



Early Diagnosis and Management of Neonatal Acute Hematogenous Osteomyelitis: A Case Report

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Abstract

Background: Neonatal acute hematogenous osteomyelitis (NAHO) is a rare yet severe condition caused by bacterial infection of bone and marrow due to hematogenous spread. This case report details a 21-day-old male neonate diagnosed with NAHO of the left distal femur. The infant presented with knee swelling and restricted movement of the left lower extremity, but lacked fever or systemic symptoms, complicating diagnosis. Diagnostic imaging and blood cultures confirmed *Staphylococcus aureus* as the pathogen. Treatment with intravenous Ceftriaxone sodium for three weeks led to significant clinical improvement and complete recovery. **Method:** The diagnosis was established through a combination of imaging studies (X-ray, CT, MRI), which revealed bone destruction, periosteal reaction, and abnormal cartilage signal intensity. Blood cultures confirmed *Staphylococcus aureus*. The patient was treated with intravenous Ceftriaxone sodium for three weeks, with regular follow-up and assessments to monitor clinical response and recovery. **Conclusion:** Early diagnosis and aggressive antibiotic therapy are crucial in managing NAHO to prevent serious complications such as chronic osteomyelitis and growth disturbances. This case

emphasizes the importance of high clinical suspicion, comprehensive imaging, and timely microbiological studies. The positive outcome underscores the effectiveness of early intervention and highlights the need for heightened awareness among clinicians dealing with neonates presenting with subtle infection signs.

Keywords: Neonatal osteomyelitis, *Staphylococcus aureus*, Ceftriaxone therapy, Diagnostic imaging, Early intervention.

Introduction

Neonatal acute hematogenous osteomyelitis (NAHO) is a rare yet significant infection of the bone and bone marrow, often caused by the hematogenous spread of bacteria (Brady et al., 2008; Brook, 2008). While NAHO's incidence is lower than osteomyelitis in older children and adults, its potential for high morbidity demands timely diagnosis and treatment to prevent complications like growth disturbances, deformities, and chronic infections (Peltola & Pääkkönen, 2014; Riise et al., 2008).

Neonates' unique vascular anatomy predisposes them to bacterial seeding in the metaphysis, where slow blood flow facilitates bacterial deposition (Castellazzi et al., 2016; Iliadis & Ramachandran, 2017). Unfortunately, the clinical presentation in neonates is often subtle and nonspecific, making early diagnosis difficult (Yeo & Ramachandran, 2014). Common symptoms include localized swelling, limited limb movement, and irritability, which are frequently mistaken for other neonatal conditions (Hong

Significance | This study determines the importance of early diagnosis and aggressive treatment in neonatal acute hematogenous osteomyelitis to prevent severe complications.

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& Gutierrez, 2018). This delayed diagnosis can lead to inappropriate treatment, increasing the risk of serious complications (Saavedra-Lozano et al., 2017).

Diagnostic tools such as radiography, MRI, CT scans, and blood cultures are essential for confirming osteomyelitis and identifying the causative organism, commonly *Staphylococcus aureus* (Carter et al., 2016; Dodwell, 2013). Rapid diagnosis, supported by imaging and laboratory studies, allows for timely treatment, which is critical for minimizing long-term damage (Sarkissian et al., 2016).

In the case of a 21-day-old neonate, osteomyelitis of the left distal femur was confirmed through diagnostic workup, highlighting the importance of early identification (Krogstad, 2014). Treatment with targeted antibiotics, such as ceftriaxone sodium, resulted in complete recovery without long-term complications (Arnold et al., 2006). This case underscores the need for early and aggressive antibiotic therapy in neonatal osteomyelitis to prevent growth abnormalities and chronic infection (Weiss-Salz & Yagupsky, 2012).

Ultimately, understanding the pathophysiology and presentation of NAHO is critical for improving outcomes in affected neonates. Clinicians must remain vigilant for subtle signs of this rare condition and prioritize prompt diagnosis and intervention to prevent potentially disabling sequelae (Peltola & Pääkkönen, 2014). This case report illustrates the clinical presentation, diagnostic workup, and therapeutic approach to neonatal osteomyelitis, emphasizing the importance of early and aggressive antibiotic therapy to avoid adverse outcomes. Following a three-week course of targeted antibiotic therapy with ceftriaxone sodium, significant clinical improvement was observed, and follow-up assessments indicated complete recovery without any long-term complications. This highlights the effectiveness of early intervention in preventing serious sequelae such as growth abnormalities, deformities, or chronic infection.

