Biological Times

Volume No. 3 | Issue No. 6 | Pages 27-28

Bovine Brucellosis

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ABSTRACT

The aim of this extension article is to take an overview of brucellosis in bovines for general understanding. Brucellosis is a zoonotic disease that has a major impact on animal welfare and the economy. Transmission of brucellosis from domestic and wild animals leads to the emergence of recent cases in native areas that change epidemiological dimensions. The consumption of raw milk is a major threat to the public health in areas of endemic importance. And international travel of humans and animals leads to outbreaks of brucellosis in new areas. So, continuous screening is essential to control the outbreaks. Control of this disease is possible by continuous diagnosis and then massive vaccination of the animals.

1. Introduction:

Bovine brucellosis is also known as bangs disease or contagious abortion [1]. In humans and others, it is also known as Gibraltar fever, Malta fever, Mediterranean fever, and goat fever. Its causal agent is *Brucella abortus,* which is a gram-negative coccobacillus. Direct or indirect contact transmitted it. Brucellosis has a wide host range, and it has an effect on farm animals, and even can be transmitted to humans [2]. Its predisposing factor includes the high stocking rate, mixed farming of animals and unhygienic conditions at the form, especially in husbandry practices. Brucellosis is also a zoonotic disease and *B. abortus* can cause abortions in humans and animals [3].

Mixed farming is a big threat for its huge transmission. The small ruminants act as primary host and cattle as spill-over host. For the efficient control of bovine brucellosis, there is need for routine surveillance and isolation of these animals [4]. Massive vaccination helps in the elimination of this disease in endemic areas. For this propose smooth live vaccines and attenuated vaccines like *B. abortus* strains 19 and RB51 is effective [5]. Brucellosis as a zoonotic agent is started when animals were lived in close vicinity with the humans. Any drawbacks in the management lead to outbreaks of the brucellosis. Not only transferred to animals but also to humans and became a disease of zoonotic significance. Anthropogenic adaptation of wild animals broadens its host range and causes huge economic losses. In this extension article, we will discuss historical background, etiology, transmission, geographical distribution, pathogenesis, clinical signs, gross pathology, economic importance, diagnosis, treatment and prevention in the upcoming sections.

2. Historical background:

Brucellosis was first reported in the Mediterranean region. Historically, it is related to wars. George Cleghorn reported the details of this in 1751. It was present as separate disease during the Crimean war in Malta Island. Sir David Bruce, Hughes and Sir Themistocles Zammit gave a detailed overview of this disease in 1886 [6]. Bernhard bang was the first who discovered the *B. abortus* strain. Later on, its outbreaks are going on. Now it is also isolated from marine mammals, shows its zoonosis.

3. Etiology:

Brucellae are gram negative, non- motile and aerobic or intracellular rods. Brucella species that cause disease in terrestrial animals are *B. abortus*, B. *mellitensis*, B. *suis*, B. *canis*, B. *ovis*, B. *netamae*, and B. *microti* [7]. Brucellae can survive for months preferably in wet and cool conditions (1). Pasteurization kills the bacteria in milk.

4. Transmission:

Brucella spp. has a wide host range. They can be transmitted through vertical and horizontal routes [8]. The organism *Brucella* spp. is highly present in the placental membranes, aborted fetus and uterine discharges. Other sources of infection are water and contaminated feed. Direct transmission can happen through contact, inhalation, ingestion, abrasions and conjunctiva. Infection also transmitted during coitus from infected bulls [9]. Humans acquire brucellosis infection through the consumption of unpasteurized milk, yogurt, butter, cheese, whey and ice cream, etc.

5. Geographical Distribution:

Brucellosis is prevalent in many countries which are central Asia, Mexico, India, Italy, Africa, central and South America, Mediterranean Europe [10]. Brucellosis free countries include the United Kingdom, New Zealand, Denmark, Netherlands, Sweden, Fenlands, Norway and Cyprus. Countries of endemic importance for the brucellosis are Western Asia, Middle East, India, South America and southern Europe, Egypt [11].

6. Pathogenesis:

There are various factors which are involved in the virulence of the pathogen in the body. The factors include guanine monophosphate, adenine monophosphate, vir B, urease, LPS and 24kDa protein. Once Brucella entered the body, it multiplied by the phagocytic and dendritic cells. In pregnant animals, it invades trophoblasts and mammary glands and multiplies again and again [12]. This cause huge damage to the uterus and induces hormonal changes that cause abortion. In non-pregnant animals, it multiplies in the macrophages and dendritic cells and continues to shed in the environment through various body excretions and secretions [13].

