assistance — Comfortably restrain the cow. A squeeze chute will work, but if an animal goes down during a contraction, she may not be able to get up. The best situation is to have a small pen with a head catch. After the animal's head is in the catch, a halter is applied; once the dystocia is corrected and traction is applied to the calf, release the head and allow the cow to lay down in the pen.

The basic guidelines are **clean and gentle**. Keep the area around the birth canal as clean as possible, keep your hands and arms as clean as possible, and use lots of lubricant (mild liquid soap is fine).

The calf can only come out one of two ways — both front feet followed by the head or both back feet out together. If you are unable to correct the position of the calf to get it coming to one of the above presentations, get veterinary assistance. The three most common problems are not getting the head to come out with the front feet (head turning back) and second, having a calf that is too big to be delivered through the birth canal, resulting in hip lock. The third abnormal presentation is a breach in which the tail is the only part of the calf visible at the vulva. The presence of any of these problems usually requires veterinary assistance.

When pulling a calf, direct the traction down and away from the birth canal, not straight out behind the dam.

Do not use excessive traction; if you are unable to deliver a calf with two men pulling on the OB chains or when using a calf puller, increasing the amount of traction on the calf won't deliver it; the calf is oversized for the birth canal and should be delivered by C-section.

After delivering the calf, always make sure that there is not a twin present. This is a good time to check the birth canal for any tears and to put some antibiotic pills in the uterus (neomycin-sulfa works well).

Bruises, Lacerations, and Rupture of the Birth Canal

Causes — Calving difficulties, rough handling of the calf and maternal tissues, and careless use of obstetrical instruments by the operators during delivery of the calf.

Injuries occur more often in cows that have been in labor for several hours and when the birth canal is dry and non-lubricated.

Treatment — Give oxytocin (P.O.P.) immediately to shrink the uterus and control bleeding. Pack the uterus with antibiotics to control infection, and give systemic antibiotics (IM or IV). Try to control bleeding with coagulant compounds.

Surgical repair may be required if the laceration penetrates completely through the uterine or vaginal wall. Cows with severe blood loss will require treatment to control shock; fluids, steroids, calcium gluconate, or blood transfusions.

Uterine Prolapses

This is the expulsion of the uterus through the vulva to the outside of the body. This condition is seen more often in older animals and occurs soon after calving.

Causes — Difficult birth with injury or irritation of the external birth canal and severe straining. Retained placenta. Loose uterine attachment in the abdominal cavity. There may be an increased prevalence in some families.

Poor uterine tone post-calving. This may be related to

low blood calcium levels. Poor body condition with malnutrition.

Treatment — An **emergency** condition; rapid treatment is important. Keep the prolapsed uterus clean and moist. Apply material to pull fluid from the uterine wall: sulfa-urea powder, urea powder, sugar. For replacement, epidural anesthesia is often required. Replace the uterus or obtain veterinary aid immediately.

When replacing the uterus all of the organ must be replaced into the abdominal cavity and both horns must be fully everted. Failure to completely evert the uterine horns will cause the animal to continue to strain and prolapse again.

Treat the uterus with antibiotics and give systemic antibiotics. Most operators will suture the vulva closed for 3 to 4 days. Some cows will rupture the uterine artery during the prolapse. If this occurs the cow will hemorrhage internally, go into shock, and die.

After Effects — No permanent problem if the uterus is quickly replaced. Producers don't need to automatically cull a cow because of a prolapsed uterus, but a severe injury such as freezing, drying, or severe laceration may cause infertility.

Milk Fever

Cows that are starting to produce milk are unable to remove calcium (ca) from their bones quickly enough. If blood levels of ca fall below minimal levels, the muscles of the body are unable to function. The cow goes down, is unable to rise, and will become comatose and die.

Causes — Incidence of milk fever increases with age and number of calves. Cows of the dairy breeds or dairy cross have an increased incidence. High blood levels of estrogen inhibit ca mobilization; this may be a factor on pastures that are high in legumes.

Clinical Signs — Cow is down post-calving, and will become depressed with a slow heart rate, decreased rumen activity, low body temperature, and head turned to the side. Without treatment, most animals will become more depressed, become comatose, and die.

Treatment — Slow administration of IV calcium. Usually 300 to 500 ml of a commercial calcium solution is given over 20 to 30 minutes. A second bottle may be given under the skin at the same time.

Decrease the rate of milk removal (i.e., give the calf supplemental feeding so it will not nurse as much from the cow).

Cows that are down more than 12 hours require slinging from a hip hoist, 15 to 20 minutes twice daily, to reduce nerve and muscle injury. Animals that do not respond to treatment should be seen by a veterinarian.

Prevention — Decrease calcium intake during the last 2 months before calving by reducing legume forages. Cattle allowed to graze on a pasture with a high legume content will be at greater risk.

Use an IM injection of vitamin A/D pre-calving. It may help to change legume roughage to grass hay 2 to 4 weeks before calving.

