CONTROL PROCEDURES during outbreaks of viral abortion include strict application of sanitary practices and restricting caretakers and equipment to the affected barn. Manure and bedding should not be moved to other areas.

A mare that aborts should be left in the barn where the abortion occurred, unless she can be moved to an isolated point or placed with other horses not having contact with pregnant mares. Manure and bedding in a contaminated stall should be soaked with a strong disinfectant and left in the stall a few days before it is removed.

There is a distinct pattern of behavior of the abortion virus on breeding farms of central Kentucky. An epizootic in which signs appear only in sucklings and weanlings occurs each fall and winter. Infection by the abortion virus in the young horses causes a fever of 100°F to 4°F that lasts 1 to 6 days and a mild conjunctivitis and respiratory catarrh, which is accompanied by a watery nasal discharge. Some foals develop a mucopurulent inflammation of the nasal passages as a complication of the viral infection. Others are affected so mildly that the disease is not noticed. A pharyngitis and cough are frequent in some outbreaks. Signs of pneumonia are seen in some foals.

Infection of sucklings and weanlings usually begins in August or September, with an increasing incidence in October, but the highest incidence is in November. It recedes in December. Brood mares show no signs of the disease during the time it is present in their sucklings and weanlings. Many mares, however, are infected, but only a few abort. Abortions usually occur 1 to 3 months after the disease becomes evident in the young horses.

Horses may be affected severely when assembled from isolated areas into large groups. Continuous introduction of susceptible animals provides opportunity for increased virulence of the virus and the bacteria that are involved in secondary infections. Pharyngitis, pneumonia, abscess formation, enteric disturbances, and other aberrant forms are frequent. Then the disease closely resembles the conditions usually diagnosed as influenza.

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Diseases of Foals

E. R. DOLL

SOME of the diseases that may attack a newborn foal are strictly problems of management. Others are acute infections that require the prompt attention of a veterinarian.

The breeder who supervises foaling and carefully watches the foal during its first 3 days of life will be able to correct minor disturbances before they become serious. Early detection of illness and correct treatment have saved the lives of many foals.

The life of the mare or the foal may be lost during birth from a lack of attendance.

Normally a foal is born within 20 to 30 minutes after actual labor begins. Longer periods of labor usually indicate that foaling is not progressing properly and that help may be needed.
In normal birth the front feet appear first. The foal’s nose is between its knees and its back is toward the back of the mare. The feet and nose usually appear 5 to 10 minutes after the water breaks.

Signals of trouble are the appearance of only one foot, failure of the nose to appear, more than two feet showing, feet turned upside down, failure of the foal to appear soon after the water breaks, and prolonged labor. A veterinarian should be summoned immediately.

Membranes should be freed from the foal’s head after the head has cleared the birth canal. Some breeders allow the navel cord to be broken naturally. Others prefer to break it by pulling at the constricted part 2 or 3 inches below the stump. The cord should not be cut or tied. The cord should be disinfected after it is broken. Mild tincture of iodine is suitable. An effective means of application is to pour about 1 ounce of the disinfectant in a small jar, hold the jar firmly against the foal’s abdomen, and shake it so that the antiseptic is in contact with the navel for about a minute.

After the delivery, the mare and foal should be permitted to rest and get up of their own accord. A foal ordinarily will be up and nursing within 1 or 2 hours. Foals that are not up and nursing in 3 hours need help in rising and assistance in standing while nursing. If the weakness persists for 5 to 6 hours, it is wise to call a veterinarian, because weak foals often have developed bacterial infections before birth.

Meconium, the fetal feces, may be impacted in the bowels, and an enema is required to remove it. Enemas are not necessary for every foal. Normally the foal begins to pass the meconium in a few hours. Retention of the meconium is indicated when the foal carries its tail high, strains frequently without bowel movement, and has colicky symptoms.

Enemas, warm water or 2 ounces of glycerin in 1 quart of water, should be given with a small, soft rubber tube, which is inserted 10 to 14 inches into the rectum. No more than 1 quart of enema fluid should be used. Excessive or too frequent enemas may cause a diarrhea. Syringes with metal or hard rubber barrels should not be used, because they may puncture the wall of the rectum. If the impaction of the meconium is persistent, professional assistance should be called in.

