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Case Report

Acute hematogenous osteomyelitis in children: a case series

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Abstract

Background Chronic osteomyelitis is still a major cause of morbidity and disability in children living in developing countries. Neglect of acute osteomyelitis and its progression to chronic osteomyelitis leads to significant morbidity. This report is the first series to describe such cases in Indonesia.

Objective To describe 12 pediatric cases of chronic osteomyelitis in order to remind clinicians about the debilitating complications of musculoskeletal infection.

Methods This report is a case series of 12 children with chronic osteomyelitis admitted to Dr. Soetomo General Hospital, Surabaya, East Java, in 2011-2017. We acquired data from medical records. The patients' quality of life was measured using the Child Health Assessment Questionnaire Disability Index (C-HAQ-DI).

Results The patients' mean age was eight years and they were predominantly male. The most common infection location was the femur (7/12). Microbial cultures were positive in 9/12 of cases, predominantly with Staphylococcus aureus. Erythrocyte sedimentation rate (ESR) was elevated in 11 patients. All patients were diagnosed late, with an average delay of presentation to Orthopedics of 10.5 months. Most of patients experienced mild to moderate disability after the disease, as assessed by the C-HAQ-DI.

Conclusion Diagnosis of osteomyelitis in children is quite difficult, given the lack of specific diagnostic tests. Delayed diagnosis and inappropriate treatment may result in long-term morbidity and disability. Clinicians should have an increased awareness of the clinical features of osteomyelitis, including unusual presentations such as calcaneal osteomyelitis. **[Paediatr Indones. 2019;59:222-8; doi: http://dx.doi.org/10.14238/pi59.4.2019.222-8]**.

Keywords: *chronic hematogenous osteomyelitis; diagnosis pitfall; morbidity; pediatric; C-HAQ-DI*

Osteomyelitis is an infection involving the bone, bone marrow, periosteum, and surrounding soft tissues, resulting in sequestrum and destruction of the bone. The clinical course of chronic osteomyelitis is varied with intermittent pattern and high rate of recurrence. Moreover, complete cure is difficult to achieve.[1]

The symptoms of acute osteomyelitis typically appear within two weeks after bacterial infection. Chronic osteomyelitis may progress six weeks after initial infection, and is marked by the presence of sequestrum.[2] Pediatric chronic osteomyelitis is currently rare in developed countries, but remains a burden in third-world countries. This disease poses severe morbidities in children for the remainder of their lives.[3] In Cambodia, the incidence of pediatric musculoskeletal infection was 13.8/100,000, of which 51% was single-limb osteomyelitis.[4] Meanwhile, in the Philippines, the prevalence of osteomyelitis was 0.015% of total children.[5] However, the epidemiological data regarding musculoskeletal

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infection, especially chronic osteomyelitis, are still limited in Indonesia.

In recent years, Indonesia experienced a health reformation which has increased overall health coverage in citizens. However, there is still a significant disparity between urban and rural areas. As such, the problems of malnutrition and infection in children remain unsolved.[6] Poverty is one of the obstacles for the patients with chronic osteomyelitis to obtain treatment.[7]

Here we describe a series of pediatric chronic osteomyelitis cases, the course of the disease, diagnosis pitfalls, treatments, and outcomes. This report was done in order to remind clinicians about the debilitating outcomes caused by late diagnosis and treatment of musculoskeletal infections.

Methods

This case series included children diagnosed with chronic hematogenous osteomyelitis and admitted to Dr. Soetomo Hospital, Surabaya, East Java, from January 2011 to December 2017. Data were acquired from the electronic medical records. The patients' medical and surgical records, microbial culture results, and radiographs were all reviewed. The data collected were demographic data, anatomical location of infection, length of time before presenting to an orthopedic surgeon, microbial culture result, treatment, and morbidity. Length of time before presenting to an orthopedic surgeon was defined to any delay before presenting to orthopedics after initial contact to any healthcare professionals. Patients' quality of life was measured using the C-HAQ-DI.[8] Diagnosis was based on the patient history and physical examination. Laboratory values, including erythrocyte sedimentation rate (ESR), C-reactive protein (CRP), and complete blood count (CBC), were obtained to aid in the diagnosis. Radiographic evaluation included plain radiographs of the affected area.

Patients were interviewed either in person or over the phone to assess their current condition in terms of quality of life. The C-HAQ-DI index values were categorized as mild to moderate disability (score 0 to 1); moderate to severe disability (score 1 to 2); or severe to very severe disability (score 2 to 3).

