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Brucellosis in Animals: A Hidden Threat to Livestock Productivity and Public Health

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INTRODUCTION

Brucellosis is one of the most important infectious diseases affecting livestock and is a major concern for animal health, reproductive efficiency and public health. It is a contagious bacterial disease that primarily affects cattle, buffaloes, sheep, goats, pigs and other susceptible animal species. The disease is particularly important in dairy animals because it can cause abortion, infertility, retained placenta and reduced milk production, resulting in substantial economic losses for livestock farmers. Brucellosis is also a major zoonotic disease, meaning that it can spread from animals to humans. Farmers, veterinarians, animal handlers, laboratory workers and abattoir personnel are at increased risk of infection. Humans may acquire the infection through direct contact with infected animals, contaminated reproductive materials or consumption of unpasteurised milk and dairy products. The disease is often difficult to recognise because infected animals may show no obvious clinical signs until reproductive complications occur. Therefore, early diagnosis, vaccination, farm hygiene and appropriate disease-control measures are essential for preventing its spread. Brucellosis is not merely an animal disease; it is a livestock productivity and public health challenge. [1,2]

Causative Agent

Brucellosis is caused by bacteria belonging to the genus *Brucella*. These bacteria are small, Gram-negative, non-motile, non-spore-forming coccobacilli that can survive and multiply within host cells. Although these bacteria have preferred animal hosts, cross-species infections may occur. *B. abortus* is particularly important in bovines, while *B. melitensis* is a major cause of brucellosis in sheep and goats. [1,3]. The major species associated with domestic animals are:

***Brucella* species**	**Major animal hosts**
Brucella abortus	Cattle and buffaloes
Brucella melitensis	Sheep and goats
Brucella suis	Pigs
Brucella canis	Dogs

Mode of Spread and Transmission

Brucellosis spreads mainly through contact with infected animals and contaminated materials. The bacteria are shed in large numbers in the placenta, aborted foetus, uterine discharges and other reproductive secretions of infected animals.

The major routes of transmission include:

1. Ingestion of contaminated material: Animals become infected by consuming feed, water or pasture contaminated with infected placental tissues, foetal fluids or uterine discharges.

2. Direct contact: The bacteria may enter through wounds, skin abrasions or mucous membranes when animals come into contact with infected secretions.

3. Reproductive transmission: Exposure during abortion, calving, lambing or kidding is a major route of infection within herds and flocks.

4. Milk transmission: Infected animals may shed the bacteria in milk, which can infect suckling young and contaminate dairy products.

5. Introduction of infected animals: Purchasing infected animals without appropriate testing can introduce brucellosis into previously unaffected herds.

6. Venereal transmission: Transmission through infected semen or reproductive contact may occur, although contaminated reproductive materials and environmental exposure are particularly important routes.

The bacteria can persist in contaminated environments, especially under cool and moist conditions. Consequently, improper disposal of aborted foetuses and placentas can facilitate further spread. [1,3]

Clinical Signs: Clinical manifestations vary with animal species, age, reproductive status and the stage of infection. Many infected animals remain apparently healthy, making laboratory diagnosis essential.

A. Clinical signs in female animals

The most characteristic manifestation is abortion, particularly during the later stages of pregnancy. Common signs include:

- Abortion during late gestation.
- Retention of foetal membranes or retained placenta.
- Endometritis and prolonged uterine discharge.
- Repeat breeding and infertility.
- Stillbirth or birth of weak offspring.
- Reduced milk production.
- Increased calving interval and poor reproductive performance.

In many infected animals, abortion may occur during the first affected pregnancy, while subsequent pregnancies may proceed to term. However, the animal may continue to shed bacteria and remain a source of infection.

B. Clinical signs in male animals: In males, brucellosis primarily affects the reproductive system. Clinical signs may include:

- Orchitis, or inflammation of the testes.
- Epididymitis.
- Swelling of the scrotum.
- Reduced fertility or infertility.
- Inflammation of accessory reproductive organs in some cases.

