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Melioidosis: An Emerging Under-diagnosed Tropical Infection

Kanchuboyina Divya[1], Kandi Vanitha[2], Akali Sowjanya[3], Praveen Kumar Uppala[*4], Ramaiah Maddi[5]

[1,2,3]*B.Pharmacy, Maharajah's college of Pharmacy vizianagaram,Andhra pradesh, India*

[4]*Assistant Professor, Dept.of pharmacology, Maharajah's college of Pharmacy vizianagaram, Andhra Pradesh, India.*

[5] *Professor & Principal, Maharajah's college of Pharmacy vizianagaram, Andhra Pradesh, India*

Abstract

Melioidosis is a serious infectious disease caused by the environmental Gram-negative bacterium Burkholderiapseudomallei. The organism is naturally found in soil and stagnant water, particularly in tropical regions. The disease is a major public health challenge, but it is frequently unrecognized in endemic areas such as Southeast Asia and northern Australia. Individuals with occupations that involve agricultural work pose a greater risk to infection, with exposure to contaminated environments being common. However, despite many people having contact with the pathogen, only a small proportion develop melioidosis. This evidence suggests the presence of both bacterial and individual host factors that influence the risk of infection and the severity of the disease.

Recent advances in genomic research provide new opportunities to explore the interplay between bacterial variation and human genetic diversity in infectious diseases. Ongoing research investigates combined analyses of the pathogen and the host in the context of integrated genomic approaches. Projects such as BurkHostGEN obtain biological samples from infected patients but also healthy populations and analyze host DNA, gene expression, and the genetic variation of the bacterium. Researchers investigate environmental sources, such as the presence of B. pseudomallei in household water, to determine the presence and diversity of the pathogen. Integrating microbial genome-wide association studies in conjunction with host genetic data represents an emerging strategy to identify the genetic factors associated with the risk for infection, disease progression, and clinical outcomes in patients with melioidosis.

In the long term, such comprehensive genomic studies can improve the overall understanding of melioidosis and further contribute to research of infectious diseases with environmental transmission.

Keywords: Melioidosis, Burkholderiapseudomallei, Genomic research, Host–pathogen interaction, Infectious disease epidemiology, Environmental transmission

1. Introduction

Melioidosis is a serious infectious disease caused by the Gram-negative bacterium Burkholderiapseudomallei. The organism is commonly found in soil and stagnant water, particularly in tropical and subtropical regions, with a high prevalence in Southeast Asia and tropical Australia. Humans typically get the disease by direct contact with polluted soil or water, inhalation of dust or aerosols containing the bacteria, or ingestion of polluted water. The disease can affect the body in ways ranging from mild localized infections to severe conditions like pneumonia, bloodstream infections, and multi-organ

dysfunction. The variable clinical manifestations and high mortality rate in untreated cases make melioidosis a significant health problem in endemic regions [1].

Studies have shown that exposure to B. pseudomallei is relatively common in areas where the disease is endemic, especially among those with occupations in agricultural work such as rice farming. However, only a small proportion of exposed people actually develop symptoms. This suggests that the occurrence of the disease depends on complexes mix of factors, including the degree of exposure, the pathogenicity of the bacterial strain, and the individual's immune status. Certain predisposing conditions, such as diabetes mellitus, chronic kidney disease, and compromised immunity, increase significantly the risk of developing severe forms of infection and complications.[4]

Advances in molecular and genomic research have improved understanding of host–pathogen interactions in infectious diseases. Genomic studies help identifying differences between bacterial strains as well as variation in human genetic makeup that may affect susceptibility, immune response, and disease outcome. Integration of microbial genomic data with information about the host genetics is an emerging approach to provide valuable insights on the factors affecting the risk for infection and the progression of melioidosis.

In the study of melioidosis, large-scale genomic research initiatives such as the BurkHostGEN program focus on exploring bacterial and human genetic factors associated with the disease. Such projects collected not only biological samples of subjects with the disease and healthy populations, but also environmental samples, to identify genetic variations that may affect susceptibility to infection and disease outcome [12].By exploring these datasets, researchers attempt to gain a better understanding on the mechanisms between interactions of pathogen and host leading to the development and progression of melioidosis. These insights are crucial for improving the knowledge of disease mechanisms and can aid the development of more accurate diagnostic methods, effective prevention strategies, and personalized treatment approaches.

History of Melioidosis

Melioidosis is an infectious disease caused by the Gram-negative bacterium Burkholderiapseudomallei. The disease was first reported in the early 1900s, gaining recognition as an important topic in the field of tropical medicine. The earliest record dates back to 1911, when British pathologist Alfred Whitmore along with C. S. Krishnaswami reported an cases of previously unknown infection in individuals in Yangon.In honor of his contribution, the disease was named Whitmore disease initially.

Upon its discovery scientists noted similarities between the causal organism and Burkholderia mallei, the bacterium causing glanders. Because of these similarities, the organism was first classified in the genus Pseudomonas and named Pseudomonas pseudomallei. However, later studies regarding biochemical tests and genetic analysis led to its reclassification in the genus Burkholderia, where it is classified today as Burkholderiapseudomallei [3].

fig 1: burkholderiapseudomallei bacteria

During the mid twentieth-century, an increase in cases was reported from areas such Southeast Asia and northern Australia, thus confirming melioidosis as a disease occurring in tropical climates. Initial studies demonstrated the ability of the bacterium to grow in the soil and surface water, infection being mediated by broken skin, inhalation of contaminated particles, or by swallowing contaminated water. The disease attracted wider attention during Vietnam War, when infections were reported in the military personnel exposed to contaminated environments [4].

