

Acute Primary Hematogenous Osteomyelitis of the Epiphysis: Report of Two Cases

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Acute primary infection of the epiphysis is uncommon. We present 2 cases of acute osteomyelitis of the distal femoral epiphysis. They were not diagnosed until 10 days and 3 weeks, respectively, after the onset of symptoms. The epiphyseal infection spread into the knee joint, and surgical debridement was performed. The majority of reported cases in the medical literature are of bacterial etiology, and the most common pathogen is *Staphylococcus aureus*. We report a rare case which was infected by *Salmonella enteritidis*. Prompt diagnosis and early treatment are required to prevent further destruction and growth disturbance. (*Chang Gung Med J* 2003;26:851-6)

Key words: epiphysis, osteomyelitis.

Acute hematogenous osteomyelitis in young children occurs mostly in the metaphysis of a long bone. Acute primary infection of the epiphysis is uncommon.⁽¹⁾ Only a few cases of primary epiphyseal osteomyelitis have been reported,⁽²⁻¹²⁾ because delays in the diagnosis and treatment of an acute hematogenous epiphyseal osteomyelitis are common.⁽⁸⁾ The interval between clinical presentation and diagnosis of epiphyseal osteomyelitis was reported to be from 5 to 14 days.^(4,5,11) A delay in diagnosis of epiphyseal infection may allow the infection to spread from the epiphysis into the knee joint.^(4,5) This, in turn, may lead to a sequelae of physeal plate injury and joint surface destruction. We reviewed 185 cases of acute septic arthritis and hematogenous osteomyelitis in children during 12 years of clinical experience and found only 3 cases with acute osteomyelitis of the distal femoral epiphysis. Two patients, including one that was infected by *Salmonella enteritidis*, were followed up for more than 6 months.

CASE REPORTS

Case 1

A 28-month-old boy was admitted to our hospital with a 7-day history of spiking fever and a 2-day history of left knee pain and limping gait. Physical examination revealed mild swelling, tenderness, and local heat over the left knee. The left knee was kept in flexion position, and the range of motion was 25°-70°, being limited by pain.

Significant laboratory values on admission were an elevated white blood cell (WBC) count of 10,400/cmm with a left shift and a C-reactive protein (CRP) value of 94.7 mg/L. Initial radiographs showed negative findings at the left knee, and blood culture showed no organism. Empirical intravenous oxacillin was given but the spiking fever still persisted after 1 week. There was also progressive swelling and fluid accumulation at the left knee. A bone scan 1 week later revealed a mildly increased uptake involving the lateral epiphysis of the left dis-

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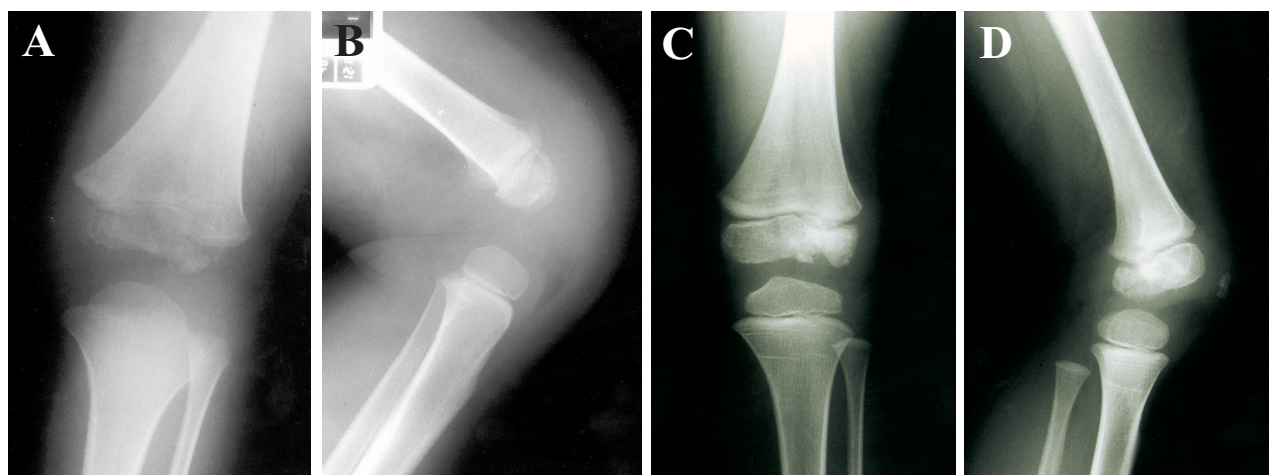


