Trapped periosteum in a distal femoral physeal injury: magnetic resonance imaging evaluation*

Interposição de fragmento periosteal na fratura da placa epifisária femoral distal: estudo por ressonância magnética

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Abstract Epiphyseal fractures are frequently associated with knee trauma during sports in children and adolescents. Usually, Salter-Harris types I and II fractures are conservatively treated. However, failed closed reduction of displaced fractures suggest the presence of trapped periosteum, with indication for surgery. The present report describes a case of Salter-Harris type I fracture of the distal femur in a child, complicated with trapped periosteum detected at magnetic resonance imaging.

Keywords: Trapped periosteum; Physeal injury; Magnetic resonance imaging; Femur.

Resumo Fraturas epifisárias são frequentemente relacionadas a traumatismo do joelho durante práticas esportivas em crianças e adolescentes. Fraturas Salter-Harris tipos I e II são tratadas conservadoramente, no entanto, quando irredutíveis, sugerem interposição de fragmento periosteal, sendo indicada cirurgia. Este trabalho relata fratura epifisária Salter-Harris tipo I do fêmur distal de uma criança, com interposição de periósteo detectado no exame de ressonância magnética.

Unitermos: Interposição periosteal; Fratura epifisária; Ressonância magnética; Fêmur.

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INTRODUCTION

Physeal injuries are common sports-related fractures of the knee in children and adolescents. Distal femur physeal fractures correspond to 5–15% of all epiphyseal fractures, and most of them are of the Salter-Harris type II.

Proposed mechanisms, based on gross radiologic and morphologic features, include hyperextension or varus or valgus strain. Magnetic resonance imaging is a useful supplement to radiography in cases of occult or subtle injuries because distal femoral physeal injury leads to physeal growth disturbance or potential limb shortening in 14–38% and angular deformity in 24–51% of cases[1].

Historically, most Salter-Harris type I or II fractures are considered as innocuous injuries[2]. The usual management is closed manipulation and casting of the leg. Failed closed reduction is recognized in the orthopedic literature as most often due to an interposed periosteal flap.

If the periosteal fragment is sufficiently large, surgical reduction is indicated with the purpose of reducing the incidence of premature physeal closure[3,4]. Entrapped periosteum has been described as a cause of irreducible fractures in different sites including distal radius, proximal humerus and distal tibia[5]. Other soft tissues such as muscles, tendons, ligaments and neurovascular bundles, may also get trapped in the fracture site, resulting in irreducibility.

CASE REPORT

A female, 11-year-old child complaining of pain in the right knee after hyperextension while playing on a trampolin. Conventional radiography revealed a subtle widening of the physis in the lateral compartment of the knee (Figure 1). Because of failed closed reduction of the fracture, magnetic resonance imaging was performed four days after the trauma and demonstrated the presence of trapped periosteal fragment in the posterolateral aspect of the distal femoral physeal in association with distension of the belly of the femoral biceps muscle and small joint effusion (Figures 2 and 3). There were no other tendinous, ligament or meniscal injuries.

After one week, the patient was submitted to surgery for removal of the periosteal fragment confirming diagnosis.

DISCUSSION

Conventional radiography is the mainstay of imaging for physeal injuries. Although the periosteum is not directly visualized with plain radiography, inappropriate closed reduction may suggest the presence of a trapped periosteum. A study has concluded that Salter-Harris types I and II fractures of the distal tibia with a residual physeal gap > 3 mm after closed reduction is suggestive of trapped periosteum[6]. Such finding has been associated with premature physeal closure in 60% of the patients versus 17% in cases where the gap ranged from 1 to 3 mm. However, using radiography alone may underdiagnose the presence of trapped structures in the fracture. In some patients, trapped periosteum is not

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associated with physeal widening[6]. Computed tomography with multiplanar reconstructions provides better outlining of osseous structures compared to radiography but it also does not allow visualization of the periosteum. Physeal widening, metaphyseal compression and epiphyseal fractures are better visualized at computed tomography than at conventional radiography. Late complications such as bony bridges are also better quantified with computed tomography[5].

