The Journal of Foot & Ankle Surgery 54 (2015) 840–843

Contents lists available at ScienceDirect

The Journal of Foot & Ankle Surgery

journal homepage: www.jfas.org

Antibiotic Treatment and Surgery for Acute Hematogenous Calcaneal Osteomyelitis of Childhood

Markus Pääkkönen, MD [1,2], Markku J.T. Kallio, MD [3], Heikki Peltola, MD [4], Pentti E. Kallio, MD [3]

[1] Surgeon, Division of Diseases of the Musculoskeletal System, Turku University Hospital and the University of Turku, Turku, Finland
[2] Surgeon, Department of Hand and Microsurgery, Tampere University Hospital, Tampere, Finland
[3] Assistant Professor, University of Helsinki and Children's Hospital, Helsinki University Central Hospital, Helsinki, Finland
[4] Professor, University of Helsinki and Children's Hospital, Helsinki University Central Hospital, Helsinki, Finland

ARTICLE INFO

Level of Clinical Evidence: 3

Keywords:
antimicrobial
aspiration
calcaneus
child
trepanation

ABSTRACT

Acute hematogenous calcaneal osteomyelitis characteristically affects children. A recent trend has emerged toward shorter courses of antibiotics. In our randomized, prospective treatment trial of children aged 3 months to 15 years, the intravenous antibiotic (clindamycin or a first-generation cephalosporin) was given only for the first 2 to 4 days and the remainder of the 20- to 30-day course was completed orally. A bone sample for culture was to be taken routinely, but all additional surgery was performed on special demand. We performed a retrospective subanalysis of cases affecting the calcaneus. The follow-up period was 1 year. Of the 14 participants enrolled, 11 completed the 1-year follow-up period, and their data were analyzed. *Staphylococcus aureus* was the cause of 10 cases; all strains were methicillin sensitive. The median intravenous treatment duration was 3 days. Four patients required open incisional trepanation (trephination). All participants attending the 1-year follow-up examination had fully recovered. The outcome of calcaneal osteomyelitis caused by methicillin-sensitive *S. aureus* in a child will be good, if the patient seeks treatment early and antibiotic therapy is started promptly. A bone biopsy is needed to obtain a representative sample for bacteriology.

Acute hematogenous osteomyelitis (AHOM) in children involves the calcaneum in 9% to 11% of the cases (1–3). The treatment in recent years has shifted toward shorter antibiotic courses (4). The paucity of cases has prevented large treatment trials of calcaneal AHOM; however, several series have been published (5–12). Compared with other types of osteomyelitis, the symptoms and signs of calcaneal osteomyelitis are often rather mild and insidious, which can cause a delay in presentation (8,12).

Our large treatment trial of patients with pediatric osteomyelitis included cases affecting the calcaneus (3,13–15). We hypothesized that a short-term intravenous treatment of 2 to 4 days, with a total course of 20 days, would be sufficient in uncomplicated cases of calcaneal AHOM. The secondary aim was to determine the need for surgical procedures.

Materials and Methods

We performed a retrospective subanalysis of prospectively collected cases of calcaneal AHOM in the largest-to-date prospective, randomized, open-label, treatment trial of acute osteoarticular infections of childhood. The patients were enrolled from January 1983 to December 2005 (3,13). In the main trial, all participants aged 3 months to 15 years who had presented with acute AHOM at 1 of the 7 attending hospitals were evaluated by liaison staff (listed in the Acknowledgments section). To ensure an accurate diagnosis, the participants were included in the main trial only if bacteria were isolated from the focus. If bacteria were isolated only from blood cultures, the patient was included only if indisputable symptoms and signs or a radiologic finding proved calcaneal involvement (Fig.). Culture-negative cases were analyzed separately (15). Children with severe underlying illnesses or immunodeficiency were excluded. The primary aim of the present study was to compare short and long antibiotic treatment and to compare 2 antibiotic agents. The participants were randomized using a computer-generated number to receive antibiotics for 20 or 30 days and further quasi-randomized according to their birth date to receive clindamycin (40 mg/kg/day divided in 4 equal doses) or a first-generation cephalosporin (150 mg/kg/day divided in 4 equal doses) (3,13). The intravenous phase routinely lasted for only 2 to 4 days, and the intravenous antibiotic was converted to an oral antibiotic immediately after the clinical signs and descending C-reactive protein (CRP) had indicated a successful response to the antibiotic therapy (13). The secondary aim of the present study was to determine the need for surgery. The study protocol recommended, whenever possible, percutaneous bone drilling or open biopsy or trepanation to obtain a representative sample for bacteriology; in addition, blood samples for culture were always taken. The decision to

