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Propionibacterium acnes Osteomyelitis: Case Report and Review of the Literature

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***Propionibacterium acnes*, a part of the skin flora, caused vertebral osteomyelitis in a man who had recently undergone a microdiskectomy. The identifying characteristics and antibiotic susceptibility pattern are presented for this unusual human pathogen. The relationship of *P. acnes* to bone infection is summarized for the first time. A typical patient with *P. acnes* osteomyelitis is an adult male who has had prior surgery. Most patients respond favorably to prolonged antibiotic therapy.**

Propionibacterium acnes, a non-sporeforming, anaerobic, gram-positive bacillus, normally inhabits hair follicles and sebaceous glands of the skin (1). It is unusual as a pathogen but may be a contaminant of body fluids that require skin puncture for collection. *P. acnes* is a common contaminant of anaerobic blood cultures (11, 44, 46). Of 151 patients with blood cultures positive for *P. acnes*, only 1 had significant infection (46). Although an unusual pathogen, *P. acnes* or organisms identified as *Propionibacterium* species have been identified, usually in conjuction with other anaerobes or other bacteria, as a cause of brain abscess (4, 19, 32), subdural empyema (9, 25, 47), parotid and dental infections (16), anaerobic pleuropulmonary infection (15), and peritonitis (11). *P. acnes* in pure culture has caused central nervous system shunt infections (3, 13) and endocarditis in patients with and without artificial heart valves (14, 46) and other serious infections as reviewed by other authors (22, 24). *P. acnes* has also been identified in cultures of blood, synovial fluid, and synovial tissue from some patients with rheumatoid arthritis (2), but this observation has not been confirmed.

Other *Propionibacterium* species are even less commonly identified as pathogens. *P. granulosum* has been cultured from the wounds of cat and dog bites (17). Osteomyelitis caused by *P. acnes* is rare. The purpose of this report is to describe a case of *P. acnes* osteomyelitis and to summarize prior accounts in the literature of *P. acnes* and its relationship to bone infection.

CASE REPORT

A 50-year-old man was admitted to the University of Kentucky Albert B. Chandler Medical Center because of back pain. Despite conventional therapy, the pain had persisted for 3 months and radiated down his left leg and into his lateral left foot. He had a positive straight-leg-raising test. A lumbar myelogram demonstrated spinal stenosis at L4-L5 with a herniated disk at L5 compromising the nerve roots. He underwent a microdiskectomy, and the L4-L5 disk was removed. At 4 weeks after the operation, the patient developed increasing, nonradiatng low back pain, and daily fever to 101°F. The patient was readmitted to the hospital, and a computerized tomographic scan of his back showed lytic changes involving the end plates of the L4-L5 vertebrae and an associated soft tissue mass. The following day, day 33 after his operation, fluid from a needle aspiration of the L4-L5 interspace grew *P. acnes*. A blood culture drawn on postoperative day 34 was also positive for *P. acnes*. On the postoperative day 38, an open biopsy of the L4-L5 disk space was performed, and the tissue that was removed grew *P. acnes*. All isolates were susceptible to penicillin G, carbenicillin, cefoxitin, chloramphenicol, clindamycin, erythromycin, and tetracycline and resistant to metronidazole. The patient was treated with 3×10^6 U of penicillin G intravenously every 4 h for 54 days via a Hickman catheter. His therapy ended on day 102 after the original surgery. A Wintrobe erythrocyte sedimentation rate 1 day before the original operation was 16 mm/h. Other postoperative values were as follows: day 32, 51 mm/h; day 56, 39 mm/h; day 90, 16 mm/h; and day 104, 15 mm/h. The patient has remained well for 1 year following the completion of penicillin therapy.

