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CASE REPORT

Rothia mucilaginosa Prosthetic Device Infections: a Case of Prosthetic Valve Endocarditis

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***Rothia mucilaginosa* is increasingly recognized as an emerging opportunistic pathogen associated with prosthetic device infections. Infective endocarditis is one of the most common clinical presentations. We report a case of *R. mucilaginosa* prosthetic valve endocarditis and review the literature of prosthetic device infections caused by this organism.**

CASE REPORT

A 36-year-old man was admitted to the hospital in January 2012 with a chief complaint of left foot pain for 1 week. He described redness and swelling on the dorsum of his left foot. He denied trauma to the foot. He had been taking acetaminophen for pain intermittently without relief. He denied fever or chills, visual changes, back pain, muscle weakness, or numbness. He had a history of *Streptococcus mitis* mitral valve endocarditis and required mechanical mitral valve replacement in 2009. He had no history of peripheral vascular disease or claudication. He had no known drug allergies. His home medications included warfarin, methadone, and acetaminophen. He was an active intravenous heroin user. He was a former tobacco user with a 5-pack-year history who had quit 7 years before.

On examination, the patient appeared well. His temperature was 100.9°F (38.3°C), pulse 108 beats per minute, blood pressure 133/64 mm Hg, and respirations 20 per minute. Cardiovascular examination revealed normal S1 and S2 and no murmurs, rubs, or gallops. The dorsum of the left foot had mild erythema, slight edema, and point tenderness of the mid-dorsal region. The left dorsalis pedis pulse was easily palpable. Skin examination revealed track marks at the right antecubital fossa. The remainder of the examination was normal. Laboratory studies revealed a white blood cell count of 20×10^3 cells/mm^3 (reference range, 4×10^3 to 11×10^3/mm^3), neutrophils at 88%, creatinine at 0.8 mg/dl, and an erythrocyte sedimentation rate of 35 mm/h (reference range, 0 to 10 mm/h). Other routine laboratory tests were normal. A left-foot radiograph revealed no fracture, and an ultrasound of the left lower extremity revealed no deep vein thrombosis. Intravenous vancomycin and piperacillin-tazobactam were administered empirically for a presumptive diagnosis of left-foot cellulitis. The fever resolved, but the patient had persistent pain in the left foot, which subsequently turned blue and felt cold. Computed tomographic angiography revealed left popliteal artery thrombosis. A left popliteal thromboembolectomy was performed on day 4 of hospitalization. The pathology of the left popliteal thrombus revealed an organized thrombus with clusters of Gram-positive cocci. On day 4 of hospitalization, two sets of blood cultures obtained on the day of admission grew *Rothia mucilaginosa* from the aerobic bottles only.

The organism was identified based upon biochemical tests, automated identification platforms (Phoenix system), and phenotypic characteristics. Gram stain revealed Gram-positive cocci that were catalase negative and grew sticky "staph-like" colonies which were whitish to gray in color, nonhemolytic, smooth, and round (Fig. 1). Remel Bacticard strep reactions revealed positive results for L-leucine-beta-naphthylamide (LAP), L-pyroglutamyl-beta-naphthylamide (PYR), and esculin and ferric citrate (ESC). The BD Phoenix automated microbiology system for identification and antimicrobial susceptibility testing was used and revealed a 99% confidence value for *Rothia mucilaginosa* identification, with a profile number of 000003B284506FC6. Additional identification methods were not deemed necessary.

Transthoracic and transesophageal echocardiography revealed several mobile echodensities on the mechanical mitral valve prosthesis, with valve dehiscence, multiple areas of perforation, and paravalvular regurgitation. A diagnosis of *R. mucilaginosa* prosthetic valve endocarditis was made. The patient underwent mitral valve replacement on hospital day 14. The postoperative course was uneventful. The left foot appeared erythematous and warm, with less edema and tenderness. The patient was discharged to a subacute care facility on hospital day 26, with plans to complete a 6-week-total postoperative course of intravenous vancomycin (antimicrobial susceptibility results were unavailable at time of discharge). He was seen in the emergency department for an unrelated issue 1 week after antibiotic completion. During that visit, he was afebrile and had no clinical signs or symptoms of active infection. He was lost to follow-up thereafter.

Subsequently, antimicrobial susceptibilities were reported. Susceptibility testing was performed using the AB Biodisk Etest. The MIC results demonstrated sensitivity to penicillin (0.016 μg/ml), vancomycin (2.0 μg/ml), ceftriaxone (0.016 μg/ml), and daptomycin (2.0 μg/ml). Rifampin testing was performed by the Kirby Bauer method using a BD BBL 5-μg rifampin disk. The zone size was 35 mm.