Financial Disclosure: None reported.
Conflict of Interest: None reported.
Address correspondence to: Markus Pääkkönen, MD, Surgeon, Division of Diseases of the Musculoskeletal System, Turku University Hospital, P.O. Box 52, Turku 20521, Finland.
E-mail address: Markus.Paakkonen@helsinki.fi (M. Pääkkönen).

1067-2516/$ - see front matter © 2015 by the American College of Foot and Ankle Surgeons. All rights reserved.
http://dx.doi.org/10.1053/j.jfas.2015.01.006

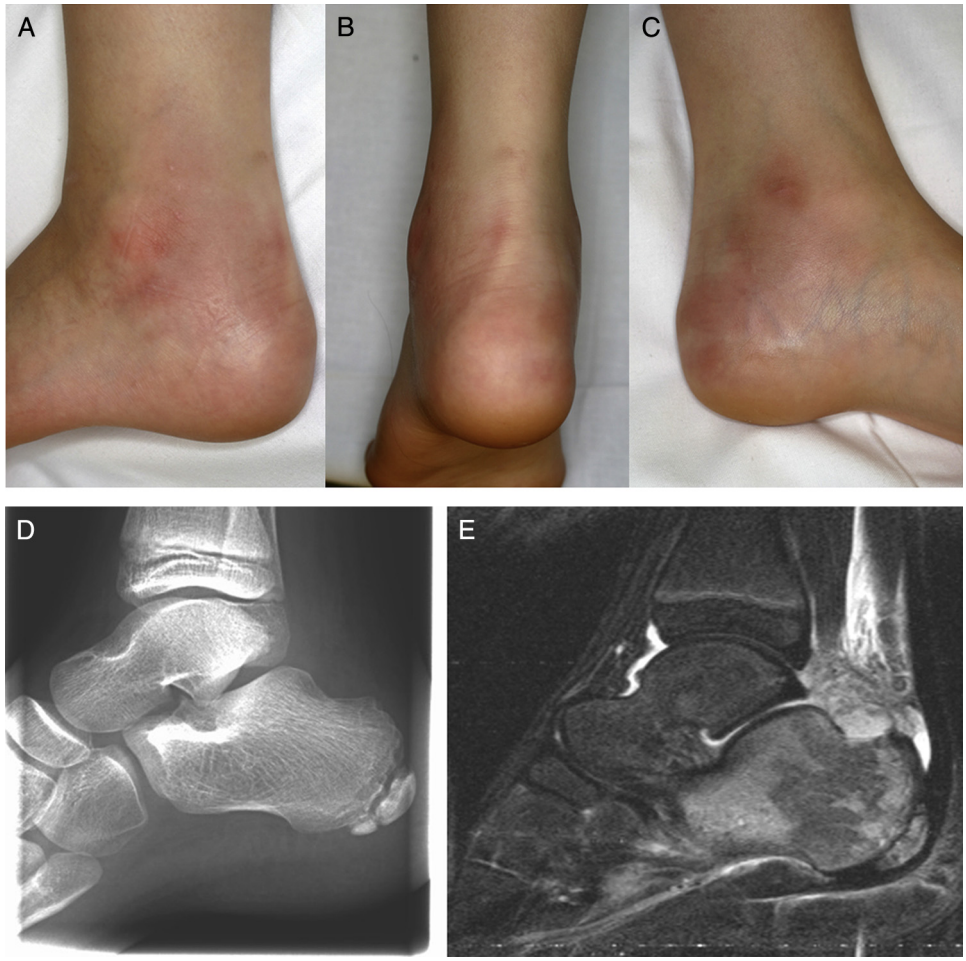

Fig. View of the heel of an 8-year-old female with culture-positive calcaneal osteomyelitis enrolled in the present study. (*A* to *C*) Minor swelling and redness were observed at admission. (*D*) A plain lateral projection radiograph did not reveal the extent of the bone infection, which was clearly seen by (*E*) magnetic resonance imaging. (*C*, From Pääkkönen M. Diagnostics: Classic OM, SA and OM + SA [academic dissertation]. In: *Simplified Treatment of Childhood Acute Bone and Joint Infections,* ed 1, Yliopistopaino, Helsinki, Finland, 2011.)

perform additional surgery was left entirely to the attending pediatric or orthopedic surgeon, because no universally accepted guidelines regarding the indication or timing of trepanation for AHOM are available.

The main outcome parameters were subsiding symptoms and clinical signs, normalization of the serum CRP (cutoff 20 mg/L), and normal findings on plain radiographs (14). The per-protocol follow-up period lasted for 1 year, with a physical examination at 2 weeks, 3 months, and 1 year after discharge, including CRP and erythrocyte sedimentation rate measurements and radiographs. The participating hospitals' ethical committees approved the study, and the legal guardians of the patients provided informed consent. Two of us (H.P. and P.E.K.) worked as the outcome assessors and treating clinicians. Two others of us (M.J.T.K. and M.P.) abstracted the data from the medical records. StatView (SAS Institute, Cary, NC) was used for data analysis. The *t* test was used to test the null hypothesis. Statistical significance was defined as the 5% level.

Results

