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CMPT Clinical Bacteriology Program

Innovation, Education, Quality Assessment, Continual Improvement

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Challenge M243-4

November 2024

Brain abscess: *Streptococcus anginosus*

HISTORY

A simulated brain abscess sample collected from a 55 year old male in-patient with ataxia was sent to category A laboratories. Participants were expected to isolate and report *Streptococcus anginosus* and perform susceptibility testing.

CMPT QA/QC/STATISTICS

All simulated abscess samples are produced at CMPT according to CMPT internal protocols. The sample contained a pure culture of *Streptococcus anginosus.*

The samples are assessed for homogeneity and stability using in-house quality control methods and random selection of samples before and during production, and post sample delivery. The number of random samples selected is 15% of the total production batch.

The challenge sample lot was confirmed to be homogeneous and stable for 14 days. Organism identification was confirmed by a reference laboratory.

All challenge components have in-house assigned values based on the most clinically appropriate result; the most clinically appropriate result is determined by expert committee evaluation. No further statistical analysis is performed on the results beyond that described under "Suitability for grading."

SURVEY RESULTS

Reference laboratories

Identification: 12/12 (100%) labs reported *Streptococcus anginosus*, 1 lab does not normally process this type of sample

Susceptibility: 12/12 (100%) labs reported penicillin and ceftriaxone S; 9/12 (75%) labs reported vancomycin S, 3 labs did not report.

Participants

Identification: 37/45 (82%) reporting labs reported *Streptococcus anginosus*, 6 participants reported other *Streptococcus* species, 1 lab does not normally process this type of sample (Table 1).

MAIN EDUCATIONAL POINTS from M243-4

1. *S. anginosus* is a member of the anginosus group of organisms consisting of *S. anginosus, S. intermedius,* and *S. constellatus*.
2. *S. anginosus* is part of the normal human microbiota, frequently colonizing the oropharynx, urogenital and gastrointestinal tracts.
3. The association of *S. anginosus* and in fact the entire group to form abscesses has long been recognized, particularly brain and liver abscesses.
4. Although resistance is rare, penicillin susceptibility should always be reported.

Susceptibility: 36/45 (80%) labs reported penicillin S and 35/45 (78%) ceftriaxone S; 24/45 (53%) labs reported vancomycin S (Table 2A-C).

Suitability for Grading

A challenge is considered suitable for grading if agreement is reached by 80 percent of selected reference group and at least 50 percent of the participants.

Organism identification and susceptibility to penicillin and ceftriaxone were correctly performed by at least 80 percent of reference laboratories and greater than 50 percent of all laboratories and were therefore, determined to be suitable for grading. Susceptibility to vancomycin did not reach consensus and for this reason could not be graded.

Grading

Maximum grade: 12

Reporting *Streptococcus anginosus* was graded 4.

Reporting the organism susceptible to penicillin and ceftriaxone was graded 4 for each antimicrobial agent.

Table 1. Identification results

Reported	Total	Grade
Streptococcus anginosus ± group/Streptocoque du groupe anginosus	34	4
Streptococcus anginosus (*S. anginosus/milleri* group)	1	4
Streptococcus anginosus (Group C Strep) Abundant	1	3
Streptococcus constellatus	1	3
light growth of *Streptococcus anginosus*, light growth of *S. mitis/oralis*	1	0
Streptococcus gordonii	1	0
Beta Group C Streptococcus	3	0
Streptococcus pyogenes (group A)	1	0
no growth found	1	0
no report	1	0
sample not normally processed	5	ungraded
Total	**51**	

COMMENTS ON RESULTS

All reference labs that processed this specimen correctly reported Streptococcus anginosus and all reported penicillin and ceftriaxone as susceptible. 75% also reported vancomycin susceptibility.

Among other participating labs, 37 (82%) identified *S. anginosus* and 1 reported *S. constellatus* (anginosus group). 82% and 78% reported penicillin and ceftriaxone susceptibility respectively, 53% reported vancomycin.

One laboratory received a scores of 3. One reported *Streptococcus anginosus* (Group C Strep). While not technically wrong, the inclusion of "Group C Strep" could potentially be misleading. Another identified the isolate as *Streptococcus constellatus*. While this species falls within the "Anginosus" group of Streptococci, the answer was not technically correct. Several laboratories either contaminated the specimen or reported the wrong identification resulting in a score of 0.