Advances in microbiology, epidemiology, and molecular sciences during the late twentieth century led to significant improvements in the understanding of the disease. Researchers realized that melioidosis may present differently, from mild localized infections to severe bloodstream infections and widespread organ involvement. Recently, genomic research has led to more in-depth discoveries about the diversity of bacterial strains as well as the role of host factors for determining susceptibility and the severity of the disease.

Nowadays, melioidosis is considered an emerging infectious disease with great importance in terms of public health in tropical and subtropical regions. Continuing researches regarding the origins, transmission patterns, and molecular characteristics contribute to an essential role in improving methods for the diagnosis, treatment, and prevention of melioidosis [4]

Epidemiology

Melioidosis are caused by the Gram-negative bacterium Burkholderiapseudomallie; which typically occurs in tropical and subtropical regions. It is an important but often ignored disease in public health. The occurrence of the disease is strongly related to environmental factors, climatic conditions, and risk factors [Fig 2].

Global Distribution

Melioidosis cases are most frequently reported in countries of Southeast Asia and northern Australia, where it is considered endemic. Cases have also been noted In parts of South Asia, East Asia, Africa, and the Americas. Global estimations propose that a high number of infections occur yearly, with a high proportion leading to death. However, the real burden of the disease is likely higher than reported owing to lack of adequate diagnostic facilities and insufficient disease surveillance in a number of regions. In certain low- and middle-income countries, inadequate laboratory infrastructure often leads to underdiagnosis or under-identification of cases[2].

Environmental Reservoirs and Transmission

B. pseudomallei is present on the soil, muddy water, and other aqueous environments, especially in agricultural settings. Humans typically get the disease by direct contact with polluted soil or water, inhalation or swallowed particles containing the bacteria, or by drinking unsafe water. People with an occupation involving farming activity, especially cultivation of rice, are at a higher risk to infection due to frequent contact with these environments. Thus, seasonal patterns are also to be considered with infections frequently being reported during rainy periods, when the bacteria are likely brought to the surface by flooding and soil perturbation [14].

Geographic and Environmental Factors

The presence of B. pseudomalei is influenced by environmental factors. Certain conditions such as the type of soil, water movement, land elevation, and morphological characteristics of the terrain affect the survival and propagation of the pathogen. These differences could be responsible for the occurrence of disease in different regions. Moreover, climatic extremes such as high rainfall, cyclones, and floods could worsen the disease risk by spreading polluted soil and water. The ability of the organism to survive in diverse environmental conditions, including low nutrient soils, further contribute to its presence in endemic settings [6].

Population at Risk

Although melioidosis can occur in any age group, a specific risk in adults with occupational exposure to soil and water is apparent. Patients suffering from underlying health conditions such as diabetes mellitus, chronic kidney disease, or immunosuppression are more prone to get the infection and likely to develop severe manifestations. Especially in endemic areas, agricultural workers are at risk and lack of access to healthcare facilities in rural populations lead to worsen disease outcomes [4].

Epidemiological Trends

Recent advances in genomic research led to better understanding of melioidosis epidemiology. There have been reported multiple bacterial lineages circulating within endemic areas, which could have different survival or spreading characteristics. Analysis of large bacterial isolates showed the preference of certain strains in specific geographic areas. These evidences represent the significance of both environmental factors and genetic diversity in the disease pattern. Modern tools such as genome surveillance and improved laboratory diagnosis are more frequently applied to track transmission and support control measures [6]

Public health significance

Melioidosis is a major but underestimated tropical disease. Delays in diagnosis and limited awareness of healthcare professionals often lead to poor patient outcomes. Early detection and timely treatment is critical to decrease mortality rate of the severe cases, which are quite high. Thus, strengthen the public health surveillance, improving the diagnostic infrastructure and enhancing the awareness in population at high risk is a key for reducing the burden of melioidosisworldwide [3].