Results

Twelve pediatric patients with chronic hematogenous osteomyelitis were reviewed (seven males and five females). The patients' mean age was eight years, with a range of 2-13 years. In the course of disease, destruction of the affected bone was progressive, as depicted in one patient (**Figure 1**).

All patients had some degree of morbidity, which affected their ambulation. The most common complaint was pain (3/12), followed by swelling (3/12). One patient presented with a pathological fracture. The predominant anatomical locations were the femur (7/12) and tibia (3/12); other sites were the calcaneus and humerus.

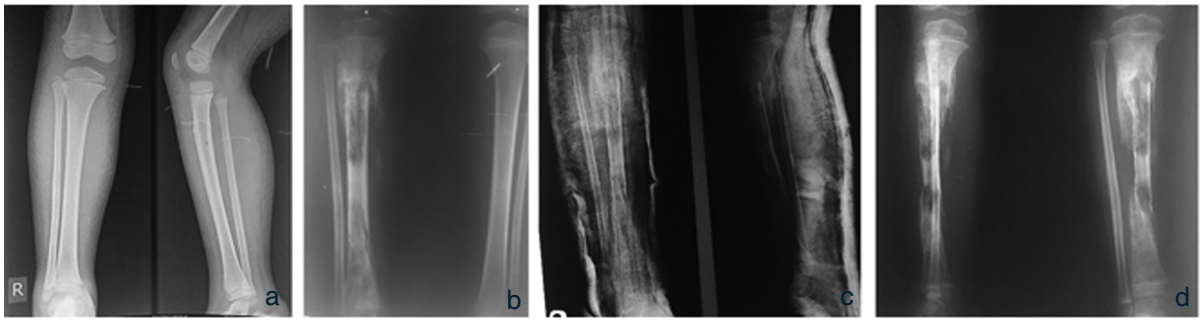

Figure 1(a) X ray of osteomyelitis patient one week after onset of the disease, there is no bone destruction, only tissue swelling. (b) (c) (d) Radiological appearance of patient with neglected acute hematogenous osteomyelitis of right tibia (different patient from figure a), showing the progressive destruction of the bone within a year; figure (b) was taken two months after onset of the disease; figure (c) was taken two months after onset of the disease, directly after surgery; and figure (d) was taken three months after onset of the disease.

Most patients had visited a health care facility (9/12), and only one patient had gone to a traditional bonesetter. The average time for patients to present to an orthopedic surgeon was 10.5 months. Seven patients visited general practitioners and one patient went to a pediatrician. The longest interval was three years and the shortest was 1.5 months.

Blood or wound/bone aspirate cultures were positive in 9/12 of cases. The most common isolate was from the Staphylococcus group. Erythrocyte sedimentation rate (ESR) was elevated in 11 of 12 patients at the time of admission. Meanwhile, white blood count (WBC) and C-reactive protein (CRP) was elevated in only 3/12 of cases. The mean ESR, CRP, and WBC in patients were 62.33 mm/hour, 3.96 mg/dL, and 9.2 x10^3/μL, respectively.

We evaluated clinical outcomes of the patients using the HAQ-DI. Two patients had moderate to severe disability (C-HAQ-DI score 1-2). The other patients experienced mild to moderate disability (C-HAQ-D score 0 to 1).

All patients were treated surgically. Most patients underwent debridement and sequestrectomy. Surgical debridement was done after a minimum of six weeks antibiotic administration. Surgery was done only if there were signs of acute exacerbation. Two patients had histories of two previous surgeries and one patient had had one previous surgery. The other nine patients had not had surgeries prior to admission to our hospital. Patients' data are presented in **Table 1**.

Discussion

In this case series, we present twelve pediatric patients with chronic osteomyelitis. We found that most of the patients had presented to healthcare worker before admission to our hospital, except one who had gone to a traditional bonesetter. However, the average delay of presentation to an orthopedic surgeon was 10.5 months. Such delays are common in developing countries where people often seek initial treatment from the traditional bonesetter.[9] In Indonesia, treatment by bonesetters is associated with complications.[10] In another study, patients delay visiting the doctor due to lack of transportation, low educational status, occupation, or other social reasons.[11] Delays pose an unfavorable prognosis for patients, as a delay of as little as five days was identified to be a risk factor for worse prognosis.[12]

The mean age at presentation in our study was eight years, similar to studies in the Philippines and Cambodia.[4,13] The majority of our patients were male (7/12), in accordance with another study.[14] The predominant anatomical locations of infection were the femur (7/12) and tibia (3/12), also similar to other studies.[13,15] The metaphysis of the long bones was most often involved because of its rich vascular supply.

