



## Assessment and Care of the Newborn Foal<sup>1</sup>

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Everyone knows that newborns of the equine species arrive in a variety of sizes, shapes and colors. Nonetheless, assessment of the newborn foal, including recognition of both normal and abnormal conditions, is essential for the farm manager and those in attendance at the foaling. The moment foaling is completed, the care of the newborn becomes a matter of primary concern.

The neonatal period, considered to comprise the first 4 days of life, is a very important time for a foal. During this period, certain normal and characteristic behavior patterns can be anticipated and observed. Early identification of sick or injured foals is also critical, since it enables treatment to be initiated in time to be effective.

### Physiological Changes

Any discussion about the birth of foals and the foaling procedure must consider the many changes each foal must undergo to adapt to the environment outside the mare's uterus. Certain physiological changes involving specific structures, biochemical reactions, functions and behaviors are necessary to ensure a successful transition from the intrauterine environment to the world outside. Dramatic adaptations are evident, for instance, in the neonate's lungs, heart, body temperature and behavioral movements. Among these are very specific functional changes in the foal's respiratory system, such as lung expansion and initiation of respiration. Anatomical changes involving the heart and cardiovascular system include closure of the ductus arteriosus and foramen ovale. The status of the

circulatory system can be determined by monitoring the heart rate and the color of the oral and mucous membranes. The heart rate can be determined by placing a hand over the heart on the left side of the chest and counting the beats for one-half to one full minute. The usual range in healthy foals following normal delivery is 40 to 80 beats per minute. During the time the foal is attempting to stand, the rate may increase to 150 beats per minute. When the foal is 2 to 3 hours of age, its normal resting rate will be 70 to 100 beats per minute.

Prior to birth, the placenta serves as the circulatory and respiratory system of the developing fetus. Immediately upon presentation, the foal's most urgent adjustment is that of establishing respiration. In most instances, the newborn foal begins to breathe within 30 seconds of final delivery. This is accomplished by respiratory movements of the chest and abdomen and may be accompanied by a series of coughs or gasps. Following the onset of respiration, the breathing rate will be approximately 70 to 100 beats per minute and will gradually decrease to 50 respirations per minute at one hour of age. Respiratory distress can be a major cause of death in the newborn. Occasionally, a foal will require such stimulation as a slap or even some artificial respiration to establish a regular breathing pattern. Any obstructions in the foal's nostrils and mouth should be cleared. The use of shaving materials in foaling stalls is not recommended because these materials may easily enter the nostrils and mouth.

1. This document is VM-88, one of a series of the college of veterinarian medicine, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Printed February 1994. Reprinted May 1996. Please visit the FAIRS Web site at <http://hammock.ifas.ufl.edu>.
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Premature foals are susceptible to respiratory problems and can lack adequate lung development. Weak or premature foals also are subject to a condition known as "failure of passive transfer" (FPT), which can increase the likelihood of respiratory distress and infection. In some situations, the use of a small oxygen tank on the farm can benefit weak foals that experience respiratory difficulty. Other important physiological developments include the sucking and swallowing reflex, accompanied by the ability to digest and absorb food. Fortunately for horse owners and farm managers, the rooting instinct, which causes the foal to search for the teat, and the sucking and swallowing capability are well-developed in newborn foals.

In most instances, the mare delivers the foal while lying down and may remain in that position for a period of time after delivery. This allows the umbilical cord to stay intact, enabling the transfer of a significant portion of blood from the mare to the foal through the umbilicus. Under normal conditions, the umbilical cord ruptures when the foal attempts to stand following delivery. In most instances, the umbilical cord ruptures approximately 2 inches from the foal's abdomen. When the cord fails to break, it is advisable to sever it by placing one hand on the foal's abdomen and snapping the cord with the other hand. If the cord remains intact, a white, constricted area will appear at the site where the cord should be severed. Cutting, clamping or tying the umbilical cord is not recommended as a routine procedure. Clamping or tying are only indicated when the umbilical vessels do not retract and bleeding from the cord continues.

