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Editorial Article Open Access

Clinical Significance of Bacillus Species Other than *Bacillus anthracis*

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Editorial

Gram positive aerobic or facultatively anaerobic spore forming gram positive bacilli were first identified by Christian Gottfried Ehrenberg in 1885 and were later classified by Ferdinand Cohn in to a separate genus Bacillus [1]. Aerobic spore forming gram positive bacteria are commonly referred to as ASB's and includes members of Bacillus spp which are basically saprophytes living as thermophiles, psychrophiles, acidophiles, alkaliphiles and halophilies exhibiting survival in versatile environmental conditions (*B acidophilus*, *B thermophilus*, *B halodurans, B alcalophilus* and *B coagulans*). There are around 260 species of the genus Bacillus, prevalent worldwide showing both molecular and physiological diversity. Among this group of bacteria, there are certain members responsible for accidental and opportunistic human infections [2,3]. Few among the Bacillus spp, infect animals that include *B anthracis* and *B larvae, B lentimorbus, B popilliae, B sphaericus* and *B thuringiensis* infect invertebrates (insects). Human infections with *Bacillus anthracis*, although is not rare, the cause of concern now is the increasing reports of human infections with other Bacillus spp like the *B cereus*, *B subtilis* and *B licheniformis*, *B alvei*, *B brevis*, *B circulans*, *B coagulans*, B macerans, *B pumilus*, *B sphaericus* and *B thuringiensis*. Bacillus spp are widely recognized for their utility as biological controls in clinical microbiology laboratories where the spores of *Bacillus stearothermophilus* are used to determine the efficacy of sterilization by autoclave and hot air oven. It should also be noted that there are a few antibiotics which are extracted from Bacillus spp (Bacitracin, polymixin and gramicidin were extracted from B subtilis, B *polymyxa* and B *brevis* respectively). Bacillus spp are also used to extract enzymes which can tolerate high temperatures (*B thirungenesis*) required for performing molecular procedures like the polymerase chain reaction (PCR). *B amyloliquefaciens* is another member which is used to produce natural antibiotic substance, a ribonuclease. In fact Bacillus spp have been in high demand for their medicinal, agricultural, pharmaceutical and industrial applications [4].

Human infections by Bacillus spp are infrequently reported in literature barring anthrax. The major drawback for the inadequate reporting of Bacillus spp infections by clinical microbiology laboratories is the fact that most of these bacteria are saprophytic and their isolation in human clinical specimens is ignored as laboratory contaminants as shown in Figure 1. Bacteraemia, endocarditis, wound infections, infections of the eyes and ears, respiratory tract infections, infections of the urinary and gastrointestinal tract, food poisoning and meningitis are a few clinical conditions wherein Bacillus spp have been isolated [5-7]. Since not all human infections are caused among the immunocompetent individuals, Bacillus spp other than B *anthracis* could well be recognized as opportunistic pathogens in immunocompromized and debilitated individuals [8]. Among the many predisposing factors responsible for human infections with Bacillus spp other than B *anthracis*, chronic alcoholism, presence of intravascular devices, intravenous drug abuse and trauma have been noted as significant [9].

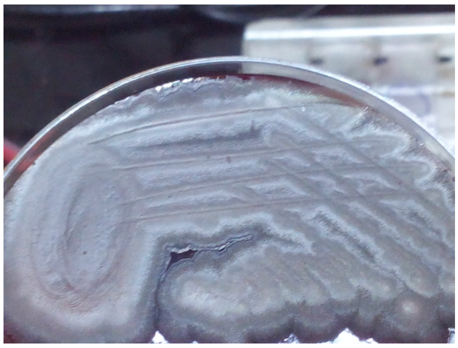

Figure 1: Growth of aerobic spore forming gram positive bacilli on blood agar.

Laboratory identification of Bacillus spp includes certain biochemical and physiological properties such as ability to grow anaerobically, growth at temperatures above 50°C, growth in 7% sodium chloride, motility, catalase production, presence of parasporal bodies and lipid globules in protoplasm, citrate utilization, nitrate reduction, ability to hydrolyze casein and starch, fermentation of glucose and propionate utilization. Barring *Bacillus anthracis* and *Bacillus cereus* (Proteinaceous lethal toxin causes necrosis of skin and mucus cells and also accumulation of fluid in the intestines), the virulence determinants of other Bacillus spp involved in human infections have not been yet identified [8]. Recent research has attempted to identify the mechanisms by which *Bacillus cereus* evades immune response and cause human infection [10].