Obturator Paralysis/downer Cow

Cattle that have had a difficult delivery will have a variable amount of swelling and tissue trauma around the birth canal. This swelling and bruising may damage the nerves from the spinal cord or those in the hip that supply the legs, preventing normal leg function. In some cases, excessive traction while pulling a calf will fracture the middle lower bones of the pelvis.

Causes — Excessive pulling to deliver a calf, pulling a calf straight out from the cow rather than down and backwards, or having the calf in the birth canal too long (several hours). Some cows may deliver normally but because of poor footing will slip and "split out." Damage, in this case to the pelvis, produces a downer cow.

Treatment — Steroids must be used to reduce swelling and assist in nerve healing. Cows that are unable to stand should be hoisted 15 to 20 minutes twice a day.

Cows that split out but can stand should be placed in a clean dry pen fitted with hobbles that prevent the legs from splaying out to the sides. An administration of IM vitamin E/Se may help.

Retained Placenta

Usually the placenta is passed in 3 to 8 hours after calving. If it has not passed by 8 to 12 hours, the placenta is retained, and the animal should be treated.

Causes — Dystocia, C-sections, fetotomy, twinning, or abortion will all increase the chance of a retained placenta. Some infectious diseases such as IBR, brucellosis, listeriosis, and leptospirosis will cause abortion and retained placentas. Other causes are malnutrition and feed deficiencies, especially low carotene, vitamin A, iodine, selenium, and vitamin E.

Treatment — Use slight manual traction, and gently pull on the placenta. If the placenta resists, stop and pack the uterus with boluses or use fluid douches to keep antibiotics in the uterus. Be very careful to use good hygiene when treating the uterus, or the problem will become worse.

Systemic antibiotics are useful, particularly if the uterus develops an infection (metritis). Prostaglandins may aid in getting the uterus to reduce in size and in releasing the placenta.

Producers must make sure the calf is nursing and to treat any other problems that may have caused the retained placenta. Oxytocin is useful only in the first 48 hours and may be used to reduce the size of the uterus. If used later than 48 hours, managers must sensitize the uterus with estrogen.

Grass Tetany

Similar to milk fever in that cattle in heavy post-calving lactation are losing large amounts of magnesium (mg) in their milk. Most types of mixed pasture grasses are low in mg. If cows are exposed to cold weather stress during early lactation, their blood mg levels may drop low enough to cause grass tetany.

Clinical Signs — Early, most affected cattle will appear restless, stop grazing, and have increased activity with an unusual high stepping gait. As the condition progresses, the animal falls down, the legs are stiff, and convulsions occur. The eyes move in an erratic manner and may roll in the head.

The heart rate and body temperature are elevated. Some animals may become very aggressive and attempt to charge or butt using their heads.

Treatment — IV mg is usually given with calcium. Treatment is not as effective as with milk fever, and many affected animals do not respond.

Prevention — Supplemental feed (hay) to lactating cows that are grazing lush pasture particularly during cold, wet weather.

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Cattle Producer's Library

Management Section CL780

Effect of P.M. Feeding on Daytime Calving

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Watched pots never boil and heifers calve on their own schedule. These two old sayings are only partially true. Given enough time and heat a watched pot will boil, and feeding cows in the p.m. will cause about 70 percent of the cows to calve during the daylight hours.

Gus Knoefal, a purebred breeder from Manitoba, Canada, was one of the first individuals to investigate the possibility of changing calving time by manipulating feeding time. He established two different feeding programs for his cows: one group was fed 11 a.m. to noon and from 9 to 10 p.m. The second group was fed from 8 to 9 a.m. and again from 3 to 4 p.m.

Knoefal continued these feeding regimes from 1 month before the start of calving. He recorded the time of day when each calf was born (Table 1). Cows fed later in the day had more calves born during the daylight hours compared to cows fed earlier in the day (80 vs. 38 percent, respectively).

Iowa State University conducted a survey of 15 cattle producers who fed either early in the day (before noon) or late in the day (5 to 10 p.m.). Cows fed late had 85 percent of their calves born during the day while only 15 percent were born at night (Table 2). Only 49.8 percent of the cows in the morning-fed group calved during daylight hours.

In a 3-year study conducted at the Livestock and Range Research Station (LARRS) at Miles City, Montana, researchers found that approximately 67 percent of the cows fed early (7 to 9 a.m.) calved from 6 a.m. to 10 p.m., and 33 percent calved at night (10 p.m. to 6 a.m.) (Table 3). In the cows fed late category (5 to 6 p.m.), 78.1 percent calved during the day and early evening hours and 21.8 percent calved at night.

In the Knoefal study and Iowa survey, feeding occurred as late as 9 to 10 p.m., whereas cows in the LARRS study were mostly fed at 5 to 6 p.m. in the late feeding group. This 3 to 4 hour difference may account

Table 1. Influence of feeding time on calving time.*

		Calving time	
Feeding time	**# calvings**	**7 a.m.-7 p.m.**	**7 p.m.-7 a.m.**
Fed 11 a.m. to noon and 9 to 10 a.m.	44	80%	20%
Fed 8 to 9 a.m. and 3 to 4 p.m.	39	38%	62%

*Reported by R. S. Stagmiller and R. A. Bellows (1981) from data by Gus Knoefal, Arborg, Manitoba.

