Reproductive aspects of sexually transmissible diseases

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Pathogens gaining access to semen along with secretions from testis, accessory sex glands, penile mucosa, urethra or contaminants from prepuce, unsterilized instruments used in artificial insemination technique enter in female reproductive tract at the time of natural service or artificial insemination. Thus the spread of disease occurs from infected male to umpteen healthy females. In natural service, infected cows may spread the infectious pathogens present in cervical passage, vagina portion, vestibular area or perivulval region to healthy bulls. Thus, spread of the disease occurs from infected female to healthy male. Both these routes are considered for venereal spread of infection and the diseases transmissible by these routes are called as sexually transmissible diseases.

Many bacterial, viral, protozoal and mycotic infections spread in breedable animals from infected ones to healthy by venereal route. These infections may cause epidemics in diary animals. Losses caused by these diseases are severe and storm of abortions are possible in organized dairy sector with spread of these diseases. There are major seventeen diseases identified as sexually transmissible disease in animals. However, most frequently recurring diseases, which need rigid control for effective breeding programme, are discussed in this article.

Artificial insemination is an improved method of breeding in dairy animals and is being followed all over the world. The bio-technique is double-edged sword as on one side it totally prevents spread of infections and the same technique may violently spread the infections, if followed in an irresponsible, negligent, ignorant manner by trained inseminators

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or practiced by incompetents. The technique needs genetically superior semen, highly fertile spermatozoa and disease free medium with strict hygienic care as basic prerequisites.

Spread of specific Infections through artificial insemination or natural service leads to failure of conception, repeat breeding, embryonic death, abortion, placental retention. Loss of milk and calf, post partum infertility and spread of infection. It is impossible to treat affected animals with costly treatment for prolonged periods, which may prove risky in affected animals. New purchases are also risky as there is possibility of entry of some other infections with new comers in the herd.

Major economic loss occurs in dairy animals due to abortions caused by sexually transmissible diseases. Abortion may occur by nonspecific (accidental) causes in isolated cases but specific (infectious) causes are responsible for abortions in more number of animals within short specific period. Generally, overall abortion incidence indicate 55 – 65 per cent bacterial causes, 20 – 25 per cent fungal causes, 15 – 20 per cent viral causes, 05 – 10 per cent protozoal causes and Less than 05 per cent accidental causes.

Important infectious causes of abortions are Brucellosis, Campylobacteriosis, Leptospirosis, Listeriosis, Tuberculosis under bacterial category, Trichomoniosis, Toxoplasmosis, Anaplasmosis under protozoal category, Aspergillums, Penicillium, Mucor, Yeast agents of fungal category and Foot-mouth disease, Infectious Bovine Rhinotreachitis, Epizootic Bovine Abortion caused by viral pathogens.

It is always necessary to investigate each case of abortion to pinpoint exact cause. Laboratory diagnosis is essential in each aborted case. Following steps are important while attending abortion cases.

- Attend the case within 6 to 8 hours and record detail history
- Carry half a dozen sterilized vials without preservatives for sample collections
- Collect pieces of placenta with cotyledons
- Collect whole blood of aborted animal
- Perform post mortem of aborted foetus and record the findings
- Collect foetal heart blood, abomasal contents
- Collect pieces of foetal spleen, lung and liver
- Send the vials carrying samples to the lab on ice at the earliest
- Collect convalescent phase serum samples after three weeks of abortion

Effects of sexually transmissible diseases on reproductive aspects are important as the pathogens may get transferred not only to the breedable partners but also occasionally to the newborns. These diseases are also responsible for low breeding efficiency in infected animals. Reproductive problems evident in venereal diseases cause unpredictable losses due to disturbances in planned breeding policy. Clinically important diseases and their reproductive affections are as under.

**Brucellosis**

Brucellosis is a genitourinary infection of animals. The disease is also known as Contagious Bovine Abortion, Malta fever and Bangs disease.

The disease is caused by intracellular, gram negative, non-motile, aerobic *Brucella* organisms. Bernard Bang isolated the positive organisms for the first time in 1887. There are 8 biotypes of Brucella infectious organisms in cattle. All the biotypes carry same antigenecity or pathogenicity, however the identification of biotype is important in epidemiological studies.

Organisms can survive for 60 days in soil but they never form capsulation or spores. The organisms can be very easily killed by direct sunlight, drying, putrefaction, pasteurization or by disinfectants. Transmission of the infection through natural service may not infect the female but intrauterine inseminations may lead to infections in female. Incubation period is variable in Brucellosis and is inversely proportional to the stage of gestation.

On localization of infection in testis, the organisms are continuously spread through semen. Affected bull exhibits pain on palpation of scrotum and seminal vesicles. Semen carries pus cells. Unilateral orchitis is seen bulls and bulls are more resistant to infection than cows. The
semen and libido is not affected in males and bulls may show serologically negative test. Mastitis, hygroma and orchitis are also observed in infected animals.

