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Brucellosis: Global Reportable Disease in Most Countries

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Abstract

Brucellosis, Bang's disease, Crimean fever, Gibraltar fever, Malta fever, Maltese fever, Mediterranean fever, rock fever, or undulant fever, is a highly contagious zoonosis caused by ingestion of unpasteurized milk or undercooked meat from infected animals or close contact with their secretions.

Keywords: Infected animals; Animal husbandry; Zoonosis; Raw milk; Chronic disease; Brucellae

Introduction

Brucellae species are small, Gram-negative, nonmotile, nonspore-forming, rod-shaped bacteria. They function as facultative intracellular parasites, causing chronic disease, which usually persists for life. Four species infect human: B. melitensis, B. abortus, B. suis, and B. canis. B. melitensis is the most virulent and invasive species; it usually infects goats and occasionally sheep. B. abortus is less virulent and is primarily a disease of cattle. B. suis is of intermediate virulence and chiefly infects pig. B. canis resides in the dogs [1]. Symptoms include profuse sweating and joint and muscle pain.

Brucellosis is a bacterial disease caused by various Brucella species, which mainly infect cattle, swine, goats, sheep and dogs. Humans generally acquire the disease through direct contact with infected animals, by eating or drinking contaminated animal products or by inhaling airborne agents. Most cases are caused by ingesting unpasteurized milk or cheese from infected goats or sheep [2].

Brucellosis is one of the most wide spreading zoonosis transmitted by animals and in endemic areas, human brucellosis has serious public health consequences. Expansion of animal industries and urbanization, and the lack of hygienic measures in animal husbandry and in food handling, partly account for brucellosis remaining a public health hazard.

Brucellosis is found globally and is a reportable disease in most countries. It affects people of all ages and both sexes. In the general population, most cases are caused by the consumption of raw milk or its derivatives such as fresh cheese. Most of these cases are from sheep and goat products.

The disease is also considered an occupational hazard for people who work in the livestock sector. People who work with animals and are in contact with blood, placenta, foetus and uterine secretions have an increased risk of contracting the disease. This method of transmission primarily affects farmers, butchers, hunters, veterinarians and laboratory personnel [3].

Worldwide, Brucella melitensis is the most prevalent species causing human brucellosis, owing in part to difficulties in immunizing free-ranging goats and sheep.

Prevention of brucellosis is based on surveillance and the prevention of risk factors. The most effective prevention strategy is the elimination of infection in animals. Vaccination of cattle, goats and sheep is recommended in enzootic areas with high prevalence rates. Serological or other testing and culling can also be effective in areas with low prevalence. In countries where eradication in animals through vaccination or elimination of infected animals is not feasible, prevention of human infection is primarily based on raising awareness, food-safety measures, occupational hygiene and laboratory safety [4].

Literature Review

Pasteurization of milk for direct consumption and for creating derivatives such as cheese is an important step to preventing transmission from animals to humans. Education campaigns about avoiding unpasteurized milk products can be effective, as well as policies on its sale.

In agricultural work and meat-processing, protective barriers and correct handling and disposal of afterbirths, animal carcasses and internal organs is an important prevention strategy.

Brucellosis typically causes flu-like symptoms, including fever, weakness, and malaise and weight loss. However, the disease may present in many atypical forms. In many patients the symptoms are mild and, therefore, the diagnosis may not be considered. The incubation period of the disease can be highly variable, ranging from 1 week to 2 months, but usually 2–4 weeks [5].

Treatment options include doxycycline 100 mg twice a day for 45 days, plus streptomycin 1 g daily for 15 days. The main alternative therapy is doxycycline at 100 mg, twice a day for 45 days, plus rifampicin at 15mg/kg/day for 45 days. Experience suggests that streptomycin may be substituted with gentamicin 5mg/kg/daily for 7–10 days, but no study directly comparing the two regimes is currently available. The optimal treatment for pregnant women, neonates and children under 8 is not yet determined; for children, options include trimethoprim combined with an aminoglycoside.