The aim of this study is to underscore the importance of prompt recognition and management of NAHO to prevent potentially disabling complications. Through detailed analysis of this rare case, it provides a valuable reference for clinicians encountering similar presentations, enhancing their diagnostic acumen and treatment strategies in neonatal osteomyelitis. Early identification and targeted therapy remain the cornerstones for favorable outcomes in neonatal patients diagnosed with this rare but potentially devastating condition.

Case Report

Patient Presentation:

A 21-day-old male neonate was brought to the hospital with complaints of swelling in the left knee and restricted activity of the left lower extremity for the past three days. The parents reported no fever, redness of the local skin, or systemic signs of

infection. The neonate was otherwise feeding and sucking well, but he was noted to cry easily upon handling, particularly when the left leg was moved. There was no history of trauma or any recent infections.

Physical Examination on Admission:

On admission, the neonate was alert and afebrile, with a temperature of 36.6°C, pulse rate of 140 beats per minute, respiratory rate of 46 breaths per minute, and a weight of 4.8 kg. General physical examination revealed no jaundice, rash, or bleeding points. The anterior fontanelle was normal in size (2.0 cm × 2.0 cm) and level. Cardiopulmonary examination findings were normal, with clear heart sounds and normal respiratory examination. The abdomen was soft with normal liver and spleen palpation, and bowel sounds were present. Examination of the left lower limb showed mild flexion with swelling around the knee joint. There was no local skin temperature change, but tenderness was present on palpation. The right lower extremity appeared normal, with no swelling or tenderness.

Initial Differential Diagnosis:

The initial differential diagnosis for the neonate presenting with left knee swelling included left distal femur osteomyelitis and neonatal sepsis with possible joint involvement. To confirm the diagnosis, several investigations were conducted. Blood investigations revealed a White Blood Cell (WBC) count of 11,200 cells/mm³, with 65% neutrophils and 42% lymphocytes, which suggested a mild elevation typical of infection. The C-Reactive Protein (CRP) level was normal, while the Erythrocyte Sedimentation Rate (ESR) was elevated at 18 mm/hr. Routine urine and stool examinations were normal, as was the anti-streptolysin O (ASO) titer. Imaging studies were crucial in diagnosing the condition. An X-ray of the left knee demonstrated bone destruction at the left distal femur with a periosteal reaction, indicative of osteomyelitis. A subsequent CT scan of the left knee revealed local bone destruction and punctate high-density lesions in the left distal femur, along with soft tissue swelling, further suggesting an infectious process. Magnetic Resonance Imaging (MRI) of the left knee showed abnormal signal intensity in the metaphyseal and epiphyseal cartilage of the left femur, accompanied by soft tissue swelling, which was consistent with infectious lesions. Microbiological studies played a pivotal role in confirming the diagnosis, with blood cultures testing positive for *Staphylococcus aureus*, a common pathogen responsible for osteomyelitis. These findings collectively confirmed the diagnosis of acute hematogenous osteomyelitis of the left distal femur.

Diagnosis:

Based on clinical presentation, imaging findings, and microbiological results, a diagnosis of acute hematogenous osteomyelitis of the left distal femur was established.

Treatment:

The neonate was started on intravenous Ceftriaxone sodium at a dose of 50 mg/kg. The treatment was planned for a three-week duration along with supportive care to manage inflammation and prevent complications. The antibiotic choice was based on the sensitivity pattern for *Staphylococcus aureus*.

Response to Treatment:

After one week of treatment, the neonate showed significant clinical improvement. The swelling of the left knee had reduced, and there was a marked increase in the activity of the left lower extremity. Blood investigations were repeated after one week, and both CRP and ESR had normalized. Blood culture was repeated and returned negative, indicating effective clearance of the infection.

After two weeks of treatment, the child was afebrile, alert, and active. There was no swelling, tenderness, or warmth around the left knee. Both lower extremities exhibited normal movements and appeared symmetrical.

Follow-Up and Outcome:

The child was discharged after completing three weeks of intravenous antibiotic therapy, with complete resolution of symptoms. Follow-up visits were conducted over two months post-discharge, showing normal development, no limb length discrepancy, and no angular deformity.

Discussion

Acute hematogenous osteomyelitis in neonates, particularly involving the distal femur, is a rare but serious condition that requires timely diagnosis and management to prevent long-term sequelae. The rarity of neonatal acute hematogenous osteomyelitis (NAHO) and its often-subtle clinical presentation can result in delayed diagnosis, which increases the risk of complications. In this case, the neonate presented with non-specific symptoms such as knee swelling and restricted limb movement without systemic signs like fever, which are typical in older children with osteomyelitis. This lack of specificity underscores the challenges in diagnosing NAHO and highlights the importance of a high index of suspicion among clinicians.