On entry of the organisms in healthy animals, bacteria normally reach towards nearest lymphnode. In females organisms occupy udder and supra-mammary lymph nodes, which is the site of permanent settlement of infection.

Ulcerative endometritis is characteristic in Brucellosis, which extends to cotyledons and chorionic villi. Erythritol (4-C, polyhydric alcohol) is responsible for spread of infection during pregnancy. The effects of endotoxin produced by the bactrins leads to interruption of foetal function. Foetal death is followed by autolytic changes in foetus. Abortions in the last trimester of pregnancy, grayish-white mucoid or mucopurulent discharge is common in Brucellosis.

Post mortem diagnosis is characterized by oedema and thickening of chorion, oedema of foetus, pneumonia with necrotic foci in foetal lever. Bronchopneumonia is most characteristic finding in foetal lungs and placenta is edematous.

Infected cows usually abort once and seldom more than twice, although in the subsequent pregnancies uterus may be re-infected from udder but cow then carries foetus to term. Bacterial count $10^{12}$ per ml. of uterine discharge is recorded after abortion.

Calves born out of infected dams may not necessarily positive but if fluids are engulfed at the time of delivery, chances of infections are common. Calves born from infected uterus may not retain the infection, however 5.00 per cent calves may retain the infection.

Effects of Brucellosis on fertility depend upon – degree of infection, chronic infection without effect on reproduction, degree of exposure, virulence of organisms, dose of inoculums, stage of gestation in females, type of resistance acquired (natural or vaccinal) and physiological status of the animal (age/sex).

Chlorhexidine gluconate is strong antiseptic, which can be used to avoid professional risk of Brucellosis. The organisms are intracellular
and hence the treatment is costly, risky and rarely successful. There should not be any attempt to treat the animals.

Vaccines for control of Brucellosis are available in market viz. Cotton strain 19 (Live vaccine), Strain 45/20 (killed adjuvant), Strain RB 51 (rough lie vaccine) or Bruvax (Live vaccine by Indian Immunologicals). Vaccination is carried in female calves at 5 to 7 months of age with *brucella abortus*, strain 19 vaccine. No vaccination should be carried out in adults and males.

Vaccination is recommended to healthy breedable females only if incidence of disease marks to 30 per cent. Vaccination prevents clinical incidence of abortion but not the infection. Natural infection and vaccination result in immunity to abortion but not to the infection and hence infected animals remain serologically positive throughout the life. No vaccination should be carried out in males.

Diagnosis of Brucellosis can be carried out with serum and blood agglutination tests. Laboratory diagnosis consists of isolation and identification of organisms from foetus stomach, placenta, uterine fluid, milk and semen. Other tests include Milk ring test, Whole milk/whey plate agglutination test, Seminal plasma/vaginal mucus agglutination test, Serum and Milk ELISA tests.

**Agglutination Titers**

<table>
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<th>Test</th>
<th>Indian standard</th>
<th>Int. Standard</th>
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<tbody>
<tr>
<td></td>
<td>Cows</td>
<td>Bulls</td>
</tr>
<tr>
<td>Positive</td>
<td>80</td>
<td>40</td>
</tr>
<tr>
<td>Doubtful</td>
<td>40</td>
<td>20</td>
</tr>
<tr>
<td>Negative</td>
<td>20</td>
<td>10</td>
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Follow three testing in case of doubtful titers, rising titers indicate active infection and constant titers or declining titers indicate no active infection. Seminal plasma tube agglutination test is most critical and meaningful in Brucellosis. All the bulls from infected herd should be considered infected irrespective sero-clinical status.
Prevention and control

Brucellosis is the completely irradiated disease in many developed countries through test and slaughter policy. Control of the Brucellosis includes isolation of infected animals, regular testing, use of disinfectants, hygienic parturitions and proper disposal of uterine discharges.

Brucellosis carry variable incubation period, degree of shading of organism is more, control of livestock movement is impossible and size of herd stock is increasing hence control of Brucellosis difficult.

The disease is important from zoonotic point. Perpetual risk of undulant fever in human beings is possible on consumption of raw milk and the disease is zoonotically important. Malta fever in humans is characterized by an acute septicemic phase followed by a chronic stage that may extend over many years and may involve many tissues.

Regular testing, identification of sero positive cases is necessary in animals. Slaughter policy is unlawful hence culling of animals and putting them away from healthy stock is necessary.

Non specific measures include Isolation of affected animals, Hygienic disposals of genital discharges, restrictions on animal movement, quarantine measures for newly purchased animals with mass Education and training regarding the disease,

Bovine Brucellosis progressive control programme is beneficial in terms of importance of public health for control of spread of infection. Considering society as epidemiological unit, milk testing of pooled samples is carried out. The programme has added advantages like increased milk yield, reduced infertility, cost effectiveness and high herd immunity.