Table 2. Effect of feeding time on calving time.*

		Calving time	
Feeding time	**# calvings**	**6 a.m.-6 p.m.**	**6 p.m.-6 a.m.**
Morning-fed only (before noon)	695	49.8%	50.2%
Evening-fed only (5 to 10 p.m.)	1,331	85.1%	14.9%

*Reported by R. S. Stagmiller and R. A. Bellows (1981) from data by Iowa State Extension Service, C. Iverson.

Table 3. Effect of feeding time on time of calving at the LARRS Miles City, MT.*

		Calving time	
Feeding time	**# calvings**	**6 a.m.-10 p.m.**	**10 p.m.-6 a.m.**
Early-fed (7 to 9 a.m.)	334	66.9%	33.3%
Late-fed (5 to 6 p.m.)	347	78.1%	21.8%

*Summary of 3 years of data. Reported by R. S. Stagmiller and R. A. Bellows.

for more cows calving during the daylight hours in the earlier studies.

Advantages are many to calving during the day. Producers can more easily observe the herd and assist with calving during daylight hours. With fewer cows struggling through the night to calve on their own, fewer calves are lost. Newborn calves get off to a better start when sunshine is immediately available to warm them and the possibility of hypothermia is reduced.

Predator losses usually occur in the nighttime hours. Calving at night might reduce perdition losses. Feeding cattle just before the colder nighttime temperatures might actually aid in body heat preservation of the animal because of heat generated by rumination and retention of heat as fill in the rumen.

Feeding cows in the evening has shown to increase the number of cows calving during daylight hours; however, this has not eliminated nighttime calving. Standing forage and over feeding cows will lower the success rate of daytime calving for obvious reasons. Therefore, beef cattle producers still need to observe their cows during the late night and early morning hours.

A drawback to getting daylight calves is producers will probably be feeding hay in the dark. But which would producers rather be doing in the dark, throwing out hay or pulling calves?

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Cattle Producer's Library

Animal Health Section CL648

Prevention of Baby Calf Diseases

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Infectious organisms that affect intestines, lungs, or perhaps all systems at once, constitute some, not all, of the causes of "disease." For example, some nutritional deficiency diseases are related to improper feeding of the dam, and underfeeding of the calf, and also deficiencies of the defense mechanisms. The term "baby" calf, as used here, refers to the very critical age period — the first week or two of life — after which a well-started calf, on a well-managed, healthy cow, usually flourishes.

Prevention of disease is, of course, preferred to treatment. One key to prevention, according to some, is to keep things simple or as natural as possible. But in nature or the wild, disease of the newborn often causes rates of loss that would be unprofitable for livestock producers. And while it might be wise to keep things natural or simple, the fact is, the situation has been made unnatural by putting up fences, crowding the animals, fixing the calving season, and giving the cattle no choice as to feed. Is there a way to prevent that occasional wreck? Or, if excessive problems occur, how can losses be minimized? Part of the answer is for producers to keep thinking, keep abreast of new developments, and continue to learn from other knowledgeable people and from the mistakes of others.

The following should be read with the realization that there is a lot of new information concerning calf problems and some increase in understanding, but the problems haven't been mastered. Many problems can now be avoided, however, and some of our troubles can be managed well enough to minimize losses.

As part of a preventative medicine program, a representative number of cattle should be sampled for blood selenium and zinc and serum copper. Appropriate micronutrient supplementation will prevent or reduce the severity of diarrhea outbreaks.

When in the midst of a disease problem, good investigative efforts, usually by a team, are aimed at determining exactly what factors accounted for the problem. The team might include a practicing veterinarian (and his/her professional contacts in many disciplines), county extension agents, nutritionists, epidemiologists, and producers.

The whole story might be difficult to discover, but often enough, the discovery of important contributory weaknesses in management, health programs, and nutrition, etc., can lead to remedial measures that will stop the disease processes. Early intervention is important so that proper samples can be taken while the cause is still detectable, and remedial measures can be instituted at a time before the situation gets out of hand.

A word of caution is in order. Subpar husbandry of the cattle, whether willfully or by mistake, usually cannot be overcome by anything that comes through a needle, a tube, or a balling gun! The damage can be minimized on an emergency basis in some cases, but a full investigation should point to needed changes that lead to total prevention.

Prevention of Neonatal Calf Diseases

Three factors are extremely important in determining whether a calf remains healthy, survives a disease, or dies. Managers must recognize all these factors.

1. The amount of immunity the calf receives from the dam via colostrum.
2. Kind and amount (dose) of infectious disease agents in the calf's environment.
3. Stress, which is a factor (or factors) that facilitates or encourages the establishment and destructive effects of disease.

Immunity

Specific immunity to infectious disease is available to the calf only through the first milk (colostrum). The colostrum contains antibodies that are absorbed from the intestine into the calf's blood stream and search for and destroy viruses, bacteria such as *Salmonella*, and some parasites. It follows that the cow has to do a good job of manufacturing these antibodies, and to do that, she has to be doing well herself for the many months before calving. If she is not given the proper nutrients to be in excellent health, not only will she not produce good colostrum, but she may produce a calf that is weaker and smaller than desirable.

