The *Streptococcus anginosus* group

Often underestimated, unrecognized, and misidentified

By Kerry Pierce, MS

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She earned her Bachelor's and Master's Degrees at Florida State University in Tallahassee. Her studies were focused on molecular microbiology.

Before joining Hardy, Kerry held several college level teaching positions for biology and microbiology.

Kerry takes pride in serving and assisting customers at Hardy Diagnostics and has become involved in various writing and training assignments.

Classification, nomenclature and identification of the *Streptococcus anginosus* group (SAG) have been historically problematic and unreliable, mainly due to variability in bacteriological characteristics and clinical presentations.

SAG was first discovered in 1956 by Guthof, when examining non-hemolytic streptococcal species isolated from oral infections. This group included an assortment of streptococci associated with serious pathogenic infections.

Lancefield group reaction, along with other common laboratory techniques used to identify bacteria, are inconsistent throughout the *S. anginosus* group, making it difficult to classify these microorganisms. The species name, "milleri," was chosen in honor of the microbiologist, W.D. Miller, but was later amended to include small beta-hemolytic, along with non-hemolytic streptococci in groups C, F or G and collectively referred to as the "*Streptococcus milleri*" group. Unification of these streptococci into a single species, *Streptococcus anginosus*, was later proposed, as this is the oldest approved name for members in this group and, therefore, took precedence over the name "milleri."

More recent molecular analysis shows three discrete DNA homologies within SAG, corresponding to three distinct strains:

- ☐ *Streptococcus constellatus*
- ☐ *Streptococcus intermedius*
- ☐ *Streptococcus anginosus*

"In general, members of SAG have a propensity to form abscesses and cause invasive pyogenic infection, including head and neck infection, brain abscesses, intra-thoracic and intra-abdominal infections."

Members of this group are phenotypically characterized by their microaerophilic or anaerobic growth requirement, the formation of pin-point or "minute" sized colonies, and the frequent

presence of a distinctive caramel-like smell when cultured on a solid agar medium.

Members of SAG are considered normal commensal flora in humans and are commonly isolated from the oral cavity, oropharynx, gastrointestinal tract and vagina. However, these bacteria possess the potential to cause a variety of multiple body site infections in both human and animal hosts.

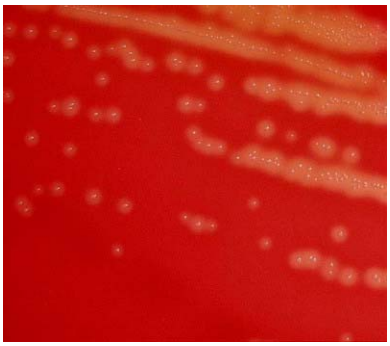


Figure 1: **Streptococcus constellatus** ***is a Group C beta hemolytic strep forming small colonies on Blood Agar. It is a member of the*** **Streptococcus anginosus** ***group (SAG).***

Unlike other types of viridans streptococci, members of SAG are oftentimes associated with bacteremia and abscess formation; in general, treatment of abscesses requires surgical intervention and drainage. The pathogenic mechanisms of this group are not well known or completely understood, but it is widely believed that the presence of a polysaccharide capsule helps these opportunistic pathogens evade the body's natural defense systems and escape phagocytosis prior to infection. In addition, their ability to produce extracellular enzymes capable of degrading connective tissue, including hyaluronidase, deoxyribonuclease, ribonuclease, gelatinase and collagenase, may contribute greatly to their overall pathogenicity.

The *Streptococcus anginosus* group is also known to release extracellular products that have an immunosuppressive effect, further permitting them to survive and flourish within the confines of an abscess.

After their initial isolation from oral infections, subsequent research on SAG confirmed their role in pathogenic oral and teeth infections, as well as their carcinogenic potential. Studies investigating the bacteriology of dental caries and abscesses show that members of SAG have been isolated from dental aspirates, with some patients showing nearly pure colony growth of SAG, while others have a majority of SAG mixed with other oral anaerobes.

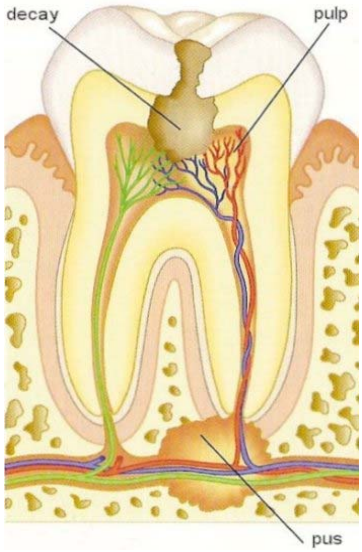


Figure 2: SAG is a common cause of dental abscesses.

Head and neck infection by SAG is generally associated with dental origin and the majority of these patients usually require surgical intervention. Consequently, odontogenic infection cannot be ruled out in patients with SAG bacteremia of unknown source, especially in patients with poor dental hygiene.

