World Journal of Biology Pharmacy and Health Sciences
eISSN: 2582-5542
Cross Ref DOI: 10.30574/wjbphs
Journal homepage: https://wjbphs.com/

(REVIEW ARTICLE)

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Understanding melioidosis: Review

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World Journal of Biology Pharmacy and Health Sciences, 2024, 20(01), 113–115

Publication history: Received on 22 August 2024; revised on 02 October 2024; accepted on 04 October 2024

Article DOI: https://doi.org/10.30574/wjbphs.2024.20.1.0721

Abstract

Melioidosis is an infectious disease caused by the Gram-negative intracellular bacterium *Burkholderia pseudomallei*, first identified in 1911. While it is predominantly reported in Southeast Asia, cases have also emerged in other regions, including parts of the United States. The clinical presentation of melioidosis often mimics that of tuberculosis and influenza, leading to diagnostic confusion that can delay appropriate treatment. This delay is particularly concerning, as timely diagnosis and intervention are critical to prevent severe complications, including septicemia and potential death. Education about this disease and taking preventive measures play a crucial role in managing this disease. The possibility of using the causative bacterium as a biological weapon poses a serious threat to public health.

Keywords: Melioidosis; *Burkholderia pseudomallei*, Signs and symptoms of melioidosis; Diagnosis of and treatment of melioidosis; Vaccination against melioidosis; *Burkholderia pseudomallei* as bio-weapon

1 Introduction

In 1911, Alfred Whitemore and C.S. Krishnaswami identified the bacterium that causes melioidosis in Myanmar. This is why it's called Whitemore disease but later in 1921, it was named Melioidosis. The first human case was detected in 1927 and Ceftazidime, an antibiotic of the cephalosporin group that efficiently treats this disease, was discovered in 1989. The name *Burkholderia pseudomallei* was coined formally in 1992. [1] This disease is mainly endemic to southeast Asian countries and northern Australia. For example: Thailand, Laos, Malaysia, Indonesia, Singapore, China, India, Sri Lanka, etc. Some cases have also been detected in the USA [2].

2 Bacteriology and pathogenesis of *Burkholderia pseudomallei*

Burkholderia pseudomallei is a Gram-negative facultative intracellular bacterium living in the soil near the plant's root. *B. pseudomallei* infiltrates different types of cells. Like epithelial cells, phagocytic cells, etc. It can last and increase numbers within the phagocytic cells for a long time. When bacterial replication within cells reaches the highest limit they induce apoptosis of host cells and are released from the host cells. *B. pseudomallei* also stimulates host cells to form an actin-based cell membrane projection. When this projection is engulfed by other phagocytic cells, these bacteria move to engulfing cells. This is a common pattern of cell-to-cell transmission of these bacteria. The formation of multinucleated giant cells is also a common characteristic of these bacteria [3].

2.1 Transmission

Heavy rainfall, floods, hurricanes, and other severe natural events help this bacterium to come out of the surface area of the soil[2]. This bacteria can infect humans through skin cuts, inhalation, ingestion, or aspiration. The rainy season is the peak time of the year to spread this disease [4]. It can also infect animals.

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3 Clinical presentation

Symptoms usually develop 1 to 4 weeks after infection with *Burkholderia pseudomallei.* The clinical feature depends on which parts of the human body are affected. Pulmonary melioidosis is characterized by symptoms such as cough, difficulty breathing, chest pain, fever, headache, etc. Melioidosis in the skin causes soreness, ulcers, abscesses, enlarged lymph nodes, and fever. It also causes septicemia, which is characterized by fever, fatigue, headache, difficulty in breathing, arthralgia, and confusion. Disseminated or chronic melioidosis has symptoms of chronic cough, fever, night sweats, weight loss, hemoptysis, chest pain, arthralgia, headache, seizures, etc [4].

3.1 Diagnosis

Detection of *B. pseudomallei* from body fluids (blood, urine, sputum, skin lesion, cerebrospinal fluid, oropharyngeal swabs, abscesses) by culture is the gold standard for the diagnosis of melioidosis. But it takes time and skill. So serological tests are performed first in some areas for rapid diagnosis [5]. Metabolomic profiling, a method to study both the pathogen and pathogen-specific host cell and tissue response study, is also useful for diagnosing infectious diseases like melioidosis [6].

3.2 Treatment

The treatment of melioidosis consists of two phases of antibiotic therapy. The first, intensive phase involves administering intravenous antibiotics for two weeks. The second one, the eradication phase, consists of three months of oral antibiotic therapy[4].

During the intensive phase, the choice of antibiotics for patients with no complications is ceftazidime but if the patient has complications like neuro melioidosis, persistent bacteremia, or in an intensive care unit is treated with meropenem. This phase may be more than 2 to 4 weeks if the case is severe (development of septic shock, deep-seated abscesses, extensive pulmonary injury, septic arthritis, osteomyelitis, neurologic complications) [7].

The first choice for the oral eradication phase is trimethoprim/sulfamethoxazole. If the organism is resistant to this antibiotic or it is contraindicated for a patient, the second choice is amoxicillin/clavulanic acid (co-amoxiclav) [7].