The pathophysiology of osteomyelitis in neonates is influenced by their unique vascular anatomy and immune response. The rich metaphyseal blood supply and slow blood flow in neonates provide a favorable environment for bacterial deposition, growth, and infection following bacteremia. Unlike in older children or adults, where osteomyelitis may present with more obvious systemic symptoms, neonatal osteomyelitis often presents with localized signs, which can be mistaken for other neonatal conditions, further complicating early diagnosis. In this case, the initial suspicion of osteomyelitis was confirmed through a combination of imaging studies and microbiological evidence.

Radiological imaging plays a crucial role in the diagnosis of neonatal osteomyelitis. In the presented case, initial X-rays showed

bone destruction and periosteal reaction, suggestive of osteomyelitis. However, X-rays have limited sensitivity in the early stages of the disease, as bone changes may not appear until 10-14 days after the onset of infection. Computed tomography (CT) provided a clearer picture of local bone destruction, high-density lesions, and soft tissue swelling, all indicative of an infectious process. Magnetic Resonance Imaging (MRI) was particularly useful for early detection, revealing abnormal signal intensity in the metaphyseal and epiphyseal cartilage, along with associated soft tissue changes. MRI is considered more sensitive than X-ray and CT in identifying early bone marrow and soft tissue involvement, making it an invaluable tool for early diagnosis (Brady et al., 2008). Laboratory investigations also provide essential diagnostic clues. In this case, although the White Blood Cell (WBC) count was mildly elevated, it remained within the normal range, demonstrating that WBC alone is not a reliable indicator of osteomyelitis. The elevated Erythrocyte Sedimentation Rate (ESR) and normal C-Reactive Protein (CRP) levels reflect the variable nature of inflammatory markers in neonatal osteomyelitis (Castellazzi et al., 2016). CRP, in particular, can increase within hours after infection and decrease rapidly after successful treatment, making it a useful marker for monitoring treatment response. Blood cultures confirmed the diagnosis, identifying *Staphylococcus aureus* as the causative organism, which is consistent with most cases of acute hematogenous osteomyelitis in neonates.

Effective management of neonatal osteomyelitis hinges on early and aggressive antibiotic therapy. The neonate in this case was treated with intravenous Ceftriaxone sodium, a third-generation cephalosporin, for three weeks, which led to significant clinical improvement. The choice of antibiotic therapy was guided by the sensitivity pattern of the isolated organism. For Methicillin-resistant *Staphylococcus aureus* (MRSA), alternative antibiotics like vancomycin or clindamycin are recommended. The timely initiation of appropriate antibiotic therapy is critical to avoid complications such as chronic osteomyelitis, growth disturbances, or joint deformities (Brady et al., 2008).

Surgical intervention may be necessary in cases where there is abscess formation, failure to respond to antibiotics, or the presence of orthopedic complications. Early orthopedic intervention can prevent deformities and ensure better functional outcomes. In this case, no surgical intervention was required, and the neonate responded well to medical management alone, with no adverse sequelae noted on follow-up.

The prognosis for neonatal osteomyelitis is closely related to the timeliness of diagnosis and the effectiveness of treatment. Delayed recognition and inadequate treatment can lead to severe consequences, including chronic infection, growth abnormalities, and functional impairment. The presented case highlights the effectiveness of early recognition, appropriate imaging, and

targeted antibiotic therapy in achieving favorable outcomes without long-term complications. This case emphasizes the need for heightened clinical awareness, thorough investigation, and early intervention in managing neonatal osteomyelitis to ensure optimal patient outcomes.

Conclusion

Neonatal acute hematogenous osteomyelitis (NAHO) is a rare but potentially serious condition that requires prompt diagnosis and timely intervention to prevent long-term complications such as chronic osteomyelitis, growth disturbances, and joint deformities. This case report of a 21-day-old male neonate with osteomyelitis of the left distal femur underscores the diagnostic challenges associated with the subtle presentation of the disease in neonates, where classic systemic signs like fever may be absent. It highlights the critical role of comprehensive imaging, including X-ray, CT, and MRI, in detecting early bone changes, and the importance of microbiological studies in identifying the causative pathogen. Early initiation of targeted antibiotic therapy, as demonstrated in this case with Ceftriaxone sodium, is essential for achieving complete recovery and preventing serious sequelae. The positive outcome in this neonate reinforces the necessity for a high index of suspicion among clinicians when encountering neonates with non-specific symptoms of infection and emphasizes a multidisciplinary approach for effective management. Overall, heightened clinical awareness and early, aggressive treatment are key to ensuring favorable outcomes in neonates diagnosed with this rare but potentially devastating condition.

Author contributions

S, N, and MC handled clinical diagnosis, case management, and data collection; AV supervised, guided research, and manuscript preparation.

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Competing financial interests

The authors have no conflict of interest.

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