Case report

Staphylococcus pseudintermedius catheter-related bloodstream infection after exposure to domestic dogs and a cat

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Accepted 2 November 2019

SUMMARY

We report a case of a catheter-related bloodstream infection due to oxacillin-susceptible *Staphylococcus pseudintermedius* in a patient receiving haemodialysis who possibly acquired the organism from her pets. Because of persistent bacteremia and the organism's ability to form biofilm, catheter removal and antimicrobial therapy were indicated to attain source control. Both clinical and microbiological cure were confirmed. Catheter care education should include information about pet exposure and the possibility of zoonotic infections.

BACKGROUND

Staphylococcus pseudintermedius is a rare opportunistic pathogen in humans but the leading cause of skin and wound infections in dogs and cats. *S. pseudintermedius* is found on canine and feline skin, and this opportunistic pathogen is easily transmitted from dogs and cats to humans and vice versa. This staphylococcal organism is coagulase positive, as are *Staphylococcus aureus* and *Staphylococcus intermedius*. Microbiological identification may be challenging, and treatment is difficult because of prevalent antimicrobial resistance patterns. *S. pseudintermedius* has virulence factors similar to those of *S. aureus* and forms multilayered biofilm in most cases of infection.[1]

To our knowledge, this is the second reported case of a catheter-related bloodstream infection (CRBSI) caused by *S. pseudintermedius* that may have been acquired from a pet.[2] Because the biofilm-formation mechanism of this organism is a virulence factor, and because our patient had persistent bacteremia, the catheter was removed and antimicrobial therapy was given; these actions led to a cure. Although *S. pseudintermedius* infections are rare in humans, patients with catheters would benefit from risk assessments that involve their pets and education on preventing such infections. Moreover, patients are often their best advocates for care when provided with pertinent information about how to control the spread of organisms from pets.

CASE PRESENTATION

A 36-year-old woman came to our emergency department and reported fever, nausea and vomiting for 1 week. On evaluation, she was afebrile but hypotensive. She had end-stage renal disease secondary to a congenital renal anomaly, had received three failed renal transplants and had been receiving haemodialysis via a femoral haemodialysis catheter for 5 years without complications. Skin excoriations without signs of purulence were present at the site of her femoral line. She had no murmur or cutaneous manifestations of endocarditis. She had a cat and four dogs that frequently sat on her lap.

INVESTIGATIONS

Laboratory studies determined the following values: haemoglobin, 116 g/L (reference range, 121–151 g/L); white blood cell count, 6.8×10^9/L (reference range, $3.4–10.8\times10^9$/L); platelet count, 179×10^9/L (reference range, $150–450\times10^9$/L); sodium, 131 mmol/L (reference range, 134–144 mmol/L); potassium, 3.0 mmol/L (reference range, 3.5–5.2 mmol/L); serum urea nitrogen, 33 mg/dL (reference range, 8–27 mg/dL); creatinine, 5.68 mg/dL (reference range, 0.76–1.27 mg/dL); lactate, 1.0 mmol/L (reference range, 0.5–1.0 mmol/L); and procalcitonin, 4.19 ng/mL (reference range, <0.15 ng/mL). The patient was admitted to the intensive care unit, and fluid bolus therapy and broad-spectrum intravenous antibiotics (vancomycin and piperacillin–tazobactam) were initiated immediately. Two sets of aerobic and anaerobic peripheral blood cultures yielded Gram-positive cocci in clusters that were identified as *S. pseudintermedius*. The susceptibility profile showed that *S. pseudintermedius* was sensitive to oxacillin, cefazolin, ceftriaxone, vancomycin, trimethoprim–sulfamethoxazole and tetracycline. Although the patient was given antibiotics, repeated blood cultures remained positive for *S. pseudintermedius* for several days and until the catheter was removed. Cultures from the haemodialysis catheter grew >15 colony-forming units of the same organisms. Transesophageal echocardiography did not show evidence of endocarditis.

