Venereal Diseases

Infectious diseases can affect the reproductive system in the following main ways:

● Impaired sperm survival or transport in the female tract, leading to reduced fertilization rate.

● Direct effects upon the embryo. This includes infections that result in early embryonic death, and those that infect the more advanced fetus or its placenta, resulting in abortion, stillbirths or the birth of weak calves.

● Indirect effects upon embryo survival. This includes infections that have adverse effects upon uterine function and those that infect the maternal component of the placenta. Again, these result in embryonic death, fetal death with abortion, mummification or stillbirth.

● Systemic illness causing fetal losses (e.g. pyrexia-induced abortion) or a direct impairment of reproductive cyclicity.

BACTERIAL AGENTS

Genital campylobacteriosis

Infection due to *Campylobacter fetus* (formerly *Vibrio foetus*) has long been recognized as a cause of abortion in sheep and cattle.

Clinical signs and course of disease

The bull normally carries the infection for life without any interference with its reproductive behavior or seminal qualities. The organism is confined to the glans penis, prepuce and distal urethra. Thus, the bull acts simply as a mechanical carrier and transmits the infection at service to the female. The sites of infection in the cow are the vagina, cervix, uterus and uterine tubes. Later abortion occurs between 4 and 7 months. Embryonic deaths may occur before the maternal recognition of pregnancy, in which case return to oestrus occurs 3 weeks after service. Embryonic deaths occurring after recognition of pregnancy result in later, irregular return to estrus, often between 25 and 35 days after service. Placental lesions are very similar to, although less severe than, those caused by *Brucella abortus*.

Diagnosis

A variety of diagnostic tests can be used to diagnose *C. fetus* infection. These are:

● identification of the organism in preputial Washings direct smears, culture and fluorescent antibody tests

● serological tests

● vaginal mucus agglutination.

Preputial washings or scrapings of the penile or preputial mucosa can be examined. Material can be examined using direct culture or fluorescent antibody techniques. Tissues from an aborted fetus (lung, spleen, liver) and abomasal fluid; thus in investigating a herd it is important to ensure that all non-pregnant cows that were first exposed to service more than 60 days previously should be sampled.

Treatment and control

Control is based on three epidemiological facts:

● Transmission is venereal.

● Bulls remain permanently infected.

● Infected cows overcome the infection, or become immune, in a period of 3–6 months from service.

Thus, a ‘self-cure’ of the cows will occur if natural service by infected bulls is replaced by artificial insemination. As *C. fetus* is sensitive to streptomycin this antibiotic has been used to treat the disease in bulls. Dihydrostreptomycin, at a dose rate of 22 mg/kg subcutaneously. An oily suspension of procaine penicillin and streptomycin for intrapreputial infusion was used to treat or prophylaxis of campylobacteriosis in bulls. Combination of neomycin and erythromycin, in a waxy base, is effective in eliminating *C. fetus*

from bulls in which streptomycin has been ineffective. Using oil adjuvant bacterins with high cell counts of immunogenic strains of *C. fetus venerealis*. Vaccination should preferably be carried out 30–90 days before breeding commences and, since the immunity wanes annually, revaccination is recommended for optimum protection as close to the time of service as possible.

Brucellosis (contagious abortion)

Brucellosis in cattle is most commonly caused by *Brucella abortus. Brucella melitensis*, which occurs in sheep and goats, can also be transmitted to cattle. *Brucella* causes abortion in the second half of pregnancy, together with metritis and retained fetal membranes (RFM). In bulls, it can cause orchitis, epididymitis, seminal vesiculitis or infection of the ampullae.

Epidemiology

Cattle can become infected by ingesting *B. abortus* from contaminated pasture, food or water. Infection may occur by licking an aborted fetus. It may even occur through the teat by infected milk of another cow, or through the vagina by infected semen. The fetus is aborted 48–72 hours after death. The fetal membranes are very frequently retained. The completion of uterine involution.

Clinical signs

Due to abortion in the second half of gestation, earlier abortions occur at the beginning of an outbreak. In addition, some calves will be born alive but they will be weak and unthrifty. RFM is more common in cows. Such animals show delayed involution of the uterus, and are prone to secondary bacterial invasion with resultant puerperal metritis.