Fig. 1 Case 1 (left knee). The repeat AP (A) and lateral (B) radiographs 10 days after onset of the disease showed radiolucency in the lateral aspect of the right distal femoral epiphysis. AP (C) and lateral (D) radiographs 16 months after the operation showed remodeling of the epiphysis and no physal growth arrest.

tal femur. Repeat radiographs (Fig. 1A, B) 10 days later showed osteopenic lesions in the lateral epiphysis of the left distal femur. Arthrocentesis was performed, and culture of the synovial fluid showed no organism. The antibiotics were shifted to vancomycin and gentamicin, but the symptoms did not improve. The repeat WBC count was 13,900/cmm, and the CRP was 88.1 mg/L on day 20 after admission. The patient underwent a lateral arthrotomy to approach the distal femoral epiphysis under fluoroscopy. The lytic area of the epiphysis was curetted and irrigated.

Tissue culture obtained during surgery grew *Salmonella enteritidis*. Ceftizoxime was given and continued for 5 weeks. The patient became afebrile by the 13th postoperative day. The knee was splinted for 3 weeks, then range-of-motion exercises were begun. Five weeks after the operation, the WBC count was 6700/cmm, and the CRP was < 2 mg/L. Ten months after the operation, radiographs showed a 0.8×0.7-cm lytic lesion in the epiphysis. Sixteen months after the operation, radiographs (Fig. 1C, D) showed remodeling of the epiphysis and no physal growth arrest. The patient was able to walk normally, and the range of motion of the left knee was 0° to 120°.

Case 2

A 27-month-old girl was transferred to our hos-

pital from a local medical hospital with persistent tenderness and swelling of the right knee. She had been admitted to that local medical hospital 2 months previous under the impression of mycoplasma pneumonia and reactive arthritis of the left knee. Three days later, the symptoms of the left knee had resolved, but tenderness and limited range of motion of the right knee began.

Significant laboratory values were an elevated WBC count (14,600/cmm) and an erythrocyte sedimentation rate (ESR) of 105 mm/h. The CRP level was 3.25 mg/L. Blood culture upon admission grew *Staphylococcus aureus*, but the culture of the synovial fluid showed no growth of organism.

The Ga-67 citrate scan showed increased uptake in the right distal femur and right knee joint. The radiographs (Fig. 2A, B) 3 weeks later showed main changes of radiolucency, fragmentation, and a crescentic margin in the epiphysis of the right distal femur. Surgical procedures including an arthrotomy and curettage of the lytic areas of the distal femur were performed and were followed with a course of intravenous vancomycin for 6 weeks. Because tenderness and swelling of the right knee persisted and the repeat ESR was 113 mm/h, she was transferred to our hospital for further management.

At admission, her body temperature was 38°C. Physical examination revealed tenderness, swelling, and erythematous change of the right knee area. The