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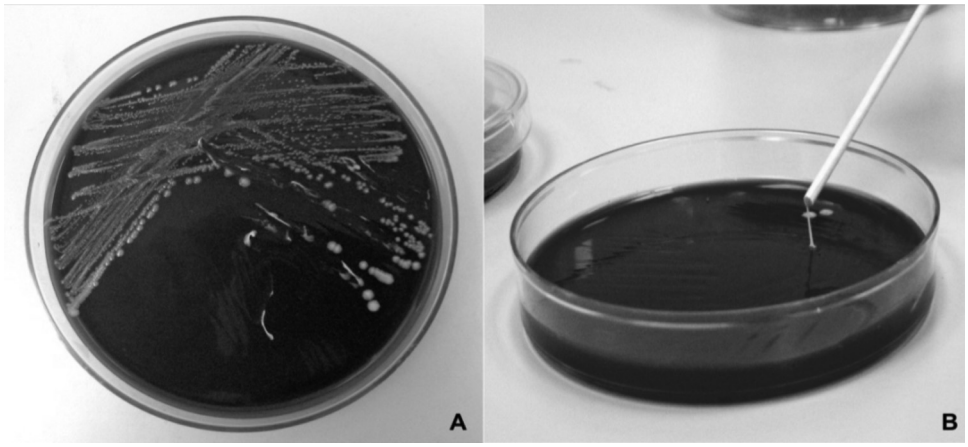

FIG 1 (A) Growth on chocolate agar produced sticky colonies that adhered to the agar. (B) Growth on sheep blood agar produced sticky, "staph-like" colonies that were whitish to gray in color, nonhemolytic, smooth, and round and exhibited the typical tenacious morphology of *Rothia mucilaginosa*.

Rothia mucilaginosa was formerly known as *Staphylococcus salivarius*, *Micrococcus mucilaginosus*, and *Stomatococcus mucilaginosus*. It was reclassified into a new genus belonging to the family *Micrococcaceae* in 2000 (1) based on 16S rRNA sequencing. The organism is an oxidase-negative, catalase-variable Gram-positive coccus bacterium. Gram staining reveals non-spore-forming, encapsulated Gram-positive cocci that can appear in pairs, tetrads, or irregular clusters. It is a facultative anaerobic bacterium which grows well on most nonselective media and in standard blood culture systems. On sheep blood and chocolate agar, the bacterium forms clear to gray/white, nonhemolytic, mucoid or sticky colonies that adhere to the agar surface. It can be difficult to distinguish from coagulase-negative staphylococci, micrococci, and streptococci based on the catalase test result. Its inability to grow in 6.5% sodium chloride and its ability to hydrolyze gelatin and esculin distinguish it from species of the *Staphylococcus*, *Micrococcus*, and *Enterococcus* genera (2). Identification from automatic methods should correlate with phenotypic identification; otherwise, genetic sequencing may be needed to identify this organism.

R. mucilaginosa is a normal inhabitant of the human oral cavity and respiratory tract (2). It is an infrequent pathogen, mostly affecting immunocompromised hosts, such as patients with cancer and severe neutropenia, human immunodeficiency virus infection, alcoholism, diabetes mellitus, and chronic liver disease (3–5). Recently, infections in immunocompetent hosts have been reported with increasing frequency. Risk factors for this infection include intravenous drug abuse, cardiac valve disease, and the presence of prosthetic devices, especially prosthetic heart valves. Infections caused by this organism have been described in various organ systems, including patients with bacteremia (6), endovascular infection, (5, 7–9), central nervous system infection (10), ocular infection (11), bone and joint infection (12, 13), pulmonary infection (14), biliary tract infection (15), and skin and soft tissue infections (16). Endocarditis is by far the most commonly reported clinical manifestation caused by this organism.

Pérez-Vega et al. reported a case series of *R. mucilaginosa* infective endocarditis in the literature. In this series, the typical patient with *R. mucilaginosa* endocarditis was a healthy patient with underlying cardiac disease or an intravenous drug abuser with prosthetic heart valves or mitral valve prolapse. In all patients, endocarditis affected the left-side valves, involving native valves and prosthetic valves almost equally. All patients with native-valve endocarditis recovered with antibiotic therapy alone. However, most patients with infected prosthetic heart valves required a combination of antibiotic therapy and surgical valve replacement (5).

Table 1 describes 8 patients reported in the literature with prosthetic device infections caused by *R. mucilaginosa* (7–9, 17–19). The reported prosthetic devices include prosthetic heart valves (5 patients), a prosthetic hip (1 patient), a cerebral ventricle catheter (1 patient), and a peritoneal dialysis catheter (1 patient). Three of 5 (60%) patients with prosthetic valve endocarditis developed septic emboli. Six of 8 (75%) patients had a good outcome with antibiotic therapy combined with prosthetic device removal.

