given light exercise after the temperature returns to normal. Exercise is important for reducing and preventing swelling of the legs.

Affected horses should not be returned to work until a normal physiological state is established. In mildly and moderately affected horses with uncomplicated recovery, a good rule would be 3 weeks after the temperature has returned to normal. Severely affected horses and those that develop complications may need more time.

Medicinal treatment should be prescribed by a veterinarian. Early treatment, at the first appearance of fever, may include the use of one or several antibacterial drugs to prevent development of complicating bacterial infections. Often no other treatment is necessary. Severe cases may require medication for regulating the bowels. Cardiac and respiratory stimulants may be necessary. Prostrate animals require artificial feeding and administration of fluids, salts, and nutrients intravenously.

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Breeding Problems
E. R. DOLL

DIFFICULTIES in reproduction are a major problem in raising work stock and pleasure horses. They include any cause of infertility or sterility of mares or stallions, breeding practices, abortions, foaling difficulties, and some diseases of foals.

General good health of breeding animals is important.

Brood mares must have adequate housing, balanced nutrition, regular exercise, and proper attention for the control of parasites and infectious diseases. About 50 percent of mares that are bred under ordinary circumstances without consideration of these principles have healthy foals. On specialized breeding farms where each animal receives careful attention, 60 to 80 percent of the mares bred produce healthy foals.

Breeding efficiency is improved when mares are bred in accordance with their natural breeding habits. Wild horses usually breed during the spring months. Conception rates are higher late in the spring after mares have grazed new grass, have shed their winter hair, and are gaining weight.

The animal's sexual behavior, activity of the genital organs, maintenance of pregnancy, and mating are regulated by hormones secreted mainly by the pituitary gland, ovary, and testicle.

Abnormal secretion of the sex hormones may result in sterility or reduced fertility in either sex. In the male it may be manifested by impotency or temporary or permanent sterility. The impotent animal has no sexual desire or activity. The infertile or sterile animal is active sexually but is unable to reproduce. Effects on the female may be irregular sexual rhythm, failure to conceive, abortion, or complete cessation of sexual activity.
The egg usually is expelled from the ovary and passes to the uterus about 24 to 48 hours before the end of the heat period. Spermatozoa—the sperms—live 12 to 48 hours in the mare's genital tract. It is desirable, therefore, to breed 1 or 2 days before the mare goes out of heat. The length of the heat period of the mare usually is 18 to 21 days. Most mares are in heat 2 to 5 days. Mares tend to have uniform estrual cycles. If records are kept on the length of the heat periods of individual mares, the proper time for breeding is easily determined. Conception rates are higher for mares bred on the last day of the heat period. If the stallion breeds only 12 to 15 mares, mares may be bred every other day through the heat period with good conception rates.

Improvement of the conception rate results from having sperm available for fertilization at the time of ovulation. A stallion usually is permitted to breed 35 to 40 mares each breeding season and to serve a mare only once at each heat period. Excessive use of a stallion reduces his fertility and results in lowered conception rates.

Some mares have irregular heat periods that vary in length from 2 to 30 days. Others come in heat, but an egg is not produced by the ovary. Some have regular sexual cycles but do not show heat. Frequent examination of the genital tract of mares that have quiet or irregular heat periods enables the veterinarian to determine the correct time for breeding and will spare services of valuable stallions on mares that do not ovulate.

Hygienic practices during breeding and foaling and systematic veterinary examination of mares are largely responsible for the success of specialized horse breeding farms.

Barren and maiden mares should have veterinary examination during the fall to determine their soundness for breeding. Early detection of abnormalities permits adequate time for treatment and recovery of the mare before breeding the following spring.

The examination consists of thorough cleansing of the hind parts of the mare and inspection with a speculum of the vagina and cervix for infection or abnormalities. Infection is indicated by inflammation and abnormal secretions. If infection is present, a bacteriological culture is made to identify the infecting organism. Also, a manual examination of the ovaries and uterus is made by palpation through the walls of the rectum to determine if there are abnormalities that would prevent conception or response to treatment.

Infected mares may be given medicinal treatment appropriate for correcting specific infection. If necessary, the upper part of the vulva may be closed by surgical operation. Surgical closure of the vulva is the most effective single procedure for correcting uterine infections.

Similar examination should be made of the genital organs of foaling mares. Their genital organs usually return to normal within 7 days, and they come in heat 7 to 12 days after foaling. Examination of the genital tract should be made on the seventh or eighth day. Mares should not be bred at this heat period if the placenta was retained more than 3 hours; if any lacerations have not entirely healed; if severe bruises of the cervix, vagina, or vulva occurred; if purulent secretion or urine is found in the vagina; if the vagina or cervix are discolored or congested; or if the vagina or uterus lacks normal tone.