### Care of the Navel

After the foal is delivered and respiration is established, attention should be given to disinfecting the umbilical stump. Generally, an iodine preparation is used for this procedure. It has been stated that the value of this procedure decreases in direct proportion to the length of time required to complete it. If the navel remains moist or bleeding occurs, it is beneficial to apply the iodine solution several times during the first 2 or 3 days of life. The object of navel disinfection is to prevent infection: Once the navel has become contaminated and infected, it is difficult to disinfect it completely.

The value of routinely injecting antibiotics is controversial. These medications should be administered only when a veterinarian recommends their use as necessary or worthwhile for a particular situation.

The normal foal usually will stand and nurse within 1 to 2 hours after birth. Apparently, there is an inborn behavioral instinct that enables the foal to stand. The forelegs are extended and the hocks flexed; the foal raises the fore quarters first, then the hind quarters, as does the adult horse. Most foals, even the stronger ones, have to roll, stumble and fall several times before they can stand. This important process aids in the development of muscle tone and coordination.

### The Importance of Colostrum

Foals are born without any antibodies to protect them from infection. For this reason, it is vitally important that they receive high-quality colostrum, the first milk, soon after birth as feasible. Foals obtain antibodies from their mothers that provide a high degree of resistance against many common bacterial infections. It is extremely important that foals receive these protective antibodies before infection has an opportunity to start. Foals that require more than 2 hours to stand and nurse should be considered potentially abnormal. If, for any reason, a foal is unable to nurse, it is a good practice either to hold it up to the mare or to milk the mare and feed the foal with a bottle or stomach tube. Mares usually produce colostrum for 36 to 48 hours. If a mare leaks colostrum from the udder prior to foaling, the foal may not receive the necessary colostrum. For this reason, some of the larger breeding farms maintain a "colostrum bank." On these farms, 8 to 10 ounces of colostrum is collected from each mare after her foal nurses. This colostrum can then be frozen and stored. During the foaling season, colostrum from this bank can be administered to foals which, for one reason or another, do not receive colostrum from their dams.

It has been reported that 10 to 20 percent of foals experience partial or complete failure of this passive transfer of antibodies from the mare. This failure can be caused by one or a combination of the following conditions: a) the mare's failure to produce good-quality colostrum; b) loss of colostrum prior to foaling; c) the foal's failure to nurse during the first 24 hours of life; or d) the foal's failure to absorb antibodies from the intestinal tract.

The importance of antibody transfer from the mare's colostrum to the foal is demonstrated by the fact that most breeding farms routinely assess the serum antibody concentration of the foal at 18 to 24 hours of age. There are several methods available for making this assessment, which usually is performed by the attending veterinarian.

Once failure of passive transfer is diagnosed and treatment is prescribed, the age of the foal must be considered. If the foal is less than 24 hours of age, colostrum may be given by bottle or stomach tube. Occasionally, a foal may be more than 24 hours of age when FPT is diagnosed; such a foal can no longer absorb antibodies from the intestinal tract. In these instances, the recommended treatment is intravenous administration of compatible equine plasma. A large volume of plasma is required because generally the antibodies are not as concentrated in plasma as they are in colostrum. Volume overload to the foal is a potential problem when such a large amount of plasma is required. Although the use of plasma is thought to help prevent septicemia in foals with passive transfer failure, this is not well proven.

## Meconium Evacuation

Meconium is the first fecal material that accumulates in the colon and rectum as a result of glandular secretions and amniotic fluid digested during fetal development. Meconium is usually brown or black and appears as hard pellets or paste-like material; it also may be covered with mucous. Although many foals clear the rectum of accumulated meconium after nursing and some exercise, a substantial number do not; thus, meconium retention is not uncommon. This condition, if left untreated, can result in severe constipation, which may be demonstrated by signs of colic. Therefore, it is routine and recommended practice in many foaling barns to give the foal an enema soon after it is up nursing and moving around. There are, however, a variety of opinions concerning the need to administer enemas to healthy newborns. Several effective enemas can be used, such as warm, mild, soapy water or glycerine in water. Many horsemen prefer to use prepackaged enemas because they are convenient and easily available. Enemas must be carefully administered, since rectal tissue is easily irritated and damaged. The soft rubber enema tubing, if used, should not be inserted more than 2 to 3 inches into the foal's rectum, and harsh or caustic detergents should be avoided. Some foals may need more than one enema to help remove all the fecal material.

