

Linezolid-resistant mucoid *Staphylococcus haemolyticus* from a tertiary-care centre in Delhi

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Abstract

We report an unusual morphological mucoid variant of *Staphylococcus haemolyticus* associated with linezolid resistance from a patient with sepsis. Linezolid resistance and mucoid character together made this pathogen difficult to treat. To our knowledge this is the first such report. © 2016 New Microbes and New Infections published by Elsevier Ltd on behalf of European Society of Clinical Microbiology and Infectious Diseases.

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Introduction

Staphylococcus haemolyticus is the second most frequently isolated coagulase-negative *Staphylococcus* from bloodstream infections and is often multidrug resistant [1]. We report an unusual morphological mucoid variant of *S. haemolyticus* associated with linezolid (LZ) resistance, from a patient with sepsis. To our knowledge, this is the first such report.

Case Report

A 55-year-old man sought care at the emergency department after a road traffic accident. At examination he had multiple tissue injuries with loss of consciousness. Ultrasound revealed right lobe liver injury, and a computed tomographic scan demonstrated subarachnoid hemorrhages with multiple contusions. On the second day in the intensive care unit he

developed high-grade fever. Total leukocyte count and erythrocyte sedimentation rate indicated sepsis.

Blood culture showed growth of smooth, nonpigmented mucoid colonies on blood and MacConkey agar which were indistinguishable from colonies of *Klebsiella* spp. (Fig. 1). Gram staining revealed Gram-positive cocci in clusters, which were catalase positive and negative for tube coagulase, mannitol fermentation and ornithine decarboxylase. The strain was identified by Vitek MS (bioMérieux) as *S. haemolyticus* and further confirmed by amplification of the 16S rRNA gene using universal primers (forward: 5'-AGAGTTTGATCMTGGCT-CAG-3', reverse: 5'-TACGYTACCTTGTTACGACTT-3') [2]. Antimicrobial susceptibility performed as per Clinical and Laboratory Standards Institute guidelines [3] showed resistance to penicillin, cefoxitin, gentamicin, erythromycin and clindamycin. Minimum inhibitory concentration values for LZ (32 µg/mL) and vancomycin (1 µg/mL) demonstrated the strain to be vancomycin sensitive and LZ resistant. LZ resistance mediated by *cfr* gene was detected by PCR using the forward (5'-TGA AGT ATA AAG CAG GTT 3GG AG-3') and reverse (5'-ACC ATA TA A TTG ACC ACA AGC AG-3') primers [4].

Discussion

Mucoid variants of *Staphylococcus aureus* have been previously been described [5,6]. However isolation of mucoid



FIG. 1. *Staphylococcus haemolyticus* showing mucoid colonies.

S. haemolyticus has not yet been reported. The mucoid nature of isolates has been attributed to the production of capsular polysaccharides, which in turn lead to enhanced virulence [5]. *S. haemolyticus* has been shown to have capsular polysaccharide by electron microscopy; however, production of visible mucoid colonies on culture media has not previously been reported [1]. The mucoid colonies of *S. haemolyticus* were indistinguishable from *Klebsiella* spp. and retained mucoid characteristic on serial subcultures. The patient was treated with vancomycin, as the isolate was susceptible. However, the patient died of infection, which could be attributed to the higher virulence of the mucoid strain and to other comorbidities in the patient. Although LZ resistance mediated through the *cfr* gene has previously been reported among methicillin-resistant, coagulase-negative staphylococci after exposure to LZ, our isolate was mucoid and resistant to LZ without a history of exposure [6,7].

Although extremely rare, microbiologists should be aware of the existence of mucoid variants of *S. haemolyticus* from clinical

specimens and should carefully differentiate these species from coliforms. Furthermore, infection control practices should be stringently followed in hospitals, as strains carrying plasmid-mediated resistance could act as reservoirs in the hospital and spread horizontally among patients and within species.

Conflict of Interest

None declared.

References

- [1] Flahaut S, Vinogradov E, Kelley KA, Brenan S, Hiramatsu K, Lee JC. Structural and biological characterization of a capsular polysaccharide produced by *Staphylococcus haemolyticus*. *J Bacteriol* 2008;190:1649–57.
- [2] Lane DJ. 16S/23S rRNA sequencing. In: Stackebrandt E, Goodfellow M, editors. *Nucleic acid techniques in bacterial systematics*. New York: Wiley; 1991. p. 115–47.
- [3] Clinical and Laboratory Standards Institute. Performance standards for antimicrobial susceptibility testing. Twenty-first informational supplement M100S22. Wayne, PA: Clinical and Laboratory Standards Institute; 2014.
- [4] Cui L, Wang Y, Li Y, He T, Schwarz S, Ding Y, et al. *cfr*-mediated linezolid-resistance among methicillin-resistant coagulase-negative staphylococci from infections of humans. *PLoS One* 2013;8:e57096.
- [5] Lee JC, Michon F, Perez NE, Hopkins CA, Pier GB. Chemical characterization and immunogenicity of capsular polysaccharide isolated from mucoid *Staphylococcus aureus*. *Infect Immun* 1987;55:2191–7.
- [6] Stirling J, Maeda Y, Millar BC, McClurg RB, Rooney PJ, Loughrey A, et al. Mucoid *Staphylococcus aureus* isolated from a patient with a suspected urinary tract infection. *J Med Microbiol* 2008;57(pt 11):1436–7.
- [7] Rajan V, Kumar VGS, Gopal S. A *cfr*-positive clinical staphylococcal isolate from India with multiple mechanisms of linezolid-resistance. *Indian J Med Res* 2014;139:463–7.