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Brucellosis: An Infectious Outbreak in China and New Threat to Civilization after COVID-19

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Abstract

Brucellosis, otherwise called “Undulant fever”, “Mediterranean fever” or “Malta fever” is a disease caused by a group of bacteria from the genus *Brucella*. These bacteria can infect both humans and animals and spreads in humans when people eat contaminated food, raw meat and unpasteurized milk. It affects people of all ages and both sexes. The bacteria can also be spread through the air or in contact with an open wound. The incubation period of the disease is usually 2–4 weeks. The disease causes flu-like symptoms, including fever, headaches, muscle pain, weakness, malaise and weight loss. Some symptoms can become chronic with subsiding over time. Treatment options include doxycycline 100 mg twice a day for 45 days, plus streptomycin 1 g daily for 15 days. The prevention of human infection is primarily based on raising awareness, food-safety measures, occupational hygiene and laboratory safety.

Introduction

Health Commission of Lanzhou has confirmed recently that several thousand people in northwest China have tested positive for brucellosis, amidst the Covid-19 outbreak. Sometime around July to August 2019, Zhongmu Lanzhou Biological Pharmaceutical Factory was manufacturing brucellosis vaccine for animals. While producing the vaccine, it accidentally expelled an aerosolized version of the *Brucella* bacteria into the air. The accident was noticeable by the use of expired sanitizers and disinfectants, meaning not all bacteria were eradicated in the waste gas which led to the spread of the bacterial disease across the nearby area through the air. Approximately 3,245 people have contracted the disease, while 1,401 have tested preliminarily positive. In total, 21,847 people have been tested in Lanzhou city so far.

Disease Symptoms and Complications

The disease causes symptoms including headaches, muscle pain, fever, weight loss, abdominal pain, appetite loss and fatigue. Some symptoms can become chronic with subsiding over time. According to the United States’ Centres for Disease Control and Prevention (CDC) the disease can cause arthritis or swell in organs and these symptoms can last for prolonged periods making the treatment.

The infection can affect almost all parts of the body, such as the central nervous system, heart, liver and the reproductive system. One of the serious problems due to the disease can result in inflamed testicles which lead to infertility in men. Other possible side effects of brucellosis include; joint pain, endocarditis, encephalitis, meningitis, etc. The pace of mortality for brucellosis is about 2%.

Disease Epidemiology

Brucellae are Gram-negative coccobacilli, facultative intracellular bacterial pathogens of both animals and humans. In view of the distinction in pathogenicity and in host preference, six species are distinguished within the genus *Brucella*: *B. melitensis*, *B. abortus*, *B. suis*, *B. canis*, *B. ovis* and *B. neotomae*. Among them, *B. abortus* and *B. melitensis* are the primary pathogenic species around the world, responsible for bovine brucellosis and the fundamental etiologic specialist of ovine and caprine brucellosis (a disease that causes abortion in ewes and goats bringing about huge losses in economy, especially in the Mediterranean countries. Recently, two new species have been proposed to be added to this class, *Brucella cetaceae* and *Brucella pinnipediae* confined from marine vertebrates, cetaceans and pinnipeds, respectively. *B. abortus* contamination is gained by people through the utilization of unpasteurized dairy items and contact with tainted domesticated animals. Differentiation among biovars and species is at present performed by differential tests dependent on phenotypic characterization of phage typing, lipopolysaccharide antigens, H₂S creation, CO₂ necessity, dye sensitivity and metabolic properties.

Diagnosis

The identification and isolation of *Brucella* offers a definitive diagnosis of brucellosis and may be helpful for epidemiological purposes and to screen the advancement of a vaccination programme. *Brucella* can be limited from cerebrospinal fluid, bone marrow, pus, wounds, and so on, blood is the material most often utilized for bacteriological culture. The PCR technique can be utilized for the immediate detection of *Brucella* organisms in the blood.