Indications for repeating the procedure are signs of straining, tail switching and excessive thrashing or rolling. Certain foals may exhibit these signs 4 or 5 hours after foaling, but they are more commonly observed 12 to 24 hours after birth. Many foals with such abdominal pain will throw themselves down and lie on their backs.

The foal's failure to respond to an enema administration can indicate that the meconium mass is

impacted in the colon. Such a condition is life-threatening and a veterinarian should be consulted. When correction of such an impaction requires a day or two, the associated conditions of bloating, dehydration, stress and infection also must be considered and treated.

## Injuries and Abnormal Conditions

The foregoing conditions are by no means the only afflictions that may befall the neonatal foal. Other conditions, including patent urachus, congenital heart defects, neonatal isoerythrolysis, cleft palate, atresia ani and septicemia are discussed in the following sections.

### Rupture of the Bladder

An injury associated with birth is rupture of the bladder. The incidence of rupture of the urinary bladder in neonatal foals is reported to be less than one percent and males are reported to be more commonly affected than females. Such ruptures are believed to occur during parturition because of the pressure placed on the bladder when it is distended. This condition also has been reported to occur when the navel cord is suddenly or violently pulled while still attached to the foal. The affected foal usually appears normal at birth and remains so for the first 12 to 24 hours. Then the foal may begin to appear dull and may not be as lively or nurse as often as previously. The foal then will attempt to urinate and defecate by straining. Some urine may be voided but the amount's usually less than normal, depending on the size and location of the tear in the bladder wall. By the second or third day of life, these symptoms are more evident as the abdomen becomes distended; the foal's temperature also may be elevated several degrees. At this time, the foal will be very lethargic and unwilling to nurse and will have an elevated respiratory rate with pale mucous membranes. Signs of straining, rolling and looking at the flanks are similar to the signs exhibited with meconium retention. Diagnosis usually is confirmed by distention of the abdomen, and an abdominal tap performed by a veterinarian will reveal the presence of urine in the abdominal cavity. Early surgical repair of the bladder defect is the only treatment. If the condition is neglected, the foal may rapidly develop uremic poisoning, suffer severe convulsions and die from toxicity.

### Fractured Ribs

A frequently reported injury of very young foals is that of fractured ribs. In most instances, it is assumed that the mare has caused the injury by stepping on the foal, but this is probably seldom the case. Actually, it is more likely that

such fractures are sustained at birth as a result of pressure within the birth canal. One to six ribs on one or both sides of the thorax may be fractured. The signs most often observed are rapid, shallow breathing and a characteristic grunt when air is inhaled. Experienced foal watchers are well aware of this potential hazard and assess each foal accordingly. Displacement of the fractured rib may or may not occur; this will, of course, determine the amount of tissue damage and the eventual outcome. When there is no displacement of the fractured rib ends, the condition may be difficult to diagnose and complete recovery is possible. If the fractured end of a rib penetrates the lung or some other vital tissue, death usually results. It is important to determine the condition of the fractured ribs so that the foal can be carefully handled and restraint or rough handling avoided. Most foals with fractured ribs will get up to nurse once or twice; however, as time passes and the pain increases they will spend more time down unless made to stand up. The prognosis for such a condition depends totally on the severity of the fractures and the extent of internal tissue damage.