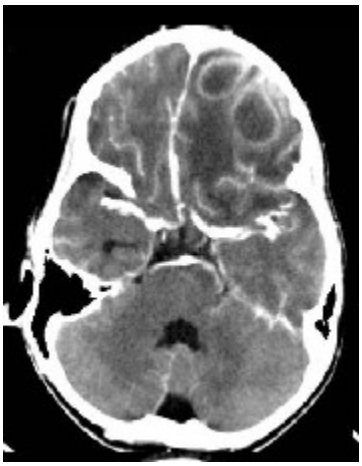


Figure 3: A CT scan of a SAG brain abscess from an 8 year old presenting with fever and headache for one month.

Chronic alcohol consumption is a major risk factor for cancers of the upper digestive tract. In fact, the incidence of esophageal cancer in alcoholics is reportedly much higher than as seen in the general population, suggesting the presence of certain risk factors in chronic alcohol consumption-related carcinogenesis. Recent research into the concentration of *S. anginosus* present in the saliva of alcoholics compared to healthy patients or patients with other types of chronic oral/digestive diagnoses (esophageal cancer, periodontitis, gastritis, etc.) shows elevated levels of *S. anginosus* in the saliva of

alcoholics, suggesting they have a higher than average risk for *S. anginosus* infection.

In general, members of SAG have a propensity to form abscesses and cause invasive pyogenic infection, including head and neck infection, brain abscesses, intra-thoracic and intra-abdominal infections. Predisposing or underlying conditions noted with infection by SAG include previous surgery, trauma, diabetes, immunodeficiency, and malignancy, but may also be related to hygiene or the patient's overall general health condition as outlined above.

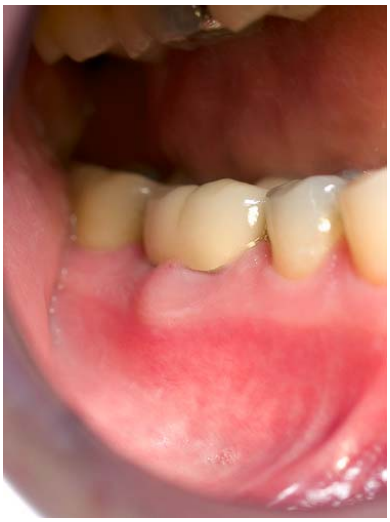
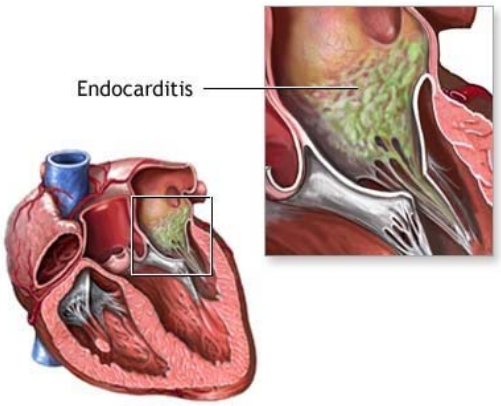


Figure 4: A gingival abscess

Different species of SAG appear at differing rates and of different degrees of pathogenicity. Research shows that *S. constellatus* and *S. anginosus* are isolated at roughly the same frequency from clinical specimens, but at a rate four times more often than *S. intermedius*. The majority of isolates were recovered from exudates, aspirate or fluid samples, and additional isolates were recovered from blood. *S. intermedius* and *S. constellatus* are more likely to cause abscesses than *S. anginosus*, while *S. constellatus* and *S. anginosus* appear more likely to be polymicrobial. Previous research also suggests that, although *S. intermedius* is the least commonly isolated species, it appears to be the most pathogenic in terms of the etiology of disease.

Other than pyogenic infection, infective endocarditis has been reported in a significant number of patients with SAG bacteremia; however, the incidence of infective endocarditis appears to be declining. Current literature suggests that endocarditis caused by beta-hemolytic streptococci and SAG show that the majority of patients with SAG endocarditis also appear to have underlying complications due to pre-existing heart diseases. Among the species of streptococci in the *Streptococcus anginosus* group, it is believed that *S. anginosus* is the most likely member to cause endocarditis. Studies using mouse models support the finding that *S. anginosus* is more likely to cause endocarditis, because this species is generally found in higher cell densities within infected tissue.



In conclusion, members of SAG have a tendency to cause abscess formation, but different species have a different propensity for pyogenic infection. Therefore, since the three species of SAG are associated with different clinical manifestations and symptoms, it is useful to identify these microorganisms in order to further investigate the etiology of disease and optimize patient outcomes.

Figure 5: Hardy's Rapid Anginosis ID Kit performs an arginine decarboxylase (positive seen in the second tube) and a Voges-Proskauer test (positive seen in the fourth tube) to quickly place a strep within the anginosus group.

Consequently, Hardy Diagnostics has developed the

Rapid Anginosus Kit (Cat. no. Z14) which can be used to detect arginine decarboxylase activity and perform the Voges-Proskauer test in as little as four hours, to assist in the identification of streptococcal isolates suspected of belonging to the anginosus group. This kit offers a simple method to quickly distinguish the possibly pathogenic SAG from the other usually harmless members of the viridans streptococci.

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