Leptospirosis

The disease is caused by spirochetes, Leptospira pomana. All warm-blooded animals are susceptible and organism have predilection for kidneys. The disease is characterized by acute febrile condition, haemoglobinuria, anaemia, icterus. The incubation period of organisms in animals is normally 4 – 10 days. The organisms principally cause liver and kidney damages. Destruction of RBC’s and haemolytic anemia are
regularly observed in acute stage. Acute febrile stage is followed by anemic condition.

Venereal infection is relatively uncommon but organisms have been isolated from semen of infected bulls. The condition leads to moderate rates of abortion i.e. 25 to 30 per cent at about 5 to 6 months of pregnancy. Foetal death indicates no specific lesions. Aborted foetus indicates avascular placenta. Cotyledons appear yellowish brown and gelatinous edema of allantois chorion is recordable. Organisms can be demonstrated in blood and urine of infected animals. Serum agglutination test 2-3 weeks after febrile illness gives positive results.

**Tuberculosis**

The disease is chronic debilitating pneumonic disease and has capability for generalization. The zoonotically important disease is caused by *Mycobacterium bovis*. The organisms also produce systemic and genital infection but it is usually secondary. Low-grade fever, progressive wasting, weakness, and loss of production, chronic cough, dyspnea, increased rate of depth of respiration characterize the condition.

The spread of the disease occurs by generally by haematogenous route but venereal route is also possible. In case of genital tract infection, tuberculous metritis is produced which is characterized by chronic discharge of thick yellow pus. Abortions due to tuberculosis organisms occur in late pregnancy and placental lesions are similar to brucellosis. Tuberculosis spreads to vagina through haematogenous infection through Gartner’s ducts and the condition is considered as diagnostic sign of uterine tuberculosis. Tuberculous orchitis in males is characterized by slow destruction of germinal tissue and indurations of testicles.

Double intradermal tuberculin test is most accurate for the diagnosis of the diseases and the same is necessary to be tested to each six months in all breedable animals. On post mortem examination, consolidation of lung, tubercular nodules and tubercles on peritoneum, pleura, mesentry are observed and hence the disease is called as pearly disease.
Campylobactariosis

The disease is bacterial and caused by *vibrio foetus* sp. *intestinalis* and *vineralis*. The organisms are gram negative, motile, comma shaped rods and may form helix. The organisms are non-spore forming, non-capsule forming and can be observed under phase contrast microscope in shape and movement. Transfer of infection is basically through coitus, contact, infected beddings. Incubation period of the organisms is variable and it extends from 15 to 80 days.

Bulls more than four years of age are more susceptible and organisms generally harbor in deeper crypts of penile membrane in old bulls. The infected bulls are permanent asymptomatic carriers and no clinical symptoms are produced. The organisms on penis and prepuce of breeding bulls produce no lesions. Reproductive behavior and seminal qualities are unaffected in affected bulls. Bull simply acts as carrier.

Regular and irregular heat cycles without conception is characteristic in vibriosis. After repeating for 5 to 6 cycles (roughly 5 – 6 months), immunity develops gradually and then the animals carry pregnancies. Infected animals carry the infection and newly purchased or young heifers added to the breeding stock further carry the infection. This pattern of continuous spread of infection is known as flying herd infection.

Organisms rapidly multiply in vagina after infected service and subsequently spread to cervix, uterus. Infection sets within 8 to 10 weeks of entry in female genital tract. Cervicitis leads to copious mucus secretions. Sub acute diffuse mucopurulent endometritis is produced in females and the condition is characterized by exudates in endometrial lumen and lymphocytic infiltration. The endometritis is non palpable on per rectal examination. In 25 per cent females, infection may reach oviducts and bilateral salpingitis is produced.

The organisms do not disturb fertilization and implantation but tissue reaction caused by the organisms is inimical to embryonic nourishment and hence there is early embryonic mortality. Organisms restrict oxygen supply to the embryo and causes embryonic death. Only 12 per cent infected females abort and microscopic foetuses are expelled. Semi
opaque placenta with thickening, haemorrhages and oedema is evident in aborted cases. Flakes of pus on visceral peritoneum of foetus are also characteristic.

Diagnosis of infection is carried out with prepucial washings for bacterial isolation and in females vaginal mucous agglutination test is most reliable. Blood agglutination titres are unreliable and because the organisms are more concentrated in genital tract, and agglutination test carried out on saline extract of vaginal mucus is the standard diagnostic test. The test is positive within 40 to 80 days of infection. 1:50 titre is generally considered as positive however, any amount of agglutination is suspicious. One positive reaction is sufficient to establish herd infection.

No test is or method is detecting the infected bull but female served by the breeding bull is found infected then bull is assumed to be infected. At AI center, test mating of bull with 2 virgin heifers is practiced.

