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Review article

Melioidosis (infectious disease)

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Abstract:

Melioidosis is an emerging infectious disease in the tropics caused by a soil saprophyte, *Burkholderia pseudomallei*. The disease is characterized by its protean clinical manifestations and high case fatality rates. Increase in the number of reported cases from various parts of India over the past one decade, underscore the possibility of endemicity and under-diagnosis of the disease in the sub-continent.

Keyword: *Burkholderia, Melioidosis, soil saprophyte*

Introduction:

The discovery of the disease melioidosis was done by Alfred Whitmore and CS Krishnaswami, while performing a post-mortem in April, 1911 upon a body of a Burman (resident of Rangoon, Burma; now known as Myanmar) aged 40 years. Dr. Whitmore elaborately described the findings of the patient at the autopsy table in Rangoon General Hospital as "At the post-mortem examination, the principal lesion discovered was a peculiar cheesy consolidation of the lungs. The distribution and appearance of this consolidation were those of neither ordinary lobar pneumonia nor tubercular infection ….", which on microscopy, showed "large number of non-Gram staining bacilli of the size and shape of *Burkholderia mallei* (*B. mallei*)". The newly discovered bacterium, *Bacillus pseudomallei,* has lost substantial amounts of its genetic material in the process of becoming adapted as an equine pathogen (Holden et al., 2004).

The bacterium had many nomenclatures: *Bacille de Whitmore* or *Bacillus whitmorii*, followed by *Malleomyces pseudomallei*, and then, most commonly known for many years as *Pseudomonas pseudomallei*. It is renamed as *Burkholderia pseudomallei* in the year 1992 (Yabuuchi et al., 1992). The disease got its name from the Latin words "melis" (distemper of asses) and "eidos" (resemblance) in 1932 (Stanton et al., 1921).

Burkholderia genus consists of over 40 species and *B. pseudomallei* is one among them. This bacterium is motile, aerobic, non-spore forming and Gram negative

bacillus. It did not induce the characteristic Strauss reaction. A decade back, the Sanger Institute has published the 7.2 Mb genome of *B. pseudomallei*, with two chromosomes (4.07 Mb and 3.17 Mb), and a G+C content of 68% (Holden et al., 2004). *B. mallei* is another species which causes glanders in horses and other solipeds and is highly virulent in humans, and *B. cenocepacia* is the other which can cause opportunistic infection in patients with cystic fibrosis. However, the other two less virulent isolates includes, *B. thailandensis*, which is found in the soil of Thailand and Australia, and *B. oklahomensis*, in the Midwestern United States (Wiersinga WJ *et al*., 2012).

Melioidosis in Animals

Camels, ponies, lambs, cattle, horses, pigs, and kangaroos have all been demonstrated to be vulnerable to melioidosis, as have koalas, llamas, deers, cats, and canines, as well as confined marine creatures. Despite their regular contact to mud, cattle, water buffalo, and crocodiles are thought to be reasonably resistant to melioidosis. Melioidosis is likewise thought to be largely resistant in birds, however instances have been observed. Animals such as inbred mouse strains, chickens, rats, and guinea pigs have all been utilized in experimental studies. The vulnerable BALB/c and more resistant C57BL/6 inbred mouse strains have lately been employed extensively in investigations of *B. pseudomallei* host responses.

Bacteriology in general

B. pseudomallei is a gram-negative bacillus with bipolar staining that is vacuolated, thin, and has rounded ends; it is sometimes referred to as a "safety pin" bacillus. It is oxidase positive, and its capacity to digest arabinose distinguishes it from the closely related but less pathogenic B. thailandensis. Whitmore separated it from Burkholderia mallei by its motility on a suspended drop, although this observation is less accurate in semisolid medium.

The organism has different colonial morphology in culture, with typically smooth colonies at first and then dry or wrinkled colonies after more incubation. In Thailand, the therapeutic importance of diverse colony types, particularly small-colony variations, is being explored prospectively (N. Chantratita, personal communication).

B. pseudomallei's epiphytic nature was discovered in French Indochina in 1955. Based on the high incidence among helicopter crews, several early investigations identified the aerosolization of dry dusts as a route of acquisition for American personnel in Vietnam (204). However, more research has shown that wet soils and pooled surface water produce the maximum yields.

The significant link between monsoonal rains and melioidosis is reinforced by the strong link between occupational and recreational exposure to surface water and mud, particularly with flooding of rice paddies and planting at the start of the monsoonal season.

Virulence Factors in Bacteria

B. pseudomallei, like many saprophytic organisms, is a hardy bacterium that can tolerate a wide range of adverse circumstances, including food shortage, acid and alkali pH, disinfection and antiseptic solutions (including detergents and chlorine), antibiotic exposure, and temperature extremes. Proteases, lipases, lechithinase, catalase, perioxidase, superoxide dismutase, hemolysins, a cytotoxic exolipid, and a siderophore are all produced by B. pseudomallei to adapt to its many hosts. It can survive in many eukaryotic cell lines, including professional phagocytes like neutrophils and macrophages, and is resistant to complement, lysosomal defensins, and cationic peptidases.

Slow-growing small-colony variations, for example, can be seen on primary plates from clinical specimens (V. Wuthiekanun, personal communication) or produced by passaging in vivo or in vitro, and are likewise linked to considerable antibiotic resistance. These variations may then return to their original shape and antibiotic sensitivity on their own. Other mutant forms of the organism, such as cell wall-deficient L-forms that can only be produced in vitro by passing through rabbit alveolar cells, have yet to be determined. This shows that unexpected processes, such as the "globi" seen in macrophages and large cells in autopsy specimens, may be involved in B. pseudomallei's survival within the body.

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