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Multiloculated Cystic Lesion of the Second Metacarpal in an 8-Year-Old Child: Contribution of MRI and Diagnostic Discussion - A Case Report

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Abstract | **Case Report**

Bone lesions of the hand are rare in children. Among them, aneurysmal bone cyst is a benign, expansile, osteolytic lesion that may mimic a locally aggressive process. We report the case of an 8-year-old child investigated for swelling of the dorsal aspect of the right hand evolving over one month. Plain radiography showed an osteolytic lesion of the second metacarpal with focal cortical breakthrough. MRI demonstrated a well-defined multiloculated mass centered on the second metacarpal, composed of multiple septated cystic cavities with fluid-fluid levels. The lesion showed heterogeneous low signal intensity on T1-weighted images, heterogeneous high signal intensity on T2/proton density fat-suppressed sequences, and peripheral and septal enhancement after gadolinium administration. These findings were primarily suggestive of an aneurysmal bone cyst. Through this case, we highlight the role of MRI in lesion characterization, locoregional staging, and diagnostic orientation of pediatric bone tumors of the hand.

Keywords: Child; Hand; Metacarpal; MRI; Aneurysmal bone cyst.

INTRODUCTION

Aneurysmal bone cyst is a benign but locally aggressive bone lesion that predominantly affects children and young adults [1,2]. It accounts for a small proportion of primary bone tumors, with a clear predominance before the age of 20 years [1–3]. Its occurrence in the hand is rare, particularly in the metacarpal bones, making it an unusual entity in pediatric practice [4–7].

Clinically, aneurysmal bone cyst most commonly presents with swelling, pain, or functional discomfort [1,2]. Imaging plays a central role in diagnostic orientation. Plain radiography helps identify an expansile osteolytic lesion with cortical thinning or cortical breakthrough, whereas MRI provides a more accurate assessment of the internal architecture of the lesion, its anatomical relationships, and its locoregional extension [2,8]. The presence of fluid-fluid levels within a multiloculated lesion is a suggestive feature, although it is not pathognomonic [2,8].

We report the case of a lesion involving the second metacarpal in an 8-year-old child, whose MRI appearance was highly suggestive of an aneurysmal bone cyst.

CASE REPORT

An 8-year-old child was referred for evaluation of swelling of the dorsal aspect of the right hand evolving over one month. The initial plain radiograph, which was not available for iconographic documentation at the time of writing, had revealed an osteolytic lesion of the second metacarpal with focal cortical breakthrough.

MRI of the right hand was performed using the following protocol: T1-weighted and T2 DIXON sequences in axial and coronal planes, coronal T1-weighted sequence, proton density fat-suppressed sequences in the three planes, followed by post-gadolinium T1 DIXON fat-suppressed sequences in axial and coronal planes.

The examination showed a mass centered on the second metacarpal. It was roughly rounded, regular in outline, relatively well defined, and multiloculated, composed of multiple septated cystic cavities with fluid-fluid levels. The lesion demonstrated heterogeneous low

signal intensity on T1-weighted images and heterogeneous high signal intensity on T2-weighted and proton density fat-suppressed images, with peripheral and septal enhancement after gadolinium administration (Figures 1, 2, and 3).

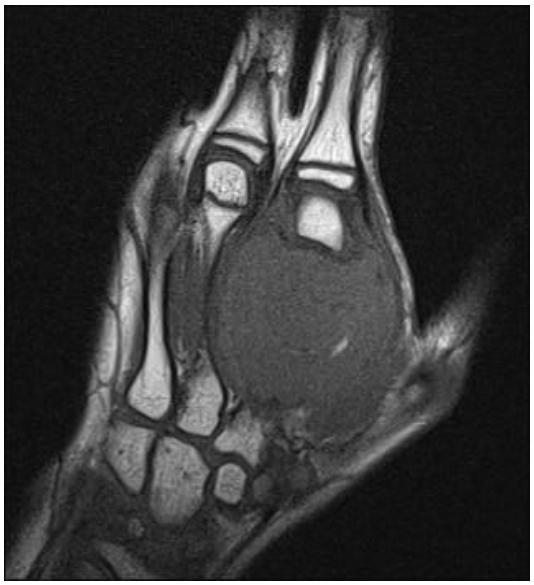

Figure 1: MRI of the right hand, coronal T1-weighted image: well-defined lesion centered on the second metacarpal, showing heterogeneous low signal intensity and an expansile appearance