C. Other clinical manifestations: Occasionally, infected animals may develop arthritis, bursitis or other inflammatory conditions. In horses, brucellosis may be associated with fistulous withers or poll evil.

Abortion alone cannot confirm brucellosis because several infectious and non-infectious conditions can cause pregnancy loss. Laboratory confirmation is necessary. [1,2,3]

5. Pathology and Pathogenesis: After entering the animal's body, *Brucella* bacteria are taken up by immune cells and can survive and multiply within certain host cells, particularly macrophages. They may spread through the lymphatic system and bloodstream to different organs. The bacteria have a particular affinity for reproductive tissues, including the uterus, placenta, mammary gland and male reproductive organs. In pregnant animals, infection of the placenta can cause placentitis, tissue damage and disruption of normal nutrient and oxygen exchange between the mother and foetus. Major pathological changes are: -

1. Placenta: Thickening, inflammation and oedema of placental tissues may occur, sometimes with necrotic areas and exudate.
2. Foetus: Aborted foetuses may show autolysis, oedema, fluid accumulation or inflammatory lesions, although gross lesions are not always distinctive.
3. Uterus: Inflammation of the endometrium may occur, contributing to delayed uterine recovery and reproductive problems.
4. Testes and epididymis: Infected males may develop orchitis, epididymitis and associated tissue damage.
5. Lymph nodes and internal organs: Enlargement of lymph nodes and inflammatory changes in organs such as the spleen may occasionally be observed.
6. The pathological changes are not always specific to brucellosis. Therefore, the examination of tissues should be supported by appropriate laboratory tests. [2,3]

6. Diagnosis: Early and accurate diagnosis is essential for controlling brucellosis. Clinical signs can raise suspicion, but confirmation requires laboratory testing.

A. Clinical and reproductive history: The veterinarian should assess abortion history, reproductive performance, retained placenta, repeat breeding, introduction of new animals and possible contact with infected livestock.

B. Serological tests: Serological tests detect antibodies against *Brucella* and are widely used for screening individual animals and herds.

Commonly used tests include:

- Rose Bengal Plate Test (RBPT): A rapid screening test.
- Standard Tube Agglutination Test (STAT): Detects agglutinating antibodies.
- Enzyme-Linked Immunosorbent Assay (ELISA): Used for screening or confirmatory testing, depending on the assay.
- Complement Fixation Test (CFT): Used in established diagnostic programmes.

The choice and interpretation of tests depend on the animal species, vaccination history and local disease-control programme. Positive screening results should be evaluated using the prescribed confirmatory testing strategy.

C. Milk testing: The Milk Ring Test (MRT) can be used for herd-level screening of dairy cattle. Other validated milk-based tests may also be used.

D. Molecular diagnosis: Polymerase Chain Reaction (PCR) can detect *Brucella* genetic material in appropriate samples. It can provide rapid and specific evidence of infection when performed by a qualified laboratory.

E. Isolation and identification: Bacterial isolation and identification can provide definitive evidence of infection, but these procedures require specialised facilities and stringent biosafety precautions because *Brucella* poses a significant laboratory-acquired infection risk.

Safety precaution: Samples of aborted foetuses, placentae and uterine discharges should be collected and transported only by trained personnel using suitable protective equipment and approved laboratory procedures. [2,3]

7. Treatment: Treatment of brucellosis in livestock is generally not recommended as a routine disease-control strategy. Although antimicrobial drugs may suppress bacterial multiplication, complete elimination of infection is difficult because the organisms can survive within host cells. Treated animals may remain infected and continue shedding bacteria. The use of antibiotics in food-producing animals also raises concerns regarding drug residues, treatment failure and the continued spread of infection. Therefore, the preferred approach is testing, isolation, vaccination where recommended, and control or removal of infected animals according to the applicable veterinary regulations and official programme. When an animal is suspected of having brucellosis:

1. Isolate it from the rest of the herd.
2. Restrict access to the calving or abortion area.
3. Contact a qualified veterinarian or the appropriate animal-health authority.
4. Arrange laboratory testing and follow official instructions for handling and disposal of contaminated materials.
5. Avoid selling, moving or breeding the animal until its status and the applicable requirements have been clarified.