One unusual case involved the calcaneus. The calcaneus has an apophysis which is equivalent to a long bone's metaphysis, which may explain the development of infection at the site.[16] The diagnosis itself is challenging, as heel pain is often diagnosed as Sever's disease in children, usually leading to delayed diagnosis.[17] Such delays in diagnosis of osteomyelitis of the calcaneus has also been associated with worse prognosis.[18] Indeed, our nine-year-old male patient underwent an amputation below the knee.

Common morbidities in our patients were swelling (3/12), pain (3/12), limping (2/12), and stiffness (2/12). Other studies on acute osteomyelitis noted that in addition to swelling, pain, limitation of motion, and redness, fever was also common.[19] A review stated that children with fever of unknown origin (FUO) should be evaluated for acute osteomyelitis, especially during its peak incidence in prepubertal male children.[20]

Erythrocyte sedimentation rate (ESR) was elevated in 11 of 12 patients. However, CRP was elevated in only 3/12 of cases. The CRP is more useful in monitoring acute cases and its decline is associated with better outcomes.[20] Both ESR and CRP are not specific enough to diagnose chronic osteomyelitis.1 Procalcitonin is a sensitive and specific marker to diagnose acute osteomyelitis. However, to increase the sensitivity and specificity, the cut-off point should be 0.4 ng/mL, not the usual 0.5 ng/mL.[21]

The majority of patients usually presents with late stage of the disease, due to inadequate treatment.[22] Misdiagnosis and undertreatment are still common even though the patients sought advice from health care providers early in the course of disease. Likewise, a previous study found that delayed diagnosis of osteomyelitis resulted in greater disability, as well as lower rates of positive culture and biopsy findings.[23]

Table 1. Patients' demographic factors and clinical features

Patient	Age, years	Sex	Delay time, months	WBC/ESR/CRP	Microbial culture	Morbidity	HAQ-DI score	Number of surgeries	Treatment	First examiner	Location
1	11	Male	3	6/100/0.8	Sterile	Persistent mass	0.45	1	Debridement and sequestrectomy	Nurse	Tibia
2	13	Female	12	5.4/36/0.1	*Staphylococcus haemolyticus*	Stiffness	0.55	1	Debridement and subtalar arthrodesis	GP	Tibia
3	8	Female	12	9.6/90/1.5	Staphylococcus aureus	Persistent mass	1	1	Debridement and curettage	Nurse	Femur
4	9	Male	1.5	17.7/130/5.3	*E. coli*	Amputated	1	3	Debridement and BKA	Ped	Calcaneus
5	6	Male	12	6/13/0.1	*Staphylococcus aureus*	Limping	0.35	1	Debridement	GP	Femur
6	6	Female	18	9/40/0.2	*Staphylococcus aureus*	Swelling	0.32	3	Debridement	GP	Tibia
7	10	Male	12	12.1/80/0.7	*Staphylococcus aureus*	Pain	0.25	1	Debridement, decortication, and sequestrectomy	GP	Femur
8	2	Male	3	12.9/120/3.7	Sterile	Swelling	0.2	1	Debridement and sequestrectomy	Bonesetter	Femur
9	12	Male	12	9/28/0.4	*Mycobacterium tuberculosis*	Limping	0.3	1	Debridement, sequestrectomy and curettage	GP	Femur
10	11	Male	3	6.3/35/0.2	*Staphylococcus aureus*	Bowing	0.2	1	Debridement and sequestrectomy	GP	Humerus
11	6	Female	36	9.3/41/0.2	Sterile	Pathological flexion deformity fracture	0.4	1	Debridement and sequestrectomy	GP	Femur
12	2	Female	1.5	7.5/35/0.8	*Pseudomonas aeruginosa*	Pain	0.4	2	Debridement and curettage	GP	Femur

WBC=white blood cell count (x103/μL); ESR=erythrocyte sedimentation rate (mm/hr); CRP=C-reactive protein (mg/dL); Ped=pediatrician; GP=general practitioner; BKA=below knee amputation

