**Staphylococcus lugdunensis:** novel organism causing cochlear implant infection

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**Abstract**

A majority of cochlear implant infections are caused by Staphylococcus aureus or Pseudomonas aeruginosa. Reported here is a pediatric patient with a cochlear implant infection caused by methicillin-resistant Staphylococcus lugdunensis, a coagulase-negative Staphylococcus that has only recently been determined to be clinically relevant (1988). Unlike other coagulase-negative Staphylococcus, it is more aggressive, carrying a greater potential for tissue destruction. In pediatrics, the organism is uncommon, poorly described, and generally pan-susceptible. Described herein is the presentation and management of this unusual organism in a pediatric setting.

**Case Report**

A 6-year-old female with bilateral congenital deafness status post right Nucleus Freedom internal cochlear implant in 2011 presented to ENT clinic with a one week history of right posterior auricular swelling over the implant transmitter site. The examination was notable for local tenderness only without fever, erythema, or any other systemic symptoms. The patient was initiated on a course of cephalexin was broadened to piperacillin/tazobactam and cefuroxime. Significant physical findings includ-

**Discussion**

*Staphylococcus lugdunensis* is a coagulase negative *Staphylococcus* first described by Freney et al. in 1988. Coagulate negative *Staphylococcus* (CoNS) is considered normal skin flora. However, in context of medical devices, catheters, and other foreign body instrumentation, colonization CoNS may be pathogenic. While CoNS is typically associated with less severe and sub-acute illnesses, *S. lugdunensis* is potentially more virulent than other CoNS and has been associated with endocarditis, CNS infections, peritonitis, bacteremia, osteomyelitis, skin and soft tissue abscesses, infections of prostheses, and surgical site infections. *S. lugdunensis* potential virulence is similar *S. aureus*. Of note, the microbiology laboratory typically has a two-step process for identification of organisms as either *Staphylococcus aureus* (coagulase positive *Staphylococcus*) or CoNS: a slide test and slide agglutination test that is similarly seen with *Staphylococcus aureus*.

Typically *S. lugdunensis* is susceptible to methicillin; however resistant isolates have been emerging, first described in China, Brazil, and Europe. Current literature on *S. lugdunensis* is primarily limited to adult patients; pediatric cases have been reported with VP shunt infections and endocarditis. The majority of the isolates have been methi-
cillin susceptible. The emergence of resistance to methicillin has appeared internationally including in a 29-week gestation neonate with sepsis located in Singapore, but there have been limited reports in the United States. To the author’s knowledge, there has been only one U.S. reported case of methicillin resistant S. lugdunensis, and this was in a pediatric patient with endocarditis.7

Cocharil implantation is a complex, invasive surgical procedure; however, the rate of surgical complications is reasonably low with the most common complication being post-operative infection of the skin and soft tissue. Causes for these infections vary but share the common risk of hematogenous seeding and the potential for meningitis. Davids et al. reviewed 462 patients, and found that two (0.43%) patients developed infections. One was the result of picking at the skin over the implant, and the second case was caused by a hematoma becoming infected on postoperative day 1. Both required surgical intervention. S. aureus was identified in the first implant while the other remained unidentified by the authors.9 Comparatively, Loundon et al. reported 15 of 434 (3.5%) of pediatric patients presented with cutaneous infections requiring surgical intervention of the cochlear implant with a mean delay of 2.2 years. Although organisms were not specified in the report, the authors noted that recurrent infections among the major soft tissue infections were due to biofilm.10 Looking back at older reviews, the complication rate from 1990 to 2007 was higher at 6.8%. The culture results of the infections were published, and the most common organisms were S. aureus and Pseudomonas aeruginosa. Other organisms that were identified by culture included in decreasing order: CoNS, Alcaligenes xylosoxidans, Staphylococcus schleiferi sp. nov., Staphylococcus lugdunensis sp. nov. and diphtheroids. None of these organisms showed unusual antimicrobial resistance patterns.11

There are several aspects that make this case presentation unique. First, the patient was complication free for two years following placement of the implant. The presentation was unusual because there was no evidence of trauma, induration, or erythema over the area of infection with no previous history of antibiotic use. Additionally, the patient presented with a methicillin-resistant isolate of S. lugdunensis. Based on literature review, this is the first reported case of methicillin-resistant S. lugdunensis cochlear implant infection in the pediatric population. Only one other report available describes similar S. lugdunensis infections on foreign bodies in adults with 4 of 28 isolates being methicillin-resistant.12 In this study, the authors emphasized the similarities between S. aureus and S. lugdunensis, which altered the treatment protocol usually used for CoNS. For example, a minimum inhibitory concentration (MIC) of methicillin ≥1 µg/mL would typically exclude its use in treating CoNS other than S. lugdunensis; however, this same MIC is considered susceptible for S. lugdunensis. Of note, the authors recognized that ß-lactams offered better penetration into bone versus vancomycin. This difference in acceptable MIC resulted in the vancomycin group returning sooner with an infection compared to the ß-lactam group.

Treatment of S. lugdunensis in our patient has proven challenging because a biofilm organized around the implant unit based on the surgical reports. It has been noted that the pathogenesis of S. lugdunensis includes the production of glycocalyx as a virulence factor in 25% of cases.13 Although our patient was placed on the appropriate antibiotic therapy, the poor vascularization, as well as the presence of a biofilm, probably prevented the trimethoprim/sulfamethoxazole from effectively penetrating the area of infection. A similar case was reported involving an infected cochlear implant several years post placement that developed a biofilm formed by methicillin sensitive S. aureus. Despite combination therapy including rifampin to penetrate the biofilm, removal of the implant was also required for definitive treatment.14

Conclusions

The importance of differentiating CoNS at the species level at times is critical for treatment. In the past, most laboratories would not routinely identify CoNS to a species level. However, with advancements in microlaboratory capabilities to identify CoNS to the species level, identification at species level can be routinely achieved.15 Our current case illustrates the difficulty in eradicating S. lugdunensis with the foreign material in place despite appropriate antibiotics making a strong argument for early removal in similar situations.

References