Pathogen Safety Data Sheet: Infectious Substances – *Streptococcus salivarius*

SECTION I - INFECTIOUS AGENT

NAME: *Streptococcus salivarius*

SYNONYM OR CROSS REFERENCE: Part of the Salivarius group of streptococci [1-7].

CHARACTERISTICS: A member of the Salivarius group of viridans streptococci [7, 8]. *S. salivarius* is an α-haemolytic streptococci [9], existing as a commensal of the oral cavity [1, 3, 5, 8, 10-12], skin [4, 5, 9, 10, 12], gastrointestinal [3, 5, 10-12], oropharynx [4, 13], and genitourinary tracts [3, 8, 10, 12]. Streptococci, in general, are spherical or ovoid in shape and typically exist in chains or pairs [11]. They are gram positive, non-motile, non-sporing, catalase negative, and facultatively anaerobic.

SECTION II - HAZARD IDENTIFICATION

PATHOGENICITY/TOXICITY: *S. salivarius* has been associated with a variety of infections [14]. The most common reports refer to meningitis [3-5, 9, 12, 13], and bacteraemia [6, 15]. Other cases include pericarditis, spontaneous bacterial peritonitis, acute jejunitis, pancreatic abscess, multimicrobial endocarditis, early neonatal sepsis, sinusitis, endophthalmitits, bullous impetigo and femoral osteitis [14]. It must be noted, however, that although *S. salivarius* frequently enter the bloodstream, infections with *S. salivarius* are rare due to their low virulence [1, 3, 5, 16]. Many patients with *S. salivarius* bacteraemia have predisposing local factors such as mucosal disruption and/or serious underlying diseases, such as malignancy or liver cirrhosis [16].

EPIDEMIOLOGY: Worldwide, all streptococcus species are obligate parasites of the mucosal membranes of humans [4, 11].

HOST RANGE: Humans [1, 3-5, 9-13, 16].

INFECTIOUS DOSE: Unknown.

MODE OF TRANSMISSION: *S. salivarius* is part of the normal human flora. It can be transmitted by direct contamination of sterile body fluid, for example, contamination of cerebrospinal fluid following epidural anaesthesia or lumbar puncture [4, 5, 9, 10, 14], due to contaminated equipment, by migration of the organism from the patient's skin along the outer surface of the catheter [4, 5, 9], or via air droplets originating from the oropharynx [10]. *S. salivarius* in the oral cavity can also enter the bloodstream (bacteraemia) following endoscopy and associated therapeutic

interventions [5, 14-16]. Once the organism is in the bloodstream it can seed various anatomical sites (including the meninges and the cerebrospinal fluid) [14].

INCUBATION PERIOD: Unknown.

COMMUNICABILITY: Many suspected cases of human-to-human transmission have been recorded [4, 5, 9, 10, 12]; however, very few cases have been confirmed. So far, only one report was able to unambiguously identify the source of infection, which was from the throat of a doctor to a patient during a lumbar puncture procedure [13].

SECTION III - DISSEMINATION

RESERVOIR: Humans [1, 3-5, 9, 11, 12, 14, 16].

ZOONOSIS: None.

VECTORS: None.

SECTION IV - STABILITY AND VIABILITY

DRUG SUSCEPTIBILITY: Sensitive to various antibiotics, including ciprofloxacin, levofloxacin, metronidazole [8], penicillin [2, 10, 13], amoxicillin [2, 5, 12, 16], ceftriaxone [2-5, 14], clindamycin, rifampicin [2], gentamycin [5], cefuroxime, moxifloxacin [16], ceftoxime [1], and vancomycin [1, 2, 4, 12, 14]. Certain strains of *S. salivarius* have shown partial resistance to penicillin [1, 4, 16], ceftriaxone [4], erythromycin [1, 2, 16], and meropenem [1].

SUSCEPTIBILITY TO DISINFECTANTS: Susceptible to 5.25% sodium hypochlorite, and cresophene (30% paramonochlorophenol, 5% thymol, 0.1% dexamethasone), 21% alcohol, and 2.0% chlorohexidine [17].

PHYSICAL INACTIVATION: Streptococcal species are inactivated at low pH [15].

SURVIVAL OUTSIDE HOST: Unknown. Studies in the 1930s and 1940s suggest that *S. salivarius* can survive on drinking glass rims and utensils for at least a couple of days [18, 19]; however, genetic identification was not available at this time, and it is unknown whether species-specific identification was possible.

