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CMPT Clinical Bacteriology Program

Innovation, Education, Quality Assessment, Continual Improvement

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Challenge M241-5

May 2024

Blood: *Staphylococcus lugdunensis*

HISTORY

.A simulated blood sample collected from a 35 year old female, in-patient, with a peripherally inserted central catheter (PICC) line was sent to category A laboratories.

Participants were expected to isolate and report *Staphylococcus lugdunensis;* laboratories were also expected to report susceptibilities.

CMPT QA/QC/STATISTICS

All simulated blood samples are produced at CMPT according to CMPT internal protocols. The sample contained a pure culture of *Staphylococcus lugdunensis.*

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 15 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 *Staphylococcus lugdunensis*

Susceptibility: 12/12 (100%) labs reported oxacillin S (2 of which reported cloxacillin S); 5/12 (42%) labs reported vancomycin S, 7 labs did not report.

One lab indicated it does not process blood culture samples

MAIN EDUCATIONAL POINTS from M241-5

1. When using coagulase for identification of staphylococci from clinically significant sites, it is vital that a tube coagulase test be performed to avoid misidentification of those staphylococci that test positive by the slide coagulase test (due to bound coagulase) as *S. aureus*. *S. lugdunensis* does not test positive in the tube coagulase test.
2. It is important to speciate coagulase-negative staphylococci in clinically significant cultures as the susceptibility breakpoints for cloxacillin/oxacillin are different for *S. lugdenensis* as compared to other coagulase-negative staphlylococci such as *S. epidermidis*.
3. Clinical infection caused by *S. lugdunensis* is more closely resembles that caused by *S. aureus* than many of the other coagulase-negative staphylococci and should therefore be managed accordingly.

Participants

Identification: 44/47 (94%) labs reported *Staphylococcus lugdunensis*; two participants reported *S. lugdunensis* but reported a second organism; one lab reported *S. aureus* (Table 1).

Susceptibility: 40/47 (96%) labs reported oxacillin S (5 of which reported cloxacillin S) (Table 2A); 29/47 (62%) labs reported vancomycin S, 17 labs did not report (Table 2B).

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.

Grading

Maximum grade: 12

Reporting *S. lugdunensis* was graded 4.

Reporting the strain susceptible to oxacillin and vancomycin was graded 4 for each agent.

Organism identification, and susceptibility to oxacillin (methicillin) was 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.

Table 1. Identification results

Reported	Total	Grade
Staphylococcus lugdunensis	44	4
Staphylococcus lugdunensis, Escherichia coli	1	0
Staphylococcus lugdunensis, Staphylococcus epidermidis	1	0
Staphylococcus aureus	1	0
sample not normally processed	4	ungraded
Total	**51**	

COMMENTS ON RESULTS

The majority of laboratories report the identification of *Staphylococcus lugdenensis* correctly – all 12 reference labs as well as 44/47 of the participant labs. 2 participant labs reported *S. lugdenensis* but also reported another organism and since this culture that was sent was pure, they received a grade of 0. Another lab reported the incorrect identification of *S. aureus* (slide coagulase positive and tube coagulase negative) and was also given a grade of 0. 4 labs were ungraded as they do not normally process blood cultures.

The cloxacillin/oxacillin susceptibility results were the only antibiotic that was graded as there was not consensus on the reporting of vancomycin. 45/47 labs reported Cloxacillin/Oxacillin as susceptible and were given full marks. One lab reported the Cloxacillin result from the Vitek and did not indicate that the result was checked by doing the cefoxitin Kirby Bauer and interpreting accordingly for *S. lugdenensis*, and was given a grade of 0. One lab (the one that reported the ID as *S. aureus*) reported cefoxitin and penicillin and was given a grade of 0. The four labs that didn't process were ungraded.

All laboratories provided a full identification and susceptibility testing results for this organism and did not treat the organism as a probably contaminant, as is sometimes done in single set blood cultures which grow a coagulase-negative staphylococcus in the absence of a line culture, which was the intended response

ISOLATION AND IDENTIFICATION

Staphylococcus lugdunensis is a coagulase-negative staphylococcus (CNS) that produces bound coagulase via a clumping factor and thus gives positive results for the slide coagulase test.

