

BRUCELLOSIS

Brucellosis is an infectious bacterial disease of animals caused by *Brucella* sp. and characterized by abortion in Late Gestation (3rd Trimester) and formation of Granulomatous lesions in genital organs, joints and fetal liver. Infection is **ZOONOTIC**.

History & Synonym

Brucella melitensis, was the first member of the genus to be recognized, was isolated in 1887 from the spleen of patients who died from "**Mediterranean Fever**", "**Gastric Fever**", or "**Bruce's Septicaemia**", later called "**Malta Fever**" by **Sir David Bruce**. The genus "Brucella" and the disease "brucellosis" are named after him.

Ten years later, in 1897, was isolation and identification of ***Brucella abortus*** from aborted bovine foetuses and foetal membranes by the Danish veterinarian **Frederick Bang**. The infection of cattle caused by *B. abortus* has since been known as "**Bang's Disease**" or "**Bang's Abortion Disease**". The characteristic undulating or recurrent fever usually seen in the human disease has given rise to the name "**Undulant Fever**" (undulant = rising and falling like waves; L. unda = wave).

Brucella suis, was identified in 1914 by **Traum** in aborted pig foetuses.

Brucella ovis, as the cause of epididymitis in rams in 1950s; and

Brucella canis, as the cause of abortion in dogs in 1960s.

- **Bang's Disease, Mediterranean Fever, Gastric Fever,**
- **Bruce Septicaemia, Malta Fever**
- **Undulant Fever In Humans**
- **Rock Fever of Gibraltar**
- **Ram Epididymitis; Contagious Abortion**

Etiology

Brucella is small, Gram-negative, bacillary (rod-like) or coccoid organisms:

- *Brucella melitensis*- Mainly Goat, but also in Sheep
- *B. abortus*- Cattle
- *B. suis*- Swine
- *B. ovis*- Sheep
- *B. canis*- Dogs

Spread / Transmission :

The infection in cattle is of worldwide distribution. The brucella organism usually spreads by contact or through ingestion of contaminated feed and water with aborted foetal contents or foetal membrane. It is also transmitted through inhalation and may

pierce the intact or **abraded skin** or **conjunctivae**. The organism is also excreted in milk. Congenital infection may also occur.

Pathogenesis

After entry, organisms first localize in regional lymph nodes, where they proliferate within reticulo-endothelial cells. Most infections are acquired by ingestion. The organisms enter and travel through the intestinal epithelial cells Overlying Peyer's patches by Endocytosis. Then they enter into the lymphatics. Development of bacteraemia allows localization of the bacteria in a variety of tissues. Bacteria have a particular affinity for male and female reproductive organs, placenta, foetus, and mammary glands. The organisms may also localize in other organs, such as lymph nodes, spleen, liver, joints, and bones, resulting in different clinical signs. At all sites, brucella organisms proliferate intracellularly.

Although readily phagocytosed by macrophages, *B. abortus* is resistant to intracellular destruction. It can survive and multiply inside normal macrophages. This is because *B. abortus* has a resistant cell wall, and can prevent lysosomes from fusing with the phagosome. That is, it blocks phagosome-lysosome fusion. Thus, the bacteria are never exposed to lysosomal enzymes. The lysosomes remain distributed in the cytoplasm and bacteria continue to grow within phagosome inside the macrophages. As a result, antibodies are ineffective against these organisms, and the bacteria are distributed throughout the body inside macrophages. The macrophages ultimately rupture as a result of the expanding physical bulk of the growing bacteria. Where ever the organisms are localized, a granuloma develops.

The affinity of brucella for placenta and foetus, particularly for chorio-allantoic trophoblasts, is due to the presence of sugar **Erythritol** in these tissues. It is the striking proliferation of brucella **in trophoblasts** which causes placentitis, infection of the foetus, and abortion, which characterize brucellosis in animals.