Some mares with young foals will not manifest heat. They must be examined with the speculum every 2 or 3 days, starting about 25 days after foaling, to detect heat and ovulation. Many horsemen prefer not to breed on the foaling heat but to wait for the second heat period. This practice lessens the risk of future troubles, such as genital infections, abortions, and diseased foals.

The placenta, or fetal membranes, normally are expelled in entirety within 2 hours after the foal is born.
The membranes should be inspected by a veterinarian to determine if all parts come out. Retention of a part or all of the placenta for longer periods indicates abnormalities.

Systematic hygienic practices should be employed in the breeding shed. Mares showing signs of infected genital organs should not be admitted for service.

In preparation for breeding, the external genitalia of the mare are washed with soap and water. The lips of the vulva are swabbed clean with cotton moistened in a mild antiseptic and rinsed with water. The tail is wrapped with a clean bandage. The mare should be restrained properly to prevent accidents or injury to attendants or the stallion. Breeding hobbles, a neck guard for the mare, and a nose twitch usually are enough. Owners of valuable animals usually do not use breeding stocks.

Before service, the penis of the stallion is washed with soapy water, swabbed with an antiseptic solution, and rinsed with clean water. The stallion is cleaned again after service.

Mares that have sutured vulvas must be protected from tears during breeding. This is done by use of a surgical stitch through the vulva at the lower margin of the repaired portion and use of a breeding roll, which restricts the depth of insertion of the stallion’s penis.

Many breeders have the stallion’s semen examined following each service to determine viability or abnormalities of the sperm and the presence of pus cells. A stallion having pus cells in the semen, indicating inflammation or infection of the genital organs, should be withheld from service.

When artificial insemination is practiced, semen is collected with an artificial vagina or in a breeder’s bag. Semen from one ejaculate may be divided for insemination of 4 to 8 mares. This practice may prevent spread of some genital diseases, but may also result in genital infection unless conducted with scrupulous cleanliness.

A veterinarian can diagnose pregnancy by rectal examination 40 to 45 days after breeding. Pregnancy also may be determined 42 to 120 days after breeding by injecting mare’s blood serum into laboratory animals or by chemical tests on mare’s urine. Early examination for pregnancy is most valuable for detecting mares that did not become pregnant, so that measures can be taken to continue breeding or correct causes of their failures to conceive. Most specialized breeding establishments prefer to have pregnancy diagnosis made by manual examination, as reasons for failure to conceive may be determined at the same time.

About 50 percent of abortions in mares result from bacterial and viral infections. The cause of about 40 percent of abortions is unknown. A few are caused by injuries.

It is estimated that one-third of mares that become pregnant abort or have a weak or diseased foal when husbandry practices are no better than average. Properly managed breeding establishments have few such losses.

Streptococci alone cause nearly 20 percent of all abortions. Abortions from this infection are frequent in early pregnancy, but may occur at any stage of gestation. Some foals are born with streptococcic infection that was acquired before birth.

Diagnosis of streptococcic abortion is made by bacteriological examination of the aborted fetus, of the fetal membranes, or of the genital tract of the mare after abortion.

Abortion often results from infection of the uterus and fetal membranes without invasion of the fetus by the streptococci.

Mares become infected with streptococci after foaling or during mating or when a poor conformation of the genital organs permits air or feces to enter the genital tract. Difficult foaling, injury of the genital tract during foaling, and retained placenta predispose to infection.

Stallions rarely transmit the disease
Breeding Problems

except mechanically from infected mares.

Streptococcic abortion cannot be avoided by vaccination or medicinal treatment of pregnant mares.

Many losses can be prevented by breeding only noninfected mares and stallions and using hygienic precautions during breeding.

Examination of the mare’s genital tract before breeding is essential. Bacterial cultures should be made from the cervix or uterus of any mares that show abnormalities. It is best to take cultures during a heat period. For foaling mares, the examination should be made on the seventh or eighth day. Medicinal douches and instillation of antibacterial drugs into the uterus may eliminate the infection.

Surgical closure of the upper part of the vulva is the most dependable corrective procedure. Strict sanitary precautions at foaling time and avoiding nonprofessional manipulation of the genital tract will do much to prevent infection. Ninth-day breeding should be avoided.

CONTAGIOUS equine abortion is caused by the bacterium Salmonella abortio-equinus. Abortions caused by this organism may occur at any stage of pregnancy, but usually they happen from the fourth to eighth month. Mares get the infection by ingesting the infectious organism on pasture or with feed or water. Mares may show signs of generalized illness preceding or following abortion.

Diagnosis may be made by cultural examination of the aborted fetus, the fetal membranes, and the genital tract of the mare and by testing the mare’s blood for specific agglutinins about 2 weeks after abortion.