In our cases, routine follow-up was done using plain radiography. Abnormal radiologic findings were found only in one of five patients during the first 7-10 days of the disease. Bone marrow edema, which is the earliest pathological feature, is not visible on plain films. The other radiologic findings of acute osteomyelitis include deep soft tissue swelling, periosteal reaction, and well-circumscribed bone lucency (signifying abscess formation).[24,25] A study reported that osteolytic lesions due to bone destruction were not usually visible until 2-3 weeks after the initial symptoms, but 30-50% of the bone was already destroyed at that point. Bone scintigraphy is a sensitive alternative, but it is not very specific in diagnosing osteomyelitis.[26] MRI is the best radiologic, diagnostic tool for osteomyelitis as it is able to visualize the bone marrow edema. However, CT-scan can also be used when MRI is not possible or contraindicated, as it can be used to visualize the sequestrum.[27] Blood culture was positive only in half of cases. In chronic cases, the results are often polymicrobial. If the blood culture is negative, further investigation by bone biopsy may be done.[2]

We mainly treated our patients with surgical debridement, the standard treatment for chronic osteomyelitis in children. Implementation of reconstructive and stabilization procedures are important to ensure adequate blood supply for new bone formation. Recent advancements also incorporate use of antibiotic-laden cement and vacuum assisted closure (VAC) system.[28,29] However, despite the debridement procedures, one patient still retained marked deformity as depicted in **Figure 2a-c**.

The diagnosis and treatment of pediatric musculoskeletal infection remain a challenge. Combinations of new diagnostic methods, antibiotic resistance, as well as new types of medications and immunizations have changed the epidemiologic pattern of this disease in recent years.[30]

In conclusion, diagnosis of acute hematogenous osteomyelitis in children is quite difficult, given the lack of specific laboratory and radiographic tests. Even joint aspiration is not 100% reliable in diagnosing infection of bones and joints.[31] Clinicians should learn more about acute hematogenous osteomyelitis and be more aware in treating patients with complaints relevant to osteomyelitis. The possibility of musculoskeletal infection must always be considered in clinical practice. In children with FUO, this disease must be suspected in order to prevent late diagnosis and treatment, which may lead to progression to chronic osteomyelitis. Delayed diagnosis and presentation to an orthopedic surgeon is also still a problem, as reflected by our cases. Close multidisciplinary approaches should be done to solve this problem.[32] Hopefully, early diagnosis and treatment will prevent morbidity and save health care costs considerably.

To our knowledge, this is the first series describing cases of pediatric chronic osteomyelitis. However, this study has several limitations. Other aspects of the patient outcomes should have been explored. Moreover, this study needs to be followed up with a larger sample size and multicenter involvement to provide a better picture of chronic osteomyelitis and its outcomes in the pediatric population of Indonesia.

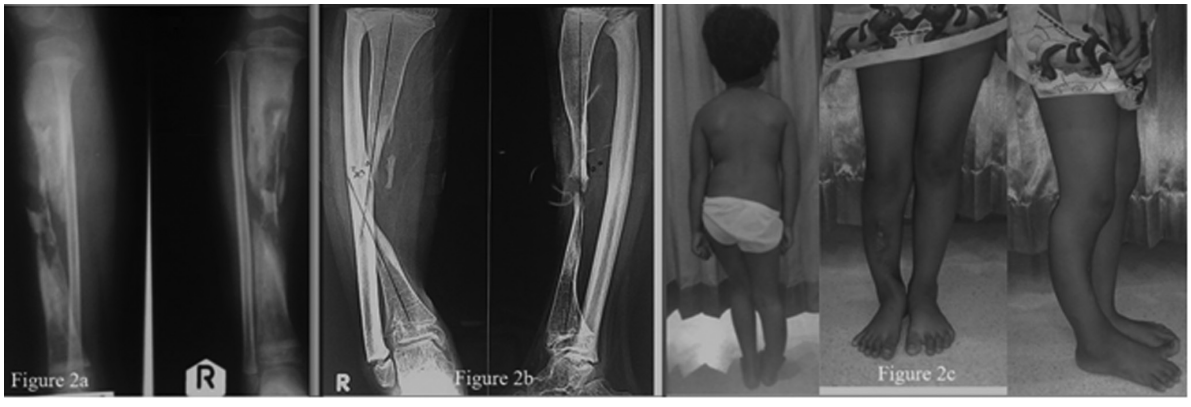

Figure 2. Radiograph of the right tibia on the same patient as in Figure 1. Figure 2(b) shows radiograph two years after two debridement procedures, sequestrectomy and guttering. Figure 2(c) shows the clinical picture of the patient, with scarring and crook deformity on the right leg.

Conflict of Interest

None declared.

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