Human infections with *Bacillus cereus* have been frequently reported in literature and most infections were among debilitated patients including the hospitalized patients undergoing dialysis, Paediatric age patients and individuals suffering from haematological malignancies [11-20]. Infection of *B pumilus* in an otherwise immunocompetent child should be considered as a cause for serious concern [21]. Identification of gram positive aerobic spore forming bacilli to the species level, assessing the pathogenic potential of such bacteria and interpreting the antimicrobial susceptibility testing results against commonly used antibiotics is the need of the hour.

In conclusion it must be understood that although Bacillus species other than *B anthracis* have been rarely associated with human infections, and that many clinical microbiology laboratories ignore these bacteria as laboratory contaminants, careful clinical and laboratory consideration is required to evaluate the actual role of these bacteria in causing human infections to effectively manage the patients.

References

1. Cohn F (1872) Untersuchungen über Bakterien. Beitrage zur Biologie der Pflanzen Heft 2 1:127-224.
2. Euzéby JP (1997) "List of Bacterial Names with Standing in Nomenclature: a folder available on the Internet". Int J Syst Bacteriol 47 (2): 590-592.
3. Xu D, Cote JC (2003) "Phylogenetic relationships between Bacillus species and related genera inferred from comparison of 3' end 16S rDNA and 5' end 16S-23S ITS nucleotide sequences". Int J Syst Evol Microbiol 53: 695-704.
4. Graumann P (2012) Bacillus: Cellular and Molecular Biology (2ndedn), Caister Academic Press.
5. Tuazon CU (2000) Other Bacillus species. In: Mandell, Bennett, Dolin (Eds) Principles and Practice of Infectious Diseases. Churchill Livingston, New York 2220-2226.
6. Drobniewski FA (1993) Bacillus cereus and related species. Clin Microb Reviews 6: 324-338.
7. Carmelita U. Tuazon. Bacillus species. (Last accessed on 2016 April 2).
8. Turnbull PCB (1996) Bacillus. In: Baron S (Ed). Medical Microbiology. (4thedn). Galveston (TX): University of Texas Medical Branch at Galveston; Chapter 15.
9. Tran S, Ramarao N (2013) Bacillus cereus immune escape: a journey within macrophages. FEMS Microbiol Lett 347: 1-6.
10. Sliman R, Rehm S, Shlaes DM (1987) Serious infections caused by Bacillus species. Medicine (Baltimore) 66: 218-223.
11. Barrie D, Hoffman PN, Wilson JA, Kramer JM (1994) Contamination of hospital linen by Bacillus cereus. Epidemiol Infect 113: 297-306.
12. Bryce EA, Smith JA, Tweeddale M, Andruschak BJ, Maxwell MR (1993) Dissemination of Bacillus cereus in an intensive care unit. Infect Control Hosp Epidemiol 14: 459-462.
13. Beecher DJ, Pulido JS, Barney NP, Wong AC (1995) Extracellular virulence factors in Bacillus cereus endophthalmitis: methods and implication of involvement of hemolysin BL. Infect Immun 63:632-639.
14. Curtis JR, Wing AJ, Coleman JC (1967) Bacillus cereus bacteraemia-a complication of intermittent haemodialysis. Lancet 1: 136-138.
15. Hsueh PR, Teng LJ, Yang PC, Pan HL, Ho SW, et al. (1999) Nosocomial pseudo epidemic caused by Bacillus cereus traced to contaminated ethyl alcohol from a liquor factory. J Clin Microbiol 37: 2280-2284.
16. Sharma R, Rao R (2015) Bacillus cereus bacteraemia in a patient of acute myeloid leukaemia. Indian J Med Microbiol 33:168-170.
17. Gurler N, Oksuz L, Muftuoglu M, Sargin F, Besisik S (2012) Bacillus cereus catheter related bloodstream infection in a patient with acute lymphoblastic leukemia. Mediterr J Hematol Infect Dis 4:e2012004.
18. Gaur AH, Patrick CC, McCullers JA, Flynn PM, Pearson TA, et al. (2001) Bacillus cereus bacteremia and meningitis in immunocompromised children. Clin Infect Dis 32:1456-1462.
19. Cotton DJ, Gill VJ, Marshall DJ, Gress J, Thaler M, et al. (1987) Clinical features and therapeutic interventions in 17 cases of Bacillus bacteremia in an immunosuppressed patient population. J Clin Microbiol 25:672-74.
20. Inoue D, Takahashi T (2012) Bacillus cereus sepsis in the treatment of acute myeloid leukemia, myeloid leukemia-clinical diagnosis and treatment, In: Koschmieder S, editor. Intech.
21. Bentur H, Dalzell A, Riordan F (2007) Central venous catheter infection with Bacillus pumilus in an immunocompetent child: a case report. Annals of Clinical Microbiology and Antimicrobials 6: 12.