MATERIALS AND METHODS

Microbiology. The isolate was identified as *P. acnes* from three different sources (needle aspirate, blood culture, and open biopsy) with the IDS RapID-ANA system (Innovative Diagnostic Systems, Inc., Decatur, Ga.). The RapID-ANA is a non-growth-dependent micromethod for identifying anaerobes. The system consisted of 18 tests which included chromogenic and biochemical reactions (5, 34). Specimens cultured anaerobically were routinely observed for 4 days. Anaerobic blood cultures were observed for 5 days. Antimicrobial susceptibility testing was performed by a modification (6) of the disk-broth method of Kurzynski et al. (26). The antibiotics tested and their final concentrations were as follows: clindamycin, 1.6 μg/ml; carbenicillin, 100 μg/ml; chloramphenicol, 12 μg/ml; erythromycin, 3 μg/ml; penicillin, 1.2 μg/ml; tetracycline, 6 μg/ml; cefoxitin, 18 μg/ml; and metronidazole, 16 μg/ml.

RESULTS AND DISCUSSION

P. acnes is an uncommon cause of osteomyelitis, and because it is usually present in skin, establishing its pathogenicity may be difficult. Table 1 lists 17 examples of bone infections ascribed to *P. acnes* or *Propionibacterium* sp. Among those patients, about whom information was available were nine men and two women. Most were adults; however, the age range was 11 to 75 years.

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TABLE 1. *P. acnes* and *Propionibacterium* sp. osteomyelitis

Reference	Age and sex or no. of patients	Predisposing condition(s)	Site(s) of infection	Source(s) of culture	Organism(s)	Antibiotic therapy (time)	Follow-up period
23	2 Patients	Hip arthoplasty	Infected femoral prosthesis	Prosthesis or bone	*Propionibacterium acnes*	NS[a]	NS
33	65 F	Internal fixation of fx. hip	Ununited hip fracture	Surgical biopsy	*Propionibacterium acnes*	Penicillin (4 mo)	15 mo
18	3 Patients	Surgically implanted foreign body	NS	Surgical biopsy	*Propionibacterium acnes*	NS	NS
39	47 M	Surgery 8 yr previously	Humerus and subdeltoid bursa	Surgical biopsy	*Propionibacterium acnes*	Clindamycin	Lost
43	51 M	Translumbar aortography	L3-L4 vertebrae	Surgical biopsy	*Propionibacterium* sp.	Penicillin (4 mo); clindamycin (6 wk)	NS
28	NS	Craniotomy	Calvarium and bone flap	Wound and tissue	*Propionibacterium* sp.	NS	NS
Present case	50 M	Diskectomy	L4-L5 vertebrae	Biopsy, blood, and bone aspiration	*Propionibacterium acnes*	Penicillin (54 days)	1 yr
33	71 M	Chronic osteomyelitis; oral prednisone	Distal humerus	Surgical biopsy	*Propionibacterium acnes; Staphylococcus epidermidis*	Clindamycin (5 wk)	20 mo
41	27 M	Reiter's syndrome; oral steroids	Cervical vertebrae and sternum	Surgical biopsy and acne lesions	*Propionibacterium acnes*	Penicillin (40 days)	NS
38	23 M	Sickle cell anemia	Femur	Surgical biopsy	*Propionibacterium* sp.; *alpha streptococci; Bacteroides melaninogenicus*	Clindamycin (42 days)	NS
7	18 M	Chronic sclerosing osteomyelitis	Chronic sclerosing osteomyelitis, femur and pelvis	Surgical biopsy	*Propionibacterium acnes*	Antibiotic	6 yr
45	40 M	Alcoholism; anemia	Sternal marrow	Sternal marrow	*Corynebacterium acnes*	Erythromycin (4 wk)	NS
36	75 M	None	C5-C6 vertebrae	Bone aspiration	*Propionibacterium* sp.	Penicillin (15 wk)	12 mo
30	11 F	None	Tibia	Surgical biopsy	*Corynebacterium acnes*	Pristinamycin (3 mo)	NS

[a] NS, Not stated.