### **Neonatal Maladjustment Syndrome (NMS)**

This noninfectious condition of newborn foals is considered a disorder of the central nervous system. The condition also is called "convulsive syndrome;" affected foals are known as "dummy foals," "wanderers" or "barker foals." The exact cause or causes of this condition cannot be not precisely determined in every instance, but the syndrome is characterized by a gross disturbance in the foal's behavior. In most circumstances, foals with NMS are reported to be delivered rapidly without complications. Such foals usually appear normal at birth but will demonstrate signs of NMS after a period varying from several minutes to several hours following delivery. The first signs frequently noticed are loss of the suckle reflex and stiff, jerky movements of the head and body. If able to stand, the foal will wander aimlessly without direction and appear blind. This behavior is followed by weakness, loss of recognition of the mare and sometimes recumbency. Abnormalities of the respiratory system with erratic breathing, gulping of air and "barking" noises have been reported. Some foals are only mildly affected, while others experience progression to convulsions and death. The management and treatment of foals with NMS is aimed at supportive care, such as maintaining necessary nutrition and body temperature and controlling convulsions. Antibiotics may be necessary if an infectious process is involved or occurs secondary to the condition. The prognosis for these foals depends on the severity of the condition and the care they receive. Good intensive nursing care will result in the survival of 50 to 75 percent

of cases if NMS is detected early, before the foal's condition deteriorates. For these foals, recovery may occur within several days or may take several weeks.

### **Patent Urachus**

This condition of the urachus, the small structure in the umbilical cord that connects the fetal bladder to the allantoic cavity during gestation, is not uncommon in young foals. Fetal fluid is stored in the allantois during fetal development and released at birth when the placenta ruptures. The urachus usually closes spontaneously at birth when the umbilical cord is severed; in some foals, however, it may remain open at birth or reopen several days after birth. The term "congenital patent urachus" is used when the structure remains open at birth. If the condition appears at a later time, it is referred to as "acquired patent urachus." This condition is reported to be more common than the congenital condition.

In either instance, urine may be observed dribbling from the foal's navel; when the foal attempts to urinate, a steady stream of urine may exit through the navel. Diagnosis of this condition, in most cases, can be made on the basis of the clinical sign and a good physical examination. Although the condition usually is not serious, it keeps the umbilical stump wet and dirty, making it an excellent location for the development of bacterial infection. In all foals, the umbilical area should be monitored for several days after birth for acquired reopening. In many cases, the condition will correct itself within a short time. It is prudent, however, to consider prompt treatment once the diagnosis is confirmed.

Therapy usually is initiated to help close the urachus to prevent infection. Many horse men believe that a patent urachus may contribute to the condition commonly referred to as joint ill and the resultant septicemia. The foal should be given systemic antibiotics and its environment kept as clean as possible until the structure has closed. Usually, the urachus is cauterized with silver nitrate or a strong iodine solution. These agents should be applied cautiously to prevent more extensive damage to other structures or tissues. If the condition does not correct itself within 3 to 6 days, an examination using ultrasonography may be indicated. Abscesses and severe infections of the umbilical structures frequently require surgical intervention.

### **Neonatal Isoerythrolysis**

Neonatal isoerythrolysis (NI) is a hemolytic anemia of newborn foal that can result from isoimmunization of the mare against the foal's red blood cells. Although

uncommon, the condition is important because it is potentially fatal unless recognized and treated promptly. The condition is sometimes referred to as "hemolytic icterus," "iso-hemolytic disease," "hemolytic anemia" or "jaundiced foal."

Neonatal isoerythrolysis is caused by the incompatibility of the foal's red blood cells with antibodies from the mare's colostrum. If the foal has inherited a blood type from the sire that is not compatible with the mare's blood type, the mare will develop antibodies against the foal's red blood cells. When the foal nurses, it absorbs these serum antibodies through the colostrum and they destroy the foal's red blood cells. Foals that develop NI appear normal at birth and exhibit normal behavior and activity for a variable period. The clinical signs of NI may occur as early as 6 hours or as late as 48 hours after birth. Usually, the foal becomes weak and dull and then fails to nurse. The body temperature may be normal or subnormal but the heart rate and respirations are increased. In severe cases, the foal may become too weak to stand, and death will occur within hours or days unless treatment is undertaken. The severity of the condition will depend on the amount of antibody the foal has absorbed.