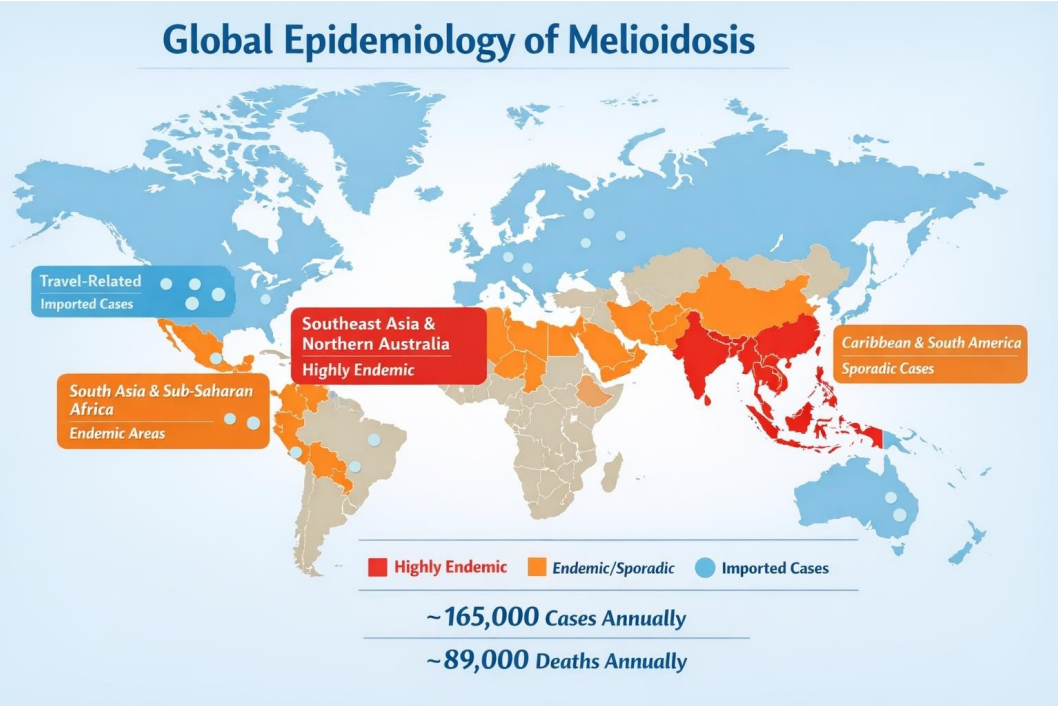


Fig 2 : Global Epidemiology of Melioidosis

Pathogenesis

Melioidosis is caused by the Gram negative bacterium Burkholderia .pseudomallie an environmental organism able to infect humans by contact with contaminated soil or water. Disease development involves multiple complex interactions between pathogen and host comprising entry into the human, survival internally, evading the immune defenses and multiplying in different organs [Fig 3].

Entry and early infection

The bacterium usually breaches the skin, inhaled contaminated particles, or ingested contaminated water introducing to the human body. After penetration, it can infect a number of cell types, such as epithelial cells or immune cells, including macrophages and neutrophils. The bacterium exploits surface molecules, facilitating its adherence to the host tissues, allowing to establish infection. After its attachment, it's internalized by host cells by various mechanisms such as endocytosis or phagocytosis, representing an initial niche where is able to avoid fast immune system destruction [8].

Intracellular survival and multiplication

The ability for B. pseudomallei to survive and replicate inside the host cells is one of its main features. After its engulfment, it can elude the internal vesicles, entering to cells cytoplasm by using specific protein delivery mechanisms, especially secretion systems, facilitating its survival. When the micro-organism is in the cytoplasm of the cells it replicates in an efficient way in immune cells and non-immune cells as well, escaping from a number of host's extracellular weapons.

Spreading among cells

The infection can spread directly from the host cell into the neighboring cells without crossing the extracellular matrix. The mechanism by which the micro-organism moves is the use of host cell actin to push into the cytoplasm creating extensions that invade the adjacent cell allowing the microbe to escape from the

immune defenses, like antibodies. As a result of that process the infected tissue could appear multinuclear, giant cells usually found in melioidosis.

Virulency determinants

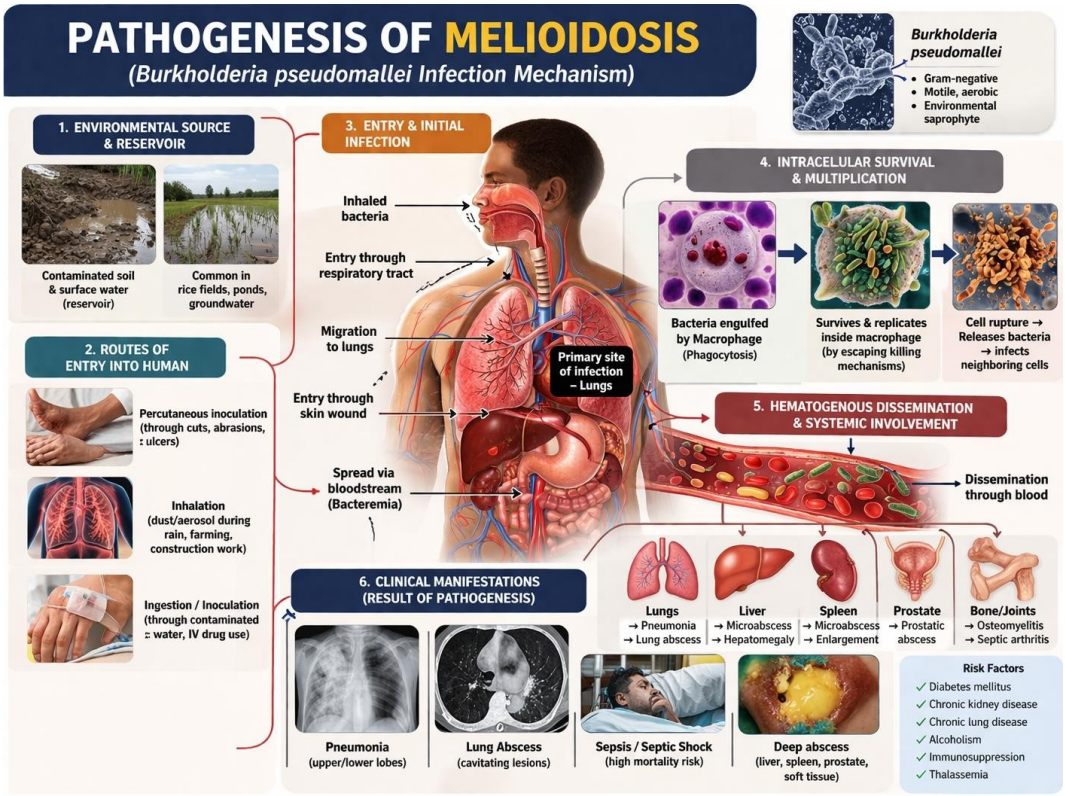
The pathogenic ability of B. pseudomallei is facilitated by several elements that improve the ability of the pathogen for its survival or spread. Such as, elements like lipopolysaccharide which leads to activate immune responses and protect the pathogen from the host defenses. A protective capsule allows the bacteria to resist from being engulfed from immune cells. Moreover, the delivery of proteins which alter the normal cell functions is allowed by secretion systems, for example motility related, facilitating movement between or within the cells. These characteristics allow the organism the ability to be persistent and establish an infection inside the host cell [8].

Host's immune response

The pathogen is recognized by specific receptors that identify and recognize the micro-organism leading to the activation of immune inflammatory pathways. As a result, the immune response leads to the recruitment of the immune response cells to the infected site and the release of molecules, signal for the immune response, as cytokines. These mechanisms are essential to control the infection. Can lead to tissue injury and severity as a consequence of a strong inflammatory response.

