

Surgical Debridement Provided for Fast Recovery in Metaepiphyseal Haematogenous Osteomyelitis with Adjacent Subperiosteal Abscess Formation in Two Children

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Abstract

Background: Primary metaepiphyseal haematogenous osteomyelitis (HOM) with subperiosteal abscess formation at initial admission is a rare but serious condition. A considerate treatment strategy is crucial to avoid damage to the adjacent physics.

Methods: Charts and radiographic data of two cases were reviewed and reported in a retrospective study approved by the Institutional Review Board.

Results: Two children presented with limping, painful restriction of movement and very mild laboratory findings. No trauma was remembered. Conventional radiography showed no abnormalities, but subsequent MRI revealed metaepiphyseal HOM as well as an adjacent sub-periosteal abscess collection.

Conclusions: Antibiotic therapy and immediate surgical debridement provided for uncomplicated healing.

Keywords: Osteomyelitis; Abscess; Early debridement; *Staphylococcus aureus*

Introduction

Primary metaepiphyseal HOM (haematogenous osteomyelitis) in children is a rare condition which is reported to occur acute, subacute or chronic [1-5]. The pathogenesis remains unclear although a history of pediatric infection (e.g. angina, bronchitis) and a concomitant trauma are usually reported. Seldomly, a periosteal abscess formation is found adjacent to the highly vascularized metaphysis in acute metaepiphyseal HOM. Therefore, careful diagnostic assessment is of utmost importance to avoid long-term complications.

The diagnosis of metaepiphyseal HOM is often delayed, as symptoms are rather unspecific, e.g. fever, weakness, joint effusions, malaise or local bone pain. Clinical investigation sometimes reveals no findings other than local tenderness and painful limping. Likewise, laboratory findings display elevated ESR (erythrocyte sedimentation rate), elevated levels of serum CRP (C-reactive protein) or abnormalities in white blood cell count.

To confirm a diagnosis conventional x-rays are obtained, which might be regular at the early stages of HOM. Besides ultrasound, MRI is helpful to confirm HOM or to rule out other serious causes of bone pain, e.g. Ewing sarcoma or Langerhans cell histiocytosis. In early OM the MRI visualizes a distinct bone marrow edema while as in advanced OM an increased contrast agent uptake marks the borders of the inflammation. While the infection spreads through the medullar canal

the intramedullary pressure increases. Subsequently, infection spreads through Havers and Volkmann's canals progressing into the subperiosteal space [6]. Hence, in only few cases of metaepiphyseal HOM a subperiosteal abscess formation is found at initial presentation. The subperiosteal abscess lies between periosteum and cortex and is due to an acute or subacute OM. According to the pathophysiologic concept by Dresing et al. the physis reflects a barrier causing the abscess to spread to the periosteal space [6]. As the abscess formation enlarges, ruptures of this collection into the adjacent soft tissue have been reported [7]. Ultimately, during a chronic course of a subperiosteal abscess formation in childhood OM pathologic fractures are reported [8].

No consensus exists whether metaepiphyseal HOM heals with conservative treatment alone. Antibiotic therapy is reported to be sufficient in the early course of HOM [9-11]. Ezra et al. treated eight patients conservatively with the same underlying pathology, and they noted no difference in duration of treatment compared to Sorensen et al. who performed additional curettage in a comparable collective [4]. According to the findings reported by Ezra et al. operative treatment is reserved for severe cases with persistent infection [11]. In contrast, Sorensen et al. reported on three patients with primary epiphyseal HOM who underwent curettage besides antibiotic administration and recovered without complications [4]. However, some authors support debridement in cases of progressive OM with adjacent subperiosteal abscess formation. Still, the relevance of intramedullary drainage remains discussed controversially [12].

As complications after HOM are acute bacterial bone and joint infections harming the adjacent physis ultimately resulting in concomitant growth disturbance an early diagnosis and appropriate treatment is crucial especially in HOM that comes close to the physis to prevent long-term complications [13].

In this manuscript, we report our clinical experience in two seldom cases of a subperiosteal abscess formation in metaepiphyseal HOM treated operatively with intramedullary drainage and additional intramedullary drainage.

Materials and Methods

Illustrative case reports

Case 1: An eight-year-old boy was presented with a two-day of pain and swelling of his right wrist. Neither the boy nor his mother remembered a previous trauma. About two weeks ago, he suffered from tonsillitis and bronchitis and therefore received antibiotic therapy. At admission body temperature was elevated. Laboratory tests showed a serum CRP of 9 mg/dl and ASLO (Anti-streptolysin) titre of 433 U/ml. At control after two days CRP was 10.7 mg/l. As pain did not subside under antiphlogistic therapy a MRI scan was performed six days after initial presentation (Figure 1).

Our diagnosis was a metaepiphyseal OM of the distal radius and ulna with a subperiosteal abscess formation adjacent to the distal radius.