Two of the 8 patients (25%) with prosthetic device infections died. Of the two patients who died, one had bioprosthetic mitral valve endocarditis complicated by septic emboli to the brain while receiving vancomycin, gentamicin, and rifampin therapy. Surgical valve replacement was considered; however, the patient had a cardiorespiratory arrest and expired on day 6 of hospitalization (8). The other death occurred in a patient who had aortic and mitral bioprosthetic valve endocarditis complicated by periaortic abscess and septic emboli to the brain. The patient deferred surgical valve replacement and expired after an 8-week course of vancomycin therapy (18).

The pathogenesis of this organism in prosthetic device infection has not been well described. The organism's ability to produce a biofilm, similar to other Gram-positive bacteria, is believed to be a key pathogenic mechanism (20). The physical protective layer provided by the biofilm presumably facilitates adhesion of the organisms to devices and renders them relatively refractory to medical therapy. This biofilm likely causes local damage, such as disruption of prosthetic heart valves or loosening of implanted devices, or systemic manifestations, such as septic emboli. Antibiotic therapy alone is usually ineffective without surgical removal of the infected prosthetic device (21, 22). The patient we describe above illustrates the positive outcome utilizing a combination of antibiotic and surgical therapy.

The optimal antimicrobial treatment of *R. mucilaginosa* infection has not been determined. The organism is generally susceptible to penicillin, ampicillin, cefotaxime, imipenem, rifampin,

and vancomycin. It is frequently resistant to clindamycin and aminoglycosides, as well as to trimethoprim-sulfamethoxazole and ciprofloxacin (13). Daptomycin has *in vitro* activity against this organism (23). Partial resistance to penicillin has been reported in the literature (7, 19). Therefore, vancomycin is recommended as empirical therapy while awaiting susceptibility testing.

In summary, *R. mucilaginosa* is increasingly recognized as an emerging opportunistic pathogen associated with prosthetic device infections. It may be difficult to identify and can easily be mistaken for staphylococci or streptococci. When this organism causes clinical infection, prosthetic valve endocarditis is not uncommon. A combination of antibiotic therapy and prompt removal of the infected device is probably necessary for a successful outcome. Physicians should be aware of this organism when treating patients infected with Gram-positive bacteria associated with prosthetic devices.

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TABLE 1 Eight cases of *Rothia mucilaginosa* prosthetic device infections reported in the literature and our case

Reference	Age of patient (yrs)	Sex	Underlying diseases/risk factors	Diagnosis	Antibiotic therapy[a]	Surgical therapy	Complications	Outcome
7	35	M	Prosthetic aortic valve replacement/ intravenous drug user	Prosthetic heart valve endocarditis	Vancomycin i.v. plus gentamicin i.v. for 4 wks then vancomycin i.v. for 4 wks after surgery	Valve replacement	Right leg weakness (left parietal lobe infarction)	Survived
8	29	M	Bioprosthetic aortic valve replacement/ intravenous drug user	Prosthetic heart valve endocarditis	Vancomycin i.v. plus gentamicin i.v. plus rifampin p.o.	None	Transient episodes of weakness on hospital day 4	Expired on hospital day 6
9	33	M	Prosthetic mitral valve replacement/ intravenous drug user	Prosthetic heart valve endocarditis	Vancomycin i.v. for 4 wks	Valve replacement	None	Survived
17	49	M	End-stage renal disease, continuous ambulatory peritoneal dialysis	Peritoneal dialysis catheter-related peritonitis	Amoxicillin p.o. plus rifampin p.o. (duration not reported)	Not reported	None	Survived
18	52	F	Bioprosthetic aortic and mitral valve replacement/intravenous drug user	Prosthetic heart valve endocarditis	Penicillin G for 6 wks plus rifampin p.o. followed by ampicillin i.v. plus rifampin p.o. for 2 wks	None	None	Expired after 8-wk course of antibiotic therapy
18	21	M	Relapsed acute lymphocytic leukemia, Ommaya reservoir for intrathecal chemotherapy	Intraventricular catheter-related ventriculitis	Vancomycin i.v. plus rifampin p.o. for 2 wks plus intrathecal vancomycin for 5 days	Ommaya reservoir removal	None	Survived
19	59	M	Total hip arthroplasty	Late prosthetic joint infection	Vancomycin i.v. for 12 wks	Partial hip revision followed by 2-stage revision	None	Survived
Our case	36	M	Mechanical mitral valve replacement/ intravenous drug user	Prosthetic heart valve endocarditis	Vancomycin i.v. for 6 wks	Valve replacement	Lower-extremity arterial thrombus/embolus	Survived

[a] i.v., intravenously; p.o., *per os*.

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