Diagnosis

The organism can be identified in stained smears prepared from suspected contaminated material. Special staining techniques using a modified Koster and Ziehl-Nielson method are quite successful. A more specific method of direct identification is a fluorescent antibody technique, which enables differentiation from other infectious diseases such as Q fever. *B. abortus* can be cultured from the fetal stomach of an abortus, or from fresh afterbirth, or uterine exudates. Because culture of the organism is time-consuming and expensive, alternative methods of identification have been devised. A colony blot ELISA using monoclonal antibodies provides a rapid, inexpensive and reliable method of identifying *B. abortus*. Numerous serological tests have been used to diagnose brucellosis, using a wide range of biological materials such as milk, whey, serum, vaginal mucus and semen. These have then been subjected to agglutination test, complement fixation test, antiglobulin test, fluorescent antibody test and immunodiffusion or electroimmunodiffusion tests. The rose Bengal plate test was introduced as the main initial screening test of serum samples in the brucellosis eradication scheme. The milk ring test, which detects *Brucella* antibodies in milk, is very useful in screening the presence of brucellosis in herds by collecting bulk milk samples or in individual animals.

Control

Brucellosis is not only a cause of abortion in cattle, but it also causes a serious disease, undulant fever, in man.

Vaccination. S19 vaccine typically vaccination occurs at some time between 2 and 10 months of age. Cows should be revaccinated after their first calving.

Eradication. Eradication can be undertaken by testing and slaughter of seropositive animals.

Leptospirosis

Leptospirosis is an important zoonotic disease of cattle and other mammals which is caused by pathogenic spirochaetes of the species *Leptospira interrogans*. Causing fetal death, abortion, stillbirth and

weakly live calves. The spirochaete was isolated from the vagina in 21.7%, the ovary and tubular genital tract in 57% and the urinary system in 62% of the animals.

Clinical syndromes

Transmitted in semen after natural service or AI. The organisms localize in tissues that are inaccessible to antibodies, notably the kidney tubules, cotyledons and fetus. Leptospires can be present in puerperal discharges for up to 8 days, and can persist in the pregnant and non-pregnant uterus for up to 142 and 97 days after infection, respectively. The demonstrate leptospires subgroup *sejroe* in the genital tracts of bulls, vesicular glands, as well as the urinary system.

- An acute febrile disease, characterized by temperatures of 40C° or more, deaths may occur, especially in calves, and there may be abortions.
- A less acute type of disease where there is no pyrexia; abortion, stillbirth or the birth of weakly calves. Abortion can occur at all stages of gestation from the fourth month to term; it is most common after 6 months. Leptospiral mastitis or the 'flabby bag' milk-drop syndrome.
- Leptospiral mastitis and milk-drop syndrome. Infection causes a bacteraemia with or without a concurrent pyrexia. There is a precipitous fall in milk yield.

Diagnosis

Diagnosis of leptospirosis as a cause of abortion is based almost entirely upon demonstrating specific antibodies in fetal sera or by demonstrating leptospires in fetal organs, particularly lungs, kidneys and adrenal glands, by culture or immunofluorescence. The MAT is used extensively in the diagnosis of leptospirosis, using serum from animals that have aborted or are suspected of being infected.

Treatment and control

There are two methods of specific treatment and control: the use of a vaccine or parenteral streptomycin/dihydrostreptomycin, or a combination of both. The antibiotic should be used at a dose rate of 25 mg/kg by intramuscular injection with no greater a volume than 20 ml at any one site. Vaccination of all members of the herd should be done annually.

Haemophilus somnus

Haemophilus somnus organism has been isolated from 28% of normal cows and 90% of normal bulls. It causes abortion, endometritis, vaginitis and cervicitis. Organisms responsible for granular vulvovaginitis. The bull cause testicular degeneration or even frank orchitis. *H. somnus* also causes bovine epididymitis. Diagnosis can be made following culture of the organism. Serological tests are currently unreliable. Penicillin and streptomycin have been reported to have been used successfully in treating cows where Since the organism colonizes the genital tract of the bull and can be isolated from semen,. Good hygiene and the use of combinations of antibiotics should control infection following artificial insemination.