A newborn healthy calf will usually get up and find the milk supply within a few hours. Keep in mind that if the cow has been lying in some scours from an earlier calf in the pen or pasture, the newborn may suck down massive doses of pathogens (germs) before it finds the colostrum. In some cases, this automatically results in severe diarrheal disease and quick death.

The newborn calf has the capacity to absorb the colostral antibodies into its bloodstream only for the first 12 to 24 hours of life. Difficult birth and stress may dramatically shorten the duration of this ability and thus reduce the amount of protection against life-threatening pathogens. After the 12 to 24 hours, unabsorbed colostral antibody is digested like any other protein, is valuable for its food composition, and may even help retard infectious organisms in the intestine. Milk replacers or milk don't have this protective effect.

To receive enough protective antibodies, the beef calf should consume at least 2 to 3 quarts of colostrum in the first 12 hours after birth. Sick cows, cows with blind quarters, and perhaps some first-calf heifers, may not produce that quality. Also, some heifers may not bond with the calf soon enough. When in doubt, first milking colostrum obtained from dairies, frozen and stored in advance, can be fed to the deficient calf, 2 quarts right away and 2 quarts 6 to 8 hours later. In the case of first calf heifers, prolongation of the time before the calf gets up and tries to suckle may interfere with bonding. Therefore, when supplementing the calf of the first-calf heifer, probably no more than 3 cups should be fed at a time. Dairy cow colostrum tends to be a little less concentrated in terms of antibody, hence the need to feed a little more than the 2 to 3 quarts of beef cow colostrum mentioned previously when supplementation is the only source of colostrum. It would be wise to check the quality of the dairy colostrum with a "colostrometer" before purchase.

Vaccinations

The protective spectrum of the colostrum can be enhanced by vaccinating the cow against the diseases that may threaten the newborn calf. The antibodies manufactured in response to the vaccine given at the proper time (read directions) appear in the colostrum. Target disease agents are, for example, *Escherichia coli (E. coli), Clostridium perfringens*, rota virus, corona virus, infectious bovine rhinotracheitis virus (IBR), bovine virus diarrhea virus (BVD), and others. The effectiveness of some of these vaccines is sometimes questionable, with apparently great results on one farm and poor results on another. Some of the apparent failures of vaccines are due to not following directions or vaccinating cows that are not in good enough condition to mount a good response to the vaccine. Also, the vaccine organisms may differ slightly from the ones carried in the herd, and therefore protection by vaccination may not be optimal in such a case.

Infectious Disease Agents (Pathogens)

Since many of the calf disease agents are carried by the cows, those agents will be in the calf's environment when it is born, and in large doses, especially if all the cows are crowded in an area that also serves as the maternity area. Whether an agent causes a disease or not depends on how potent its disease-causing ability (pathogenicity) is, the number of organisms the calf is exposed to (dose), and the amount of antibodies carried by the calf (strength of immunity). Infections through the navel (navel ill) by invasive *E. coli* occur at birth, especially under conditions of heavy contamination of wet muddy maternity areas. From the navel, the infections commonly spread to joints (joint ill), belly cavity, heart-sac, and brain. Clean calving areas and the practice of soaking the navel with strong tincture of iodine soon after birth seem to be important and logical factors for preventing navel infections.

One management objective is to keep the environmental load of ever-present pathogens at the lowest possible level. The area where the calf is born is of particular concern because the time before suckling is when the calf is most susceptible. Therefore, the calving area should not be the area where (possible disease-carrying) cows have been congregated before calving. The calving area should be chosen so that calves will not be born in muddy areas contaminated with feces and urine, and individual cows should be placed in this calving area only when calving is imminent.

Since diseased calves shed vast quantities of infectious organisms, and calves may show diarrhea as early as 2 to 3 days of age, a system of segregation should be designed to prevent exposure of young healthy calves to large doses of infectious organisms shed by unidentified carrier cows and sick calves. Ear tagging and dipping of the navel with strong tincture of iodine at birth should be followed by moving the cow/calf pair from the calving area to a cow/calf area. Should any calf in this second area begin to show signs of illness, the pair should be moved to a sick pen/hospital area for thorough evaluation and treatment if indicated. The calving area and the second cow/calf area should be as free as possible of gross contamination with excretions of ill animals.

The location and design of the sick pen area should take into account the weather conditions and treatment ease. Adequate shelter, power for heat lamps, and dry bedding are minimal requirements. Water troughs should be low enough for calves, and loose salt (1/2 sodium chloride and 1/2 potassium chloride) should be accessible by the scouring calf. Low blood potassium is characteristic of some of the most depressed scouring calves.

This type of arrangement has been helpful in preventing or minimizing diarrhea outbreaks, and in providing adequate supportive care for sick calves. With the water and salt available, some calves will actually treat themselves. If a calf is too dehydrated and depressed, the manager will have to supply adequate amounts of the right type of balanced electrolyte/fluid, perhaps by esophageal feeding (see CL647, CL649).