The patients fell into four general categories: local infection after surgery or an invasive procedure, infection in a compromised host, infection in patients with no obvious predisposing factors, and patients in whom *P. acnes* may not have been a pathogen. The largest number of patients, including the present case, a total of 10, developed *P. acnes* osteomyelitis after surgery or an invasive procedure (18, 23, 28, 33, 39, 43). Infection was associated with implantation of a foreign body, a prosthesis or pin, in 6 of the 10 patients (18, 23, 33). In Hall's series of 40 patients with anaerobic osteomyelitis, a total of 8 patients (20%) had *P. acnes* infection, but in only 3 (Table 1) was *P. acnes* isolated in pure culture (18). Each of the three patients had a surgically implanted foreign body at the site of the infection. Other patients (Table 1) developed osteomyelitis after a surgical procedure with no foreign body present, craniectomy (28), surgical repair of a shoulder dislocation (39), diskectomy (the present case), and finally, infection at the site of a prior translumbar aortography (43). Except for the patient with shoulder surgery, *P. acnes* was likely introduced at the time of the surgical procedure. In that patient, the time interval was 8 years between the shoulder surgery and the osteomyelitis, an interval too long to be the result of a postoperative infection. Omitted from Table 1 was a report by the German workers Lodenkämper and Rühlcke, who studied 824 cases of osteomyelitis from 1957 through 1973 (29). Anaerobic bacteria were cultured from 98 cases (12%). Bacteria designated as anaerobic corynebacteria were isolated from 51 of the 98 anaerobic infections. Those anerobic corynebacteria were most likely the same as *Propionibacterium* species, and they were present in 23 of 43 cases in which only one anaerobic bacterium was isolated. Anaerobic corynebacteria were isolated in an additional 28 of 55 cases in which mixed aerobic and anaerobic bacteria were present. Unfortunately, this report contains few clinical details. Of six patients for whom some history was provided, three were infected with anaerobic corynebacteria, but only one was in pure culture. All three patients had developed a fistula after a bone fracture (femur, one; tibia, two). One of the patients with a fractured tibia had the infection at the site of a pseudoarthrosis, and the other two had their infections at the sites of pins which had been implanted to stabilize the fractures. The Lodenkämper and Rühlcke report is unique in that a high proportion of the patients (52%) with anaerobic osteomyelitis were infected with *Propionibacterium* species. The large number of *Propionibacterium* species may have actually been contaminants which were identified because the surgical specimens were incubated for an excessively

long time (15 to 20 days), thus permitting the growth of small numbers of nonpathogenic skin flora. The present case is typical of many of these cases, i.e., osteomyelitis with *P. acnes* which appeared at the site of previous surgery.

P. acnes osteomyelitis occurred in three patients who may have had compromised immune systems (Table 1) (33, 38, 41). The first patient had sickle cell anemia and osteomyelitis with gas formation in the medullary cavity of the femur (38). Cultures revealed *Bacteroides melaninogenicus*, alpha streptococci, and *Propionibacterium* species. The site of origin of the bacteria was believed to be the gastrointestinal tract. The remaining two patients were taking oral prednisone (33, 41). One of the patients had a draining fistula and chronic osteomyelitis of the elbow joint, and *P. acnes* and *Staphylococcus epidermiditis* were isolated at the site of an arthrotomy (33). However, when the joint space was opened at surgery, no purulent material was found. The bacteriologic diagnosis was based on a second isolation of *P. acnes* from a wound irrigation catheter tip. The pathogenicity of *P. acnes* in this patient is questionable because purulent material was absent in the joint space, and the bacteria could have been present in the skin fistula. The other patient was a young man who developed acne after steroid therapy for Reiter's syndrome (41). In that patient, *P. acnes* grew from an acne lesion, as well as a bone biopsy of cervical vertebrae. The biopsy of the cervical vertebrae showed acute and chronic inflammation. Thus, in this case, *P. acnes* was most likely a pathogen.

P. acnes may be significant in the pathogenesis of acne (42), and some patients with acne have associated bone disorders. Acne in a severe form (acne fulminans) may be associated with arthralgia (27), arthritis (8) and, less commonly, osteolytic lesions which do not generally contain bacteria (20, 35, 37). These patients are usually young men who develop bone pain after worsening of their acne. The bone lesions usually respond to steroids but not antibiotics, *P. acnes* is not responsible for the bone changes in these patients. Thus, if *P. acnes* is isolated from bone lesions in such patients, contamination should be suspected.