The prevention of human brucellosis is based on Education to avoid consuming unpasteurized milk and milk derivatives. Barrier precautions for hunters and professionals at risk [6]. Careful handling and disposal of afterbirths, especially in cases of abortion. Serological or other testing of animals; immunization of herds/flocks may be envisaged; eliminate infected herds/flocks. Occupational hygiene and

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food hygiene; Vaccination is not generally recommended. All dairy products should be prepared from heat-treated milk; Consumption of raw milk or products made from raw milk should be avoided. Meat should be adequately cooked. Special precautions should be taken by laboratory workers; Physicians and health workers should be aware of the possibility of brucellosis. Public health education should emphasize food hygiene and occupational hygiene. Treatment for brucellosis aims to relieve symptoms, prevent a relapse of the disease and avoid complications. You'll need to take antibiotics for at least six weeks, and your symptoms may not go away completely for several months. The disease can also return and may become chronic [7]. Rifampicin is active in vitro against Brucellae species, is remarkably lipid soluble, and it accumulates within eukaryotic cells. In order to provide a completely oral regimen with which to treat brucellosis, the combination of doxycycline plus rifampicin, with both drugs administered for six weeks, was recommended by the WHO in 1986. Tetracycline administered for at least six weeks has long been the standard treatment of human brucellosis. Brucellosis has been eradicated from various developed countries but still it remains an important veterinary public health problem in most of the developing world as abortions and infertility in herds result in severe economic loss. Human brucellosis is commonly reported among laboratory workers, slaughter house employees, farmers and veterinarians who may be exposed to infected animals. Due to its heterogeneity and poorly specific clinical symptoms, the diagnosis of brucellosis always required laboratory conformation either by isolation of pathogen or by demonstration of specific antibody [8, 9]. The serological test available for diagnosis of brucellosis remains most useful test for preliminary identification of the disease besides its limitation of low sensitivity. Therefore, there is a need to develop rapid, reliable and user friendly system for disease diagnosis and alternative vaccines approaches. Because of inherent problems with bacterial isolation, inefficiency, cost, danger and other factors, most laboratories prefer to use other, more cost effective methods. Molecular biology as a diagnostic tool is advancing and will soon be at the point of replacing actual bacterial isolation. It is rapid, safe and cost effective, the only real problems being some uncertainties regarding specificity. Keeping in view the importance of brucellosis as an emerging infection and prevalence in our country, the present study was carried out to clone and express outer membrane protein in P. pastoris expression system. The yeast expression of this excellent antigen for sero-diagnosis will help in the bulk production of this antigen. The cloning of omp28 gene in pPIC9K vector system was done successfully. The presence and orientation of the gene in its vector was also confirmed by colony PCR and RFLP analysis. Further expression and characterization of recombinant protein using positive clones were also confirmed. Further expression parameters need to be standardized and this will be of use in the bulk production of antibody detection system for sero-diagnosis of brucellosis. Humans are generally infected in one of three ways: eating or drinking something that is contaminated with the bacteria, breathing in the presence of organisms, or having the bacteria enter the body through skin abrasions. Inhalation of Brucella organisms is not the common route of infection, but it can cause significant hazard for people in certain occupations. Brucellosis have worldwide distribution, though it is well controlled in some developed countries but still remains an endemic zoonosis in various developing countries including India. Brucella species differ in their geographic distribution as B.abortus is found worldwide in countries that have high cattle population.

Melitensis is particularly common in the Mediterranean and also occurs in the Middle East and Central Asia, around the Arabian Gulf and in some countries of Central America, Africa and India. B. ovis occurs in most sheep-raising regions of the world, it has been reported from Australia, New Zealand, North and South America, South Africa and many countries in Europe and India and B. canis occurs throughout most of the world. The Centers for Disease Control and Prevention reports approximately 100 cases each year in USA during the past 10 years, with most cases in the southwest region of USA whereas the overall occurrence of human brucellosis in world is more than 5,00,000 case per year. However the true incidence of human brucellosis in India is unknown and it may be 25 times higher than the reported incidence due to misdiagnosis and underreporting. The mode of infection is: on contact Brucellae penetrate the skin or mucosal membranes and enter the lymph nodes, which become haemorrhagic, resulting in bacteraemia, which facilitates dissemination throughout the body. During the early phase of infection, Brucellae invade macrophages, adapt to the acidic enviornment, and multiply in the vacuole compartments; it prevents phagosome [10]. Brucellosis is a systemic infection that can involve any organ or organ system of the body. Symptoms are non-specific, which may include fever, chills, headache, pain, fatigue, dementia, and arthritis, generally occurring within 2-3 weeks of inoculation. The complication involves osteo-articular complication, gastro intestinal complications, genitourinary complications, neurological complications, cardiovascular complications.

Conclusion

Vaccines against Brucellae have varying degrees of success in controlling the disease in animals; however, human vaccines are not currently available and the animal vaccines currently in use are pathogenic to humans. Both humeral and cell-mediated immune responses develop in brucellosis patients, but the cellular immunity is the essential component. Antibodies usually begin to appear in the blood at the end of the first week of the infection, IgM appearing first followed by IgG.

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Conflict of interest

None

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