3.3 Prognosis

With prompt two phases of treatment, melioidosis is curable but in 10%-20% of cases, it is fatal. The severity of melioidosis depends on comorbid conditions, the quality of treatments, and the organ affected [4].

In an observational study between 22 July 2015 and 31 December 2018 in nine hospitals in Thailand, a hyperendemic zone for melioidosis shows most patients discharged after treatment survive one year but readmission is common. After recovery, recurrent disease is very rare [8].

Another study in Townsville University Hospital in Far North Queensland, Australia shows that melioidosis is associated with a high mortality rate ranging from 9% to 42%, and some factors like lymphopenia, uremia, and elevated international normalized ratio are associated with septicemia and mortality [9].

3.4 Vaccination

There is no licensed vaccine for melioidosis available right now. But progress is ongoing. A subunit candidate vaccine (a vaccine that is made from a part of a pathogen, rather than the entire organism, and does not contain any live pathogens) has been developed at the University of Nevada, Reno (CPS-CRM 197/Hcp1) with a plan for phase I clinical trial in Oxford, UK in 2024. Some other vaccines are also in the process [10].

3.5 Prevention

Since no vaccine is currently available for *B. pseudomallei*, taking precautions to avoid infection is essential. Avoiding contact with soil and standing water in endemic areas, wearing protective boots and gloves during agricultural activities or gardening, and implementing safety measures for healthcare and laboratory professionals to prevent skin contact or inhalation is crucial [2].

4 Challenges and probability to use as bioweapon

The release of this bacteria into air, water, food, or other products has the potential to seriously compromise public health. The diagnosis of melioidosis is frequently confused with illnesses such as tuberculosis and influenza. In areas where melioidosis is infrequent, delayed treatment can result in severe outcomes, which has led the US government and CDC to designate it as a potential bioterrorism concern [2].

5 Conclusion

Melioidosis is a critical infectious disease that poses serious health risks, particularly when diagnosis and treatment are delayed. Such delays can lead to severe health complications and potentially fatal outcomes. Moreover, the possibility of this bacterium being used in bioterrorism amplifies the severity of the situation and raises critical national security alarms. Therefore, it is essential to intensify research efforts focused on the diagnosis, treatment, and prevention of this disease, while also implementing stringent security measures to prevent the pathogen's use as a bioweapon.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest is to be disclosed.

References

[1] Mahapatra PR. Clinical Melioidosis: A Practical Guide to Diagnosis and Management. 2023. Taylor & Francis Group. Available from: https://www.taylorfrancis.com/chapters/edit/10.1201/9781003324010-3/history-melioidosis-prasanta-mohapatra?context=ubx

[2] Centers for Disease Control and Prevention. About Melioidosis [Internet]. 2024 Jun 4. Available from: https://www.cdc.gov/melioidosis/about/index.html

[3] Wiersinga W, van der Poll T, White N, et al. Melioidosis: insights into the pathogenicity of *Burkholderia pseudomallei*. Nat Rev Microbiol. 2006;4:272-282. doi:10.1038/nrmicro1385.

[4] Cleveland Clinic. Melioidosis [Internet]. 2022 Aug 23. Available from: https://my.clevelandclinic.org/health/diseases/24051-melioidosis

[5] Centers for Disease Control and Prevention. Clinical Overview of Melioidosis [Internet]. 2024 Apr 30. Available from: https://www.cdc.gov/melioidosis/hcp/clinical-overview/index.html

[6] Lau SK, Sridhar S, Ho CC, et al. Laboratory diagnosis of melioidosis: Past, present, and future. Exp Biol Med. 2015;240(6):742-751. doi:10.1177/1535370215583801.

[7] Lipsitz R, Garges S, Aurigemma R, Baccam P, Blaney DD, Cheng AC, et al. Workshop on Treatment of and Postexposure Prophylaxis for *Burkholderia pseudomallei* and B. mallei Infection, 2010. Emerg Infect Dis. 2012 Dec;18(12):e2. Available from: https://wwwnc.cdc.gov/eid/article/18/12/12-0638_t2.

[8] Chantratita N, Phunpang R, Yarasai A, et al. Characteristics and one-year outcomes of melioidosis patients in Northeastern Thailand: a prospective, multicenter cohort study. Lancet Reg Health Southeast Asia. 2023;9:100118. doi:10.1016/j.lansea.2022.100118.

[9] Smith S, Buikstra E, Rubenach S, et al. Limited awareness of melioidosis in high-risk populations despite an increasing incidence of the disease in Far North Queensland, Australia. Am J Trop Med Hyg. 2022 Jul 25;107(6):1278-1280. doi:10.4269/ajtmh.22-0160.

[10] Khirikoekkong N, Asarath SA, Hill J, Wettana B, Srisawang O, Cheah PY, Dunachie S, Chamnan P. Melioidosis Vaccines (MeVa): Attitudes to vaccines, melioidosis and clinical trials in key stakeholders in Ubon Ratchathani, Thailand. Wellcome Open Res. 2023 Sep 19;8:413. doi:10.12688/wellcomeopenres.18383.1. PMID: 37969481; PMCID: PMC10646340.