## **Letter to the Editor**

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# Frequently used laboratory pathogenic bacteria and their effect on human health

Sir,

Interactions between micro-organisms with humans are diverse in nature; it can be beneficial or detrimental. According to WHO, 2004 rate of infectious diseases were found to be increases widely and account for 10 million deaths every year.1 Microorganism consider as a pathogen, when it is capable of causing diseases to human. Which further includes; the invasion in host cells and tissues, adherence to cells, persistence, release of toxic substance, and evade the host's immune system. Ability of pathogen for causing disease is termed as pathogenicity.<sup>2</sup> The pathogenesis of bacterial infection comprises of initiation of the infectious process by multiplying their number in host body which further lead to the development of signs and symptoms of disease.3 Infectious disease usually due to the detrimental interactions, and is specific to host and pathogen.

Microbial laboratory is quite sensitive to microbial contamination, working with pathogenic environment creates contamination in the surroundings which become one of the major common sources for air contamination. Microbial labs provided the greater potential for infectious disease, by monitoring the air quality of labs; whereas high microbial load was reported.<sup>4</sup> Previous reports suggested that microbial transmission can be through aerosol or skin lesions.<sup>5</sup> According to Singh, 2009 exposure of pathogenic microorganisms were more in lab worker and therefore chances of infection rate were observed to be high for them.<sup>6</sup> In case of immune-suppressant/ weak immunity individual infection by these micro-organisms can cause severe health problems or it can be life-threating.

Figure 1 illustrated the frequently used microbial species in laboratory during course of researcher analysis. Gram positive, rod shape, spore forming genus Bacillus species are ubiquitous in environment. The nature of the spore is dormant or inactive, but as the conditions become suitable, they can regenerate into vegetative form or infectious form. According to Ulrich et al, duration of survivability of Bacillus species spores were noted to be extensive, while increasing salt concentration decreased the spore germination. Previous studies demonstrated the pathogenicity of B. cereus was due to the production of large amount of virulence factors such as hemolysins, phospholipases, and proteases.<sup>8,9</sup> B. cereus reported for food poisoning, eye infection, septicemia, endophthalmitis, pneumonia, endocarditis, meningititis and encephalitis.<sup>10,11</sup> Most species of *Bacillus* are not pathogenic to humans but sometimes cross contamination or mixing of species leads to severe diseases. As Jeon et al reported a case study, in which *Bacillus subtilis* and *Bacillus licheniformis* causes the oesophageal perforation. The symptoms occurred in the patient includes; progressive pain associated with dyspnea, increased heart rate (95 beats/min) and increased respiratory rate (30 breaths/min).<sup>12</sup>

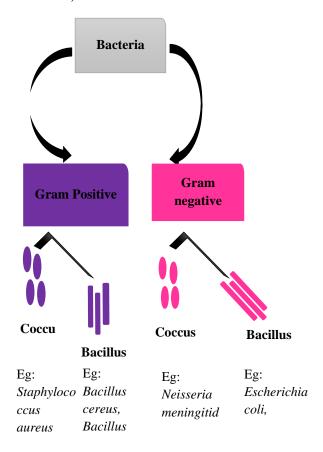


Figure 1: Common bacterial species which comes in direct contact by researcher in laboratory.

Staphylococcus aureus is a non-motile, gram-positive, coccus shape, catalase-positive and facultative anaerobic bacteria. S. aureus does not generally cause infection on healthy skin, about 15% human skin carried S. aureus on their skin. The percentages are higher for people who works in laboratories. Though, if it entered in the bloodstream or internal tissues through skin lesions, these bacteria may cause a variety of serious infections. Staphylococcus aureus can cause a wide range of

diseases, including bacteremia, infective endocarditis, skin and soft tissue infections, infections in internal organs, gastroenteritis, pulmonary infections and intoxications such as toxic shock syndrome and food poisoning. 14,15

Escherichia coli and Pseudomonas aeruginosa are gram negative and rod shape bacteria. They are commonly known as opportunistic pathogens. In some cases, it can cause lifethreatening problems to humans. 16,17 They are leading cause of nausea, vomiting, nosocomial infection, bacteremia, urinary tract infection, pneumonia, surgical wound infection, ear infection and food poisoning. 18,20 While, Neisseria meningitidis is gram-negative, diplo-coccus, fastidious, and endotoxin-producing bacteria. This is the human specific invasive pathogenic species which affect the central nervous system and nasopharynx area of human.<sup>21,22</sup> Globally, N. meningitidis rate of infection was observed in between 10-35% in healthy adults.<sup>23,24</sup> According to Pridmore et al, N. meningitidis responsible for pro-inflammatory activity in human body.25 Moreover, in order to evade the human immune system N. meningitidis changes its surface components this strategy comprises of allelic exchange of genes.<sup>26</sup>

Bio-incidents is a worldwide issue faced by researchers; it is defined as the infection acquired from laboratory. Around 500,000 workers in the US are actively working in labs. They come in the direct contact with multiple microbes which further increases their health risks.<sup>27</sup> Globally, between year 1985-2001, 16 cases of meningococcal disease were recorded including 6 cases form US from year 1996-2000. Where 50% cases were noted fatal and all were occurred in clinical microbiologists.<sup>28</sup> Richard Din, a research associate at the center's research laboratory, San Francisco (April 2012) died from Neisseria meningitidis infection, OSHA (Occupational Safety and Health Administration) reported.<sup>29,30</sup> According to Lamont and Blacksell, 27 bioincidents from bacteria, viruses and fungi were recorded between years 1982-2016; majorly from developed countries (79% were observed).31

Many microbial laboratories play an important part in India, to prevent and control the infectious diseases nationwide. Globally, laboratory-acquired infections are the most common problem. Microorganism are ubiquitous in nature, where not all microbes are pathogenic to humans. Some species are considered as opportunistic to human that will affect and cause severe diseases under suitable circumstances. Frequency of laboratories researchers/workers exposed to a variety of microbes is high due to their nature of work which directly impacts their health. Exposure to infectious aerosols was considered as one of the most common source of laboratory infection. In addition, proper laboratory procedures and correct guidelines for pathogenic microorganisms can significantly minimize the infection.

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