SECTION V – FIRST AID / MEDICAL

SURVEILLANCE: Monitor for symptoms. Confirm infection using gram-stain [4, 5, 10], followed by isolation of the organism from blood [3, 5, 6, 8, 16, 17] or cerebrospinal fluid culture [3, 5, 9, 10, 12, 13]. PCR has also been used to identify *S. salivarius* in clinical samples [13].

Note: All diagnostic methods are not necessarily available in all countries.

FIRST AID/TREATMENT: Antibiotic therapy [3-5, 8-10, 12, 14, 16], typically with ceftriaxone [4, 5, 12, 14, 16], amoxicillin [12, 16], and/or vancomycin [4, 5, 14, 16]. Treatment is delivered depending on the manifestation of the infection, for example patients suffering from meningitis due to *S. salivarius* may require mechanical ventilation [4].

IMMUNIZATION: None currently available.

PROPHYLAXIS: None.

SECTION VI - LABORATORY HAZARDS

LABORATORY-ACQUIRED INFECTIONS: No specific laboratory-acquired infections with *S. salivarius* have been reported; however, there were 78 recorded cases of streptococcal infection (species not specified), with 4 deaths up to 1976 [20].

SOURCES/SPECIMENS: Blood [6, 8, 14, 16, 17], peritoneal fluid [8], cerebrospinal fluid [3-5, 10 12, 14], and oropharyngeal secretions [4, 10].

PRIMARY HAZARDS: Accidental parenteral inoculation [9, 12].

SPECIAL HAZARDS: None.

SECTION VII – EXPOSURE CONTROLS / PERSONAL PROTECTION RECOMMENDATIONS

RISK GROUP CLASSIFICATION: Risk Group 1. This bacteria is not regulated under the *Human Pathogens and Toxins Act*, or the *Health of Animals Act*.

CONTAINMENT: Containment Level 1 facilities, equipment, and operational practices for work involving infectious or potentially infectious materials, animals, or cultures [22].

PROTECTIVE CLOTHING: Lab coat. Gloves when direct skin contact with infected materials or animals is unavoidable. Eye protection where there is a known or potential risk of exposure to splashes [22].

OTHER PRECAUTIONS: The use of needles, syringes, and other sharp objects should be strictly limited. Additional precautions should be considered with work involving animals or large scale activities [22].

SECTION VIII – HANDLING AND STORAGE RECOMMENDATIONS

SPILLS: Allow aerosols to settle and, wearing protective clothing, gently cover spill with paper towels and apply an appropriate disinfectant, starting at the perimeter and working towards the centre. Allow sufficient contact time before cleanup [22].

DISPOSAL: Decontaminate all wastes that contain or have come in contact with the infectious organism before disposing by autoclave, chemical disinfection, gamma irradiation, or incineration [22].

STORAGE: The infectious agent should be stored in leak-proof containers that are appropriately labelled.

SECTION IX - REGULATORY AND OTHER INFORMATION

REGULATORY INFORMATION: The import, transport, and use of pathogens in Canada is regulated under many regulatory bodies, including the Public Health Agency of Canada, Health Canada, Canadian Food Inspection Agency, Environment Canada, and Transport Canada. Users are responsible for ensuring they are compliant with all relevant acts, regulations, guidelines, and standards.

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Although the information, opinions and recommendations contained in this Pathogen Safety Data Sheet are compiled from sources believed to be reliable, we accept no responsibility for the accuracy, sufficiency, or reliability or for any loss or injury resulting from the use of the information. Newly discovered hazards are frequent and this information may not be completely up to date.

REFERENCES:

1. Ahmed, R., Hassall, T., Morland, B., & Gray, J. (2003). Viridans streptococcus bacteremia in children on chemotherapy for cancer: an underestimated problem. Pediatric Hematology & Oncology, 20(6), 439-444.
2. Smith, A., Jackson, M. S., & Kennedy, H. (2004). Antimicrobial susceptibility of viridans group streptococcal blood isolates to eight antimicrobial agents. Scandinavian Journal of Infectious Diseases, 36(4), 259-263.
3. Conte, A., Chinello, P., Civljak, R., Bellussi, A., Noto, P., & Petrosillo, N. (2006). Streptococcus salivarius meningitis and sphenoid sinus mucocele. Case report and literature review. Journal of Infection, 52(1), e27-30.
4. Yaniv, L. G., & Potasman, I. (2000). Iatrogenic meningitis: an increasing role for resistant viridans streptococci? Case report and review of the last 20 years. Scandinavian Journal of Infectious Diseases, 32(6), 693-696.