The outer membrane of *Brucella* contains S-LPS (Smooth Lipopolysaccharide) which is exposed to the environment like other S-phase Gram-negative bacteria (Adriana et al., 2017). For detection of antibodies to the S-LPS, the serum (tube) agglutination test (SAT), or micro-titre plate variants of this utilizing heat/ phenol-killed whole S-cells can be used. Antibodies responding against S-LPS can likewise be identified by different tests, for example, enzyme-linked immunosorbent assay (ELISA), when they are adjusted to utilize extricates which contain S-LPS.

Several tests viz., RBT (Rose Bengal Test), SAT alone or with 2-ME (2-mercaptoethanol) or DTT (dithiothreitol) reduction, Coombs antiglobulin, CFT (complement fixation test), CIEP (counter-immunoelectrophoresis), western blotting and ELISA and so on are recommended for diagnosis of brucellosis. Among all serological techniques is the most by and large valuable analytic strategy approach. A precise serological analysis of human brucellosis can be made with a test that utilizes S phase, entire cells (O'Callaghan, 2020). The consequences of a blend of tests, for example, Coombs antiglobulin and SAT can be utilized to measure the stage of evolution of the disease at the time of diagnosis.

Treatment

Tetracycline (500 mg in every six hours orally) or Doxycycline (100 mg in every 12 hours orally), a long-acting tetracycline analogue for at least six weeks are now the preferred drug for the treatment of unsophisticated brucellosis in adults and children eight years old and more seasoned. But when, tetracycline or Doxycycline is given alone, the rate of relapse stays between 10 to 20 %. Thus most specialists suggest an amino-glycoside (Streptomycin as a dose of 1 g/day intramuscularly) managed for 2-3 weeks in addition to the tetracycline or Doxycycline for the first 2-3 weeks of treatment. As per recommendation by the WHO Expert Committee in 1986, the combination of Doxycycline (200 mg/day orally) plus rifampicin (600–900 mg/day orally), with the 2 medications controlled for about a month and a half was advised to give a completely oral regimen to treat brucellosis. For secondary alternative therapy drugs like quinolones in mix with different other drugs, for example, doxycycline or rifampicin; trimethoprim or sulfamethoxazole are advised.

For children less than eight years old, trimethoprim/sulfamethoxazole (8/40 mg/kg/day twice daily orally) for about a month and a half in addition to streptomycin (30 mg/kg/day once daily intramuscularly) for three weeks or gentamicin (5 mg/kg/day once daily intravenously or intramuscularly) for 7 to 10 days as directed. Alternatives such as trimethoprim/sulfamethoxazole in addition to rifampicin (15 mg/kg/day orally) each for about a month and a half, or rifampicin in addition to an aminoglycoside are likewise suggested. Until additional experience is obtained with these medicines, it is preposterous to expect to characterize the cure of decision.

There is no persuading proof regarding the advantage of controlling *Brucella* vaccines or antigen arrangements, nor for the utilization of invulnerable framework modulators. Alert ought to be practiced in the utilization of mitigating specialists to manage local troubles; where conceivable, special advice to be required.

Prevention

As the ultimate source of human brucellosis is indirect or direct exposure to infected animals or their products, inhibition must be based on the eradication of such contact. Some central issues to prevent brucellosis are given underneath:

- The prevention of human brucellosis depends on occupational hygiene, food cleanliness and homestead sterilization with disinfectants like hypochlorite, iodophor or phenolic disinfectant at suggested working quality.
- Health workers and physicians should be aware of the chance of brucellosis.
- All dairy items ought to be prepared from pasteurized milk.
- Consumption of crude milk or items produced using crude milk should be avoided.

- Meat should be thoroughly cooked.
- Special safety measures should be taken by research center laboratories while taking care of the materials that may contain pathogenic *Brucellae*.
- Public health education should emphasize on food cleanliness and occupational hygiene by a close coordinated effort between public health and veterinary administrations.

