Septic Arthritis Caused by *Erysipelothrix rhusiopathiae* in a Prosthetic Knee Joint[▽]

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We describe the third case of prosthetic infection due to *Erysipelothrix rhusiopathiae*. The patient, a 68-year-old woman, had had total knee arthroplasty 12 months before diagnosis. She had been in contact with swine at home. We review the seven previous reports of septic arthritis due to *E. rhusiopathiae*.

CASE REPORT

A 68-year-old woman was referred to the orthopedic ward for total replacement of the right knee due to severe internal condyle osteonecrosis. She had a medical history of gout, chronic eczema of the lower limbs, and alcoholism with consequent cognitive disorders. A tricompartmental posterior stabilized cemented knee artroplasty, containing gentamicin, was performed. The patient did not experience any problems during the first 6 months of follow-up. The international knee scoring (IKS) system score was 80/200 before surgery and increased to 163/200 6 months after surgery. Soon after, the patient complained of eczema-like skin lesions on the lower limb, involving the site of surgical incision. During this period, neighbors reported seeing the patient feeding her neighbor's swine through the wire enclosure. The patient's general practitioner prescribed an intramuscular corticosteroid because of intense itching. Within weeks of receiving this treatment, she complained of swelling and pain in the right knee and received amoxicillin-clavulanate. A radiography of the knee was normal. One month later, seropurulent fistulization of the right knee was observed at the distal end of the surgical incision site, and the patient was referred to the hospital. On admission, flexion of the right knee was reduced to 90°. The patient was not febrile. No cardiac murmurs, skin rash, or lymph node enlargement was found. The peripheral white blood cell count was 6,100 cells/mm³, and the C-reactive protein concentration was 74 mg/liter. Radiography revealed advanced osteolysis of the tibia, femur, and patella. Blood cultures remained sterile. Twelve months after right knee arthroplasty, surgical arthrotomy was carried out, yielding a sanguine-purulent "chocolate-like" fluid. Synovial resection was performed, revealing large geodes resulting from osteolysis in the femur, tibia, and patella. The prosthesis was removed and replaced by a vancomycin- and gentamicin-impregnated spacer. Intravenous rifampin and vancomycin treatment was started. Eleven peroperative samples were sent to the laboratory. All Gram staining tests were negative. Cultures were grown on blood agar plates under aerobic and anaerobic conditions and on chocolate agar plates incubated under 5% CO_2. Cultures were negative on day 2. On day 4, four samples yielded pinpoint colonies. Microscopic observations of these first cultures revealed thin, short, cylindrical Gram-positive rods. Subcultures were set up for potential confirmation of *Lactobacillus* or *Corynebacterium*. These subcultures yielded enterococcus-shaped colonies on day 2. Bacteria were confirmed to be rod shaped but were longer and thinner than those observed in the initial cultures. On the basis of the patient's recent surgical history and in spite of the absence of clusters resembling Chinese letters or palisades, *Propionibacterium* was suspected. A system for the identification of anaerobic bacteria (API-Ana; bio-Mérieux) identified these bacteria as *Erysipelothrix*. Only subsequent subcultures presented the typical curved shape. The strain was rough and produced no capsule. Bacteria were definitively identified as *Erysipelothrix rhusiopathiae* by amplification and sequencing of the 16S rRNA-encoding gene *rrs*. Antibiotherapy was then switched to intravenous imipenem and ofloxacin for 2 weeks, followed by oral clindamycin and ofloxacin. The patient's condition improved. C-reactive protein levels decreased. A transesophageal echocardiogram excluded endocarditis. An exofemoral 30- to 40-ml abscess-like formation had to be drained 2 months after removal of the prosthesis. Microbiological cultures and 16S rRNA PCR from drained fluid failed to retrieve any bacteria. Five months after removal of the prosthesis, definitive knee arthrodesis was performed with a "*sur mesure*" nail Link. Antibiotics were stopped 4 weeks later (total duration, 6 months), and osseous fusion of the arthrodesis was observed within 6 weeks. The patient did not experience any other problems during the rest of the follow-up period, 32 months after knee arthrodesis.

