Brucellosis in Saudi Arabia: Review of Literature and Epidemiology

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Abstract

Brucellosis is a zoonotic disease, which is endemic in Saudi Arabia. It's an infectious systematic disease that can affect any organ, with no specific symptom to this disease. The diagnosis of Brucellosis depends mainly on the investigations. Treatment of Brucellosis requires an extensive course of antibiotics used for at least 6 weeks to avoid relapse or recurrence. This disease is caused by Brucella spp. It's considered to be a major problem in endemic countries, due to poor hygiene, and unprotected contact with animals. Brucellosis is a challenging disease diagnose since there are no special symptoms for this disease. The incidence of Brucellosis globally is up to 500,000 people infected annually therefore, it’s the most widespread zoonotic disease. There are some rare cases of Brucellosis in the Kingdom of Saudi Arabia. Several laboratory tests are used to confirm the diagnosis, and the most common laboratory test used in Saudi Arabia is the SAT. Preventing brucellosis depends on contact isolation from infected beings, safety cautions in labs, Pasteurization of milk, and controlling of vectors.

Keywords: Brucellosis; Brucella; Zoonotic; Saudi Arabia; Epidemiology

List of Abbreviations

ELISA: Enzyme-Linked Immunosorbent Assay; LPS: Lipopolysaccharide; PCR: Polymerase Chain Reaction; RBAT: Rose Bengal Agglutination Test; SAT: Standard Agglutination Test; SMX: Sulfamethoxazole; TMP: Trimethoprim

Introduction

In 1886, Brucellosis was named Bruce by means of the causative agent of the Malta dog. Where he was named the cause of Brucella melitensis, which was isolated from goat’s milk. In 1993, the Brucella abortus was resistant in the UK, and also in animals, the Brucella melitensis was not isolated in the UK. Brucellosis [1] is caused by approximately 12 species of Brucella bacteria. This group is preceded by Brucella melitensis, followed by Brucella abortus and the third is Brucella Canis. Brucella spp. is a Gram-negative, coccobacillus bacteria. Since it is a systemic disease, it can affect any organ and with vague symptoms. Clinically, it is known that Brucellosis cause systemic symptoms such as a headache, night sweats, and fever. Diagnosis of Brucellosis is confirmed by several tests, the most important one is the Standard Agglutination Test (SAT). An annual global incidence of more than 500,000 [2,3]. Treatment of Brucellosis is done by giving intensive antibiotics at a prolonged time. Managing is different in dose, duration, and type of antibiotic depends on the case and the condition of the patient.

Microbiology

Brucellosis is a zoonotic disease caused by a Gram-negative, coccobacillus bacterium, called Brucella bacteria (Figure 1) [4,5]. Brucella has nearly about 12 species [4,6-8]. The most common species causing Brucellosis worldwide are Brucella melitensis (from sheep and goats), Brucella abortus (from cows), and Brucella Canis (from dogs) respectively, also there are Brucella suis (from pigs), Brucella ovis, Brucella neotomae, Brucella pinnipedialis, Brucella microti, Brucella ceti, Brucella cetaceae, Brucella binnipediae, and Brucella inopinata [9,10]. Brucella bacteria infect animals first, then after contact with infected animals, the pathogen is transmitted to human. Infection can be transmitted by consuming raw dairy, uncooked meat, contact with infected animals or their secretions, Exposure to bacteria in the laboratory, and by Breastfeeding on mother to the child [4,11,12] Brucella bacteria lives and multiply within the cells of the monocyte pagans, the dandruff cells, and placenta cells. It also can live and reproduce within animal cells, such as Microglia, fibroblast, epithelium, and endothelium. There are three stages for Brucella bacteria in the body, which are incubation, acute, and chronic; to simplify these three stages, the incubation stage is mere without any clinical symptoms. Second, the acute phase is characterized by the spread of the pathogen and the invasion of the tissues of the body; the last stage is chronic which in the organ damage occur and can lead to the death of the infected person [7].

