

# PATELLAR FRACTURES IN CHILDREN (SLEEVE-TYPE FRACTURES)

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## SUMMARY

The authors describe a rare case of patellar fracture in an 11 year-old patient in whom an early diagnosis was not provided. The sleeve fracture – or ungloning fracture – diagnosis was reviewed for various aspects such as clinical diagnosis, imaging tests aid

and most suitable treatment. They concluded that, although rare, this kind of fracture should always be remembered, and that the most suitable treatment is surgery.

**Keywords:** Fractures; Patella

## INTRODUCTION

Patellar fractures in children are rare<sup>(1-5)</sup>, but, when present, affect patients younger than 16 years old. Its incidence occurs especially between 8 and 12 years of age<sup>(5)</sup> in less than 2% of patients with immature skeleton<sup>(6)</sup>. This happens because patella is more flexible during childhood and is less subjected to impact and tension forces during quadriceps contraction, being also involved by a large cartilage layer<sup>(4,5,7)</sup>. Those fractures can be caused by direct trauma, excessive contraction of the extensor mechanism, or by both. Houghton and Ackroyd<sup>(8)</sup>, in 1977, described an avulsion-type fracture of the distal end of the patella, in which a large amount of cartilage was withdrawn from the patella associated to a discreet bone fragment.

Although diagnosis can be suggested by clinical and radiographic evaluation, this fracture may not be diagnosed, particularly if there is a large hemarthrosis on knee joint or if x-ray studies cannot clearly show the bone fragment distally withdrawn. In these cases, the magnetic resonance imaging helps on diagnosing the injury, avoiding damages to knee extension or the formation of megapatellas with irregular joint surface.

## CASE REPORT

An eleven year-old male patient was skate rolling when he felt a sudden pain in the left knee, which resulted in a fall. He reported having heard a click, with a large edema emerging immediately after the fall, presenting extension functional disability. He received primary healthcare at the Emergency Room, where hemarthrosis was diagnosed and puncture was performed with the presence of 40 ml of blood, and knee being immobilized with plastered splint for two weeks. After that period, as the knee still remained swollen and painful at the anterior surface, he came back to the Emergency Room where a new bloody puncture was performed and a new immobilization device (plastered splint) was placed for two additional weeks. As on the 5th week, this patient could not

perform an active extension of the knee, his mother sought for a new healthcare, asking for physical therapy intending recovery. In this occasion, that patient was able to flex the knee during physical examination, but couldn't start or keep an active extension; a high patella could be perceived at palpation. The mother was asked to show her son's first x-ray image, which demonstrated a high patella with an image of withdrawal at the distal end on lateral plane (Figure 1). The radiographic examination in the 5th week showed a high patella, on lateral plane, now with the presence of ossification (Figure 2). At clinical examination, an absence of total extension of the left knee was seen (Figure 3). Magnetic resonance imaging both in T1 and T2 at axial, coronal and sagittal planes confirmed fracture with patellar distal end withdrawal with a surrounding cartilage area (Figure 4). Those findings were confirmed at surgery, where a medial and lateral retinaculum injury was also seen. After fracture curettage, a fixation method using a tension band was selected. The retinaculum was sutured, keeping knee immobilization during three weeks (Figure 5). Fracture is currently united, according to x-ray studies, and the child presents total active extension.

## DISCUSSION

The major difficulty regarding patellar fractures in children is the diagnosis. Congenital abnormalities may be confused with fractures<sup>(8,9)</sup>, and the size of the fragments, particularly in sleeve-type fractures may be underestimated in children due to the partially-cartilaginous nature of the patella<sup>(8)</sup>. Belman and Neviasser<sup>(1)</sup> noticed that the lack of diagnosis or a late diagnosis is common for patellar fractures in children.