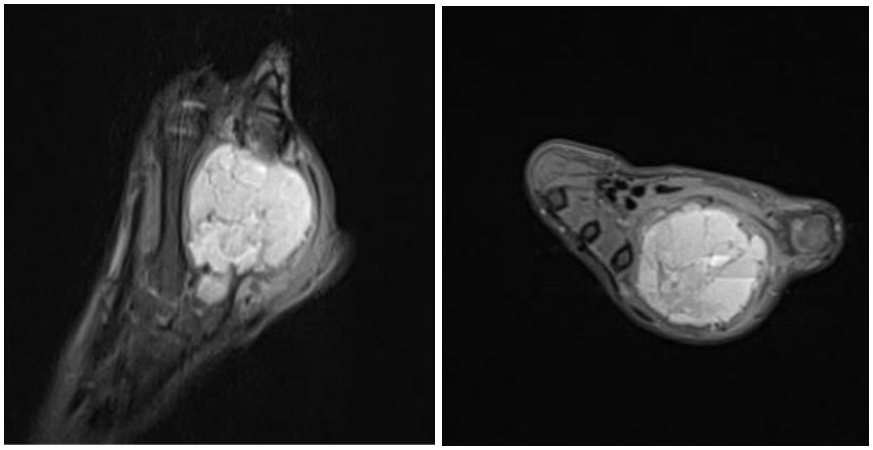

Figure 2: MRI of the right hand, T2/proton density fat-suppressed sequence: multiloculated mass composed of multiple septated cystic cavities with fluid-fluid levels

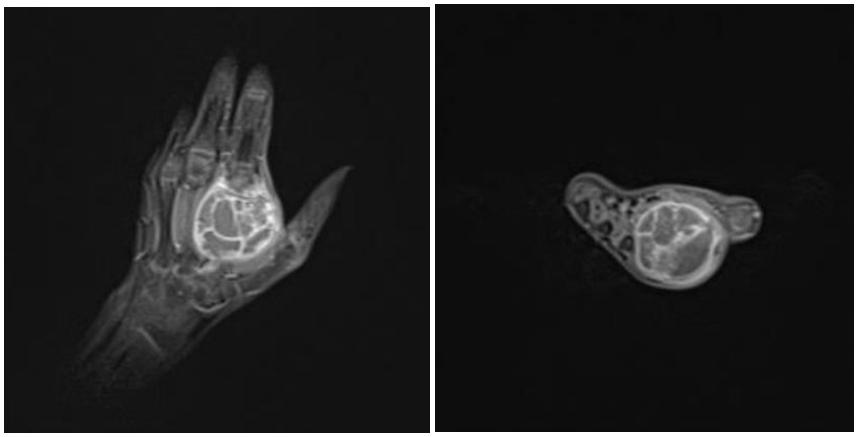

Figure 3: MRI of the right hand after gadolinium administration, T1 DIXON fat-suppressed sequence: peripheral and septal enhancement of the lesion

The lesion measured approximately 31 × 30 mm, with a longitudinal extension of about 40 mm. Distally, it extended to the level of the epiphysis and reached the proximal interphalangeal joint of the same ray. On its volar aspect, it caused mild displacement of the common flexor tendons of the fingers. Laterally, it filled the intermetacarpal space and came into contact with the cortices of the first and third rays, without identifiable cortical disruption at these levels (Figure 4). The carpometacarpal joint was preserved.

There was also mild infiltration of the adjacent soft tissues, more marked in the thenar region, with slight focal contrast enhancement. The carpal bones and phalanges were intact. No intra-articular effusion was identified.

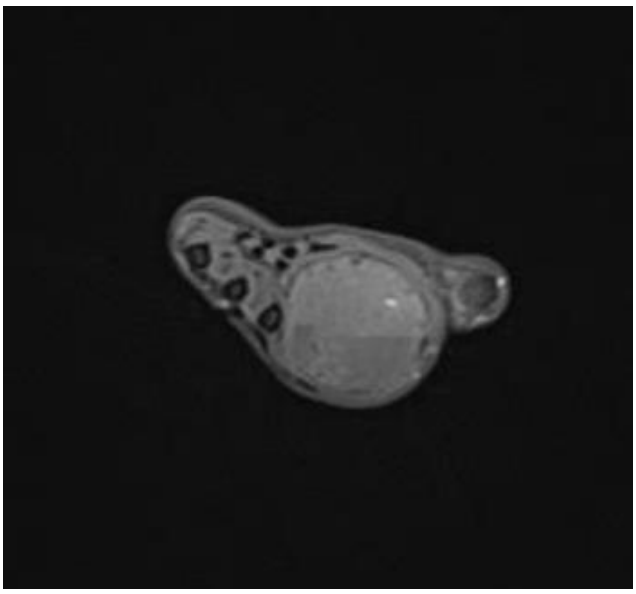

Figure 4: MRI of the right hand, axial proton density fat-suppressed image: extension of the lesion into the intermetacarpal space with mild displacement of the flexor tendons