Magnetic resonance imaging is not required in most cases of physeal injuries, but it does present some advantages such as absence of ionizing radiation, visualization of soft tissues and cartilage (including non-ossified epiphysis) in addition to its multiplanar capability. The role of magnetic resonance imaging in the evaluation of Salter-Harris types I and II fractures is not yet well defined[7], but it is considered the best method for the assessment of the complications of such injuries, such as, for example, avascular necrosis and development of bony bridges through the epiphyseal plate, which cause developmental disorders.

Magnetic resonance imaging can be used to confirm or exclude physeal injuries that may be difficult or impossible to depict on radiography, particularly Salter-Harris types I and V fractures. It is also helpful to reveal associated ligamentous injuries, which occur in half of patients with physeal separations around the knee[3].

Although this entity of entrapped periosteum has been reported numerous times as a cause of irreducible fractures, there is a lack of preoperative diagnostic imaging depictions. The absence of normal periosteum and an asymmetrically wide physis with low signal intensity material within it suggest periosteal interposition in a physeal fracture[7].

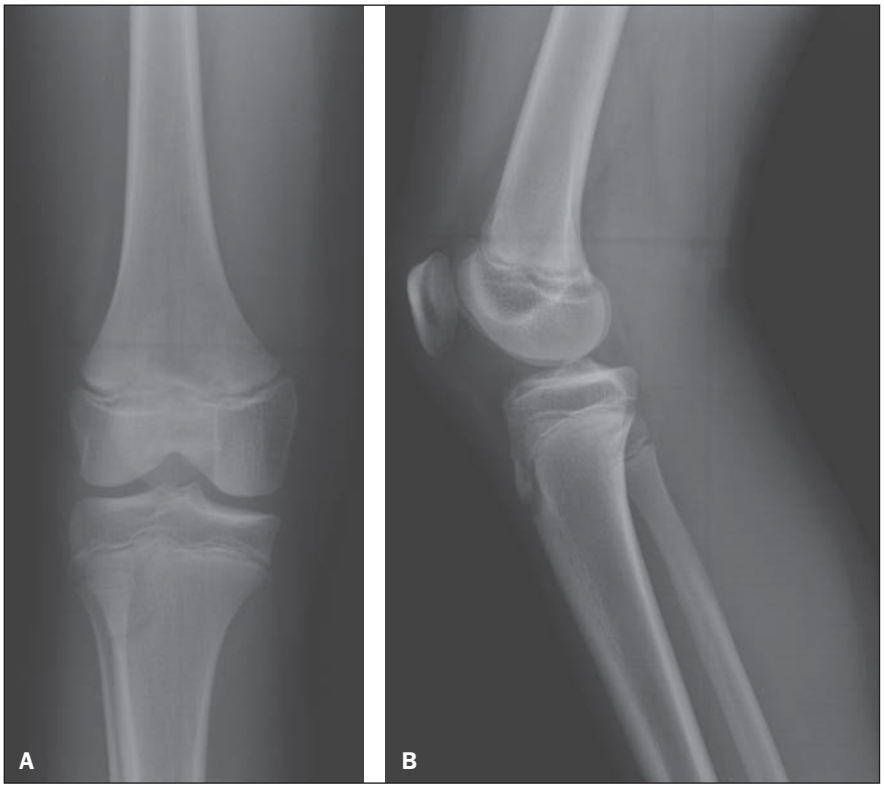

Figure 1. A: Anteroposterior radiograph – subtle widening of the distal femoral physis lateral compartment. **B:** Lateral radiograph – absence of significant changes.

CONCLUSION

Few studies have been published about radiological findings of trapped periosteum