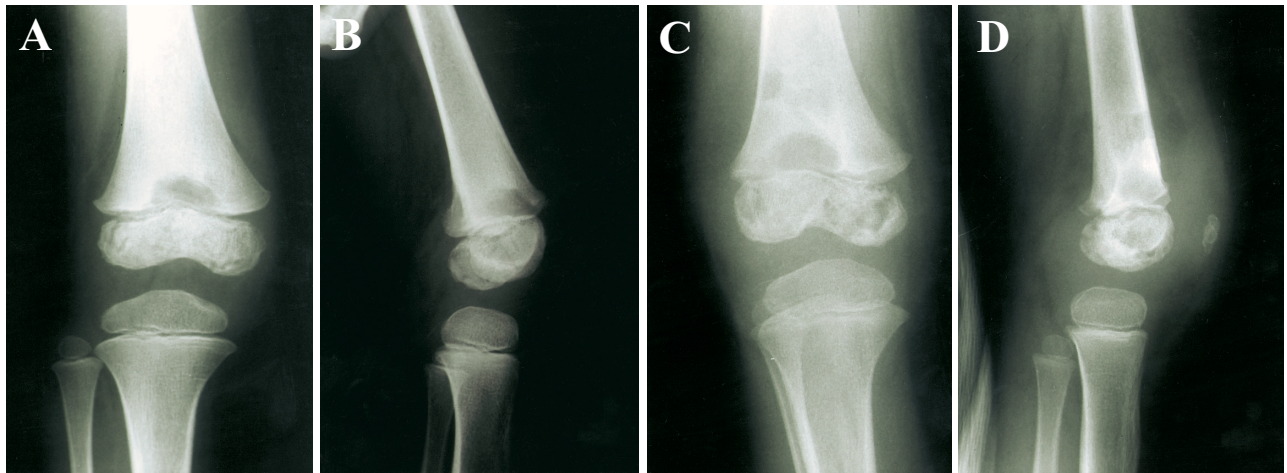


Fig. 2 Case 2 (right knee). The AP (A) and lateral (B) radiographs 3 weeks after presentation showed radiolucency, fragmentation, and a crescentic margin of the lesion in the right distal femoral epiphysis. AP (C) and lateral (D) radiographs 2 weeks after the operation showed osteopenic lesions with some surrounding sclerotic change at the right distal femoral epiphysis.

right knee was kept in flexion position, and the range of motion was 30°-110°, being limited by pain. The WBC count was 12,200/cmm, and the CRP was 21.4 mg/L. The following radiographs (Fig. 2C, D) showed progressive osteopenic lesions with some sclerotic changes and fragmentation at the right distal femoral epiphysis. Repeated aspiration and blood cultures produced no growth.

Under a diagnosis of epiphyseal osteomyelitis of the right distal femur and poor clinical response to vancomycin by the *Staphylococcus aureus* infection, intravenous teicoplanin was given for 4 weeks. The patient became afebrile 3 days later. Surgery was deferred because of the good clinical response to the intravenous antibiotics. The swelling and tenderness of the right knee improved with time. After discharge, full range of motion without weight bearing was achieved at the 6-month follow-up.

DISCUSSION

An acute primary infection of the epiphysis is uncommon.⁽¹⁾ Infections isolated to the epiphysis predominantly occur around the knee. Sorensen⁽²⁾ reviewed 21 cases of primary epiphyseal osteomyelitis and found that 20 involved the epiphysis of the distal femur or proximal tibia. The distal femoral epiphysis has been involved in up to 75% of cases of epiphyseal infection.⁽⁶⁾ Our 2 cases both

involved the distal femoral epiphysis. We reviewed 185 cases of acute septic arthritis and hematogenous osteomyelitis in children in our 12 years of clinical experience and found only 3 cases of epiphyseal osteomyelitis.

Epiphyseal osteomyelitis may present in either an acute or subacute form. The acute form is characterized by rapid onset and progression.^(4,5,8) Local symptoms of tenderness and limping are often accompanied by systemic signs. Leukocytosis and elevated ESR are usually noted. Radiographs may be normal early in the course of the disease, but a lytic lesion in the epiphysis will present at a later stage. The subacute form is insidious at onset.^(3,6) It is characterized by mild pain localized to the infected area, and symptoms are often exacerbated by activity. There are usually no systemic symptoms. Laboratory examinations are also often normal, and radiographs reveal a well-demarcated lytic lesion.⁽⁶⁾ Factors, such as increased host resistance, decreased bacterial virulence, or antibiotics given during the pre-symptomatic period, may alter the clinical picture towards a subacute form.^(5,8) Most cases of primary epiphyseal osteomyelitis are reported in the subacute form.^(3,6) According to Longjohn,⁽⁵⁾ only 5 cases of acute hematogenous osteomyelitis of the epiphysis have been reported.^(4,5,8,11) Our 2 cases are also of the acute form of osteomyelitis.