Treatment

In an effort to limit harm to the physis as well as further joint involvement the abscess formation was treated operatively in both cases. Abscess lavage with normal saline solution and consecutive drainage was performed. We performed additional intramedullary drainage to release the intramedullary pressure. In one patient, we used an antibiotic-instilling drainage for five consecutive days after the operation. In the second patient, wound closure was performed using a conventional Manovac drain until postoperative day two. In both children, a cast was applied until removal of the stitches.

Perioperative cultures of the curetted material were positive for *Staphylococcus aureus* in both children. Intravenous antibiotics were administered for eight days (Augmentin 3 g per day) followed by oral antibiotics for further six weeks.

At follow-up after one year both children were pain free and had no limitation in range of motion when compared to the other side.

Discussion

Metaepiphyseal HOM is a rare but typical childhood condition after a history of bacteremia (e.g. common cold) and occurs in an acute, subacute or chronic form. Most cases are classified subacute due to the subtle clinical findings and delayed diagnose. Thereby, symptoms of an osseous infection are masked by the antibiotic treatment targeting the bacteremia. Besides bacteremia a minor trauma might be reported but is not always memorable. This causal relationship was nicely demonstrated in a landmark work by Morrissy et al. who established a rabbit tibia trauma model. The model focused on the development of OM and consisted of 3 groups. Doing so, two groups had either bacteremia or had sustained a trauma and consecutively hardly any animal developed OM. In contrast, rabbits which had both features,

bacteremia and a corresponding trauma developed significant OM[14].

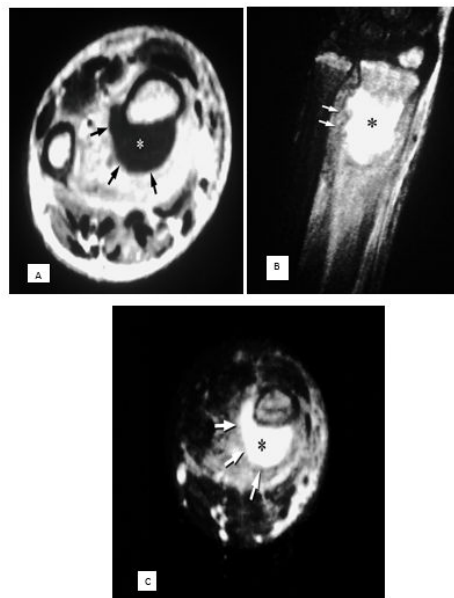


Figure 1: Eight-year-old boy with subperiosteal abscess in the distal radius (A) Axial T1 weighted sequence showing the subperiosteal abscess. The pus collection is hypointense (asterix). Arrows mark the abscess borders, (B) Coronal STIR sequence of the distal forearm: The subperiosteal abscess is hyperintense (bright) and marked with the asterix and located in the subperiosteal layer with a maximum diameter of 2.5 cm. Arrows point at the abscess border. Note the marked edema in the distal radius induced by the initial OM. Slight edema in the epiphysis of the ulna. (C) Axial STIR sequence of the distal forearm: The subperiosteal abscess is hyperintense (bright) and marked with the asterix and located in the subperiosteal layer with a maximum diameter of 2.5 cm. Arrows point at the abscess border.

Case 2: A nine-year-old girl was presented with a painful swelling and redness of the lateral malleolus. There was no history of a previous illness or a memorable trauma. Plain radiographs at initial presentation showed no pathology. At clinical follow-up three days later the ankle joint was livid, swollen and increasing motion tenderness. Further, markers of inflammation were found elevated (white blood cell count 14.300/mm³ with a leftward shift, CRP 7.0 mg/dl, ASLO titer 1612 U/ml). With elevated body temperature (37.5°C) beginning erysipelas was suspected. She underwent MRI of her ankle joint which revealed a primary metaepiphyseal OM of the distal fibula with an adjacent subperiosteal abscess collection (Figure 2).

With regard to an early diagnosis conventional radiographs should be acquired at initial presentation although the diagnosis of acute HOM is primarily clinical [15]. Moreover, osseous changes are reported to be absent until 7 to 14 days after the onset of the symptoms [6,16]. Correspondingly, plain radiographs in our patients showed no evidence of a lytic lesion or periosteal reaction. Still, Ezra et al. suggest careful assessment of plain radiographs alone to reveal the benign feature of most lesions with a high degree of reliability, thereby making additional imaging redundant [11].