Two of the most important signs of NI are icterus, or yellow coloration of the mucous membranes, and hemoglobinuria, or red coloration of the urine. The presence of hemoglobin in the urine is caused by the destruction of red blood cells. At first, the mucous membranes become pale; after 24 to 48 hours, the icterus becomes more intense. A lethargic foal and a mare with an udder full of milk may be the first indications to the horse owner or manager that something is wrong.

A veterinarian can confirm a diagnosis of NI using tests that demonstrate agglutination of the sensitized red blood cells. Because a number of other conditions can cause weakness and icterus in a foal, the diagnosis of NI should be confirmed by a veterinarian. Several diagnostic laboratories offer the hemolytic testing service. The test is generally performed within the 30 days prior to foaling when the potential for the condition is suspected. Mares usually do not develop antibodies during the first pregnancy unless previous exposure has occurred for some reason. However, multiparous mares with antibodies to red blood cell antigens will produce increasing amounts of antibody during the last 30 days of pregnancy. If a mare is determined to produce antibodies, neonatal isoerythrolysis can be prevented by muzzling the foal at birth and supplying donor colostrum and milk replacer for 24 to 48 hours. At the same time, the mare should be milked out completely and the colostrum discarded. It is very

important to provide the foal with plenty of good-quality donor colostrum during the first 24 hours after birth.

A supplementary blood transfusion may benefit foals that have nursed and become severely affected. The decision to transfuse is frequently based on the PCV and/or erythrocyte count of the foal. Sources of blood for a transfusion must be carefully chosen. Potential donors may include a horse with cross-matched blood; a gelding that has never had a blood transfusion; and even the foal's mother, provided her red blood cells are thoroughly and completely washed. Blood from the foal's sire should be used only as a very last resort.

A suitable donor is a horse whose red blood cells are not agglutinated by the mare's antibodies. Such a donor can be identified by cross-matching serum from the dam with red blood cells from potential donors.

### **Foal Septicemia**

Septicemia refers to infections that affect the entire body because of the presence of bacteria or bacterial toxins in the bloodstream. Infection may result from infection in the mare's genital tract; more often, however, the infection is acquired from the environment. If the foal has been infected while in the uterus, it will probably be delivered in a comatose or weakened condition. After birth, exposure to pathogenic bacteria through the navel, by inhalation or ingestion, can result in a septicemic condition. The mortality rate for foals with septicemia can be very high unless prompt treatment is undertaken.

Newborn foals are particularly susceptible to infection. It is thought that failure to acquire sufficient immunoglobulins from the colostrum is one of the leading causes of foal septicemia. This condition, called failure of passive transfer (FPT), was discussed earlier. Most infections in foals are caused by gram-negative bacteria; consequently, they require aggressive treatment with appropriate antibiotic therapy.

Because the clinical signs of septicemia are vague and there is no single critical sign that specifically identifies the septicemic foal, diagnosis may be difficult. Weakness, lethargy, loss of the sucking reflex, unwillingness to nurse and reluctance to stand are early signs. Fever may or may not be present; frequently, the temperature is normal or even below the normal range. A high fever may develop in foals that survive for several days. Abnormal behavior that progresses to convulsions and/or coma is not uncommon. Other signs that may indicate infection include labored breathing, bloat, colic, diarrhea and swollen or painful

joints with lameness. In many instances, by the time these symptoms are noted, the foal's ability to survive is reduced considerably. The specific infecting organism cannot be differentiated by clinical examination; therefore, diagnosis is usually based on a physical examination and a complete workup with laboratory tests and a blood culture. Such a procedure permits identification of the causative bacteria and utilization of appropriate antibiotics. Good nursing care is absolutely essential for the survival of a foal with septicemia. The treatment can be extremely time-consuming, tedious and expensive, depending on the extent of the infection. In many cases, the foal may require round-the-clock attention. For this reason, treatment should be rendered in an equine hospital or clinic that has monitoring equipment and trained personnel.

Attempts to treat severe foal septicemia on the farm are frequently discouraging and unsuccessful.

The duration of treatment with antibiotics and supportive drugs will depend on the location and severity of the infection as well as on the foal's response.