A total of 14 participants were diagnosed as having calcaneal AHOM. Of these 14 patients, 3 did not complete the 1-year follow-up examination, leaving 11 participants (8 males and 3 females) for analysis (Table 1). Their mean age was 10 (range 9 to 13) years. *Staphylococcus aureus* was identified in 10 patients (91%) and was always sensitive to methicillin. One case was due to *Streptococcus pneumoniae.* Bacteria grew from the bone and blood in 3 cases and from the bone only in 4. In 4 participants, bacteria grew from the blood only. In these cases, the diagnosis was confirmed by positive bone scan findings in 3 patients and positive clinical symptoms in 1. Spread of the infection to the subtalar joint was proved by a positive synovial culture in 1 patient, and in 1 patient, the talus was also affected.

The median intravenous administration duration was 3 (range 3 to 3) days (in the 90% range). Of the 11 participants, 5 were randomized to the 20-day and 6 to a 30-day antibiotic regimen. Of the 11 participants, 5 were given clindamycin and 6 a first-generation cephalosporin. No aspiration or other invasive procedures were performed in 3 children, because the bacteria had been identified by blood culture and the bone scan findings were consistent with AHOM. One participant with a 16-day history underwent bone biopsy without additional surgery. One participant underwent joint aspiration of the tibiotalar joint in search of arthritis. Subperiosteal needle aspiration was performed in 2 participants, and 4 participants underwent open incisional trepanation. The timing of trepanation was on admission in 1 patient, the second day of treatment in 1, and the fourth day in 2 patients. With the numbers available, no difference was found in the presence of fever at presentation in participants undergoing trepanation compared with the others (38.6°C versus 37.9°C, $p = .18$). Of the 3 participants with a symptom duration longer than 2 weeks, 2 underwent trepanation. Weightbearing was allowed by all participants at discharge; however, 3 children required crutches because of pain.

Final Recovery

The median interval to CRP normalization (<20 mg/L) was 6 (range 2 to 11) days (in the 90% range). No patient required prolongation of