Dissemination and development of the disease

After it is established, the infection can disseminate through the blood or lymphatic circulation to several organs such as the lungs, the liver, spleen, and brain. The ability to survive within cytoplasm gives to the micro-organism the ability to persist in the human for many time periods, leading to chronic or latent infections. In additional cases the disease could reactivate after a long period of activity. This persistence is one of the main contributors to the severity and recurrence of melioidosis [13].



Clinical manifestations

Melioidosis is an infectious disease caused by Burkholderiapseudomallei and is characterized by highly variable clinical manifestations. The disease can present from silent infection without visible symptoms to severe life-threatening manifestations such as septicemia and multi-organ failure. The symptoms of the disease and its severity are influenced by several factors such as the route of infection, the quantity of bacteria, the immune response of the infected individual, and the presence of underlying diseases [10].

Incubation period

The time period between the acquisition and the appearance of the symptoms normally lies between a few days up to three weeks. Sometimes the micro-organism could stay within the body inactive in long time periods leading to later appearance of the symptoms, may present after a few months or even after a couple of years. The ability to persist contributes to the occurrence of late presentation and possibility of recurrence of the disease.

Acute infection

Acute meliorosis mostly manifests itself as pneumonia, bloodstream infection or the formation of focal abscesses. The involvement of the lungs is one of the most common presentations, especially when the infection occurs via inhalation. Common symptoms are fever, cough, chest pain, dyspnea, and general weakness. In severe cases, the infection can spread into the bloodstream, leading to septicemia, a situation that may progress to organ dysfunction and requires urgent medical attention [13].

Local infection

In case in which the micro-organism penetrates the organism from break of skin, it can cause focal form of the disease. It presents as ulcers, nodule, or abscess in the place of entry usually with associated pain and swelling and redness. Nearby lymph nodes can and typically are enlarged and inflamed. When the infection is not treated quickly, the infection can spread from the focal lesion.

Pulmonary involvement

Lung involvement is a very frequent form for melioidosis and can have different levels of severity. The infection may present as mild respiratory illness or manifest itself as serious pneumonia. Symptoms often include a persistent cough, large fever, chest discomfort or dyspnea. Imaging on the lungs may show about lung infiltrates or cavity, which may resemble other respiratory infection leading to diagnostic difficulties. [Fig 3].

Disseminated disease

In some cases, the infection can spread through the blood and affect several organs. The most affected organs include the liver, the spleen, the kidneys, prostate, and brain. The widespread form of the disease can cause the formation of multiple abscesses and the presence of systemic symptoms such as prolonged fever, weight loss, and fatigue. The clinical features depend on the organs involved [9].

Chronic infection

Chronic form of melioidosis occurs when the infection persists for a long time. Other chronic diseases can have similar manifestations, such as persistent cough, intermittent fever, night sweats, and weight loss. The occurrence of nonspecific characteristics leads to difficulty in recognizing the presence of the disease and its diagnosis.

Risk factors for severe disease

There are some pedis posing factors that can increase the risk of developing severe melioidosis. Diabetes mellitus, as an example is one of the most significant, due to complications in the sugar metabolism leading to a disturbance in immunity, altered neutrophils, macrophages function, and the decreased production and increased degradation of phosphatases. Kidney insufficiency and immunosuppression are also contributing to the severity of the disease by increasing its risk factors [4].

Complications

If melioidosis is left undiagnosed or untreated, it can pose serious complications. These may include septic shock, multiple organ failure, nervous system involvement, formation of persistent abscesses, and recurrence of infection. Therefore, early diagnosis and proper management are critical to minimize these complications.[13]

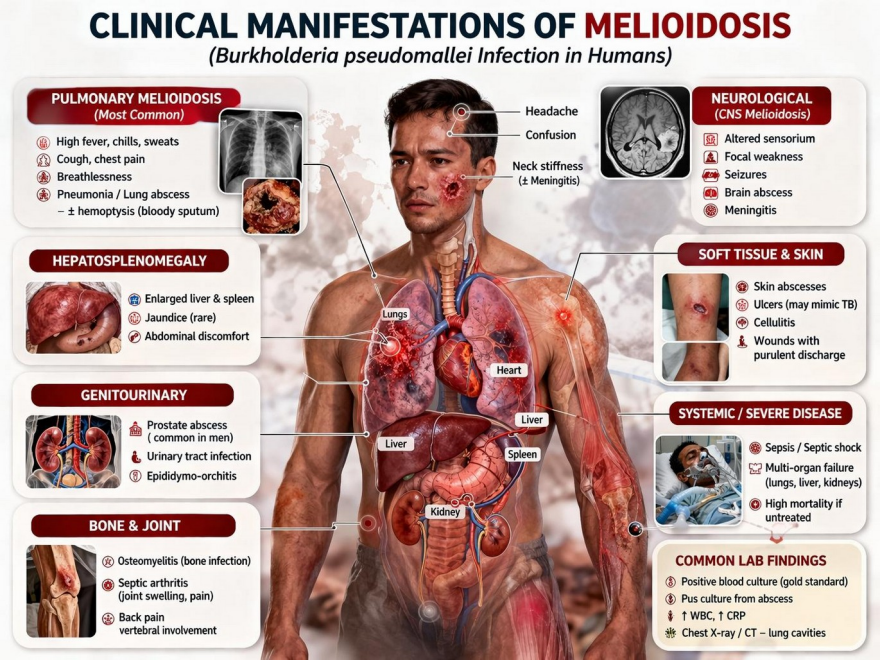


Fig 4: Manifestations of Melioidosis

Diagnosis

Diagnosis of melioidosis, an infection caused by Burkholderiapseudomallei, can be complex with similar symptoms as other diseases like Tuberculosis and bacterial pneumonia. This diversity in clinical presentation also contributes to difficulty in recognition. Diagnosis often relies on a multipronged approach combining clinical evaluation, laboratory tests, and microbiological confirmation.