MYCOPLASMA, UREAPLASMA AND ACHOLEPLASMA INFECTIONS

Mycoplasma

Mycoplasma bovigenitalium was demonstrated in the genital tract of infertile cows and the semen of bulls. The organism may also cause granular vulvovaginitis. It has been suggested that the prepuce and urethral orifice are the primary locations of the organism, but it has also been recovered from virtually every part of the male tract. It has been isolated from 15 to 32% of semen samples. It has been implicated as a cause of seminal vesiculitis, as it both is isolated frequently from clinical cases and can infect the vesicular glands after experimental inoculation. When it infects the testes or epididymides, *M.bovigenitalium* may cause detrimental changes to semen quality, especially after cryopreservation. *M. bovis* has been shown to cause abortion in both natural and experimental infections. Isolation of the organism from the placenta or

aborted fetus can be considered significant. *M. bovis* is found in bovine semen less often than *M. bovigenitalium* and its pathogenicity.

Ureaplasma diversum

Ureaplasma diversum is a common inhabitant of the genital tract of the cow. It persists only briefly in the uterus and uterine tubes, but is most commonly found in the vagina and vestibule. *U. diversum* can also produce endometritis and salpingitis. These lesions have been associated with high levels of embryonic death and returns to oestrus, which are accompanied by a mucopurulent vaginal discharge. Abortions may also occur. *U. diversum* can infect the penis and prepuce of the bull.

Acholeplasma

Three species of *Acholeplasma* have been isolated from cattle: *A. modicum, A. laidlawii* and *A. axanthum*. Cause pathological changes in the genital tract, isolated from aborted calves. It probably causes no pathological lesions of the bull.

Diagnosis

Most bovine mycoplasmas are easily recovered in conventional mycoplasma media, although some may require special supplements or conditions for optimum growth.

Treatment and control

Natural service, if used, should be suspended and semen should be collected and cultured for the presence of mycoplasmas. Infected bulls should be rested for 3 months and treated systemically for 5 days with tetracycline's. A combination of lincomycin, spectinomycin, tylosin and gentamycin added to raw semen. The uterus can be infused with a solution containing 1 g of tetracycline or spectinomycin 1 day after insemination, a treatment that has been shown to improve pregnancy rates.

PROTOZOAL AGENTS

Trichomoniasis

Trichomonas (Tritrichomonas) fetus infection as a cause of infertility.

Clinical signs

Trichomoniasis is a classic venereal disease that is transmitted to cows from asymptomatic carrier bulls during coitus.

The bull. about 50% of bulls become infected from one service of an infected cow. Bulls can remain infected for life, remaining asymptomatic throughout. The organism lives within the crypts and folds of the penile integument and preputial mucosa. Control of trichomoniasis through AI can only be achieved if the stud bulls are free of the disease, since trichomoniasis can also be spread from bull to bull via contaminated artificial vaginas.

The cow. In addition to natural service, cows can be infected via insemination with contaminated semen. Rarely, infection can occur following the use of contaminated instruments such as vaginal specula. In the cow, *T. fetus* colonizes the uterus, cervix and vagina, but it survives poorly on the vulva. Within the uterus, the organism produces a catarrhal endometritis and vaginitis, with oedema of vulva, perivaginal tissue and uterine wall. Causes embryonic death at an early stage of gestation. Many pregnancies fail at between 30 and 50 days of gestation. Embryonic death is not infrequently (up to 10% of cases) accompanied by the development of pyometra, in which the uterus is filled with enormous quantities of trichomonad-filled, thinnish pus. Vaginal discharge of this pus is common. Some abortions occur between the second and fourth months of gestation.

Diagnosis

Diagnostic samples. demonstrating the presence of trichomonads in uterine pus, vaginal discharges, cervical mucus or abortus material. The best source of material is the fetal membranes or the organs of an aborted fetus (especially the abomasum). In the bull, diagnosis is made by the collection of preputial scrapes or preputial washes. Vigorous scraping of the preputial mucosa. The bull should be allowed a period of 5–10 days of sexual rest before sampling so that the number of trichomonads can increase.

Demonstration of the organism. Various media can be used for culture, including:

- trypticase-yeast extract-maltose (TYM)
- Diamond's medium (TYM + 1% agar); for this method, an incubation period of up to 9 days is required
- In Pouch system. Organisms are visualized after culture.

immunohistochemistry and polymerase chain reaction. Agglutinating antibodies.