Climate Change and Brucellosis

Impacts of brucellosis are diverse as for territories, which might be connected to biological variables and contrasts in the board rehearses. Among several zoonoses, brucellosis has been considered to influence, regarding transmission, by the landscape modifications resulting from climate change. Land changes can modify microclimates for livestock production, leading to habitat loss, increment the movement of domestic species and give more opportunities for livestock to be in contact with wild species. These factors increase the exposure to new pathogens and *Brucella* and the bidirectional transmission of developing diseases (in wildlife or livestock). Wildlife exchange reinforced regions influenced by rising diseases and cross-outskirt unlawful traffic will build the danger of creating ailment transmission among wildlife and individuals, even in non-endemic nations or territories (Alfonso *et al.*, 2013).

Brucella sp. is capable of surviving for a long duration in the environment; thus inhalation of polluted residue in hot, dry nations (particularly in the tropics) might be a cause of infection. Microbiological contemplates uncovered that the ideal temperature for the development of *Brucella* is at 37 °C. Hence, this data would be dependable with the way that climatic anomalies, altering the humidity and the temperature in the endemic environments, would influence the conditions for the industriousness of *Brucella*, in its live and non-live supplies and has and, in the long run, they would modify the capacity of *Brucella* to be transmitted to animals and humans.

Case Study: Investigation of the Involvement of Peripheral Nervous System (PNS) in Brucellosis using Electrophysiology Studies

Background

Brucellosis is a zoonotic disease transmitted to man from animals through raw meat or unpasteurized milk. In the present study, the authors focused on peripheral polyneuropathy (manifesting symptoms include paraesthesia, tingling sensation in the leg and hands simulating diabetic neuropathy or vitamin B₁₂ deficiency).

Clinical Assessment

All patients were diagnosed for brucellosis by the detection of specific antibodies for *Brucella* in their blood. The patients reported fatigue, fever, nausea,

loss of appetite and weight, generalized myalgia or articular problems. Out of 57 patients, 11 patients exhibited symptoms of polyneuropathy and in 26 patients, no polyneuropathy was evident. The study included 42 healthy control individuals. Nine out of 21 patients with neuropathic symptoms had abnormal nerve conduction velocities.

Electrophysiology

Motor conduction studies were performed from bilateral median, ulnar, tibial and peroneal nerves by using supramaximal percutaneous stimulation with surface electrode recording, and the needle EMG was performed in one distal muscle (tibialis anterior, or gastrocnemius). The amplitudes of compound muscle action potentials (CMAP, baseline to the negative peak), distal latencies (DL, from stimulus to initial deflection) were measured with standard procedure. Nerve conduction velocities (NCV, distance divided by proximal latency minus DL) were calculated. Sensory nerve action potentials (SNAPs) were measured by using bar electrodes following orthodromic stimulation from bilateral median, ulnar and radial nerves, and antidromic stimulation for bilateral sural and medial plantar nerves in terms of DL and amplitude. The presence of polyneuropathy (PNP) was based on EMG (electromyogram) studies.

In the present study, the most important finding was that axonal involvement of sensory nerves in patients with brucellosis and PNP, in addition to mild conduction abnormalities in sensory and motornerves.

Conclusion

Brucellosis is a communicable disease caused by a group of bacteria from the genus *Brucella*. It affects people of all ages and causes flu-like symptoms, including fever, headaches, muscle pain, weakness, malaise and weight loss. Some symptoms can become chronic with subsiding over time. Treatment options include doxycycline 100 mg twice a day for 45 days, plus streptomycin 1 g daily for 15 days. Brucellosis may be avoided by using proper sanitation methods and avoiding eating or drinking contaminated, unpasteurized milk, dairy products and meat.

References

- Alfonso, J., Rodríguez-Morales., 2013. Climate Change, Climate Variability and Brucellosis, Recent Patents on Anti-Infective Drug Discovery 8, 4-12.
- Casabuono, A.C., Czibener, C., Del Giudice, M.G., Valguarnera, E., Ugalde, J.E., Couto, A.S., 2017. New Features in the Lipid A Structure of *Brucella suis* and *Brucella abortus* Lipopolysaccharide. Journal of the American Society for Mass Spectrometry 28(12), 2716-2723.
- O'Callaghan, D., 2020. Human brucellosis: recent advances and future challenges, Infectious Diseases of Poverty 9, 101.