Of all the calf disease agents, *Salmonella* species, a bacterium, is probably the most fearsome. Fortunately, it is not as much a problem in beef herds as it is in dairy calf-raising facilities. When it occurs among beef calves, it can often be traced to a saleyard dairy calf grafted on one of the beef cows. It is advisable to purchase calves for this purpose from dairies where there is good calf-rearing husbandry and little disease. There are no guarantees, however, since wild mice can carry the *Salmonella* bacteria. The grafted calf and cow should be kept separated from the rest of the cow-calf herd for at least 10 days.

Stress

Stress refers to situations and conditions that appear to make an individual more susceptible to disease than usual. Extremely cold weather, wet cold weather, wind chill, very hot weather, lack of food, breathing of dusty or otherwise polluted air, and pain, are commonly cited as stressful contributors to serious disease outbreaks. For newborn calves, lack of adequate energy supply (milk) and cold, damp, windy weather are common sources of stress. Milk is the only source of energy for the newborn calf, and the energy derived therefrom is required to make heat as well as sustain the functions of vital organs and defense mechanisms. To offset extremely cold weather (zero degrees fahrenheit or lower), the cow also has to produce more heat; thus her energy goes more for heat and less for milk. In addition, many people believing falsely that there is such a syndrome as milk scours, cut down on the cow feed with the intent of decreasing milk production and stopping the scours outbreak in the calves. This strategy seems to work; calves stop passing so much liquid feces. However, by withholding milk you don't stop the disease, just the flow of fluid. Diarrhea is actually nature's way of flushing out unwanted toxins and pathogens. Therefore, withholding milk from calves, particularly those with diarrhea, takes away their only energy source (important for keeping warm) and the major supply of desperately-needed liquid for rehydration and flushing.

In light of this, we recommend that nursing cows receive increased amounts of dietary energy during adverse winter weather and that calves have available shelter. A rule of thumb for supplementing cows is, for each 1 degree drop below 10ϒF, there is at least a 1 percent increase in energy requirement. If the weather is unusually wet and windy, the demand may be 2 percent energy increase per degree drop. However, too often, a cow cannot physically consume enough feed to meet extreme energy needs, especially if the forage is of poor quality; corn, wheat, or barley supplements may be necessary. These calculations can be made easily by most farm animal veterinarians and county Extension agents with their ration formulation computer programs.

Energy conservation is possible through use of windbreaks for cows and calves and specifically designed, portable shelters for calves only. Sanitation in these shelters is important; frequent moving and rebedding may be necessary, depending on the concentration of calves in the shelters.

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Animal Health Section CL641

Fluid and Electrolyte Therapy in Calves

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Fluids and Electrolytes in Health and Disease

Fluids and electrolytes are necessary nutritional and functional components for all mammals and are required for normal cellular and organ function and for maintaining the acid:base balance with a blood pH >7.35 to 7.45. The normal animal maintains the balance of fluid, electrolytes, and acid:base (blood pH) within narrow limits by consuming water, minerals from supplements, feedstuffs, and salt.

Many diseases cause fluid, electrolyte, and acid:base imbalances that can result in death. Appropriate fluid and electrolyte therapy (rehydration, electrolyte, and acid:base balance) is necessary to restore normal activity (Table 1).

Fluid and Electrolyte Requirements

Water represents the liquid portion of the fluid components of mammals and is one of the five major nutrients. Water provides the fluid medium in which the chemical reactions of the body take place. It also has an ability to absorb and give off heat with a relatively small change in its temperature; therefore, it is an ideal temperature-buffering system for the body.

Water is also the medium for transportation of nutrients and wastes within the body. *Fluid requirement for maintenance for cattle is approximately 45cc/lb/day; therefore, a 100-pound calf needs approximately 1 gallon of water a day, at 60º to 70ºF,* just to maintain normal bodily functions.

Table 1. Goals and treatments for fluid therapy.

Goal of fluid therapy	Treatment
Correct hydration and circulating blood volumes	Fluids
Correct acid:base balance to normal pH	Bicarbonate fluids
Correct mental depression	Fluids and electrolytes
Correct electrolyte imbalances	Electrolytes
Facilitate intestinal repair	Fluids and electrolytes
Restore suckle reflex	Glucose, fluids, electrolytes

Electrolytes are dissolved in both intracellular and extracellular fluid compartments of the mammalian system. Electrolytes are required for normal cellular metabolic functions. *The electrolytes of note in calf health are sodium (Na^+), potassium (K^+), hydrogen (H^+), chloride (Cl^-), and bicarbonate (HCO^-).* Electrolyte needs are generally met through consumption of feed and salt and mineral supplements (Table 2).

Causes of Fluid and Electrolyte Imbalances

Fluid and electrolyte imbalances are characteristic of scours, intestinal blockage (LDA), kidney disease, blood loss, salivation (VSV/FMD), persistent fever, or water deprivation. One of the most common causes of fluid/electrolyte/acid:base imbalance is diarrhea (scours). Fluid loss results in dehydration that results in decreased temperature, increased pulse and respiration, and other changes, such as sunken eyes and loss of skin elasticity. Loss of body fluid causes changes in the electrolyte and acid:base balance of the body.