TREATMENT

The division of infectious diseases was consulted. Given the findings of *S. pseudintermedius* in the removed catheter, vancomycin was discontinued and cefazolin was administered. After 48 hours of treatment with cefazolin, bacteremia clearance was documented. A new tunnelled catheter was placed 48 hours after the first documented negative blood

To cite: Diaz MA, Gardner LB, Libertin CR. *BMJ Case Rep* 2019;**12**:e231489. doi:10.1136/bcr-2019-231489

culture result. Before the patient was discharged, cefazolin was discontinued, and vancomycin was administered owing to logistic issues with administering antimicrobial therapy in the haemodialysis unit.

OUTCOME AND FOLLOW-UP

The patient's blood pressure improved over 3 days, and her symptoms resolved. After haemodialysis catheter removal and 2 weeks of antistaphylococcal therapy, the infection was microbiologically and clinically cured. Surveillance blood cultures 2 weeks after antimicrobial therapy completion were negative. The patient has remained well and stable.

DISCUSSION

S. pseudintermedius is a common skin and mucosal commensal organism in dogs, with a carriage rate as high as 80% among healthy dogs.[3] It is frequently isolated from canine skin and ear infections. In 2006, Van Hoovels *et al*[4] reported the first human infection with this pathogen. Since then, the veterinary literature has reported the pathogenic mechanisms, clinical importance and antimicrobial resistance of *S. pseudintermedius* in the canine population.

Clinical laboratories have become more aware of the microbiological characteristics of *S. pseudintermedius*, which can be confused with *S. aureus*, because both are coagulase positive, or can be misidentified as *S. intermedius* by routinely used biochemical identification systems. In 2010, Chuang *et al*[2] reported the first case of an *S. pseudintermedius* CRBSI in a haemophilic child who had contact with a dog. Antibiotic lock therapy failed, and catheter removal was needed for bacteremia clearance, similar to the treatment administered to our patient. Investigations by Pompilio *et al*[5] into the pathogenicity of *S. pseudintermedius* demonstrated that this organism can form dense biofilms and microcolonies over a polystyrene surface.[5–7] The complex structure of this biofilm may function as a potential reservoir for bacterial growth or barrier to antibiotic penetration, or both, thereby possibly resulting in antimicrobial resistance. Hence, effective infection treatment and cure may require removal of the infected foreign material.

Few *S. pseudintermedius* infections have been reported in humans. Somayaji *et al*[6] analysed 27 isolates of *S. pseudintermedius* from 24 patients. Eighteen patients (75.0%) had a skin and soft tissue infection; two (8.3%), invasive infection associated with prosthetic joint and bloodstream infection; and four (16.7%), colonisation (three, skin; one, lung). Multidrug resistance was commonly identified, and methicillin resistance was identified in three cases on six total isolates (22.2%). Of these, five patients with reported outcomes received antimicrobial therapy guided by antibiotic sensitivity studies and had resolution of infection.[7] The majority of patients (22 (92.1%)) had confirmed contact with dogs at the time of infection. Similarly, our patient had confirmed contact with multiple dogs and a cat. *S. pseudintermedius* was likely transmitted from her dogs, cat, or both via translocation from a skin wound to the catheter site or direct contamination of her intravenous line, resulting in the CRBSI and bacteremia.

If a catheter-associated infection has been diagnosed, catheter removal is often necessary for source control. Infectious Diseases Society of America guidelines strongly recommend catheter removal in cases of complicated infections associated with severe sepsis; haemodynamic instability; endocarditis; evidence of metastatic infection, erythema, or exudate due to suppurative thrombophlebitis; or persistent bacteremia after 72 hours of antimicrobial therapy to which the organism is susceptible.[8–10] In addition, long-term (≥14 days) indwelling catheters should be removed in the case of CRBSI due to *S. aureus*, *Pseudomonas aeruginosa*, fungi or mycobacteria.[11] According to existing guidelines, catheter removal was indicated in our patient on the basis of her haemodynamic instability and persistence of bacteremia.

Pet owners derive psychological and physiological benefits from their pets.[12] However, all patients should know that pets are repositories of various zoonotic pathogens. Weingart *et al*[13] reported that cancer patients with central venous catheters may express 'confidence in their knowledge of line care' but are unaware of the critical aspects of line care and recognition of infection. Information about pet-associated diseases and safe ownership practices is an important aspect of infection prevention that needs to be included in the education of patients with central lines. Patients should be encouraged to communicate with veterinarians and physicians and to learn healthy animal-contact practices.