Clinical Evaluation

The diagnostic process involves a detailed review of symptoms and medical history of the patient. Patients with fever, respiratory illness, abscesses, or signs of bloodstream infections particularly in endemic regions should be suggestive. Assessment of occupational exposure, contact with soils or contaminated water, and recent travels is vital in suspected patients. Patients with underlying disease like diabetes or chronic kidney disease need special attention because of their higher risk of severe infection.

Microbiological Culture

Isolation of the infective organism from clinical samples is the confirmed diagnosis of melioidosis. Specimens could be blood, sputum, urine, pus, throat swabs, or tissue. The bacteria grow in routine laboratory media like

blood agar and MacConkey agar usually within 1–2 days, in distinct colonies characteristically dry and wrinkled. Culture identification remains as the gold standard method to confirm the disease and to make treatment decision.

Microscopic Examination

Initial Gram staining could imply the presence of Gram-negative bacilli with bipolar staining, sometimes noted as having a pin type staining. This characteristic could be suggestive of B. pseudomallei but confirmation with additional test is needed for diagnosis.

Serological Testing

Serological tests that detect antibodies against the bacterium, like indirect hemagglutination is able to serve as additional evidence. However, in endemic region, many individuals already carry the prior antibodies. This may be a limitation to its accuracy. Thus, serological tests are primarily used as supplementary rather than concrete diagnostic techniques.

Molecular Methods

Modern molecular diagnostic techniques have improved the ability to detect B. pseudomallei. Such as polymerase chain reaction (PCR) may allow early identification of bacterial genetic material directly from the specimen. These tests are more sensitive and specific than conventional methods. These methods are helpful to test their accuracy in inconclusive or delayed culture results.

Imaging Techniques

Radiological examination can be helpful in determining the status of infection especially extent of organ involvement. Chest imaging may show abnormality of the lungs such as infiltrates or cavities. Ultrasound, computed tomography (CT), or the magnetic resonance imaging (MRI) may have the ability to detect abscess in internal organs like liver, spleen, or kidney. These investigations contribute in determining the severity of disease and additional management plan.

Differential Diagnosis

Melioidosis resembles a variety of other infections that have similar symptoms. Determination of the difference between melioidosis and other diseases that are likely to be related is important. Tuberculosis, community acquired pneumonia, bloodstream infection with other bacteria, or other fungal diseases could be often confused with melioidosis. Thus, an accurate diagnosis by proper laboratory confirmation is crucial for the right diagnosis and treatment.

Treatment

Initial Intensive Therapy

The first step in treatment is to control the infection promptly using intravenous antibiotics. This stage takes about 10–14-day course but could be extended in serious cases like involving bloodstream infection, or deep involvement. Ceftazidime, Meropenem, and Imipenem are the commonly used drug, out of which the ceftazidime is widely used as a first line drug, whereas the carbapenems are usually preferred in critical patients because its higher activity towards the organism. The other supportive care such fluid management, oxygen therapy, and treating complications is also a critical component particularly for severe cases. [8]

Eradication therapy

After the initial control to eradicate the bacteria, it needs a long time of oral drugs to eradicate any remaining bacteria and prevent the relapse. It usually takes up to 3–6-month course. The most widely prescribed drug is the Trimethoprim–sulfamethoxazole, some of which are administered alone with Doxycycline. Completion of the entire course is necessary to prevent the risk of relapse.

Management of Complication

In case of abscess development involving internal organs like liver, spleen, prostate, it needs additional intervention such as drainage procedure, apart from the usage of the antibiotics. Intensive care support is often required for severe disease like septic shock or organ failure. [8]

Challenges in treatment

Treatment might be hindered due to the natural resistance of the bacterium to a number of commonly antibiotics, which would limit the options of drug. Another issue is its risk of relapse when the treatment is not completed or cut short. It is imperative that the patient strictly adhere to the prescribed course for a successful recovery. [16]

Prevention and Control

As the bacterium B. pseudomallei is ubiquitously distributed in the environment, the eradication of the disease cannot be achieved. Thus, strategies in prevention focus on reducing the exposure and awareness.

Reducing Exposure

Workers or individuals in agricultural setting or environments need to take protection such as wearing shoes and gloves, avoidance of contaminated soil or standing water, cover or bandage skin wounds prior to exposure. [4]

Safe water and hygiene

It is beneficial for individuals in drinking clean or treated water, avoid drinking untreated surface water, and good hygienic practice particularly washing the hand after contact with soil.

Protecting high-risk groups

People with underlying diseases like diabetes, kidney disease, low immunity are more susceptible to the infections and need to take extra attention. In the prevention, it is important to educate early symptom and preventive practice especially for above groups. [9]

Surveillance and Awareness

The improvement in systems of disease monitoring and lab capacity of existing facilities could be useful for timely detection of the case and finding the local of high-risk area. Education programs help improve the general awareness of the public, which leads the people to consult the doctor if unrelived-fever, respiratory symptoms after exposure to environment. [2]

Future Directions and Innovations

Vaccine Development

Currently, there is no vaccine approved for melioidosis, and ongoing efforts are being directed toward the development of vaccines that target key bacterial components, potentially offering long-term protection, particularly in endemic areas. [7]

Improved Diagnostics

Future efforts are being dedicated to developing more rapid and accurate diagnostic tools, the applicability of which need not be limited to high-resource settings. These approaches, based on these advanced methods, may facilitate early diagnosis and potentially better clinical, prognostic, and therapeutic outcomes. [5]

New Treatment Approaches

Activities are being carried to research and develop novel antimicrobial agents and combination therapies, so that the effect against the resistance in the bacteria could be overcome. Advanced and new techniques are suitable for the search and development of the new targeted drug and the use of effective advanced delivery system may help to enhance its effect of the treatment.