**Infectious bovine rhinotrachitis (IBR)**

The disease is caused by viral pathogen and has immunological, physical, biochemical and epidemiological properties of herpes virus group. The conditions known as infectious postular vulvo-vaginitis, infectious postular balano-posthitis, bull bum, red nose, genital pox or coital exanthema are all the names given to affections caused by the same virus in different bodily organs.

The bovine herpes virus (BHV 1) is responsible for causing the disease in respiratory, ocular, cephalic and genital form. The virus leads to rhinotrachitis, balano-posthitis, entritis, conjunctivitis, abortion, encephalitis in adult animals and generalized disease of newborn. The condition is characterized by high-grade fever in farm animals for acute phase of 6 to 10 days.

The disease is causing 100 per cent morbidity and 10 per cent mortality in dairy animals. Nasal form never spreads the infection to vagina. There is no infectious bovine rhinotrachitis in animals infected by genital form i.e. infectious postular vulvo-vaginitis and also there is no spread of infection from vagina to nasal tract. However, nose to vulva contact of affected herd mates spreads the disease.
The viral disease causes abortion during 4 to 7 months of gestation and subsequently lifelong latent infection is carried with periodic shedding of virus. In aborted foetus, vaginal lesions are characterized by adherent whitish necrotic material above mucosal surfaces (called plaques), which carries leucocytes, fibrin and necrotic epithelial cells.

Unusual tail position is the first indication of the disease in females. Raised tail position in breedable females indicates irritation to vagina. Vulvo-vaginitis leads to edema and mucopurulent discharge. On vaginal inspection, pustule formations in vulval and vaginal mucosa with necrotic foci are observed. White powdered spots are evident in vaginal passage on inspection. Suspect IBR in females showing no relaxed tail positioning and lesions of vagina.

Other forms of vaginitis need to be differentiated in IBR suspected cases. Pain and irritation of external genitalia is common in Infectious postular vulvo-vaginitis. In granular vaginitis, there is hypoplasia of the lymphoid follicles of vaginal mucosa and no discharge or no discomfort is evident. Infectious postular vulvo-vaginitis infection may not be present necessarily in necrotic vaginitis.

10 Vaginal discharge with raised tail and continuous movement because of the intense itching in the vaginal form of IBR. Congestion and pustules in the mucosa of the vagina (IBR).
Affected bulls acquire infection through infected cows and subsequently there is balano-posthitis. The disease is self-limiting. Vaccination is carried out only to the healthy animals, which carries immunity for a period of one year.

**Trichomoniasis**

This disease is known as True venereal disease as the infection is always limited to reproductive tract in both male and females and the protozoan organisms of category are transmitted to healthy animals only by coitus with one exception of contact through travis, crate or teaser animal.

The disease is caused by *Trichomonas fetus* protozoan parasite and three strains of the organisms have been isolated. Organisms are 10 to 25 μ in length and 3 to 15 μ in width with characteristic 1 to 4 flagellate.

Infection colonizes in vagina, uterus, and oviducts of breedable infected females. Organisms produce catarrhal endometritis, vaginitis and oedema of vulva, peri-vaginal tissue and uterine wall. The flagellate organisms lead to profuse, intermittent mucopurulent or mucoflocculent discharge in females. Uterine discharge provokes on per-rectal examinations.
Infection in healthy non-pregnant animals remains hidden and leads to abortion only when animal becomes pregnant. Visible abortion occurs at 2 to 4 months of gestation. The organisms cause inflammatory response in uterus, destruction of uterine mucosa and foetal death. In case of abortion, foetus is expelled in gray coloured intact placental membranes. Parasites quickly disappear after abortion from vaginal discharges.

Infection if enters in pregnant healthy animals, then it leads to pyometra or foetal maceration. Termination of pregnancy of macerated foetus can be effected by luteolytic principle of prostaglandin therapy.

Infected animals may carry foetus up to term but immunity is lost after normal gestation. In females, disease is self-limiting and infection confers a relative degree of temporary resistance. Initial infections generally terminate pregnancies in females.

Organism normally harbor on penis, penile membrane, prepuce and distal portion of urethra. Affected bulls remain permanent asymptomatic carrier throughout the life and no lesions of diagnostic significance are observed in infected bulls. Semen quality and sexual behavior or libido of breeding bulls is not affected. Organisms are regularly voided in prepucial smegma in males. Pain on micturition and disinclination to mount is common in affected bulls. Infected bulls need treatment during acute phase with local and systemic antibiotic applications.

Direct visualization of flagellate organisms under microscope is the method of the disease diagnosis in Trichomoniasis. Diagnosis of the disease is simple and reliable with detection of organisms in pus flakes, mucopurulent discharges or cervico-vaginal discharges of affected cows and prepucial smegma of bulls.