In summary, we have reported the second case of a CRBSI due to *S. pseudintermedius*, a rare zoonotic pathogen that can be acquired from dogs and cats. It can be microbiologically misidentified as *S. aureus* or *S. intermedius*. In cases of CRBSI, catheter removal may be necessary for source control. Greater awareness of this pathogen by veterinarians and healthcare providers is needed to educate patients with central line catheters and to prevent transmission of this zoonotic disease from pets.

Learning points

- *Staphylococcus pseudintermedius* is a rare zoonotic, opportunistic pathogen associated with dogs and cats.
- Source control, not antibiotics alone, is the key to treatment of persistent and complicated infections because of this pathogen's predisposition for biofilm formation.
- If catheter-associated infection has been diagnosed, catheter removal may be necessary for source control.
- To prevent catheter-related bloodstream infections, all patients with central venous catheters should receive environmental risk assessments and infection prevention education, including information about safe pet ownership.

Contributors MAD: conceived and designed the manuscript. LBG: conceived and contributed to the manuscript. CRL: conceived, designed, and proofed the manuscript.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient consent for publication Next of kin consent obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

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REFERENCES

1 Singh A, Walker M, Rousseau J, *et al*. Characterization of the biofilm forming ability of *Staphylococcus pseudintermedius* from dogs. *BMC Vet Res* 2013;9:93.
2 Chuang C-Y, Yang Y-L, Hsueh P-R, *et al*. Catheter-Related bacteremia caused by Staphylococcus pseudintermedius refractory to antibiotic-lock therapy in a hemophilic child with dog exposure. *J Clin Microbiol* 2010;48:1497–8.
3 Rubin JE, Chirino-Trejo M. Prevalence, sites of colonization, and antimicrobial resistance among Staphylococcus pseudintermedius isolated from healthy dogs in Saskatoon, Canada. *J Vet Diagn Invest* 2011;23:351–4.
4 Van Hoovels L, Vankeerberghen A, Boel A, *et al*. First case of Staphylococcus pseudintermedius infection in a human. *J Clin Microbiol* 2006;44:4609–12.

5 Pompilio A, De Nicola S, Crocetta V, *et al*. New insights in Staphylococcus pseudintermedius pathogenicity: antibiotic-resistant biofilm formation by a human wound-associated strain. *BMC Microbiol* 2015;15:109.
6 Somayaji R, Priyantha MAR, Rubin JE, *et al*. Human infections due to Staphylococcus pseudintermedius, an emerging zoonosis of canine origin: report of 24 cases. *Diagn Microbiol Infect Dis* 2016;85:471–6.
7 Darlow CA, Paidakakos N, Sikander M, *et al*. A spinal infection with *Staphylococcus pseudintermedius*. *BMJ Case Rep* 2017;2017. doi:10.1136/bcr-2017-221260. [Epub ahead of print: 07 Aug 2017].
8 Rijnders BJ, Peetermans WE, Verwaest C, *et al*. Watchful waiting versus immediate catheter removal in ICU patients with suspected catheter-related infection: a randomized trial. *Intensive Care Med* 2004;30:1073–80.
9 Malanoski GJ, Samore MH, Pefanis A, *et al*. Staphylococcus aureus catheter-associated bacteremia. minimal effective therapy and unusual infectious complications associated with arterial sheath catheters. *Arch Intern Med* 1995;155:1161–6.
10 Fowler VG, Justice A, Moore C, *et al*. Risk factors for hematogenous complications of intravascular catheter-associated Staphylococcus aureus bacteremia. *Clin Infect Dis* 2005;40:695–703.
11 Mermel LA, Allon M, Bouza E, *et al*. Clinical practice guidelines for the diagnosis and management of intravascular catheter-related infection: 2009 update by the infectious diseases Society of America. *Clin Infect Dis* 2009;49:1–45.
12 Peña A, Abarca K, Weitzel T, *et al*. One Health in Practice: A Pilot Project for Integrated Care of Zoonotic Infections in Immunocompromised Children and Their Pets in Chile. *Zoonoses Public Health* 2016;63:403–9.
13 Weingart SN, Hsieh C, Lane S, *et al*. Standardizing central venous catheter care by using observations from patients with cancer. *Clin J Oncol Nurs* 2014;18:321–6.