Fluid loss routinely includes the loss of bicarbonate resulting in acidosis (blood pH <7.35). Clinically, dehydration, electrolyte imbalances, and acidosis are presented as weakness and downer animals. The body's mechanisms to correct dehydration can also result in electrolyte imbalances. Diseases such as scours can alter the integrity of the intestine resulting in further loss of fluids and electrolytes as well as decreasing the intestine's ability to absorb water and electrolytes.

Fluid and electrolyte deficits and imbalances require specific treatment protocols to correct imbalances. Oral and/or intravenous fluid therapy can be used to quickly

Table 2. Selected fluid and oral electrolyte supplements.*

Name	Use	Components	Administration	Notes
Sodium bicarbonate	Restore fluid volume Correct acidosis	$NaHCO_3$ (baking soda)	Intravenous	(4oz) +1 gal distilled water**
Calf Quencher™	Correct acidosis and electrolytes, provide energy	Dextrose†, sodium and potassium chloride, bicarbonate	Oral therapy	1 qt/treatment every 4-6 hr
Enterolyte-HE™	Correct acidosis and electrolytes, provide energy	Dextrose, glycine, sodium and potassium chloride, bicarbonate	Oral therapy	As above
Deliver™	Correct acidosis and electrolytes, provide energy	Dextrose, sodium and potassium chloride, bicarbonate	Oral therapy	As above

*Representative electrolyte solutions only. No implied preference.

**Most calves requiring IV therapy can readily receive 2 to 3 liters of fluid in 2 hours. After the initial 2 to 3 liters, the fluids should run at a rate of 1 drop/sec for 12 to 24 hours.

†Dextrose and glycine are sources of energy.

NOTE: Nutritional support must continue in addition to the fluid therapy. Milk and commercial electrolytes cannot be mixed because the electrolytes will inhibit milk coagulation. Electrolytes and milk replacers (MR) can be administered simultaneously because MR does not clot or coagulate; however, it is advisable to administer the milk or MR 2 to 3 hours apart, thereby further enhancing fluid therapy.

correct imbalances often with favorable outcome. Any disease or environmental situation that results in fluid loss and/or decreased intake requires the lost volume (deficit) to be added to the maintenance needs when formulating a treatment program.

Table 3. Guide to determination of fluid deficit and suggested route of administration.

Clinical presentation	Enophthalamia (mm)	Skin tent duration	% dehydration	100# calf, fluid deficit*	Administration route
Stands, suckle +	2-3 mm	4-5 sec	4-6%	2-3 qt	Oral
Stands with help, suckle decreased	4-6 mm	6-7 sec	8-10 %	3-5 qt	Oral or IV
Unable to stand, no suckle	>7 mm	8-10 sec	>10%	5+ qt	IV

*A 100-pound calf also requires 1 gal/24 hours for general maintenance.

For example: *a scouring 100-pound (maintenance requirement: 45cc/lb x 100 lb = 4500cc [approx 1gallon]) calf that is 7% dehydrated needs an additional 6 pints of fluid (replacement fluid needs [qt] = percent dehydration x weight in lb/2.2) added to the 4 quarts needed for maintenance to correct the fluid imbalance.*

> *NOTE*: Fluid and electrolyte requirements change as environmental and health conditions change and as the animal grows and changes production phases.

Diagnosis of Fluid/Electrolyte Imbalances

Animals exhibiting signs of disease, such as scours, respiratory distress or depression, and recumbancy, routinely are dehydrated and their hydration status must be determined to initiate effective fluid therapy. The hydration status of calves can be estimated by the moisture and color of mucous membranes, capillary refill time, skin elasticity (skin-tent duration), degree of enophthalmos (the depth of the eyes within the socket), and temperature of the lower limbs. Severely dehydrated animals are routinely depressed and recumbant (down) often requiring intravenous therapy (Table 3).

In dehydration, the eye recesses into the socket (enophthalmia) and can be a useful measure of degree of dehydration. The lower eye lid is everted to its normal position even with the bone of the socket and the distance the eyeball is recessed is determined.

Skin-tenting is also a reliable measure of dehydration. When the skin over the neck/shoulders is lifted to a peak, it will rapidly return to its normal position in a hydrated animal; as dehydration worsens, the “tent” will remain for longer time periods.

Animals with >8 percent dehydration also will have cold extremities. Animals with >10 percent dehydration in addition to severe enophthalmos, prolonged tenting, and cold extremities are routinely down and depressed and will not remain standing when raised!

Electrolyte imbalances are diagnosed more subjectively without the availability of diagnostic equipment. Scouring calves are routinely acidotic due to the loss of water and bicarbonate from the intestine, and the degree of dehydration is an indicator of the amount of bicarbonate fluids to be administered, such as <6% dehydration required oral administration of 3 to 4 liters of a calf electrolyte solution every 4 to 6 hours.

Loss of potassium is routinely associated with scours. The severity of imbalance can be estimated by the ability of a calf to stand or not. Animals that are unable to rise or remain standing if assisted to standing require IV therapy with the administration of IV potassium, which is done under the direct supervision of an attending veterinarian—too much, too rapidly will kill!