Vaginal discharges, dead fetuses, and fetal membranes should be buried deeply or burned. Stalls and equipment in contact with a mare that aborts should be cleaned and disinfected. Aborting mares should be kept isolated and not bred until the genital tract is free of the infection.

The disease may be effectively controlled by eliminating reacting mares and stallions and systematic vaccination of pregnant mares with a specific bacterin.

OTHER infectious micro-organisms cause fewer than 3 percent of known abortions.

Shigella equirulis, an organism causing septicémie infection of newborn foals, sometimes invades the uterus and causes abortion.

Escherichia coli, an enteric organism, occasionally causes uterine infection and abortion.

Staphylococci, the common wound infection organism, and Corynebacterium equi, which causes pneumonia of foals, also cause uterine infection and abortion.

Organisms less frequently found are Pseudomonas aeruginosa, Klebsiella genitalium, and flavobacteria.

Specific diagnosis can be made only by bacteriological examination of the fetus. Some of these micro-organisms cause serious infection of the genital tract and prolonged or permanent sterility.

ABORTION may result from certain drugs, including cathartics and worm repellents, and from eating poisonous plants, chemicals, and moldy or spoiled feeds. Severe illness from infectious diseases, with high fever, an attack of colic, or extensive suppurative wound infection, may cause abortion.

Twin pregnancy in the normally uniparous mare is pathological and nearly always results in abortion.

Twisted navel cords impair blood circulation in the membranes and nutrition of the fetus, with consequent abortion.

Malformations may be incompatible with development of the fetus and cause its death and abortion. Faulty attachment of the placenta causes undernourishment, death, and abortion of the fetus.

Other causes of abortion are genetic factors, hormone imbalances, kicks or
blows over the abdomen, and severe exertion, fatigue, and exposure.

Pregnant mares should have light work each day or freedom for exercise in a pasture.

In areas where horses are raised extensively, about 40 percent of abortions result from unknown causes. These abortions are sporadic, noninfectious, and noncontagious. Usually they do not interfere with subsequent breeding and foaling.

**Viral abortion** was identified originally as a disease of the equine fetus. Later research disclosed that the virus causes a fever and mild respiratory catarrh of horses. Infection and abortion of the fetus is a phase of the disease in pregnant mares.

Viral abortions occur from the 5th through the 11th month of gestation. Relatively few abortions occur from the 5th through the 7th month.

Then about 14 percent of abortions occur in the 8th month, 33 percent each in the 9th and 10th months, and 15 percent in the 11th month of gestation. Viral abortions occur from September through May. They are most frequent from December through April, when 94 percent of outbreaks and 95 percent of abortions occur. The number of abortions per farm usually varies from 1 to 3, but on some farms 25 to 90 percent of pregnant mares abort.

Affected mares usually show no signs of impending abortion or ill health. They have no history of recent illness. Expulsion of the fetus comes about and progresses rapidly. The membranes usually are expelled with the fetus or soon thereafter. The mares usually suffer no ill effect from the abortion. The genital tract returns to normal as readily as after normal foaling, and they breed equally as well as after normal foaling.

Mares that abort from viral infection may experience any accident or complication associated with foaling or a stillbirth from other causes. These include tears, bruises, or lacerations, retention of the membranes, abnormal position of the fetus, and prolapse of the uterus. These incidents are no more frequent in viral abortion than in abortion from other causes.

The incubation period—the time from exposure until abortion—varies from 20 to 90 days. An outbreak usually runs its course within 60 days after the first abortion.

Occasionally foals are born alive at full term with infection that was acquired before birth. Such foals live a few hours to several days. Signs are severe weakness and depression, difficult and rapid breathing, rapid heart rate, and foamy nasal discharge. Complications, particularly infection by streptococci and *Shigella equi*, are frequent.

The fetal carcass reveals hemorrhages on the surfaces of the oral cavity, nasal passages, pharynx, larynx, trachea, esophagus, stomach, intestines, and the internal surfaces of the chest and abdomen.

Diagnostic findings are excessive fluid in the chest cavity, severe edema of the lungs, and focal necrosis of the liver. The fluid in the chest cavity is relatively clear and serous-like, and is present in quantities from a slight excess to 2 quarts or more. The lungs are pale, firm to the touch, and heavy. The interlobular spaces are widely separated by the edema. Liver lesions are present in 50 to 75 percent of infected fetuses and consist of tiny foci of necrosis that are gray or white in color and depressed below the liver surface. Lung lesions are present more regularly than liver lesions.

Laboratory diagnosis is made from gross lesions, by exclusion of bacterial infection, and by the presence of intranuclear inclusion bodies in tissue sections. Lung, liver, and spleen are the most suitable tissues for microscopic detection of inclusion bodies.

The intranuclear inclusions are found in the bronchial epithelium and alveolar cells of the lungs, in the hepatic cells, and in the reticuloendothelial cells of the spleen.
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 10° 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.