A condition known as 9-day scours often causes worry among inexperienced horsemen. Foals often develop a diarrhea some 8 to 12 days after birth. Usually it is mild and persists for only a few days. The cause is thought to be a change in the milk that occurs in association with the mare’s ninth-day heat period.

Rupture of the urinary bladder is infrequent in young foals. The cause is not known. The rupture nearly always is lengthwise and on the upper surface of the bladder. The foal cannot urinate. All urine is deposited in the abdominal cavity. The affected foal becomes sluggish. The abdomen is distended by the accumulation of urine. Death occurs in 3 to 5 days. Most foals recover after the abdomen is drained and the urinary bladder is closed by surgery.

Contracted tendons, crooked legs, and aberrations of the feet are frequent in young foals. Any of these conditions may persist or become worse and affect the future soundness of the horse. Treatment consists of surgery on the affected tendons, use of braces, and corrective trimming of the feet.

Bacterial infections cause various diseases of foals, among them navel-ill, joint-ill (or arthritis), pneumonia, scours, generalized infections (or septicemia), tetanus, and wound infections.

The micro-organisms involved most frequently are *Shigella equirulis* and streptococci. Organisms found less often are *Salmonella abortus-equi*, *Corynebacterium equi*, staphylococci, *Escher-
ichia coli, and Salmonella typhi-murium. Almost any one of the organisms can produce one or more of the symptoms associated with bacterial infections of young foals.

*Shigella equirulis* infection is the most important single cause of illness and death of newborn foals. The organism exists in the digestive tract of horses. Infection may occur before or after birth. Symptoms frequently appear 1 to 3 days after birth. Then the disease is generalized and has little tendency to localize in joints or organs. The onset is rapid.

Symptoms are an early rise of temperature, increased pulse and respirations, congested membranes, slightly swollen joints, dullness, weakness, rapid prostration, and early death. In foals more than a week old, the course of the disease is slower, and visible joint involvement is frequent. In foals less than 3 days old, lesions of an acute generalized infection, inflammation of the intestines, and a slight excess of joint fluid are the only postmortem findings. The kidneys in older foals usually contain many small abscesses, which usually are specifically diagnostic for the disease.

*Streptococci* are second only to *Shigella equirulis* as a cause of illness and death of foals. Infection often is present when a foal is born, but pronounced symptoms may not appear for a week or longer.

Infection also is acquired after birth. Prenatal infection often results in abortion or death of the foal within a few days after birth. Foals dying during the first few days usually have generalized infection or pneumonia and the joints are involved slightly. In foals a week or more old, joint troubles are more frequent and more severe, and the course of the disease is slower. Symptoms are similar to those associated with *S. equirulis* infections, but the course of the disease is slower. Foals sometimes live 2 or 3 weeks before dying.

Streptococci frequently are found in abscessed navels and are the commonest cause of infection in wounds or injuries of young foals.

*Staphylococci* usually are found in infected wounds or with streptococci in respiratory infections.

Tetanus, or lockjaw, is associated with infected navels or puncture wounds. Use of 3,000 units of antitoxin following puncture wounds and proper care of wounds will prevent tetanus. Annual immunization of pregnant mares with tetanus toxoid should provide passive colostrum antibody protection for the foal for a month or longer after birth.

*Escherichia coli* infections cause acute septicemia. Symptoms are nervous disturbance and rapid prostration. The mortality rate is high. Death usually occurs in 1 to 4 days. Peritonitis and enteritis are frequent lesions. Occasionally the joints are involved. Many affected foals are weak or ill at birth—an indication of prenatal infection.

*Corynebacterium equi* usually affects foals 1 month old or older and causes pneumonia and abscesses of the lungs. The infection may spread and cause abscesses in the lymph nodes and other internal organs. Treatment usually is unsatisfactory.

*Salmonella typhi-murium* infections are sporadic. Foals may be affected over a wide range of age. Symptoms are high fever, profuse diarrhea, and rapid dehydration and prostration. Lesions are those of acute generalized infection and inflammation of the intestines.

The control of infectious diseases of newborn foals begins with hygiene and correct selection before the mares are bred. Infection of the genital tract may be present before breeding, or introduced when the mare is bred, or acquired later. Mares with genital infections fail to become pregnant, abort, or produce a weak or dead foal.

Manipulation of the genital tract, except by a veterinarian, should be avoided. Mares with anatomical defects that permit entry of air or foreign matter into the vagina should have
the vulva repaired surgically. Such mares must be opened before foaling to prevent injury of the external genitalia.