Sleeve-type patellar fractures occur in children participating in activities requiring knee extension force with quadriceps contraction against resistance, with injury occurring on the supportive leg. Therefore, this injury is not like those caused by direct trauma on the knee<sup>(8)</sup>. Grogan et al.<sup>(2)</sup> classified patellar fractures in children

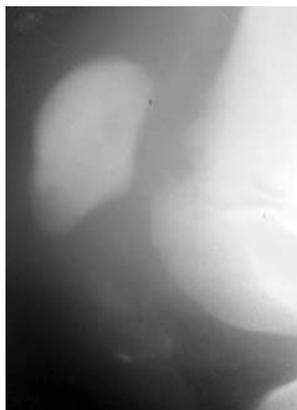
Study conducted by the Orthopaedics and Traumatology Service, Hospital Santa Teresa, Petrópolis, RJ

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according to their sites. The upper avulsion fracture involves the patellar upper end and is the most frequent one. A lower end avulsion is usually a result of an acute trauma. Medial avulsion may appear after a patellar lateral dislocation. The avulsion of the superolateral region of the patella may be considered as a bipartite patella or may be produced by stress due to repeated traction of the vastus lateralis muscle<sup>(9)</sup>. Another injury considered as repeated stress of the distal patellar end is the Sinding-Larsen-Johansson disease, producing an incomplete avulsion of the patellar ligament fibers, with subsequent necrosis and calcification<sup>(10)</sup>.



**Figure 1** - Initial x-ray image, showing a high patella and a subtle image of withdrawal at the distal end, at lateral plane.

X-ray studies of children's knees are a challenge, even for the most experienced doctors. Most of the pediatric traumatologists must be aware of a child presenting an inconclusive x-ray imaging<sup>(11-14)</sup>. Wessel et al.<sup>(13)</sup> demonstrated that in 51 patients older than 14 years old with acute knee trauma and hemarthrosis, a positive simple x-ray image could only be seen in 16 of them.



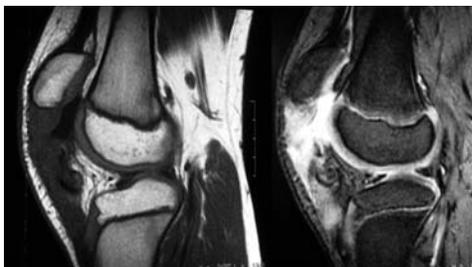
**Figure 2** - The x-ray imaging in the 5th week showed a high patella, when compared to the contralateral knee and a withdrawal fracture at the distal end of the patella, on lateral plane, now with the presence of ossification.

Thus, magnetic resonance is useful for diagnosing acute injuries. It can also be used to help on the diagnosis of patellar ligament ruptures and fractures in avulsion<sup>(12-16)</sup>. Particularly in this case, magnetic resonance was important for the diagnosis of joint cartilage injury.

The avulsion of a patellar distal fragment, most of times, includes a dislocation of the cartilage and this should be reduced in order to reestablish joint surface. Although the treatment with splints in lower limb's extension produces a reconstruction of the extensor apparatus, a patellar deformity may remain (mega-patella) with motion restraint, especially in extension<sup>(17,18)</sup>. Extensor apparatus reconstruction with absorbable sutures has not demonstrated good outcomes<sup>(3,18,19)</sup>. The best treatment method seems to be the rigid internal fixation of the fracture, keeping an anatomical reduction with the realignment of the joint cartilage. When bone fragment is small, fixation must be provided by a tension band<sup>(9)</sup>. It is important to suture medial and lateral retinacula in order to increase internal fixation stability. With a rigid fixation, the knee active flexion should be initiated after 3 weeks.



**Figure 3** - Clinical appearance of the left knee compared to right knee after 1 month. The patient could not perform total extension. There was one of the knee in addition to the depression on soft parts corresponding to a separation of the bone fragments.



**Figure 4** - The magnetic resonance imaging both in T1 and T2 at axial, coronal and sagittal planes confirmed the withdrawal fracture of the distal fragment with a cartilage area surrounding it.



**Figure 5** - Patellar osteosynthesis with tension band. X-rays in AP and Lateral planes.

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