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Research Article

Brucella spp Asa Zoonotic Pathogen: A Review

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Abstract

Brucella spp. is pathogens of significant importance in livestock and a wide range of animal species worldwide. It is also known to cause brucellosis in humans, especially those works at proximity of infected animals. This review mainly focuses on animal and zoonotic brucellosis with an emphasis on epidemiology, transmission, diagnosis, treatment, vaccination and finally control.

BRUCELLOSIS

Brucella is a Gram-negative, non-spore-forming, facultative intracellular bacteria causing brucellosis in humans and various animals. Even today, brucellosis is endemic in many parts of the world, including the Middle East, Africa, Latin America, central Asia and several regions of the Mediterranean basin [1]. Prevalence and epidemiology of brucellosis in livestock production has been described in many developing countries as seen by the number of reports generated in the past ten years [2]. Factors influencing prevalence include production systems, agro ecological zones, husbandry practices and contact with wildlife [3,4,5]. The organism was first reported and isolated by Scottish physician Sir David Bruce from the spleens of a fatally infected soldier in the year 1887, in his honor organism was designated as *Brucella* [6]. Currently, the genus *Brucella* consists of ten species with more than 90 percent DNA homology, namely *B. melitensis*, *B. abortus*, *B. suis*, *B. canis*, *B. ovis*, *B. neotomae*, *B. cetacea*, *B. pinnipedia*, *B. microti* and *B. inopinata*, among which *B. abortus*, *B. melitensis*, *B. suis* and *B. canis* cause most of the human diseases [7,8,9,10,11]. Brucellosis is transmitted to humans via: (a) intimately working in direct contact with infected animals (b) consumption of contaminated and unpasteurized milk products (soft cheese, yoghurts and ice-creams) (c) inhalation of aerosolized *Brucella* (d) increased business and leisure travel to endemic regions [1]. Based on their high infectivity via aerosols, *Brucella* is designated as category B priority pathogen by the CDC, USA [12]. Upon entry into human or animal system (blood stream), *Brucella* invades and proliferates inside macrophages and in non-professional phagocytes (eg: epithelial cells) of the infected host by creating a survival permitting compartment i.e. BCV. This BCV circumvents fusion with lysosomes, supports intracellular replication of *Brucella* and mediates their interactions with the host cells thereby dictating the outcomes of infection [13]. In animals, brucellosis results in male sterility and in pregnant livestock cause abortion, placentitis and infertility. It can also pose a significant economic loss to owners of domesticated animals due to loss of progeny, reduced milk yield and infertility [8]. The disease rarely results in human death, but symptoms of chronic brucellosis include recurrent fevers, joint pains, fatigue and complications of peripheral arthritis, spondylitis, osteomyelitis, endocarditis [14] and this leads to a few thousand cases of brucellosis per annum worldwide as reported by WHO [15]. Human *brucellosis* is often misdiagnosed and underreported mainly due to the lack of proper diagnostic methods [16]. Presently, prevention of brucellosis relies principally on vaccination of livestock, antibiotic therapy, culling of infected animals and protecting the animals from exposure to wild reservoirs such as bison, wild pig and wild boars [17]. Antibiotic therapy to eliminate human disease has been more successful and relies mostly upon the use of tetracycline or doxycyclin in combination with rifampicin and streptomycin but particularly in chronic cases it requires an extended duration. Besides, the limited number of effective antibiotics and the potential for accidental ormalicious introduction of antibiotic resistance into the organism emphasizes the need for alternative solutions [18,2,19]. Protective immunity against *Brucella* largely relies upon the cell mediated immune responses stimulating microbicidal activities and eradication of intracellular bacterial hives [20,21,22]. So far there is no FDA approved licensed vaccine for human use [23]. The commercially available vaccines include live attenuated *Brucella* vaccine strains (*B. abortus* S19, RB51 and Rev1) and are being administered to animals globally. However, even though these vaccines generate protective immunity, they often revert back to the virulent forms resulting in brucellosis even in the vaccinated animals [24]. The severe economic loss, medical burden of brucellosis and drawbacks of available vaccines have motivated scientists in search of alternative strategies to develop a better vaccine [25]. The recombinant protein based subunit vaccines have been considered to be attractive alternatives to the existing live attenuated vaccines for safer and effective intervention against brucellosis [26]. Several molecules *viz. Brucella* cell surface (BCSPs), Outer membrane proteins (OMPs), periplasmic and cytoplasmic antigens have been assessed as subunit vaccine candidate molecules mainly in association with a variety of adjuvants, but have been only partially protective [27]. Thus, developing an effective and safe vaccine against brucellosis

in humans or animals is a realistic goal. The infected animals will continue to serve as reservoirs for the spread of the disease to uninfected animals and humans. Hence, prevention of human brucellosis depends on management of the animal reservoir. Disease management in animals mainly depends on the several factors *viz.* surveillance program, control of unrestricted animal movements, epidemiological investigations, abortion notification, improved livestock management practices, training of livestock farmers, vaccination, test and slaughter, enhanced biomedical research and government commitment. Public health education, food safety, personal hygiene, improved diagnostic and treatment facilities, Collaboration between human and veterinary medicine are key factors in controlling human brucellosis [28].

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