Infections after birth may gain entrance to the body through the navel cord, but circumstances indicate that infection is more often acquired by ingestion and from the alimentary tract. Rigid sanitation should be practiced in the foaling stalls and stables that house brood mares.

Bacterins and serums have little or doubtful value in the treatment of the bacterial infections of newborn foals. Sulfur drugs are of benefit for some intestinal disturbances. Streptococccic infection may yield to treatment with several of the sulfur drugs. Early in the course of the disease, streptococcic and Shigella equirulis infections respond satisfactorily to treatment with selective antibiotics or combinations of antibiotics. Dosages should be in accordance with instructions on the packages of the product used.

In acute cases, antibiotic treatment must be started before an irreversible damage has occurred in the vital organs. Cases of longer standing, with multiple involvement of the joints or localizations of infection in other parts of the body, do not respond well to treatment with antibiotics.

Horse and mule foals are subject to hemolytic anemia and jaundice (icterus), a disease that occurs when the mare becomes immunized against the red blood cells of her fetus. The blood type of the fetus apparently is the same as the type of its sire. This disease is somewhat like the Rh disease of human infants.

Synonyms for hemolytic disease are neonatal isoerythrolysis, icterus gravis, hemolytic icterus, jaundiced foals, and isohemolytic disease of newborn foals.

It happens only when a mare is carrying a fetus with a blood type different from her own, and then only if there is a leakage of red blood cells or their components from the fetal tissues into the mare’s tissues.

When the leakage occurs, the mare’s body reacts and develops a substance—an antibody—which is capable of destroying the red blood cells of the fetus. This reaction is known as isoimmunization. The same reaction and disease are produced by injecting vaccines containing horse tissues into mares. In the absence of vaccination, the isoimmunization is infrequent.

The antibody does not pass through the fetal membranes in horses, and the foal cannot be affected before it is born. The antibody is transferred from the blood to the mammary gland as the mare prepares to foal. The first milk—the colostrum—contains 4 to 8 times more antibody than the mare’s blood. In the absence of other diseases, foals of immunized mares are perfectly healthy when born. They remain healthy until they suckle the first milk. Antibody from the colostrum is absorbed from the intestine into the foal’s blood stream, where it attacks and destroys the red cells. Hemoglobin from damaged red blood cells is converted by the liver into bile pigments, which bring about jaundice.

The foal’s movement becomes sluggish soon after it sucks the colostrum. It nurses infrequently, spends much time lying down, becomes progressively weaker, and may be prostrate within 16 to 24 hours after birth. The membranes of its lips, mouth, and eyes become pale. The heart rate and respirations are rapid. The body temperatures are normal or subnormal. Jaundice often appears within 30 to 40 hours and progressively becomes more severe for several days. The urine may be stained with blood pigments in the early stages of very acute cases. Later the urine becomes deep yellow.

The severity of hemolytic disease varies with the amount and antibody potency of the colostrum suckled by the foal. Many foals develop critical anemia and die in 16 to 30 hours. In others, 2 to 5 days are required for red cells to reach the lowest levels. Death may occur 1 to 9 days after birth, but most fatalities occur on the third or
fourth days. Mildly and moderately affected foals often show no ill effects except lack of normal vigor.

Hemolytic disease should be suspected when severe anemia and jaundice develop during the first week after birth. Laboratory tests are necessary for confirming the diagnosis and estimating the need for treatment.

The mare's serum and colostrum agglutinate horse cells of the same type as her foal. Blood cells from an affected foal do not react satisfactorily with the mare's serum.

Agglutination (clumping) of the foal's cells in the antiglobulin sensitization test is proof of hemolytic disease. The test employs an antisera for horse globulin and washed red cells from the affected foal.

Hemolytic disease may be confused with bacterial infections of newborn foals. Anemia and jaundice are absent or slight in bacterial infections, and the agglutination tests are negative.

Management and treatment of the sick foal varies with the time the disease is discovered. Usually the foal has removed all of the colostrum from the mare in 8 to 24 hours. Unless laboratory tests are available, the affected foal should not be muzzled to prevent nursing.