Fig. 1. Orogastric tube feeding systems.

Methods of Fluid and Electrolyte Therapy

The common methods of fluid administration are orally or intravenously. Oral administration of fluids is the safest in that it is more difficult to over treat an animal, but this method is most beneficial in treatment of fluid deficits in early disease or animals <6% dehydrated. Care must be used to avoid administration accidents, such as placing the fluids into the lungs or causing injury to the esophagus or trachea.

Intravenous administration requires moderate surgical skills and increased cleanliness to avoid introducing infectious agents through the needle. IV administration is generally used in down or recumbent animals. IV therapy requires close monitoring as excess fluids and electrolytes can be fatal.

Oral Fluid Therapy—Oral fluid/electrolyte solutions can be successfully administered by a nipple bottle for a calf that will suck or via orogastric intubation. Orogastric tube feeding systems consist of a bag or bottle reservoir attached to a rigid tube with protective bulbous end (Fig. 1).

Place the tube into the mouth over the tongue and direct it to the left side. The calf will usually swallow the tube, which can be seen and felt passing down the esophagus into the stomach (see video). The fluid is then allowed to flow via gravity into the stomach.

Since oral therapy is effective in early or less severely dehydrated animals, placing fluid into the lungs is rarely a problem, however, when withdrawing the tube with any fluid remaining in the reservoir, crimp the tube to prohibit inhalation of fluid during withdrawal.

Fig. 2. Setup for intravenous administration of fuids to a calf.

Intravenous Fluid Administration—Intravenous (IV) fluid administration in calves and cattle requires the placement of a catheter into the jugular vein. IV catheterization is a minor surgical procedure that your attending veterinarian may provide instruction in the procedure. Briefly, a thorough scrubbing—important to decrease contamination of the site and equipment—of the site is made with a skin cleansing detergent. An 18ga x 1 1/2 inch catheter is placed into the jugular vein and secured with suture or tissue (super) glue. The appropriate fluids are placed into an administration setup (Fig. 2).

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Animal Health Section CL644

Feeding Colostrum to a Calf

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When a calf is born it has limited immunity against infectious diseases. If it absorbs an adequate supply of colostrum its immunity is enhanced. Generally, we must rely on good management and a sanitary environment to help protect the calf from immediate infection.

Within hours of suckling colostrum from its dam, the calf absorbs protective antibodies into the blood stream and other immune cells into its lymph nodes that help to fight off infection. If the calf fails to suckle or, for some reason, does not receive an adequate amount of colostrum, it must rely on its naive immune system to develop protection soon enough to avoid clinical disease.

For most infections it takes the immune system 6 to 10 days to respond adequately. If management and environmental factors depress the calf's resistance and the infectious agent is present in large numbers or is particularly strong (virulent), the calf's immune system is overwhelmed and the calf succumbs to disease.

Natural Protection

A newborn calf does have some natural protection against infectious disease. For example, its skin, tears, saliva, and digestive juices are natural barriers for some harmful microbes. However, colostrum provides an additional and immediate source of natural protection. Ingestion of this antibody (immunoglobulin) and immune-cell rich milk is critical for newborn calf survival.

The dam's serum antibodies (IgGs) and some important immune stimulating cells are concentrated in the udder as colostrum during the last month of pregnancy. For maximum protection, a calf must receive an adequate amount within 4 to 12 hours of birth.

Researchers believe that the non-antibody immune cells found in colostrum are required for complete maturation of the calf immune system. Research has shown that without their presence calves are more susceptible to disease throughout their lives than calves that received adequate levels of these immune stimulating cells.

Colostrum in the beef cow tends to be more concentrated than in the dairy cow. Generally speaking, a 75-pound calf ingesting 2 to 3 quarts of colostrum in the first 4 to 6 hours of birth will receive adequate colostrum.

Measuring Antibody Concentration

We cannot assume that the IgG antibody concentration in the colostrum of all cows or heifers is equal. In fact, studies have shown that the antibody concentration varies considerably from cow to cow, breed to breed, and heifer to heifer. There is no practical way to measure with certainty the antibody concentration of colostrum before delivery. However, we can measure antibody concentration after birth by using a Colostrometer™. It is designed to estimate the IgG antibody concentration in colostrum. A few tips on using a Colostrometer™:

- Always collect a clean sample. Make sure no foreign debris falls into the container.
- Be certain the temperature of the colostrum is about 70ϒF. Very cool or warm temperatures will result in misleading results.
- For best results feed only colostrum that registers solidly in the green zone or >60 mg/ml.
- Fresh or fresh frozen and properly thawed colostrum is the best source of natural protection for a newborn calf.

Handling and Storing Colostrum

Even though a calf may need its own dam's colostrum for the immune stimulating cells that seem to energize its immune system, the next best substitute for the natural dam's colostrum is colostrum from another cow. This should be collected from cows within 12 to 24 hours of their calving and used fresh for optimum results. It is recommended to collect colostrum from a

quarter not yet suckled by a calf. Also, colostrum may be frozen for future use. Storing in small (quart size) containers is recommended for easy thawing and individual calf delivery.