Aborted foetuses, placentae and contaminated bedding should be handled safely and disposed of in accordance with veterinary and environmental regulations. [1,3]

8. Vaccination and Prevention

Vaccination is an important component of brucellosis control in areas where the disease is endemic. However, the choice of vaccine, target animal category, age, timing and administration must follow the authorised national programme.

Commonly recognised vaccines

Vaccine	Principal use
B. abortus strain S19	Cattle vaccination
B. abortus strain RB51	Cattle vaccination in programmes where authorised
B. melitensis strain Rev.1	Sheep and goat vaccination

These vaccines are not interchangeable. Their use depends on the species, epidemiological situation and official policy. Live vaccines may infect humans if accidentally inoculated or handled improperly; therefore, vaccination should be undertaken by trained personnel following the product label and prescribed biosafety precautions. [2,3]

Prevention and control measures: Effective control requires a combination of measures:

- Vaccinate eligible animals under the official vaccination programme.
- Test animals as required by the local disease-control programme.
- Purchase replacement animals from reliable sources and follow prescribed testing and movement requirements.
- Isolate animals that abort or show suspicious reproductive signs.
- Wear gloves and suitable protective clothing when handling birth products.
- Clean and disinfect contaminated areas using approved procedures.
- Prevent contamination of feed and drinking water by reproductive discharges.
- Maintain records of abortions, vaccinations, test results and animal movements.
- Consume only pasteurised or properly heat-treated milk and dairy products.

In herds approaching disease elimination, systematic testing and removal of infected animals may be required under official supervision. Vaccination alone may not eliminate infection from an already infected herd. [1,4]

9. Public Health Importance; Brucellosis is a major zoonotic disease that affects both animal and human health. In humans, it is commonly known as Malta fever or undulant fever.

People may become infected through:

- Drinking raw milk or consuming dairy products made from unpasteurised milk.
- Handling infected aborted foetuses, placentas and uterine discharges.
- Contact with contaminated animal tissues through cuts or mucous membranes.
- Accidental exposure during laboratory work or vaccination.

Human infection may cause recurrent fever, sweating, weakness, joint pain, headache and other complications. Anyone who develops compatible symptoms after a possible occupational or foodborne exposure should seek medical evaluation and inform the healthcare provider about the exposure. Preventing brucellosis in animals, improving farm hygiene and ensuring the pasteurisation of milk are essential measures for protecting human health. [3,4]

10. Economic Importance: Brucellosis imposes substantial financial losses on livestock farmers and the dairy industry. Abortion, infertility, prolonged calving intervals, reduced milk production, replacement costs and restrictions on animal movement can reduce farm profitability. The disease may also affect breeding programmes, livestock trade and the productivity of organised dairy farms. Prevention through vaccination, surveillance and good biosecurity is generally more effective than dealing with repeated reproductive losses after infection has spread.

CONCLUSION

Brucellosis remains a major challenge for livestock production, reproductive health and public health. Its importance lies not only in causing abortion and infertility but also in its ability to persist silently within herds and spread to humans through contaminated animal products and occupational exposure. The most effective strategy is based on early detection, laboratory confirmation, vaccination under authorised programmes, strict farm hygiene and the appropriate management of infected animals. Farmers and veterinarians must work together to recognise suspicious abortions, prevent exposure to infectious materials and maintain reliable animal-health records. A healthy herd begins with prevention, early diagnosis and responsible animal management. Controlling brucellosis protects livestock productivity, safeguards farmers' livelihoods and reduces the risk of infection in humans.

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