7. Clinical Signs:

There are numerous clinical signs of brucellosis in female animals which are manifested as storms of abortion in the herd and fragile calves' birth in the last trimester, reduced infertility, endometritis, retained fetal membranes and low milk production [14]. Clinical signs in males are manifested as orchitis, epididymitis, hygroma and cervical bursitis. And in chronic cases because of fibrous tissue formation, testes may become small. In humans, clinical signs are manifested as undulant fever, night sweats, uneasiness, chills, fatigue, constipation, insomnia, depression, nervousness, joint pain, etc. [15].

8. Gross Pathology:

There is gravid horn invasion by the necrotic placentitis that leads to death of the fetus. Cotyledons become hyperemic or congested, covered with yellowish exudates, and spread into the crypts [16]. Aborted fetus is hairless. Water in the abdominal cavities, enlargement of the spleen and liver, pneumonitis (cobblestone lesions are atypical characteristics of brucellosis).

9. Economic Importance:

Brucellosis poses a major threat to the economy due to aborted fetuses, loss in milk production and culling of animals [17]. Additionally, there is a limitation of animal trade in brucellosis prevalent areas. Regular screening of animals is a farm routine practice which is laborious work.

10. Diagnosis:

There are various methods of diagnosis:

10.1 Isolation and identification:

It is the gold standard method. For isolation, we collect samples from aborted fetus (liver, lungs, spleen, stomach, and lymph nodes) or from uterine discharges. Solid media is required for direct isolation [18]. Commercially available media include tryptose-soy agar and Brucella medium base. Castaneda's medium is preferred for the isolation of Brucella from blood and other body fluids. And then it can be identified by the morphology of a colony, catalase, urease and oxidase.

10.2 Polymerase Chain Reaction:

It is a rapid diagnostic method, used for rapid epidemiological interpretations. A real-time PCR detects numerous regions of the genome of Brucella like 16S rRNA, 31-kDa, OMP and IS711 [19].

10.3 Serological tests:

As antibodies start to produce after the 1st week of Brucella infection, serological tests are used worldwide [20]. These are helpful for surveillance, monitoring, and eradications schedules. Various serological tests include rose Bengal plate test (RBPT), CFT, standard tube agglutination test, milk ring test, ELISA, Combs test, and lateral flow assay.

10.4 Rose Bengal plate test:

It is for rapid confirmation of neurobacillosis, orchitis, epididymitis, orchitis and arthritis. It has high sensitivity but low specificity [21].

10.5 Complement Fixation Test:

It is a specific test to detect IgM and IgG1 antibodies. It is done on cattle and buffaloes vaccinated with RB51. These are helpful in control and surveillance of brucellosis [22].

10.6 Brucellin test:

It is a confirmatory test for non-vaccinated animals. It is a delayed type hypersensitivity test. Its sensitivity is low [23].

To cite this article: Abbas RZ, Muqadas, Z Saeed, MA Qureshi & Z Fatima. Bovine Brucellosis. Biological Times. 2024 June 3(6): 27-28

10.7 Standard tube agglutination test:
It is a very simple and economic test used worldwide for diagnostic purposes. It detects quantities of IgM, IgG [24]. That's a good indicator to check active brucellosis. This test is not applicable for the detection of *B. canis*.

10.8 Enzyme-linked immunosorbent assay (ELISA):
It is an excellent alternative to bacterial culture techniques. Its sensitivity is 100% and specificity is 99.2%. This technique includes agglutination and specific antigen detection [25]. There are various types of ELISAs, but for brucellosis sandwich and competitive ELISAs are preferred.

11. Treatment:
Researchers treat the cows through immunotherapy. For this purpose, RB51 phage lysates and S19 at a dose rate of 2ml at subcutaneously. It resulted in the Brucella negative test even after 3 months [26]. Vaccination in endemic areas is very crucial. Effective vaccine strains are RB51, S19, and Rev1. These are widely used vaccine strains in livestock. RB51 and S19 strains are used to vaccinate bovines while Rev-1 is administered to small ruminants.

12. Prevention and control:
As there is international trade and transport of animals and animal products, we should follow all guidelines, principles and procedures. And we should follow various testing services and proper quarantine of animals [27]. We should test the animals before purchase. Routine surveillance is very crucial for control of brucellosis. Identify the infected animals and separate them from the herd. Import of semen should be from brucellosis free farm. People should not consume raw and pasteurized milk, especially in brucellosis endemic areas. Mass vaccination should be done in replacement calves, young and adults for the effective control and prevention of brucellosis.

13. Conclusion:
The complete diagnosis of brucellosis is facilitated by history, symptoms, isolation and identification of bacteria, various serological and molecular tests. Brucellosis is among the most prevalent diseases in endemic areas. It has a major impact on public health despite massive surveillance programs. There is a need for public awareness through campaigns that cover giving awareness about transmission, symptoms and epidemiology of disease. That also elaborates the economic losses for the people. There is a need to develop a vaccine that provides lifelong or longer immunity that will help ultimately in the control and prevention of disease. For this purpose, government should provide funding in order to combat the disease.

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