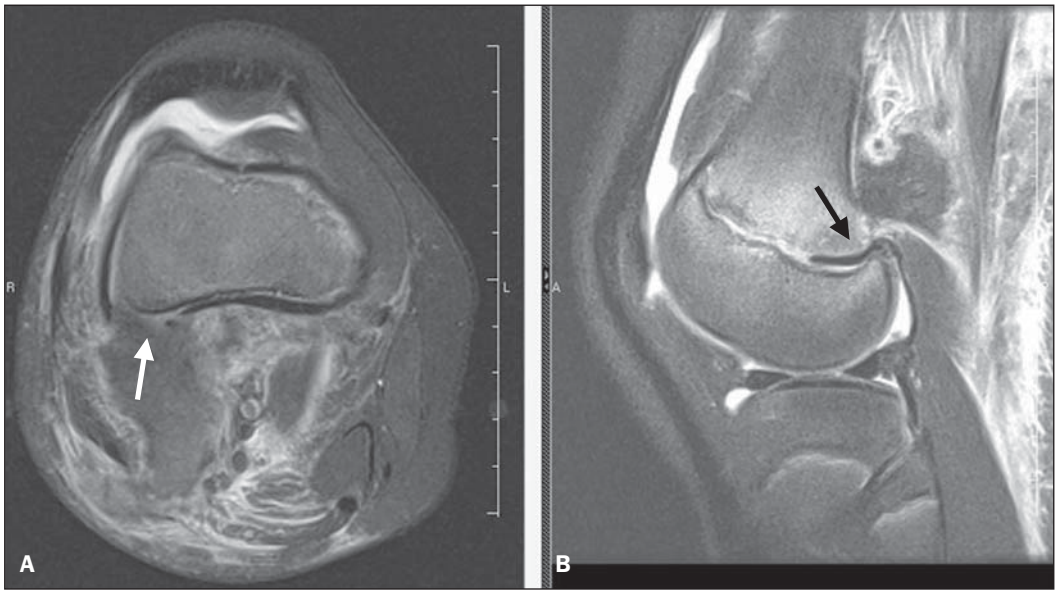

Figure 2. Magnetic resonance imaging, axial (**A**) and sagittal (**B**) T2-weighted images with fat saturation. Discontinuity in the posterolateral aspect of the cortical bone (**A**) associated with distension of the femoral biceps muscle and interposition of hypointense linear structure along the epiphyseal plate, compatible with periosteal fragment (**B**).

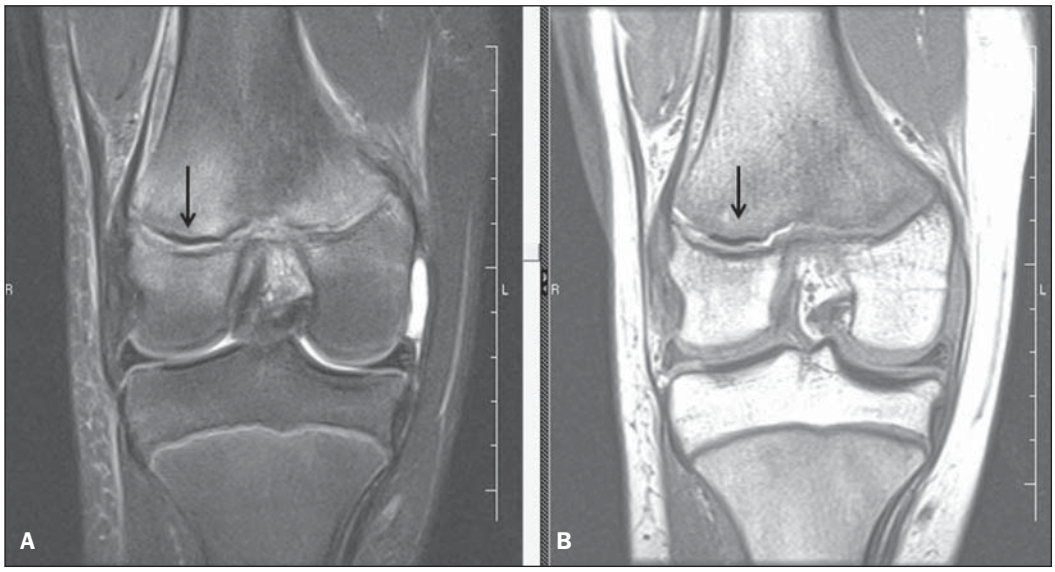

Figure 3. Magnetic resonance imaging, sagittal T2-weighted image with fat saturation (**A**) and T1-weighted image (**B**). Change in signal intensity along the lateral distal femoral epiphyseal plate, with interposition of a hypointense structure compatible with periosteal fragment.

in epiphyseal fractures, in spite of the relevance of such a diagnosis in the selection of the treatment for Salter-Harris types I and II fractures. Magnetic resonance imaging may be effectively utilized for demonstrating soft tissue interposition in fractures, as reported in the present article, allowing an appropriate and safe surgical planning.

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