Because *S. aureus* is slide and tube coagulase positive, *S.lugdunensis* can be misidentified as *S.aureus* if a tube coagulase test (or other differentiating test) is not performed. *S lugdunensis* does not produce a free coagulase giving a negative result for tube coagulase tests, unlike *S.aureus,* which gives a positive tube coagulase test result.[1,2]

Up to 67% of *S. lugdunensis* isolates can also test positive on some latex agglutination tests, therefore being misidentified as *S. aureus.*[3]

Of the many CNS that react to pyrrolidonylarylamidase (PYR), only *S. lugdunensis*, along with a small number of *Staphylococcus epidermidis* strains, is able to decarboxylate ornithine, distinguishing it from other staphylococcal species.[1,2]

Because CLSI breakpoints for oxacillin are different for *S. aureus* and S. *lugdunensis* compared to those for CNS it is important to speciate the coagulase negative staphylococci isolates from sterile body sites (or send to a reference lab when necessary).[9,10]

Table 2A-B. Susceptibility results

2A - Oxacillin	Total	Grade
Oxacillin S	40	4
Cloxacillin S	5	4
Cloxacillin (on vitek 2)|0.5 mg/L)	1	0
comment - this organism is not methicillin resistant	1	0
sample not normally processed	4	ungraded
Total	**51**	
2B - Vancomycin	**Total**	**Grade**
S	29	ungraded
no report	17	ungraded
refer	1	ungraded
sample not normally processed	4	ungraded
Total	**51**	

Misidentification of *S. lugdunensis* as another CNS is clinically significant as it could influence antimicrobial results and affect infection management through the application of inappropriate oxacillin breakpoints.[1,4]

Nucleic acid-based assays, including real-time polymerase chain reaction (PCR) have a higher identification rate for *S. lugdunensis*.[5] These tests have not been established as routine procedures, but are especially useful in the event of inconclusive or unclear results from other procedures.

The use of MALDI-TOF MS in laboratories has resulted in simpler, faster, more cost-effective, and increasingly accurate *S. lugdunensis* identification.[6,7]

ANTIMICROBIAL SUSCEPTIBILITY

S. lugdunensis, has remained susceptible to a wide range of antimicrobials. The primary mechanism of resistance encountered in *S. lugdunensis* is a penicillinase that confers resistance to penicillin; organisms however remain susceptible to penicillinase-resistant penicillins such as oxacillin.[8]

EUCAST and CLSI recommend penicillin disk diffusion as their preferred method provided that both the zone diameter and the zone edge are inspected.[9,10] However, it is important to note that the EUCAST and CLSI methods differ, with EUCAST recommending a 1 IU penicillin disk (P1) and CLSI recommending a 10 IU disk (P10). [4,9]

The prevalence of *mecA* mediated beta-lactam resistance in *S. lugdunensis* remains low, however emerging resistance has been reported.[2]

Both CLSI and EUCAST recommend using a 30µg cefoxitin disk concentration for the detection of oxacillin resistance, however while CLSI recommends using a cefoxitin breakpoint of S ≥22 mm, (same as for *S. aureus)* EUCAST recommends using a breakpoint of S ≥27 mm for *S. lugdunensis* vs S ≥22 mm used for *S. aureus*.[4,9]

CLINICAL RELEVANCE

S. lugdunensis is most commonly associated with cutaneous infections, including furuncles, abscesses, and infected sebaceous cysts. These infections may more commonly involve the breast, abdomen and, perineal and pelvic area probably due to preferential colonization of those regions.[2,14,15] Colonization of inguinal skin was 22-39% of patients, compared with 20% in the axilla and 9-18% in the nares.[15]

S. lugdunensis is an infrequent blood culture isolate associated with sepsis, and it is a cause of an aggressive infective endocarditis. This illness is characterized by a rapid course with valvular destruction, abscess formation, and embolization. In one study in the 1990s mortality was as high as 70%, but other studies have had lower rates of 29-39%.[17,18] Native valves infection can be complicated by cardiac failure, abscess formation and embolic phenomena. It has occurred as a rare complication of vasectomy. Prosthetic valve infection is associated with abscess formation and tissue destruction with high mortality (78%). Pacemaker line associated endocarditis is less frequent but may be complicated by metastatic infection.[18]

Bone and joint infections may occur including vertebral osteomyelitis and disc space infections. It may also cause prosthetic joint infections especially of the hip and knees, which may present weeks or years after placement. Infection of the eye, central nervous system, and oral cavity have been reported, and tend to be associated with inflammation, abscess formation and tissue damage. The clinical characteristics of *S. lugdunensis* infection are similar to those caused by *S. aureus* rather than coagulase negative staphylococci, with bacteremia caused by this organism having shown poor outcomes in at least one study.[2,15,18,19]

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