Figure 1: Gram staining of isolated Brucella bacteria. Positive blood agar for bacteria separation [6].
Immunology and Pathogens

*Brucella spp.* has a special wall that makes them stealthy and difficult for the immune system to respond and eliminates it completely [7]. Its wall contains the lipopolysaccharide (LPS) that stimulate the toll-like receptor 4 (TLR4), which induces the release of inflammatory cytokines and the beginning of the elimination of pathogen. The longer the LPS in the wall of the bacteria, the weaker the stimulation of TLR4 becomes, also becomes less toxicity due to a longer chain of LPS [7]. There are also some *Brucella* bacteria that don't have OPS in the LPS, and this makes them more toxic, and some of *Brucella abortus* and *melitensis* toxins are libd-carbohydrate-protein-2, keto-3-dexyoctulosonic acid. The immune response against *Brucella* is initiated by releasing of cytokines IL12, TNF-alpha, and IFN-gamma, to destroy and accelerate the death of bacteria [7,9,13]. This is not the only way of defense, it varies depending on the type of *Brucella* bacteria and its mutation and resistance for example, in *Brucella abortus* a dose of 10-1000 is enough to cause the disease [14-16]. The immune response is different depending on the antibodies IgM, IgG, IgA, and stage of the disease [9].

Symptoms and Signs

Symptoms of Brucellosis include irregular fever, night sweats, headache, tremors, loss of appetite, abdominal pain, joints pain, and muscle aches [2,11,17]. Signs include endocarditis, hepatomegaly, splenomegaly, and obvious loss of weight [3,4,18]. The lymph nodes involvement in Brucellosis is rare [19]. Multiple rare cases of Brucellosis were reported with vague signs and symptoms in Saudi Arabia. First case, a 54 years old male known case of diabetes was diagnosed with an abscess in the prostate. The case was confirmed by a pus test and was found to contain *Brucella* bacteria. Second case, a 67 years old male known case of diabetes, hypothyroidism, benign prostatic hypertrophy, vitiligo, and a previous history of Brucellosis, presented with a mass in the spinal vertebrae from C5-C7, the patient said he drank unpasteurized milk a month ago.

Diagnosis

The diagnosis of Brucellosis is divided into two steps. The first step, identifying the clinical picture of the patient including the history of contact with animal or its products, new symptoms and signs, such as arthralgia, fever, sweating, headache, fatigue, and muscle pain. The second step, in which confirmation of the disease is made by laboratory investigations [3,4].

Laboratory Investigations

Polymerase Chain Reaction (PCR) shows a high specificity (100%) and a high sensitivity of 80% (1.25 GE/μl), and more reliability [8,20]. Enzyme-Linked Immunosorbert Assay (ELISA) sensitivity 94.1% and specificity 97.1% can determine between IgG, IgM, IgA also it's more beneficial and sensitive in acute *Brucella* [21]. Rose Bengal Agglutination Test (RBAT) is a quick test but with poor sensitivity and specificity [22]. Standard Agglutination Test (SAT) sensitivity 95.6% and specificity 100.0%, which makes it the most accurate and preferable in diagnosis [4,12,21].

Epidemiology

In Saudi Arabia

Brucellosis is an endemic disease in several countries such as the Mediterranean basin and the Arabian Peninsula. Saudi Arabia has an infection rate of about 70 per 100,000 people (Figures 2 and 3) [9]. An annual global incidence of more than 500,000 and more than 10/100,000 of the population in some affected countries [2,4,5,10,23,24].

**Figure 2:** Cases rate per 100,000 populations.

![Figure 2: Cases rate per 100,000 populations.](image)

**Figure 3:** Incidence rate per 100,000 populations

**In worldwide**

Brucellosis is known to be the commonest zoonotic infection worldwide, due to traveling internationally, and socioeconomic reasons. Many endemic countries have controlled the disease over years. Here are some infection rates in countries. The average incidence in Greece between 2007-2012 was estimated to be...
that makes it stealthy and difficult to eliminate from the body. The treatment of brucellosis is mainly depending on multiple complex antibiotics therapy including aminoglycosides, TMP-SMX, tetracyclines, and rifampicin. Brucellosis symptoms are vague and systematic symptoms such as fever, night sweat, muscle ache, and abdominal pain. Signs of brucellosis can include hepatomegaly and splenomegaly. This obvious difference in incidence put Saudi Arabia in the classification of endemic countries for brucellosis. The awareness of transmission methods of Brucella can guide the community, and prevent further infections. Controlling of animals that might carry the pathogen is essential, especially in countries which have culture, and daily contact with these animals. However, animal’s dealers and raw milk consumers should be careful when contacting with animals, and make sure to boil milk or pasteurized milk to avoid brucellosis. A rapid field test on animals for early detection is necessary. Regular checkups and vaccination should be mandatory to prevent the spread of Brucellosis; all this can help in the fight against the disease, and put it outside the scope of endemic diseases in Saudi Arabia.

Competing Interests

The authors declare that they have no competing interests.

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