In the newborn, before the secondary centers of

ossification appear, the transphyseal vessels persist until 15 to 18 months of age.^(9,10) After this age, the physis provides a mechanical barrier to protect against the spread of infection. Brooks⁽¹³⁾ and Trueta⁽¹⁰⁾ tried to explain the pathophysiology of epiphyseal infection. The blood enters the epiphysis via epiphyseal arteries and is then carried to the surfaces of the articular and physeal cartilage via Hunter's circle. This forms a loop of branching arcades which anastomose with veins. Changes in the diameter of the vessels result in sludging of the blood, which is responsible for the epiphyseal infection.^(4-6,12) The majority of reported cases are bacterial with the most common pathogen being *Staphylococcus aureus*.⁽²⁻⁸⁾ *Streptococcus pneumoniae*,^(3,7) *Haemophilus influenzae*,⁽²⁾ *Kingella kingae*,⁽¹⁴⁾ and fungal infection⁽¹⁵⁾ have also been identified. We report a rare case (case 1) which was infected by *Salmonella enteritidis*. A review of the literature demonstrated only 12 cases of *Salmonella* osteomyelitis in children who did not have sickle cell disease.^(16,17)

Diagnosis of acute hematogenous epiphyseal osteomyelitis is often based on serial radiographic finding and is confirmed by positive culture at the lesion site. Making a diagnosis is often delayed.⁽⁸⁾ The time from presentation of symptoms to diagnosis of epiphyseal osteomyelitis is usually between 5 and 14 days.^(4,5,11) The initial radiographs usually show negative finding^(4,5,8) and the repeat radiographs (at 10 to 21 days later) show lytic lesions of the epiphysis. A bone scan and gallium scan are often necessary, because the radiographic changes detected in acute hematogenous osteomyelitis may only be about 20% at 10 to 14 days after the onset of illness.⁽¹⁸⁾ A bone scan may confirm the diagnosis as early as 24 to 48 hours after the onset of clinical illness.⁽¹⁹⁾ The bone scan reflects increased bone mineral turnover in general, and not specifically infection. Gallium uptake exceeds that seen on the bone scan, and incongruence of the spatial distribution of gallium and bone uptake are considered reliable indicators of osteomyelitis.⁽²⁰⁾ Therefore, combined bone/gallium scintigraphy is helpful when there is poor localization of the clinical findings.

The clinical manifestations of epiphyseal osteomyelitis are similar to those of a septic knee. The difference between them is that epiphyseal osteomyelitis involves only the femoral or tibial epiphysis, while septic knee involves both. The differ-

ential diagnosis is based on radiographic and bone/gallium scan findings in the early stage.

A delay in diagnosing epiphyseal infection may allow the infection to spread from the epiphysis into the knee joint.^(4,5) Our 2 cases similarly had a septic knee which required surgical debridement. So, aggressive intravenous antibiotic therapy is needed at an early stage, which may prevent the spread of the infection to adjacent joints if the clinical response is good.^(5,8) The antibiotic regimen is based on bacterial sensitivities, the clinical response, and subsequent ESR/CRP levels. A 4- to 6-week course of parenteral antibiotics is usually needed. Surgical intervention may be indicated when there are 1) progression on radiographic findings, 2) poor clinical response to conservative treatment with intravenous antibiotics, and 3) concomitant septic arthritis. Although no growth disturbances have been reported, observing these children to skeletal maturity is recommended.⁽⁵⁾

In conclusion, increased awareness of acute epiphyseal osteomyelitis is necessary to obtain an early diagnosis. Repeat radiographs 10 days after the onset of illness, bone scan, and Ga-67 inflammatory scan are recommended for diagnosis. Treatment should consist of proper antibiotics and surgery depending on the clinical course.

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急性骨骺 (epiphysis) 骨髓炎：二例報告

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急性骨骺感染並不常見，我們在此報告2個遠端股骨骨骺骨髓炎病例。這2個病例從發病到被診斷延遲了10到21天，感染從骨骺處擴散到膝關節，後來都接受了清創手術治療。文獻上報告的骨骺感染以金黃色葡萄球最為常見，在我們報告的病例中，其中一例是罕見的沙門氏桿菌感染。正確的診斷及早期治療才可以避免骨骺進一步破壞，以及避免將來骨頭生長受損。(長庚醫誌 2003;26:851-6)

關鍵字：骨骺，骨髓炎。

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