CLINICAL SIGNS

- **Cattle**
 - Abortion in last trimester of gestation (between the 7th – 8th months of gestation)
 - Retention of Placenta & Repeat Breeders
 - Arthralgia symptoms in Joints (Joint Swelling; Arthertis; Synovitis etc)
 - Orchitis and accumulation of fluid in scrotum in male animals.
- **Goat & Sheep**
 - Abortion and Retention of Placenta
 - Orchitis and Epididymitis in Males
 - Arthralgia symptoms in Joints (Joint Swelling; Arthertis; Synovitis etc)

- Pigs
 - Infected sows abort between the second and third months of gestation. Orchitis occurs in infected boars
- Horses
 - *B. abortus* + *Actinomyces bovis* causes “**Poll evil**” and “**Fistulous withers**” which is suppurative inflammation of ligamentum nuchae at its attachment to occipital bone.
- Human
 - Malta fever in man which is characterized by **Undulant Fever**, weakness, articular rheumatism, night sweating and muscular sweating.

Gross Lesions

- Edematous Placenta, Necrosis of cotyledons.
- Thickened and Leathery Chorion.
- Edema of foetus, serosanguinous fluid in body cavity.
- Induration of bovine mammary glands and supramammary lymphnodes
- Orchitis / Epididymitis in Rams / Bulls

Microscopic Lesions

Lesions of brucellosis in animals are as quite varying as the clinical manifestations. As mentioned, after the onset of bacteraemia, organisms localize in a variety of tissues. In the tissues, particularly the lymphoreticular system, the organisms attract macrophages and PROLIFERATE WITHIN THEM, PRODUCING SMALL GRANULOMAS. Granuloma formation is usually not the lesion in the placenta associated with abortion in Cattle/Goats, BUT it is always present in *B. suis* infection granulomas in all infected tissues. Abortion is the most serious outcome of brucellosis in most domestic animals.

In the **Bovine Placenta**, there is extensive proliferation of *B. abortus* in the chorionic epithelium and trophoblasts. This leads to necrosis of cotyledons. The inter-cotyledonary chorion is oedematous and becomes filled with an odourless, sticky, brownish exudate. Severe **PLACENTITIS** revealing pale yellow foci in cotyledons and thickening of the intracotyledonary chorioallantois.

As the disease advances, yellowish granular necrotic areas become clearly visible in the placental **Cotyledons**. Rest of the chorion is opaque and thickened, with a **Leathery consistency**. Granulomas are not seen in placenta, although small collections of epithelioid cells may be present in the endometrium.

The Aborted Bovine **Foetus** is oedematous, with serosanguineous fluid in the body cavities. The most characteristic lesion is Bronchopneumonia, which is mainly

characterized by a mononuclear infiltrate, with less number of neutrophils. Foetal lymph nodes are hyperplastic, and thymus smaller than normal.

The bovine mammary gland and the **Supramammary Lymph Nodes** are common sites of localization of *B. abortus*. This results in **induration (hardening)**. Microscopically, there is diffuse inflammation. The epididymitis, and testicle of the bull becomes enlarged and indurated. Contents of the sac formed by the tunica may result in suppuration, rupture, and discharge of the contents.

In rams, lesions of Orchitis & Epididymitis are observed AND *B. ovis* infection typically involves **Tail of the Epididymis**. Primary changes do not occur in the testicle. However, stasis results in secondary testicular degeneration. Arthralgia lesions are observed, arthritis, bursitis, with carpal bursa containing purulent exudates is seen.

In pigs, *B. suis*, Grossly, it is only in this type, that ALL affected organs show **tiny white to yellowish Nodules (Brucella granuloma)**.

B. canis infection in the bitch is accompanied by uterine and placental lesions similar to bovine brucellosis. Bronchopneumonia is seen in aborted pups.

Diagnosis

- (i) The disease is suspected based on CLINICAL SIGNS such as abortions, retention of placenta, orchitis etc and Characteristic **LESIONS**, but confirmation is made through serological Tests at Herd level and Then by prescribed Molecular Methods to identify the bacteria:
- (ii) For Serosurveillance (mass level), the **Milk Ring Test** is applied on bulk milk tank samples
- (iii) For Screening the 'Suspected Herds' **Rose Bengal Plate Test (RBPT)** is used and THEN Positive reactors are confirmed with **Standard Tube Agglutination Test (STAT)** and indirect ELISA.
- (iv) **Polymerase Chain Reaction (PCR)** is being used for identifying the specie-level of the *Brucella* involved
- (v) Historically, (a) **CARD TEST** and (b) **STRAUSS TEST** in Male Guinea Pigs were also important in random testing.