Treatment and control

Control can be attempted by:

- eliminating bulls and replacing natural service by AI
- 'active' management of groups of cows and use of bulls
- treatment and/or vaccination of cows and bulls.

Treatment. As a general principle, carrier bulls should be culled since. Iodine-based compounds, acriflavine and imidazoles have all been used. Systemic treatment was first attempted by used sodium iodide at a dosage of 5 g/45 kg body weight in 500 ml water, by intravenous injection on five occasions at 2-day intervals. More recently, treatment with imidazoles has been reported as both feasible and effective. Dimetridazole can be given orally (50 mg/kg per day for 5 days. Ipronidazole can be used. Cows with pyometra may be induced into estrus with prostaglandin F2α.

Vaccination. used killed trichomonads in a mineral oil adjuvant, which helped eliminate infection from bulls. Efficacy of trichomonas vaccines is estimated to be, at best, 60%.

VIRAL AGENTS

Bovine viral diarrhoea (BVD)

BVD was first recorded as a cause of abortion in cattle. The BVD virus is a *Pestivirus*. There are two main biotypes: a cytopathic and a non-cytopathic strain.

Transmission and pathogenesis

Infection with the non-cytopathic strain in utero between about days 30 and 125 of gestation leads to the birth of a calf that is persistently infected with the virus. Persistently infected animals shed the virus throughout life. The incidence of persistently infected calves (carriers) is about 1 per 100–1000 calves born. Persistently infected cows can transmit the disease vertically through transplacental infection to their calves. Infection of cows at other stages of pregnancy causes early embyronic death and abortion, with aborted fetuses exhibiting abnormalities of the central nervous and ocular systems.

Effects upon reproductive performance

Acute infection, with either biotype, can severely affect the embryo or fetus. During the first month of gestation, infection results in the death and resorption of a high proportion of embryos. Low pregnancy rates also result from the insemination of semen that is contaminated with BVD virus. From the second to the fourth month of gestation, infection may be followed by abortion, death with mummification, growth retardation, developmental abnormalities of the central nervous system and alopecia; some infected cows or heifers will carry calves to term, but these may well become persistently infected. From the fifth and sixth months of gestation, there can be abortion or the birth of calves with congenital abnormalities of the central nervous system and eyes. However, fetal infection can also be followed by the birth of normal premature live, stillborn or weakly calves, as well as those with congenital abnormalities.

Diagnosis

Some histological lesions are characteristic of the infection. The virus can be isolated from the fetus, particularly lymphoid tissue such as the spleen. Immunocytochemical identification of BVD viral proteins in fetal tissue, especially kidney, lung or lymphoid tissue, can sometimes be detected. In the case of live calves, serum must be obtained *before* colostrum is ingested.

Control

This can be expensive and may not be cost-effective if it requires extensive culling of persistently infected animals. Cross-infection can occur between cattle and sheep and goats, the species should be separated. Killed-virus vaccines can be used in pregnant cows.

Infectious bovine rhinotracheitis (IBR) virus

(bovine herpesvirus; BHV-1) the disease of the genital system has been variously called infectious pustular vulvovaginitis (IPV), vesicular venereal disease and coital vesicular exanthema. BHV-1 also causes abortion. BHV-1 infection is also associated with infertility in cows and heifers.

Pathogenesis and transmission

Occur via contaminated bedding and the mutual licking and sniffing of the vulva and perineum of infected and non-infected animals. Also, it can be transmitted by virus contaminated semen.

Clinical signs

Infectious pustular vulvovaginitis. Signs appear 24–48 hours after venereal transmission. The vulval labia become swollen and tender and. The quantity of vulval discharge is variable, ranging from small quantities of exudates. A speculum is useful to examine the vaginal mucosa but, because of the pain and discomfort, caudal epidural anesthesia is worthwhile.

Infertility. If semen infected with the virus was used for artificial insemination, there were reduced pregnancy rates, endometritis and shortened interoestrous intervals. When infected semen is deposited in the uterus it causes a severe, necrotizing endometritis, It can cause a bilateral necrotizing oophoritis. This damage to the developing corpus luteum may directly affect its function, perhaps resulting in lower than normal progesterone production. The virus can also directly cause embryonic death, by direct invasion of cells. The consequence is embryonic death.

