CASE REPORT

Staphylococcous epidermidis, *Staphylococcous schleiferi* Infections: Are CoNS Cons?

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Abstract

Coagulase-negative *Staphylococcus* (CoNS) represents one of the major nosocomial pathogen in multimorbid, immunosuppressed patients, especially with device-associated infections, often presenting with a diagnostic dilemma and aggressive antibiotic resistance. We report a case of a healthy young man with no comorbidities who succumbed to an extensive abdominal infection with *Staphylococcus epidermidis* and *Staphylococcus schleiferi* after an uneventful diagnostic procedure, despite aggressive antibiotic therapy and surgical source control. Early identification, diagnosis, and aggressive management of CoNS species is warranted depending on clinical scenario and should not be viewed as mere skin contaminants or physiological colonization.

Keywords: Coagulase-negative *Staphylococcal* species, Intra-abdominal infection, Postprocedure.

Indian Journal of Critical Care Medicine (2020): 10.5005/jp-journals-10071-23523

Introduction

With improved microbiological techniques, identification and differentiation of *Staphylococcus* species is feasible. Increasing resistance to methicillin and glycopeptides, coagulase-negative *Staphylococcus* (CoNS) represents one of the major nosocomial pathogen, especially in elderly, multimorbid, immunocompromised patients with device-associated health care-associated infections causing a subtle subacute or chronic course with rare aggressiveness, more frequently than earlier thought. A PubMed search on CoNS culminates in more than 15,000 references, revealing the spiraling medical influence of these bacteria.[1] We present a case report of a young, healthy man who developed fatal intra-abdominal infection with *Staphylococcus schleiferi* and *Staphylococcus epidermidis*

Case Description

A 36-year-old, diabetic man presented with obstructive jaundice. Computed tomography (CT) scan of the abdomen showed a mass at the head of pancreas. He underwent an uneventful diagnostic laparotomy for biopsy, which revealed features suggestive of chronic pancreatitis on histopathology and no bacterial growth. Ten days postsurgery, he presented with fever, abdominal pain, and shortness of breath and discharge from skin wound. Pus microscopy from surgical site showed gram-positive cocci with high probability of CoNS. CT showed necrotic pancreatic duct leak and infected large loculated peripancreatic collection extending to the paracolic, subdiaphramatic spaces and anterior abdominal wall. Collection was drained under ultrasound guidance and cultured. Patient was started on meropenum, vancomycin, and anidulafungin. Culture grew Staphylococus epidermidis sensitive to vancomycin (MIC-2 µg/mL; Central laboratory standard institute (CLSI)-stanadard <4 µg/mL) and cotrimoxazole (MIC-1/19 µg/mL, CLSI-2/28 µg/mL), clindamycin (MIC-<0.5 µg/mL: CLSI <0.5 µg/mL), and linezolide but resistant to oxacillin. Postprocedure, he was electively intubated for worsening type I respiratory failure, which eventually evolved into acute respiratory distress syndrome. With increasing purulent abdominal drain discharge and worsening hemodynamic and ventilatory parameters, he was subjected twice to peritoneal lavages. Pancreatic tissue biopsy cultures taken during the first laparotomy also grew *Staphylococcus epidermidis* and in addition *Staphylococcus schleiferi*, both having similar antibiogram and sensitivity as first culture. Vancomycin was continued. Subsequent peritoneal fluid cultures taken 2 days post-laparotomy also showed *Staphylococcus epidermidis*. Thus, CoNs were cultured on three occasions. Dual antimicrobial coverage was started with cotrimoxazole along with clindamycin, as vancomycin trough levels continued to be in single digits despite doubling the recommended doses with thrice a day administration and lack of clinical improvement (Targeted trough levels 15–20 µg/mL). Intra-abdominal infection showed improvement as evident by decreasing drain volume, CT evidence, and clinical improvement. With a stormy ICU course secondary to ventilator-associated pneumonia with carbapenase-resistant *Acinetobacter baumani* and *Klebsiella* causing hemodynamic instability requiring inotropes and vasopressors, multiorgan dysfunction characterized by acute kidney injury requiring dialysis, and progressive increase in oxygen to maintain PaO_2/FiO_2 ratios; he finally succumbed.

Discussion

Infections with CoNS can be grueling to treat due to diverse vulnerabilities among strains and multidrug resistance.[1,2]

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How to cite this article: Abraham B, Gokhale AU, Mohsin J, Prakash S. *Staphylococcous epidermidis*, *Staphylococcous schleiferi* Infections: Are CoNS Cons? Indian J Crit Care Med 2020;24(8):716–718.