The prognosis for a foal with septicemia is usually fair to poor and mortality rates as high as 75 percent have been reported, even in foals receiving treatment. For this reason, it is essential that horse owners and managers be able to recognize the very early, subtle signs of foal septicemia so that early diagnosis and treatment are possible.

Prevention of foal septicemia requires the use of effective management techniques. These include maintaining good hygiene at foaling and in the foaling environment -- for example, disinfecting the foal's navel at birth. The prophylactic use of antibiotics at birth is a controversial practice that should be discussed with your veterinarian. However, the importance of providing the foal with adequate high-quality colostrum cannot be overstressed. This measure alone will go a long way toward the prevention of foal septicemia.

## **Congenital Defects of Foals**

Congenital defects are structural or functional abnormalities that are present at birth. It has been estimated that 2 to 4 percent of all foals have developmental defects at birth. Such defects result from events that occur during fetal development and may be of either genetic or environmental origin. However, very few of the defects reported in horses have been studied thoroughly enough to verify specific genetic or

environmental causes. This is due to the long gestation period, the slow onset of sexual maturity and the relatively high cost of such long-term studies. Although more than 80 congenital defects have been reported in horses, many have no easily established cause.

### **Congenital Heart Defects**

There are approximately 12 different cardiac defects reported in horses, but the incidence of such disorders is low compared with that seen in other domestic animals. Affected foals usually demonstrate a poor ability to exercise and appear weak. Ventricular septal defect (VSD), characterized by a hole or passageway between the ventricles of the heart, is the most common cardiac abnormality reported. Foals with a small VSD may appear normal but often are stunted and show poor condition as they age. A large VSD may result in severe exercise intolerance, often indicated by blue coloration of the mucous membranes after exertion. Some foals with this abnormality may succumb to cardiac failure.

Several less common heart defects also have been reported. A prognosis for the horse's future can be given only after the exact extent of the cardiac problem has been diagnosed. Such affected animals, if they survive, probably should not be used for breeding or for any type of sport.

### **Atresia Ani**

Atresia ani is a rare congenital defect in which the anus or rectal opening is absent. Atresia coli exists when the colon ends in two blind sacs in the abdominal cavity. Both conditions can sometimes be corrected surgically if diagnosed promptly. In atresia ani, the situation is obvious at birth and surgery may be indicated. With atresia coli, the foal develops colic shortly after birth and without immediate surgery will usually succumb.

### **Cleft Palate**

Of all the congenital and developmental abnormalities reported in horses, the cleft palate is probably the easiest to diagnose. The appearance of milk in the nostrils during nursing is the most obvious sign. Normally, the nasal cavity and the mouth are separated by the hard palate and the soft palate. An opening in this partition between the nasal cavity and the mouth is termed a cleft palate. This condition ranges in severity from a small opening in the soft palate to a sizable fissure in both the soft and hard palates. In affected foals, milk runs from the nostrils during and after nursing and the foals frequently cough

and choke. The condition usually leads to secondary pneumonia due to aspiration of milk into the lungs. Surgical correction may be possible in some instances; however, in most cases with a severe fissure, surgical intervention is not satisfactory.

### **Hydrocephalus**

Hydrocephalus is caused by an accumulation of excess fluid in the cranial or skull cavity. It is considered a rare congenital abnormality and its cause is unknown. The fetus usually develops an enlarged head and the brain is compressed within the bony cranium. When the condition is severe, the foal may be stillborn or may die soon after birth. In some instances, the enlarged head may necessitate delivery by caesarean section. If the condition is not severe, the foal may live for several days with the resulting brain damage. The typical foal with hydrocephalus is weak and depressed, is unsteady on its feet and carries its head low to the ground. Most affected foals become progressively worse over a period of days. There is no practical treatment for congenital hydrocephalus.

### **Conclusion**

The birth of the foal is the end of one period, gestation, and the beginning of a new life. Having a thorough understanding of foal behavior and of the abnormal conditions that may occur is essential for the horse owner and farm manager. By responding to the foal's needs and health concerns, one can enhance the foal's ability to live a long and happy life.