Abortion. IBR virus is an important cause of bovine abortion. BHV-1 was responsible for 5.4% of abortion. Abortions occur from 4 months of gestation to term. Some calves are stillborn, and a few may be born alive. The time interval from infection to abortion varies from a few days to 100 days.

Epivag. 'Epivag' is a specific bovine venereal disease causing epididymitis and vaginitis in cattle. Most infected cows fail to conceive to service, but most eventually recover. About 15–25% of animals become sterile, due to the presence of lesions of the uterine tubes, such as adhesions, hydrosalpinx, and ovarian and bursal adhesions. Most bulls have a mild balanoposthitis after infection. Orchitis may occasionally occur.

Diagnosis

Paired serum samples are taken from the dam at the time of abortion and a second set of samples 2–4 weeks later. A significant rise in antibody titers is unlikely to be demonstrated. Fluorescent antibody tests, pieces of fetal tissue, particularly kidney and adrenal gland, should be taken together with a piece of placenta. Vaginal swabs, preputial washings and semen should be placed in virus transport medium.

Treatment and control

Spontaneous recovery of the genital lesions will occur and therefore treatment is not really necessary; however, the administration of emollient creams to the vulva, vagina and penis may be useful.

Vulval stenosis and penile/preputial adhesions and phimosis can occur during the healing phase. Vaccination is the most effective way of controlling the disease; a number of live, attenuated vaccines are available, often combined with a bovine parainfluenza virus vaccine. Heifers should be vaccinated after 6 months of age and before their first service; thereafter, annual vaccination is preferable. Pregnant animals should only be vaccinated with a killed vaccine. Both the intranasal and intramuscular routes can be used. Routine examination of semen for the presence of the virus is preferable as a method of control.

Other viral causes

Catarrhal vaginocavititis

From the enteric cytopathic bovine orphan (ECBO) group.

Clinical signs. Affected animals have a profuse, postcoital, non-odorous, yellow, mucoid vulval discharge. The typical yellow gelatinous exudates frequently accumulates in the vagina, pregnancy rates are reduced and there are prolonged, irregular returns to estrus, presumably due to late embryonic death. In some herds, fetal mummification, abortion and stillbirth have been reported as being a problem. The penis and prepuce do not show the lesions that occur following BHV-1 infection.

Diagnosis. The most reliable method of diagnosis is serological examination of paired blood samples, collected at least 15 days apart, for evidence of rising antibody titers. The virus can be isolated from vaginal mucus, but the recovery rate is frequently low.

Transmission and pathogenesis. Although the disease is transmitted venereally, it can also be spread by faecal contamination of the vulva.

Treatment and control. There is no specific treatment or vaccine. Infected bulls should not be used for service for several months, serological examination of potential additions to the herd might be contemplated.

Transmissible genital fibropapillomas

Wart-like tumors commonly occur on the penis of young bulls, and occasionally similar growths occur on the vulva, perineum and vestibulovaginal epithelium of heifers. These fibropapillomata regress spontaneously in 2–6 months; the speed of regression may be expedited by the use of a wart vaccine. Except in so far as the larger tumors (which may be removed surgically) might interfere mechanically with coitus, they do not cause infertility in female animals.

MYCOTIC ABORTION

CHLAMYDIAL AGENTS: BOVINE CHLAMYDIAL ABORTION

C. psittaci is a pathogen of both the male and female bovine genital tract. In the bull it affects the testes, epididymides and other accessory glands. It causes orchitis, possibly in association with *Mycoplasma* species. vesicular glands, been isolated from bulls that were clinically normal. Chlamydial infection also affects fertility in the cow. If contaminated semen is used then, embryonic death either due to a direct effect upon the embryo or, more likely, via its effect upon the endometrium. *C. psittaci* also causes abortion. Characteristically, abortion occurs at 7–9 months of gestation without any other clinical signs. Giemsa-stained smears for the identification of elementary bodies or inclusions are also useful. Serological tests such as the CFT have been used but are generally too insensitive. It is likely that the ELISA tests, used to detect the infection in sheep, will be developed for use in cattle. Tetracycline's could be used to treat pregnant cows that have been exposed to infection. Pregnant animals should be segregated from potential sources of infection. Vaccines are available for use in sheep but none has yet been developed for use in cattle. Following abortion there should be a natural immunity.