Given the association of an expansile multiloculated bone lesion, internal septations, fluid-fluid levels, and peripheral and septal enhancement, the diagnosis of aneurysmal bone cyst of the second metacarpal was primarily suggested.

DISCUSSION

Aneurysmal bone cyst is a benign but potentially locally aggressive lesion, occurring mainly in young patients [1,2]. In the large clinicopathological series by Vergel De Dios et al., most cases involved children and young adults, with a predilection for long bones, flat bones, and the spine [3]. Involvement of the hand skeleton remains rare [4–7]. Braatz *et al.,* reported that hand involvement represented only a small proportion of aneurysmal bone cysts [7].

Radiologically, aneurysmal bone cyst classically appears as an expansile osteolytic lesion that causes bone expansion, cortical thinning, and sometimes cortical breakthrough [2,8,9]. MRI is particularly useful for analyzing the lesion content, the presence of septa, intramedullary extension, epiphyseal involvement, tendon relationships, soft-tissue extension, and the relationship with adjacent joints [2,8]. In our case, MRI demonstrated several highly suggestive features: multiloculation, fluid-fluid levels, peripheral and septal enhancement, and an expansile behavior with focal cortical breakthrough and mild soft-tissue involvement.

Fluid-fluid levels are an imaging feature frequently associated with aneurysmal bone cyst, reflecting sedimentation of blood products of different densities [2,8]. However, this sign is not specific and may also be observed in other benign or malignant bone lesions [2,8]. Therefore, global morphological analysis and histopathological correlation remain essential.

The main diagnostic interest of this observation lies in the rarity of the metacarpal location. Several comparable pediatric cases have been reported in the literature, particularly involving the third, fourth, and fifth metacarpals [4–7]. Kotwal *et al.,* described a case of metacarpal aneurysmal bone cyst in a 5-year-old girl [4]. Schwartz *et al.,* also reported involvement of the fifth metacarpal in a 10-year-old girl [5]. More recently, De Vitis *et al.,* published an interesting case involving the fourth metacarpal with extension to an open epiphysis, emphasizing the rarity of this location in children [6].

The differential diagnoses of such a presentation include, first and foremost, a secondary form of aneurysmal bone cyst developing on an underlying bone tumor, particularly chondroblastoma or giant cell tumor, as well as telangiectatic osteosarcoma, which must be carefully excluded [1,2,8,10]. Kransdorf

and Sweet emphasized that nearly one third of aneurysmal bone cysts may be secondary to an identifiable underlying lesion [8]. This finding fully justifies diagnostic caution when evaluating any bone lesion with fluid-fluid levels.

Therapeutic management is not uniform. Traditional treatment is based on intralesional curettage, often associated with bone grafting and sometimes local adjuvant therapy [1,2,9]. In metacarpal locations, especially when the bone architecture is severely altered, some authors have proposed wider procedures with bone reconstruction because of the risk of recurrence and the specific functional constraints of the hand [4,6,7]. Treatment choice depends on lesion location, extent, patient age, cortical integrity, articular relationships, and histological findings.

In our case, MRI allowed excellent pretherapeutic mapping of the lesion. It clarified intraosseous extension, contact with the epiphysis, mild soft-tissue extension, and absence of carpometacarpal joint involvement, all of which are useful elements for guiding management strategy. However, in the absence of histological proof at the time of writing, the diagnosis should be presented as highly suggestive rather than formally confirmed.

CONCLUSION

Expansile metacarpal lesions in children are rare and represent a real diagnostic challenge. In the presence of a multiloculated bone lesion with fluid-fluid levels, aneurysmal bone cyst should be considered first, particularly in a young patient. MRI plays an essential role in lesion characterization and locoregional staging. However, definitive diagnosis relies on histopathological examination, which is mandatory to exclude a secondary lesion or a malignant diagnosis.

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