5. Megarbane, B., Casetta, A., Esvant, H., Marchal, P., Axler, O., & Brivet, F. G. (2000). Streptococcus salivarius acute meningitis with latent petromastoiditis. Scandinavian Journal of Infectious Diseases, 32(3), 322-323.
6. Wisplinghoff, H., Reinert, R. R., Cornely, O., & Seifert, H. (1999). Molecular relationships and antimicrobial susceptibilities of viridans group streptococci isolated from blood of neutropenic cancer patients. Journal of Clinical Microbiology, 37(6), 1876-1880.
7. Facklam, R. (2002). What happened to the streptococci: overview of taxonomic and nomenclature changes. Clinical Microbiology Reviews, 15(4), 613-630.
8. Peterson, M. C. (2002). Spontaneous bacterial peritonitis from Streptococcus salivarius in a compromised host. Journal of Infection, 45(3), 197-198.
9. Trautmann, M., Lepper, P. M., & Schmitz, F. J. (2002). Three cases of bacterial meningitis after spinal and epidural anesthesia. European Journal of Clinical Microbiology & Infectious Diseases, 21(1), 43-45.
10. Couzigou, C., Vuong, T. K., Botherel, A. H., Aggoune, M., & Astagneau, P. (2003). Iatrogenic Streptococcus salivarius meningitis after spinal anaesthesia: need for strict application of standard precautions. Journal of Hospital Infection, 53(4), 313-314.
11. Kilian, M. (1998). Streptococcus and Lactobacillus. In A. Balows, & B. I. Duerden (Eds.), Topley & Wilson's microbiology and microbial infections (9th ed., pp. 633-668). London: Arnold.
12. Bouhemad, B., Dounas, M., Mercier, F. J., & Benhamou, D. (1998). Bacterial meningitis following combined spinal-epidural analgesia for labour. Anaesthesia, 53(3), 292-295.
13. Veringa, E., van Belkum, A., & Schellekens, H. (1995). Iatrogenic meningitis by Streptococcus salivarius following lumbar puncture. Journal of Hospital Infection, 29(4), 316-318.
14. Rafailidis, P. I., Prapas, S. N., Kasiakou, S. K., Costeas, X. F., & Falagas, M. E. (2005). Effusive-constrictive calcific pericarditis associated with Streptococcus salivarius. Case report and review of the literature. Cardiology in Review, 13(3), 113-117.
15. Lee, T. H., Hsueh, P. R., Yeh, W. C., Wang, H. P., Wang, T. H., & Lin, J. T. (2000). Low frequency of bacteremia after endoscopic mucosal resection. Gastrointestinal Endoscopy, 52(2), 223-225.
16. Corredoira, J. C., Alonso, M. P., Garcia, J. F., Casariego, E., Coira, A., Rodriguez, A., Pita, J., Louzao, C., Pombo, B., Lopez, M. J., & Varela, J. (2005). Clinical characteristics and significance of Streptococcus salivarius bacteremia and Streptococcus bovis bacteremia: a prospective 16-year study. European Journal of Clinical Microbiology & Infectious Diseases, 24(4), 250-255.
17. Ayhan, H., Sultan, N., Cirak, M., Ruhi, M. Z., & Bodur, H. (1999). Antimicrobial effects of various endodontic irrigants on selected microorganisms. International Endodontic Journal, 32(2), 99-102.
18. Dick, L. A. (1938). Contamination of Drinking Glasses by Streptococci. Proceedings of the Branches of the Society of American Bacteriologists, , 224-225.
19. Walter, W. G. (1941). Sanitization of Beverage Glasses. Proceedings of the Branches of the Society of American Bacteriologists, , 114-115.
20. Pike, R. M. (1976). Laboratory associated infections: summary and analysis of 3921 cases. Health Laboratory Science, 13(2), 105-114.
21. Human Pathogens and Toxins Act. S.C. 2009, c. 24. Government of Canada, Second Session, Fortieth Parliament, 57-58 Elizabeth II, 2009, (2009).
22. Public Health Agency of Canada. (2017). Canadian Biosafety Guideline - Containment Level 1: Physical Design and Operational Practices. Canada: Public Health Agency of Canada.