Laboratories at a minimum should report both penicillin and ceftriaxone. The inclusion of vancomycin was not graded, however, this might be useful clinically had penicillin been reported as resistant.

ISOLATION AND IDENTIFICATION

Streptococcus anginosus group organisms are viridans group streptococci that consist of three species: *S. anginosus, S. constellatus*, and *S. intermedius*; (these species can be further divided into subspecies, but this is seldom done in practice as the clinical relevance is not clear.)[1]

Historically, these were sometimes called *Streptococcus milleri* group; however, this name does not have taxonomic standing and should not be used.[2] They usually grow on blood agar when incubated in 5% CO_2; some strains can be more fastidious. Like all streptococci, they are gram positive cocci, arranged in chains, and are catalase-negative. Colonies may appear beta-hemolytic, alpha-hemolytic, or not hemolytic at all.

Beta-hemolytic colonies of *S. anginosus* group should be differentiated from the beta-hemolytic streptococci (e.g. *S. pyogenes*) by colony size: the former are typically small (<0.5 mm after 24 h of incubation), whereas the latter are larger (>0.5 mm after 24 h incubation). *S. anginosus* group organisms may produce the Lancefield antigens A, C, F, or G, or none of the above.[3]

Biochemically, *S. anginosus* group organisms are PYR negative, allowing a further means of differentiation from *S. pyogenes*. To distinguish them from other groups of viridans group streptococci, they test positive for both Voges Proskauer (VP) and arginine.[3] Speciation of *S. anginosus* by biochemical means is possible, but commonly used biochemical identification platforms, such as the Vitek and Phoenix, are imprecise.

Table 2A - C. Susceptibility testing results

2A Penicillin	**Total**	**Grade**
S	36	**4**
no report	5	0
n/a, no ID report	2	ungraded
refer, sample not normally processed	8	ungraded
Total	**51**	
2B Ceftriaxone	**Total**	**Grade**
Ceftriaxone S	33	4
Cefotaxime S	2	4
no report	6	0
n/a, no ID report	2	ungraded
refer, sample not normally processed	8	ungraded
Total	**51**	
2C Vancomycin	**Total**	**Grade**
S	24	ungraded
no report	17	ungraded
n/a, no ID report	2	ungraded
refer, sample not normally processed	8	ungraded
Total	**51**	

MALDI-TOF can reliably identify these organisms to the group level. However, again, there is some imprecision to species level that may vary depending on species: accurate speciation appears to be more problematic with *S. constellatus* and *S. intermedius*.[4,5] It may be most accurate to report these organisms at the *S. anginosus* group level. While 16S rDNA sequencing is able to resolve identification at the species level (though not to the subspecies level),[6] this is seldom necessary, and thus rarely used in practice.

ISOLATION AND IDENTIFICATION

Antimicrobial susceptibility interpretive breakpoints for *Streptococcus anginosus* group organisms are included in the CLSI M100 interpretations for viridans group streptococci. Penicillin is considered a category A antimicrobial, with primary reporting; ceftriaxone and vancomycin are considered category B and may often be reported in sterile site infections.

S. anginosus group organisms are typically susceptible to penicillin (and other beta-lactams). Resistance is uncommon, with non-susceptibility typically reported in <5% of isolates, and may vary by species.[7] Penicillin and other beta-lactam resistance, when found, would be likely due to mutations in the penicillin-binding proteins. Vancomycin resistance has not been reported in this group of organisms.

CLINICAL RELEVANCE

Streptococcus anginosus group organisms are part of the commensal flora of the human oropharynx and gastrointestinal tract. However, they are opportunistic pathogens with the capacity to cause severe invasive infections and have a propensity for dissemination and abscess formation.

S. anginosus group organisms have been implicated in head and neck abscesses, empyemas, and intraabdominal abscesses, especially in the liver.[8] When bacteremia with these organisms is detected, it is often associated with an underlying abscess. Compared to other viridans group streptococci, endocarditis is rarer, although it has been reported. Infections with *S. anginosus* group are often polymicrobial with other anaerobes.

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