E. rhusiopathiae is a ubiquitous, Gram-positive and nonsporing rod. It can exist as a pathogen, a commensal, or a saprophyte in

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TABLE 1. Main characteristics of 8 patients with septic arthritis due to *Erysipelothrix rhusiopathiae*[a]

Patient (reference)	Sex, age (yr)	Debilitating conditions, exposure to animals	Suspected mechanism causing bacteria to spread to joint	Clinical features (duration before diagnosis)	Surgical procedures; antibiotherapy (duration)	Outcome (follow-up)
A (2)	M, 55	Hemodialysis due to terminal PKD; occupation of butcher	Penetration through occupational skin injury	Acute shoulder monoarthritis, 38°C (4 days)	Arthrotomy, lavage; i.v. benzylpenicillin (3 weeks)	Cured (NP)
B (4)	M, 67	Diabetes mellitus, CLL; no exposure known	Unknown	Chronic elbow mono-arthritis, fever NP (3 months)	Arthroscopic lavage; no antibiotics	Cured (NP)
C (1)	M, 18	No debilitating conditions; septic knee laceration on rock by seashore	Inoculation during surgery, from preoperative cutaneous infection	Acute postoperative knee monoarthritis, 38.5°C (6 days)	Arthroscopic lavage + debridement; i.v. benzylpenicillin + ciprofloxacin (5 weeks) and then oral clindamycin + ciprofloxacin (16 weeks)	Cured (5 months)
D (9)	F, 41	Oral and intra-articular steroids for SLE; Koi fish	Penetration through minor skin injury while cleaning aquariums	Chronic knee monoarthritis, no fever (1 month)	Arthroscopic lavage + synovectomy; i.v. penicillin (4 weeks) and then oral ciprofloxacin (2 weeks)	Cured (12 months)
E (6)	M, 76	Aortic valve replacement, gout; fishing	Metastasis of an infective endocarditis[b] (?)	Chronic knee monoarthritis, no fever (6 months)	No surgical procedure; i.v. benzylpenicillin (4 weeks) and repeated arthrocentesis	Cured (NP)
F (7)	M, 76	Long-term high-dose steroid use for rheumatoid arthritis and lupus nephritis; exposure to pigs while working in tanning factory	Total knee arthroplasty may have exacerbated preoperative latent chronic knee infection	Chronic prosthetic knee monoarthritis,[c] fever NP (14 months)	2-stage exchange revision with lavage, debridement, synovectomy, and antibiotic-loaded spacer; i.v. benzylpenicillin + levofloxacin (3 weeks) and then oral clindamycin + levofloxacin (7 weeks)	Cured (12 months)
G (8)	F, 73	Idiopathic osteoarthritis; hunting with his dog	Chronic wound of the heel	Chronic prosthetic hip monoarthritis,[c] fever NP (10 months)	2-stage exchange revision with lavage, debridement, and antibiotics-loaded spacer; i.v. benzylpenicillin + levofloxacin (3 weeks) and then oral amoxicillin (8 weeks)	Cured (4 months)
Reported case	F, 68	Alcoholism, gout, systemic steroids to treat very itchy skin lesions; feeding swine	Penetration through self-induced cutaneous abrasions or unrecognized erysipeloid	Chronic prosthetic knee monoarthritis,[c] no fever (2 months)	2-stage exchange revision with lavage, debridement, synovectomy, and antibiotic-loaded spacer; i.v. imipenem + ofloxacin (2 weeks) and then oral clindamycin + ofloxacin (24 weeks)	Cured with sequelae (32 months)

[a] Abbreviations: M, male; F, female; CLL, chronic lymphocytic leukemia; i.v., intravenous; NP, information not provided; PKD, polycystic kidney disease; SLE, systemic lupus erythematosus.

[b] This hypothesis is very unlikely considering infective endocarditis is "rejected" using modified Duke criteria and three hemocultures remained sterile.

[c] With radiographic evidence of periprosthetic osteolysis.

a wide variety of wild and domestic animals, affecting both vertebrates and invertebrates (3, 5). The major reservoir is generally believed to be domestic swine (5). Humans can pick up infection with this bacterium through contact with animals or environmental sources. Erysipeloid of Rosenbach is an occupational skin infection. Other rare features have been found in humans: a diffuse cutaneous form, bacteremia with or without endocarditis, arthritis, osseous necrosis, and intracranial infection (3, 5).