Only 2 of the 17 patients listed in Table 1 with *P. acnes* osteomyelitis had no predisposing factors (30, 36). One was an elderly man with C5-C6 osteomyelitis, whose diagnosis was based on local pain, an elevated sedimentation rate, roentgenographic abnormalities, and a response to antibiotics (36). The bacteriologic specimen was aspirated from the neck lesion under radiographic control, and the growth was scanty. In this setting, contamination is possible because of the path of the needle through the skin. The other case, reported by Louis et al. (30), was a young girl with a tibial lesion thought to be a tumor by X-ray and tuberculosis by histology. In her case, bacteria consistent with *P. acnes* were seen on stains of the operative material, and the biopsy culture was positive for *Corynebacterium acnes*.

P. acnes may not be a pathogen despite its presence in cultures taken from patients with osteomyelitis or other bone lesions. One such puzzling case involved what appeared to be latent infection of the bone marrow by *P. acnes* in an alcoholic (Table 1) who underwent marrow aspiration for evaluation of anemia (45). The organism was grown from three of four separate marrow aspirations and one curettage. However, the patient had no fever and no increased erythrocyte sedimentation rate, and blood cultures on five consecutive days were negative. In addition, no organisms were seen on Gram staining of the repeated bone marrow aspirations. Nevertheless, after 1 month of antibiotic therapy, no bacteria were isolated although cultures were taken from repeated aspirations. A similar difficulty in assigning pathogenicity to *P. acnes* was encountered in eight patients of Collert and Isacson with diffuse sclerosing osteomyelitis (7). *P. acnes* was isolated from one (Table 1) of two patients who had anaerobic cultures, but those patients had no fever and no organisms were seen on the bone biopsies (7). Jacobsson (21) described an additional 16 patients (not shown in Table 1) with diffuse sclerosing osteomyelitis of the mandible. His experience was different from that of Collert and Isacson in that all of his patients grew *P. acnes* and *Peptostreptococcus intermedius* from bone biopsies. Jacobsson believed that the infection reached the bone tissue via the root canal. His patients, however, were also afebrile, and no bacteria were seen in pathologic material from any of the bone biopsies. Jacobsson's patients, like those of Collert and Isacson, did not uniformly respond to antibiotic therapy. Thus, it is possible that the reports of *P. acnes* infection in patients of Lodenkämper and Rühlcke (29), Waitzkin (45), Collert and Isacson (7), Jacobsson (21), and Newman and Mitchell (36) and one of the patients of Morrey et al. (33) may be the results of specimen contamination.

Finally, a report (not shown in Table 1) by Massini from 1913 chronicles a young boy who died of complications of scarlet fever, otitis media, and chronic mastoiditis. An anaerobic diphtheroid was isolated in pure culture from the autopsy, but the microbiologic description was not adequate to identify it as *P. acnes* (31).

The results of therapy were available in nine of the patients listed in Table 1, and all with clear-cut osteomyelitis were cured by therapy with a variety of antibiotics including penicillin G, clindamycin, erythromycin, and pristinamycin used by Louis et al. (30). Pristinamycin, an antibiotic used in France, is a cyclic peptide derived from *Streptomyces pristinaspiralis* (40). The patients listed in Table 1 who was not cured (7) did not have typical bacterial osteomyelitis but rather chronic sclerosing osteomyelitis, which does not respond to antibiotic therapy. *P. acnes* is susceptible in vitro to penicillin G, chloramphenicol, clindamycin, cephalothin, cefoxitin, tetracycline, ceftizoxime, cefoperazone, and cefoxitin (10, 12). *P. acnes* is resistant to metronidazole (12).

Our patient was typical of most of the previously reported cases. He developed osteomyelitis after a surgical procedure and was cured after prolonged penicillin therapy. Although this organism is frequently considered a contaminant, repeated isolation from an operative site, blood, or both, as in our patient, should alert the clinician to the fact that *P. acnes* may on rare occasions cause osteomyelitis.

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