Blood counts indicate the need for blood transfusion, which is the only successful treatment. Blood transfusion is not necessary if the foal's red cell count is 6 million or higher. Foals with red cell counts between 4 million and 6 million will survive without treatment, but blood transfusion speeds recovery. The cell counts between 3 million and 4 million are critical. When the cell count falls below 3 million, death may be expected.

The blood donor must be selected carefully to obtain red cells that are compatible with the antibody in the mare's serum. Acutely affected foals must not be transfused with cells that agglutinate in its dam's serum, because that intensifies the disease. Transfusion with the mother's blood is likely to kill the foal.

Severely affected cases need an exsanguination transfusion, in which blood volumes of 1 pint are alternately injected into and withdrawn from the foal. The amount of blood transfused should raise the red cell count to approximately 7 million. That usually requires injection of 6 to 7 quarts of compatible blood and removal of 5 to 6 quarts from the foal.

The response to blood transfusion is rapid. Prostrate foals may be up nursing the mare in 20 minutes after a transfusion is completed. Foals with hemolytic disease of moderate severity often respond satisfactorily to transfusion of 2 or 3 pints of blood.

The disease can be prevented after a mare is known to have jaundiced foals. Two methods may be used.

The mare's serum may be tested with blood of stallions to select a compatible sire for future foals. Hemolytic disease will not develop in a foal with red cells that are compatible with the antibody in the mare's serum.

If a compatible stallion cannot be found, it is necessary to watch for foaling and muzzle the foal before it nurses. The antibody-laden colostrum is removed by hand milking the mare for 24 hours, after which it is usually safe for the foal to nurse. While the mare is being milked by hand, the foal should be fed milk from another mare or a dehydrated formula as used for babies. One tablespoonful of dehydrated formula is mixed with 2 ounces of water. The foal is fed 4 to 6 ounces every 5 or 6 hours.

This practice should be followed for all foals from immunized mares unless laboratory testing is available. Some foals inherit the blood type of the mare and will not develop jaundice even if they suck the colostrum. When these foals are identified by laboratory tests, milking the mare is not necessary.

Foals that are muzzled and withheld from nursing do not receive the natural protective and laxative properties of colostrum. Without the protective colostrum, the foals are quite
susceptible to intestinal disturbances and bacterial infections. Careful attention must be given to regulation of the bowels, and antibiotic drugs should be administered as directed by a veterinarian for 3 or 4 days to prevent bacterial infections.

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Equine Infectious Anemia

C. D. Stein

INFECTIOUS anemia is known also as swamp fever, malarial fever, slow fever, and mountain fever. It affects horses, mules, and donkeys. Its prevalence in the United States has been declining with the substitution of motorized equipment for horse power in industry, agriculture, and the Army, but it is still of grave concern to the world over to the establishments that handle large numbers of horses.

Infectious anemia is most prevalent in poorly drained, low-lying sections, but it has been found in wooded sections and marshy pastures at high altitudes. It also appears to be more prevalent when biting insects are most numerous and in wet years more than in dry seasons.

The active form of the disease appears in May or June, reaches its height in midsummer, and usually declines late in the fall. Chronic cases may be seen in the winter.

Outbreaks in the United States have been chiefly sporadic—isolated cases confined to small areas and showing little tendency to spread. Small outbreaks have been reported from time to time in parts of Idaho, Oregon, Nevada, Montana, Mississippi, Wyoming, Louisiana, and Texas.

A number of severe outbreaks have occurred at establishments where large numbers of horses are assembled, and maintained, such as Army posts, breeding farms, dude ranches, and biological institutions. A serious outbreak occurred in 1947 in a large group of Thoroughbred race horses in New England, but it was promptly controlled by destroying affected animals and applying strict sanitation.

A chronic form, formerly prevalent among mules on large cotton plantations in the Mississippi Delta, has abated because tractors have replaced many mules.

The cause is a filterable virus—which under natural conditions appears to affect only horses, mules, and donkeys. The virus may persist in an infected animal for years. It is apparently present in the blood and body tissues of affected animals at all times and may be eliminated with some of the secretions or excretions, such as the milk, semen, saliva, eye and nasal secretions, urine, and manure.

The exact nature of the virus remains a matter of discussion. It has not been cultivated in vitro (outside the animal body) and cannot reproduce itself consistently in other animals.

Experiments by investigators in the Department of Agriculture with strains of virus from different areas indicated that it varies greatly in virulence. Among the factors that apparently influence the virulence are the suscep-