Source of support: Nil

Conflict of interest: None

Each time CONS is isolated, like wolves in sheep's clothing, it often fires a dilemma whether it constitutes an authentic infection or a mere contaminant or just a physiological colonization, often getting overlooked as an etiology for serious infection.[1,3] Clinical symptoms of foreign body-related infections can be vague, initially leading to infection resulting in metastatic seeding, embolic complications, and septic thrombophlebitis.

Repeated segregation of same strain over the sequence of the infection and from pure culture of infected tissue increases the prediction of a true infection. At least two positive blood cultures of CoNS within 5 days or clinical evidence of infection with one positive blood culture, presence of central venous catheter, neutropenic patients, time to positivity ≤16 hours, a Charlson score ≥3 or a Pitt score ≥1 increases the predicament of CoNS blood stream infections. True repercussions of less frequently isolated species may be underrepresented due to difficulties in delineation of CoNS in the premolecular/mass spectrometry era. With matrix-assisted laser desorption ionization-time of flight mass spectrometry (MALDI-TOF MS) and whole-genome sequencing methods, more of these species are being diagnosed.[1,4]

Staphylococcus epidermidis comprises of 65–90% of all staphylococci forming the most rampant and tenacious species isolated on the human skin and mucous membranes.[1,5] *Staphylococcus epidermidis* activates human monocytes to release cytokines like TNF-α, IL-1, and IL-6 mimicking symptoms of toxic shock syndrome. About 37–47% of early cases and about 25% of late cases of prosthetic valve infective endocarditis (PVIE) are caused by *S. epidermidis*. They commonly cause infections of prosthetic devices, stents, and catheters by means of biofilm production mainly by small colony variants. Infections are rarely seen in a healthy person due to low virulence of these bacteria. However, impaired or inappropriate host immune responses may cause infection. Ability of the organism to evade the host immune innate response may contribute to infections in the absence of foreign body. Treatment with specific antibiotics may thus yield frustrating results, as they internalize into nonprofessional phagocytes evading natural immune defense.[1]

Staphylococcus schleiferi, a coagulase-negative anaerobic *Staphylococcus* species, was primarily delineated as a zoonotic pathogen in dogs. The sparse existence of *S. schleiferi* in human flora could explain the low incidence of infections. *Staphylococcus schleiferi* is commonly misrepresented as *Staphylococcus aureus*, as both manifest clumping factor, and heat-stable DNase but can be differentiated by its production of heat-stable nuclease, free coagulase, protein A, and Q-ribitol teichoic acid. Both *S. schleiferi* strains (schleifen and coagulans) express esterase, lipase, and β-hemolysin as ostensible virulence factors and are often incriminated in infections in elderly men, immunosuppressed, and cancer patients producing toxin genes such as staphylococcal enterotoxins and toxic shock syndrome toxin. They have been isolated from surgical site, body fluids, wound, and prosthetic infections. Co-colonization by coagulase-negative and -positive species increases the propensity for horizontal gene transfer.[6,7]

MecA-positive CoNS like *S. epidermis* and *S. Schleferri* horizontally relay their genes within the *Staphylococcal* genus with the propensity to give rise to new methicillin-resistant strains with potential to induce superantigens and cytotoxins increasing their virulence. The biofilm production and tissue invasion by CONS are aided by qurom sensing system and production of extracellular proteins, hemolysins, and enzymes.

Both clindamycin and cotrimoxazole are considered class A drugs in terms of *in vitro* sensitivity for *Staphylococcus* species.[8,9] When faced with multi-drug resistant *Staphylococcus*, including vancomycin resistance or in species sensitive to vancomycin but with inadequate clinical response dual antibiotics have been used. Increasing resistance for *S. aureus* to vancomycin has been reported when MIC is >2 μg/mL.[10] Whether this can be extrapolated to CONs in not clear. Cotrimoxazole has been added among other antibiotics.[9] Clindamycin although a bacteriostatic agent has been shown to have a synergistic effect. It also demonstrates antistaphylococcal toxin effect.[10] Besides, clindamycin has excellent tissue penetration compared to vancomycin for intra-abdominal sepsis.[11] Faced with a difficult situation with inadequate vancomycin levels and clinically worsening patient, a combination of cotrimoxazole and clindamycin along with source control with repeated debridement was used.

Our patient developed infection in the postoperative period. Initial cultures were negative. Screening is not routinely carried out for CoNS as they represent skin flora. Bacteria can colonize and tract from skin colonization. The abdomen was closed primarily during the first surgery with no drains. The cause of surgical site infection could not be ascertained and possibility of perioperative contamination cannot be ruled out. Treatment of infection with severe clinical manifestations often warrants use of multiple antibiotics to improve synergism along with aggressive source control.

Conclusion

Early identification, diagnosis, and aggressive management of CoNS species is warranted and should not be dismissed as mere skin contaminants or physiological colonization.

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