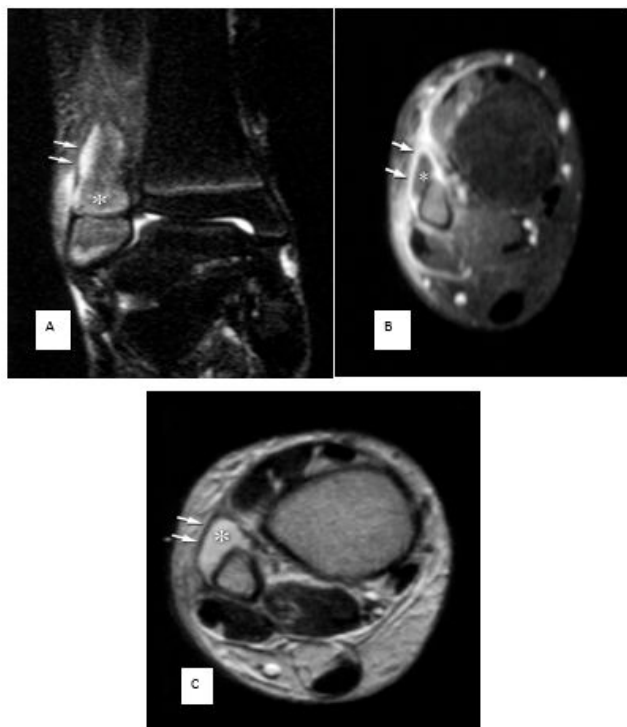


Figure 2: Nine-year-old girl with subperiosteal abscess in the distal fibula. (A) Coronal STIR sequence (heavily T2 weighted sequence with fat suppression): Arrows show the subperiosteal fluid collection in the distal fibula diaphysis without interruption of the periost. The Asterisk is located in the bone marrow of the distal fibula that shows increased signal intensity as a sign of reactive bone marrow edema. (B) Axial T1 weighted sequence with fat suppression after the injection of gadolinium. Arrows point at the contrast enhancing abscess border. (C) Axial T2 weighted sequence. The arrows indicate the periosteal layer that is separated from the cortical bone and also represents the abscess border. The asterisk is located within the abscess with a diameter of 12 mm.

But considerable subperiosteal collections, as found in our reported cases might then be missed causing prolonged treatment. Therefore, MRI is reported to be a key imaging tool to confirm OM [17]. MRI quantifies bone involvement and is thereby a crucial imaging modality to identify cases that profit from surgical repair especially in patients with subperiosteal abscess formation and soft tissue collection.

MRI should be obtained with a T1 and T2 weighted sequence without fat suppression. In addition, a STIR sequence as well as a T1 sequence after the injection of gadolinium should be performed. The T1 sequence precisely pictures anatomic details as well as the bone marrow fat content. Thereby, the STIR sequence is most sensitive for bone marrow edema and fluid collection. Moreover, the T1 sequence after injection of gadolinium with fat suppression perfectly delineates the boarder of the inflammation.

If MRI is not immediately available ultrasound is reported to be useful to detect a subperiosteal abscess formation [18]. Ezra et al. recommend ultrasound as an available, noninvasive method [11]. To our opinion ultrasound provides only limited information regarding

the extent of the OM. Ultimately, ultrasound is reported to be useful for needle aspiration of a subperiosteal abscess formation in selected cases [16,18].

As in every case of HOM bacterial culture has to be obtained by aspirate, intraoperative specimen or blood culture to identify the infecting organism and assure appropriate antibiotic regimen. Nevertheless, cultures of aspirated material are reported to be negative in up to 75% [19,20]. But even in the absence of positive culture patients with epiphyseal OM are reported to improve during the course of antibiotic treatment [19]. Therefore, antibiotic regimen has to be started at the onset of symptoms targeting *Staphylococcus aureus*, which accounts for approximately 50% to 60% of AHMO [7,19,21].

Current literature is inconclusive whether a metaepiphyseal HOM with abscess formation heals with AB treatment alone or requires surgical repair, although recent literature tends towards surgical debridement with additional decompression of the intramedullary cavity [22]. In our opinion antibiotics alone may be sufficient in metaepiphyseal HOM in the absence of a periosteal collection. But a subperiosteal formation is a result of high intramedullary pressure and the physis reflects a natural barrier for fluid and pus. The periosteum is loosely attached to the cortex and an increased intramedullary pressure can cause a subperiosteal abscess, which reflects the severity of this condition [16,18]. Still, no threshold is defined at which size a surgical drainage is indicated. Howard et al. for example suggested a subperiosteal formation of 2 mm to be a reasonable threshold for surgical debridement [23]. While Mah, et al. report uneventful recovery after spontaneous rupture of a subperiosteal abscess collection the authors at the same time favor surgery allowing for faster recovery [7]. Besides presence of a subperiosteal abscess formation, our decision to perform surgery was based on the MRI findings regarding the epiphyseal affection. Two drill holes thereby released the intramedullary pressure and limited the progression of the infection. This goes in line with findings reported by Montgomery et al. who support abscess drainage as well as intramedullary drainage in order to decrease the risk of repeated surgical interventions [22].

Conclusion

Due to the rarity of periosteal abscess formation in metaepiphyseal HOM in children various treatment strategies are reported based on surgeon's experiences. In case of adjacency to the physis as in our presented cases, we emphasize surgical repair to avoid any harm to the growth plate. As the subperiosteal abscess reflects the increase in intramedullary pressure we support the additional intramedullary drainage. However, further research is needed to confirm our observations.

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