Genomic Research

The genomic research is a way to understand better the diversity of the bacteria, transmission patterns and resistance mechanisms. Therefore, it may enable the researchers to identify more new therapeutic targets and develop a better control strategy. [6]

Environmental Monitoring and Prediction

It is expected that mapping the environmental distribution of the bacterium and climate-based prediction model might be useful to identify the high-risk area and anticipate the outbreaks. The change of climate pattern can often affect the spread of the disease, which can even become an important issue for response.

Integrated health approach

Comprehensive approach that integrates the human, animal, and environmental health is necessary for the better control on melioidosis. Interdisciplinary cooperation could be helpful for monitoring, prevention, enhancing the early detection of the outbreak. [2]

Novel Treatment Approaches for Melioidosis

Melioidosis, an infectious disease caused by Burkholderiapseudomallei, remains a significant therapeutic challenge due to the bacterium's ability to survive within host cells, establish chronic infections, and develop resistance to several antimicrobial agents. The current treatment regimen includes an intensive phase with intravenous antibiotics such as ceftazidime or meropenem, followed by a prolonged eradication phase using trimethoprim-sulfamethoxazole. However, researchers are actively exploring innovative treatment strategies to improve patient outcome

Emerging Antimicrobial Agents

Cefiderocol: A novel siderophore cephalosporin that exploits bacterial iron uptake mechanisms to penetrate bacterial cells. Laboratory investigations have demonstrated promising activity against multidrug-resistant Gram-negative pathogens, including B. pseudomallei.

Advanced β-lactam/β-lactamase Inhibitor Combinations: New combinations such as ceftazidime-avibactam and meropenem-vaborbactam are being assessed for their effectiveness against resistant bacterial strains.

Combination Antibiotic Approaches

Researchers are evaluating the use of multiple antibiotics together to enhance bacterial eradication and decrease the risk of disease recurrence.

Potential combinations include:

Meropenem with trimethoprim-sulfamethoxazole

Ceftazidime with doxycycline

Carbapenem-based regimens combined with intracellularly active antimicrobial agents

Host-Targeted Therapeutic Strategies

Rather than directly attacking the pathogen, these therapies aim to strengthen the body's immune defenses.

Examples include:

Immunomodulatory agents that enhance macrophage activitybased treatments designed to improve intracellular bacterial clearance

Anti-inflammatory approaches that regulate excessive immune responses while preserving antimicrobial protection

Monoclonal Antibody Therapy

Monoclonal antibodies directed against specific bacterial surface components are being investigated as a means to neutralize the pathogen and facilitate immune-mediated clearance. Although promising, these therapies remain largely in the preclinical stage.

Vaccine Research and Development

Currently, no approved vaccine is available for melioidosis. Nevertheless, several vaccine platforms are under development, including:

1. Protein subunit vaccines
2. Live attenuated vaccines
3. Glycoconjugate vaccines

An effective vaccine could substantially reduce disease burden in endemic regions, particularly in Southeast Asia and Northern Australia.

Nanotechnology-Assisted Drug Delivery

Nanoparticle-based delivery systems are being explored to transport antibiotics directly into infected cells where B. pseudomallei can persist.

Potential advantages include:

- Enhanced penetration into infected tissues
- Sustained drug release
- Reduced systemic toxicity

Bacteriophage-Based Therapy

Bacteriophages, viruses that specifically infect bacteria, are being studied as an alternative treatment option for antibiotic-resistant infections. Although research is still at an early stage, phage therapy has shown potential for managing difficult-to-treat bacterial diseases.

Genomic and Precision Medicine Strategies

Advances in genomic technologies may support personalized treatment approaches for melioidosis.

Key applications include:

Whole-genome sequencing to identify resistance mechanisms and guide therapy selection

Rapid molecular diagnostic tools for earlier detection and targeted treatment

Current Perspective

Despite ongoing advances in therapeutic research, the established standard of care for melioidosis continues to be intravenous ceftazidime or meropenem during the intensive phase, followed by oral trimethoprim-sulfamethoxazole for eradication therapy. Most novel interventions remain in laboratory, animal, or early clinical investigation stages and have not yet replaced conventional treatment protocols.

2. Conclusion:

Melioidosis represents a serious infectious disease that is caused by BurkholderiapseudomalleI. This bacterium is common in the soil and water in tropical and sub tropic regions. The illness can vary extensively from a mild localized infection, to severe life-threatening conditions that involve bloodstream and multisystem organ involvement. It is often easily missed or misdiagnosed particularly in resource limited settings with similarities with others. Its prognosis can be favorable (mild infection) but rather the case for serious conditions.

Melioidosis infection has a significant health burden, as suggested in the epidemiological data, on populations living in endemic region such as Southeast Asia and northern Australia. The primary mode of transmission of infection is a contact with contaminated soil or water. Those affecting by underlying health conditions especially diabetes and other chronic diseases are more at risk of developing severe form of the illness. Recent achievements in microbiology and molecular diagnostic investigations have contributed to better ability in detection of the disease. However, the early detection is still a problem in majority of the world especially, though the effective treatment is based on early administration of appropriate antibiotics in intensive phase followed by a protracted course to ensure complete eradication of the organism and reduce the risk of recurrences.