Whereas arthritis is one of the most common features caused by *E. rhusiopathiae* in mammals, the involvement of a joint is rare in humans (3, 5). Previous reports of infection in humans have described the following features: arthritis due to local extension of an adjacent cutaneous infection; and polyarthritis or polyarthralgia accompanying systemic infections, such as diffuse cutaneous infection (3, 5). However, septic arthritis has rarely been proved by isolation of the bacteria. Here we review previous reports of *E. rhusiopathiae* isolation using joint aspiration or surgical procedures. Cases of reactive arthritis are not considered. Only seven additional cases have been reported previously (1, 2, 4, 6–9). The main characteristics observed are summarized in Table 1. Typically, *E. rhusiopathiae* septic arthritis presents as a chronic process (6/8 cases) involving a single big joint (8/8), particularly the knee (5/8). Only two reports described moderate fever. The peripheral white cell count was normal in most patients, with only mild elevation of C-reactive protein levels (median concentration = 27 mg/liter).

The pathogenesis of joint infection is poorly understood. Most previously described patients had a cutaneous lesion at the site of the infected joint and had carried out occupational or leisure activities that exposed them to a reservoir of infection: working as a butcher, feeding swine, hunting, fishing, cleaning aquariums, and knee laceration at the seashore. Thus, *E. rhusiopathiae* infection may have occurred through unrecognized erysipeloid or nonspecific cutaneous lesions. *E. rhusiopathiae* may also be able to penetrate the safe skin barrier (3). Although half of the reported cases occurred after a surgical procedure and could therefore qualify as nosocomially acquired infections, it is likely that these infections were contracted in the community. Septic arthritis probably resulted from postoperative transcutaneous infection in patient G and in the present report (8). In patient F, a preoperative latent infection of the knee may have been triggered by surgery (7). In patient C, arthroscopic incision through an unrecognised cutaneous infection may have resulted in direct inoculation through the knee (1). Blood cultures, when performed, remained sterile (5/5). No patient showed clinical or echocardiographic signs of infective endocarditis. These findings suggest that septic arthritis is unlikely to result from hematogenous spread. Rather, it may be attributed to a local or regional portal of entry, even through minor skin lesions, or exacerbation of previous latent infection by invasive procedures. Most of the patients underwent surgical lavage of the infected joint (7/8) and received efficient intravenous antibiotic treatment for several weeks (7/8). The overall outcome was favorable: all patients recovered without sequelae, with the exception of the patient described here, who underwent knee arthrodesis. *E. rhusiopathiae* is naturally resistant to vancomycin and gentamicin. These two antibiotics are frequently used in the empirical treatment of arthritis, particularly to treat postoperative prosthesis infections, and are included in spacers (5).

This review highlights the role of debilitating host factors. Six of eight patients suffered from one or more severe immunosuppressive conditions: terminal renal insufficiency, diabetes mellitus, chronic lymphocytic leukemia, systemic lupus erythematosus or rheumatoid arthritis, use of systemic and/or intraarticular steroids, and alcoholism. Few cases of *E. rhusiopathiae* bacteremia, with or without endocarditis, have been found in patients who are immunocompromised or who have a history of alcohol abuse (3, 5).

Previous findings regarding possible mechanisms of pathogenicity have been conflicting, with inconsistent data reported for the virulence of smooth (S) and rough (R) colonies and the presence of a hyaluronidase, a neuraminidase, and a capsule (3, 5).

Erysipelothrix is not a fastidious microorganism. However, the diagnosis of this pathogen is difficult if bacteriologists are not aware of clinical suspicion of animal contact (3). The species is rarely found in clinical routine analyses, and its initial morphology in culture frequently leads to suspicion of *Corynebacterium*, *Lactobacillus*, *Streptococcus*, or *Listeria* (3–5). This report provides one such example. Gram staining of clinical samples was positive in only one of eight previously described cases, with the result being misinterpreted as Gram-negative rods. Paracentesis cultures were negative for four of six cases, whereas samples obtained in surgical procedures gave rise to *E. rhusiopathiae* in all seven cases where such cultures were established. Bacterial growth was usually slow, and definitive identification was often delayed. Gram staining of initial cultures was atypical or confusing in several cases, including the case reported here. *E. rhusiopathiae* is known to yield small colonies, which can be missed, and the typically curved shape requires several subcultures (3). Important biochemical characteristics allow the identification of *E. rhusiopathiae*: the absence of catalase and H_2S production. This bacterium may also be identified by its resistance to vancomycin but not to penicillin. Amplification of the *rrs* gene encoding 16S rRNA is also a sensitive and useful test to confirm its identification (3).

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