Many modern freezers that have an automatic defrosting system may cause the frozen colostrum to lose a percentage of its protective antibodies and all of the immune stimulating cells during storage. Despite this, most natural cow colostrum is superior to other colostral supplements even after freezing and thawing.

Some care must be taken when thawing frozen colostrum. Studies have shown that rapid defrosting using boiling temperatures destroys a portion of the colostrum by destroying the protein antibodies. These same studies have shown that defrosting in a microwave has the same result.

One method that can be recommended is a warm water thaw. The container (1 or 2 quarts) of colostrum is immersed in 110ºF water and stirred every few minutes to assure even thawing and warming. Continue process until colostrum reaches 104ºF. The process will take approximately 40 minutes.

Colostrum Supplements

What can be done for the calf that is in some way deprived of an adequate supply of colostrum? During the past several years, many colostral products have been promoted for use in calves. These products are not adequate substitutes for cow colostrum. They are most effective as colostrum supplements for calves that have already received some natural colostrum. Following are examples of colostrum supplements that are commercially available.

Colostrum Powders

These are generally products derived from filtration of cheese whey. The label on each bag should state the concentration of antibody immunoglobulin or IgG contained in the package or delivered in the label dose. The highest concentration of IgG currently available in this product form is 50 grams of immunoglobulin. A calf requires between 150 to 250 grams, therefore, it must consume three to five bags of the best products. These products are reconstituted at about 1 quart/bag.

In order to receive adequate amounts of antibody mass, a calf would need to be given 3 to 5 quarts within 12 hours. Five quarts is not recommended for small (<60 pounds) calves.

Other colostrum powder products have less than 10 grams of antibody concentrate. Producers are encouraged to know the IgG value of the product they choose and, therefore, know how best to use it for supplementing colostrum to calves.

Colostrum Boluses and Pastes

These products have been reported to contain from 0.3 to 5 grams of immunoglobulin in each delivery unit (bolus or tube). It would be difficult to deliver even a minimal 50 grams of immunoglobulin (antibodies) to a newborn calf with these products. They too are supplemental colostrum products.

Many products on the market are promoted for colostrum supplementation of the newborn calf. We have given just a few examples. Remember, these products are supplements, not complete substitutes, and research has not shown that all provide protection. When used as supplements, however, some may provide additional protection against infectious diseases.

"Tube-Feeding" Colostrum and Other Fluids

Giving colostrum or other oral fluids to a calf may be accomplished in one of two ways: (1) let them suckle from a bottle, or (2) restraining them and delivering the fluid down the esophagus into the stomach by tube.

Tube-feeding a calf requires restraint, gentle technique, and a specially designed device called an esophageal feeder. There are two passageways or "tubes" going down the throat: (1) the windpipe (trachea) that goes to the lungs, and (2) the stomach tube (esophagus) that goes into the rumen or fore-stomach. You do not want to put fluids down the windpipe. The calf will drown and die.

Several varieties and styles of esophageal feeders are commercially available. The essential feature of a calf esophageal feeder is a relatively non-flexible hollow tube about 1/2-inch in diameter with a 3/4 to 1 inch diameter bulb on the end of the hollow tube. The hollow tube is attached to a container designed to hold fluids such as colostrum. The better-designed feeders have a stopper or fluid-release valve that prevents fluids from entering the hollow feeding tube until the operator releases them.

The rounded bulb is important because it helps prevent accidental puncture of the back of the mouth and throat. Its ball-like shape is important because it helps the tube by-pass the opening of the windpipe. The opening to the esophagus is above and slightly next to the opening of the windpipe at the back of the mouth where the mouth joins the throat. Recommended steps to tube-feed a calf with colostrum:

1. Have the feeder cleaned, ready, and filled with desired amount of colostrum pre-warmed to body temperature.
2. Restrain the calf by stepping over its back, gripping its lower jaw, and pulling its head up toward your body.

3. With the calf's head held up as described, gently place the feeder into the side of the calf's mouth and direct the tube over the tongue to the back of its mouth and throat.
4. With the calf's head still held up between your legs, apply gentle pressure on the feeder down toward the back of the throat until you feel the feeder slip down the calf's throat into the esophagus.
5. Continue gentle downward pressure until the feeder-tube appears to be halfway down the throat between the head and chest.
6. As you reach this point you should be able to see the bulb end of the tube passing down the throat by just looking at the outside of the calf's throat.
7. Stop pressure now and place a hand on the outside of the throat and feel the bulb-end of the feeder through the skin of the calf.
8. If you **see and feel** the bulb-end of the feeder in the calf's throat, it is safe to continue further down, stop, and release the fluid into the tube after it is well placed in the esophagus.
9. **If you cannot see or feel the feeder tube going down the throat, then pull the tube out and repeat steps 1 though 8.**

It is important to note that most calves will struggle against your restraining efforts. Be prepared so that you do not lose control of the calf while you are delivering the fluid. This could allow a large volume of fluid to accidentally enter the windpipe and drown the calf.

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