Prevention strategies include mainly to limit the exposure to the contaminated environments, improving awareness at risk population and improving the public's health monitoring system. Current strategies on melioidosis have been improved survival rate, however the non-availability of an approved vaccine and its inherent resistance of naturally the bacteria to a number of antibiotics made the further research in treatment a necessary. The future research with the use of rapid diagnostic tools, vaccine development, development on novel antimicrobial therapy, and with genomic investigations are hopeful to control the disease and reduce its impacts in the world. Furthermore, the combined efforts from the clinical, environmental, and epidemiological investigation should be helpful to move the prevention steps of the disease.

References :

[1] Karunanayake P. Melioidosis: clinical aspects. Clin Med (Lond). 2022 Jan;22(1):6-8. Doi: 10.7861/clinmed.2022-0014. PMID: 35078788; PMCID: PMC8813014.

[2] Norman, F. F., Blair, B. M., Chamorro-Tojeiro, S., González-Sanz, M., & Chen, L. H. (2024). The Evolving Global Epidemiology of Human Melioidosis: A Narrative Review. Pathogens (Basel, Switzerland), 13(11), 926. https://doi.org/10.3390/pathogens13110926

[3] Wiersinga WJ, Virk HS, Torres AG, Currie BJ, Peacock SJ, Dance DAB, Limmathurotsakul D. Melioidosis. Nat Rev Dis Primers. 2018 Feb 1;4:17107. Doi: 10.1038/nrdp.2017.107. PMID: 29388572; PMCID: PMC6456913.7107.

[4] Cheng, A. C., & Currie, B. J. (2005). Melioidosis: epidemiology, pathophysiology, and management. Clinical microbiology reviews, 18(2), 383–416. https://doi.org/10.1128/CMR.18.2.383-416.2005

[5] .5. DeMers, H. L., Nualnoi, T., Thorkildson, P., Hau, D., Hannah, E. E., Green, H. R., Pandit, S. G., Gates-Hollingsworth, M. A., Boutthasavong, L., Luangraj, M., Woods, K. L., Dance, D., &AuCoin, D. P. (2022). Detection and Quantification of the Capsular Polysaccharide of Burkholderiapseudomallei in Serum and Urine Samples from Melioidosis Patients. Microbiology spectrum, 10(4), e0076522. https://doi.org/10.1128/spectrum.00765-22

[6] Seng, R., Chomkatekaew, C., Tandhavanant, S., Saiprom, N., Phunpang, R., Thaipadungpanit, J., Batty, E. M., Day, N. P. J., Chantratita, W., West, T. E., Thomson, N. R., Parkhill, J., Chewapreecha, C., &Chantratita, N. (2024). Genetic diversity, determinants, and dissemination of Burkholderiapseudomallei lineages implicated in melioidosis in Northeast Thailand. Nature communications, 15(1), 5699. https://doi.org/10.1038/s41467-024-50067-9

[7] Badten, A.J., Oaxaca-Torres, S., Basu, R.S. et al. Evaluation of highly conserved Burkholderiapseudomallei outer membrane proteins as protective antigens against respiratory melioidosis. Npj Vaccines 10, 186 (2025). https://doi.org/10.1038/s41541-025-01246-2

[8] Panigrahy, R., Sahoo, L. K., Sahu, K. K., Rout, S. S., Roy, S., & Mishra, S. N. (2025). Melioidosis and Burkholderiapseudomallei : Disease mechanisms, drug resistance, and treatment challenges. Journal of Integrative Medicine and Research, 3(1), 14–23. https://doi.org/10.4103/jimr.jimr_55_24

[9] Pacheco, Andrea R et al. “Case Report: Risk Factors Associated with Mortality in Adults with BurkholderiaPseudomallei Bacteremia: A Retrospective Case Series of Melioidosis in Cambodia.” The American journal of tropical medicine and hygiene vol. 111,2 277-280. 18 Jun. 2024, doi:10.4269/ajtmh.23-0369

[10] Suseela, K. V., Alex, A., & Das, S. (2024).Clinical presentations of melioidosis and antibiogram of Burkholderiapseudomallei: An 8-year study in a tertiary care center, South India. International Journal of Advanced Medical and Health Research, 11(1), 31–35. https://doi.org/10.4103/ijamr.ijamr

[11] Angchagun, K., Boonklang, P., Chomkatekaew, C., Pakdeerat, S., Wongsuwan, G., Amornchai, P., Wuthiekanun, V., Panapipat, S., Ngernseng, T., Waithira, N., Walton, S., Limmathurotsakul, D., Surawong, A., Siriboon, S., Chamnan, P., Chantratita, N., Dunachie, S., Corander, J., Davenport, E. E., Knight, J., Parkhill, J., Peacock, S. J., Thomson, N. R., Day, N. P. J., &Chewapreecha, C. (2023).

[12] Angchagun K, Boonklang P, Chomkatekaew C et al. BurkHostGEN: a study protocol for evaluating variations in the Burkholderiapseudomallei and host genomes associated with melioidosis infection [version 2; peer review: 2 approved]. Wellcome Open Res 2023, 8:347.

[13] Hui H, Sheng Y, Han X, Wang S, Zhang G, Wei X. A clinical study on clinical features,manifestations and drug resistance of melioidosis. Pak J Med Sci. 2022 Nov-Dec;38(8):2301-2306. Doi: 10.12669/pjms.38.8.5506. PMID: 36415241; PMCID: PMC9676572.

[14] . Airborne transmission study (Hong Kong outbreak)Wu, W.-G., Shum, M. H.-H., Wong, I. T.-F., Lu, K. K., Lee, L.-K., Leung, J. S.-L., Lao, H.-Y., Lee, A. W.-T., Hau, P.-T., Chan, C. T.-M., Wong, H. F.-T., Fung, S. K.-Y., Wong, S. C.-Y., Ng, I. C.-F., Ng, T. T.-L., Chow, N., Ho, A. Y.-M., Hung, M. F., Chow, F. W.-N., Wong, M. M.-L., To, W.-K., Lam, T. T.-Y., Luk, K. S., & Siu, G. K.-H. (2023).

