

Streptococcus suis: An Emerging and re-emerging Pathogen of Public Health Importance

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The emergence and re-emergence of several zoonotic pathogens in the past decades have attracted the attention of the public health organizations throughout the world. A plethora of factors are responsible for the emergence and re-emergence of pathogens. Of the 1415 microbial infections affecting human beings, 61% are zoonotic and among the emerging infections, 75% are zoonotic (Pal, 2014). Emerging and re-emerging microbes, which include viruses, bacteria, fungi, Rickettsia, protozoa, and helminthes, are transmitted through several routes. They produce high morbidity and mortality among the susceptible population, especially in infants, elderly, pregnant women, and immunocompromised individuals, and are reported from many countries of the world (Pal, 2007; Pal, 2014). Among these, *Streptococcus suis* is an emerging bacterial pathogen that produce life threatening infections in humans and pigs.

The recorded history of *Streptococcus suis* goes back to 1954 when the bacterium was first described by three veterinarians, namely Field, Buntain and Done in 1954, following outbreaks of meningitis, septicemia, and purulent arthritis among piglets. Perch and co-investigators (1968) are credited to report the first human case of *S. suis* in Denmark. Since then increasing numbers of human cases have been reported in many countries, such as Argentina, Australia, Belgium, Brazil, Cambodia, Canada, Chile, China, Croatia, Denmark, France, Germany, Greece, Hong Kong, Iceland, Italy, Japan, The Netherlands, Norway, Poland, Singapore, Spain, South Korea, Thailand, Taiwan, United Kingdom, United States, United Kingdom, and Vietnam (Breton., *et al.* 1986; Kopic., *et al.* 2002; Lun., *et al.* 2007; Pal, 2007; Smith *et al.* 2008; Hughes., *et al.* 2007; Scultz *et al.*, 2009; Wertheim., *et al.* 2009; Pal, 2014). In addition to pigs, the bacterium can be isolated from other animals, such as cats, cattle, deer, dogs, goats, horses, and sheep (Pal, 2007; Pal, 2014).

Streptococcus suis is a major pathogen of pigs as reported from many regions of the world, and can be transmitted to humans by close contact with sick or carrier pigs. There are an increased numbers of human infections due to *S. suis*, particularly in Southeast Asian countries because of high density of pigs. The infection is mainly sporadic in nature; however, outbreaks are also reported. A massive outbreak of *S. suis* in humans occurred in 2005 in China where 204 people were affected and 38 of them succumbed to death (Lun., *et al.* 2007). The infection is frequently encountered in men than women. Certain occupational groups, such as pig handlers, pig breeders, butchers, abattoir workers, employees of meat processing plant, veterinarians, and meat inspectors are at higher risk of acquiring *S. suis* infection (Breton., *et al.* 1986; Watkins., *et al.* 2001; Pal, 2007; Smith., *et al.* 2008).

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Streptococcus suis belongs to the Family *Streptococcaceae*, and Genus *Streptococcus*. It is a Gram positive, facultative anaerobic, small ovoid cocci, non-motile, catalase negative, Voges - Proskaur negative, hippurate negative but esculin positive. The organism produces acid from glucose, lactose, maltose, and sucrose. The bacterium shows alpha haemolysis on sheep blood agar, and has the ability to synthesize capsule and secrete hemolysin. *Streptococcus suis* grows well at 37°C but no growth occurs at 10°C and 45°C (Pal, 2014). Presently, 35 serotypes of *S. suis* are known but serotype 2 is considered as the most pathogenic to humans as well as swine (Lun., *et al.* 2007).

The pigs serve as the natural reservoir of *Streptococcus suis* to human beings (Lun., *et al.* 2007). However, the role of other animals in the transmission cycle is not known. *Streptococcus suis* infection is transmitted by close contact with pigs or pig products, and the pathogen enters through abrasions, cuts or wounds on the skin of hands, or by the bite of the pig. Very rarely, bacteria may gain entry through eyes (Pal, 2007). It is mentioned that exposure to infected pigs and pork products considered as the chief risk factors to humans (Wertheim., *et al.* 2009).

The incubation period of disease may range from hours to few days. *Streptococcus suis* causes a systemic infection in humans that affects several organs of the body. The clinical spectrum in humans includes meningitis, septicaemia, toxic shock syndrome, pharyngitis, endocarditis, endophthalmitis, arthritis, uveitis, spondyloarthritis, lymphadenopathy, and skin lesions (Lun., *et al.* 2007. Pal, 2007). Meningitis is the predominant clinical syndrome noticed in over 60% of the patients (Pal, 2014). The case fatality rate may reach very high (63%) in patients with septicemia and septic shock (Hughes., *et al.* 2009). *Streptococcus suis* infection can cause mortality of 3–18%, and hearing loss up to 66% of survivors (Wertheim., *et al.* 2009). It is mentioned that 6% to 31% of patients may develop skin lesions (Pal, 2014).

Laboratory help is needed to confirm the diagnosis of *S. suis* infection. Direct microscopic demonstration of Gram positive cocci in the lesions by Gram's method, isolation of pathogen from blood, cerebrospinal fluid (CSF), pleural fluid, peritoneal fluid, brain and other organs on blood agar at 37°C, fluorescent antibody technique, and multiplex polymerase chain reaction (PCR) assay are employed to diagnose the infection (Pal, 2007; Pal, 2014).

A number of antibiotics, such as ampicillin, ceftriaxone, ceftiofur, chloramphenicol, getamicin, penicillin, streptomycin, sulphonamides and vancomycin are tried for the treatment of *S. suis* infection in humans (Pal, 2007; Hughes., *et al.* 2009). Some patients with meningitis showed relapse after 14 days of therapy with penicillin or ceftriaxone, however, prolonged treatment of 4 to 6 weeks duration resulted in good response (Gottschalk., *et al.* 2007). Some isolates of *S. suis* were resistant to clindomycin, gentamicin, kanamycin, and sulphonamides. The high rate of resistance was observed for tetracycline (Pal, 2014).

Currently, no vaccine is available to immunize the high risk groups, and therefore, certain preventive measures, such as prompt disinfection and dressing of cuts, wounds, and abrasions at work place, protection of the skin from pig bite or injury with sharp tools by people occupationally exposed to pigs and pig products, wearing gloves during slaughtering and processing of pig meat, proper washing of hands after attending sick pig or handling raw pork, thorough cooking of pork, maintenance of hygienic conditions in pig farm, and health education of occupational groups (pig farmer, abattoir worker, butcher, meat inspector, veterinarian) about the mode of transmission, severity of disease, and protection of skin wound will certainly mitigate the incidence of *S. suis* infection (Pal, 2007; Hughes., *et al.* 2009; Pal, 2014). The persons with skin lesions are advised not to expose to pigs and pork (Pal, 2007). It is pertinent to mention that early diagnosis and prompt treatment with potent antibacterial antibiotic are vital to prevent the morbidity and mortality in patients.

There is a need to create awareness of physicians and microbiologists about the growing importance of *S. suis* as a human pathogen. It seems imperative to undertake additional research to elucidate the virulence in *S. suis*. Further studies should be conducted on the molecular epidemiology of *S. suis* infection.

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