[15] Withatanung P, Janesomboon S, Vanaporn M, Muangsombut V, Charoensudjai S, Baker DJ, Wuthiekanun V, Galyov EE, Clokie MRJ, Gundogdu O and Korbsrisate S (2024) Induced Burkholderiaprophages detected from the hemoculture: a biomarker for Burkholderiapseudomallei infection. Front. Microbiol. 15:1361121. Doi: 10.3389/fmicb.2024.1361121

[16] Nguyen Phuong Anh, Vu Thi Ngoc Anh, Tran Thi Le Quyen, Bui Nguyen Hai Linh, & Trinh ThanhTrung. (2025). Evaluation of antibiotic susceptibility of Burkholderiapseudomallei isolated from melioidosis patients in northern Vietnam . Vietnam Journal of Science, Technology and Engineering, 67(3), 75-80. https://doi.org/10.31276/VJSTE.2024.0103

[17] Nitin Gupta, Tirlangi Praveen Kumar, AsthaSethi, Pooja Kumari, Harpreet Kaur, ChiranjayMukhopadhyay,

[18] Melioidosis in India: A systematic review of individual cases,Regions,Volume 18,2026,100843,ISSN 2772-7076,https://doi.org/10.1016/j.ijregi.2026.100843.

[19] Mohapatra PR, Behera B, Mishra B. Melioidosis: An Indian Perspective. J Assoc Physicians India 2025;73(5):63-68.

[20] Kannan, S., Singh, S., Earny, V. A., Chowdhury, S., Ashiq, M., Eshwara, V. K., Mukhopadhyay, C., & Kaur, H. (2025). Two Decades of Melioidosis in India: A Comprehensive Epidemiological Review. Pathogens, 14(4), 379. https://doi.org/10.3390/pathogens14040379

[21] , M. V. S.1; Reddy, D. Amulya1; Pamidimukkala, Umabala2; Sree, Aakula Suguna1; Padmaja, Kanne2; Kapoor, Anu3. A retrospective observational study of epidemiology, clinical characteristics and outcomes of melioidosis in a tertiary care hospital in Hyderabad. Journal of Clinical and Scientific Research 12(Suppl 1):p S14-S19, July 2023. | DOI: 10.4103/jcsr.jcsr_89_22

[22] Raj, Sruthi; Sistla, Sujatha; Sadanandan, Deepthy M.1; Kadhiravan, Tamilarasu2; Rameesh, Basheer Mohamed Syed2; Amalnath, Deepak2. Clinical Profile and Predictors of Mortality among Patients with Melioidosis. Journal of Global Infectious Diseases 15(2):p 72-78, Apr–Jun 2023. | DOI: 10.4103/jgid.jgid_134_22

[23] Raj, Sruthi; Sistla, Sujatha; Sadanandan, Deepthy M.1; Kadhiravan, Tamilarasu2; Rameesh, Basheer Mohamed Syed2; Amalnath, Deepak2. Clinical Profile and Predictors of Mortality among Patients with Melioidosis. Journal of Global Infectious Diseases 15(2):p 72-78, Apr–Jun 2023. | DOI: 10.4103/jgid.jgid_134_22

[24] Koshy, M., Jagannati, M., Ralph, R., Victor, P., David, T., Sathyendra, S....Varghese, G. M. (2019). Clinical Manifestations, Antimicrobial Drug Susceptibility Patterns, and Outcomes in Melioidosis Cases, India. Emerging Infectious Diseases, 25(2), 316-320. https://doi.org/10.3201/eid2502.170745

[25] Basheer A, Iqbal N, C S, Kanungo R, Kandasamy R. Melioidosis: distinctive clinico-epidemiological characteristics in southern India. Tropical Doctor. 2021;51(2):174-177. Doi:10.1177/0049475520943698

[26] Anjuna Radhakrishnan, BijayiniBehera, Baijayantimala Mishra, PrasantaRaghabMohapatra, Rajesh Kumar, Arvind Kumar Singh,Clinico-microbiological description and evaluation of rapid lateral flow immunoassay and PCR for detection of Burkholderiapseudomallei from patients hospitalized with sepsis and pneumonia: A twenty-one months study from Odisha, India,AtropiaTropica,Volume221,2021,105994,ISSN 0001-706X,https://doi.org/10.1016/j.actatropica.2021.105994.

[27] Gassiep IArmstrong M, Norton R2020.Human Melioidosis. ClinMicrobiol Rev 33:10.1128/cmr.00006-19.https://doi.org/10.1128/cmr.00006-19

[28] Ella M. Meumann, Bart J. Currie,Approach to melioidosis,CMICommunications,Volume 1, Issue 1,2024,100008,ISSN 2950-5909,https://doi.org/10.1016/j.cmicom.2024.100008

[29] Mohapatra P, Mishra B Burden of melioidosis in India and South Asia: Challenges and ways forwardThe Lancet Regional Health – Southeast Asia, 2022; 2

[30] Easow JM, Bhosale NK, Pramodhini S, Priyadarshini R. Case Series of Melioidosis in a Tertiary Health Care Centre in Puducherry, India. J Pure ApplMicrobiol. 2024;18(1):185-192. Doi: 10.22207/JPAM.18.1.55

[31] Koshy, Maria. Melioidosis: An Emerging Infection in India. Current Medical Issues 18(2):p 94-97, Apr–Jun 2020. | DOI: 10.4103/cmi.cmi_72_19