Bilateral Sleeve Patella Avulsion: A Case Report and Literature Review

ABSTRACT

Sleeve patella avulsion is rare in children. The bilateral form is exceptional and only few cases are reported in literature. It often goes unnoticed upon initial presentation. MRI is golden standard for a precise description of the lesion. Early diagnosis of patellar sleeve fracture is important for successful treatment.

We present a case of bilateral patellar sleeve fracture in an 11-year-old boy who was diagnosed early and treated surgically with osteosuture in the left knee and a tension band construct in the right one. He regained full and painless active range of motion of bilateral knees within 18 months of his surgery but presented a radiological non-union of the inferior pole of the right patella.

Keywords: sleeve patella avulsion, active extension deficit, patella alta, MRI, surgery

1. INTRODUCTION

Patella fractures are rare in children (<1%) [1]. Fracture of the lower pole of the patella with sleeve patella avulsion is specific to children. This is a tearing of a small bone or cartilaginous fragment from the distal part of the patella which is generally invisible on x-ray. Patellar sleeve fractures occur in children between 8 and 16 years-old, with a peak incidence at the age of 13 [1] and affects especially boys. Bilateral involvement is rare. The diagnosis is often difficult. Treatment of patella sleeve fracture is mainly surgical. Through a case of bilateral sleeve patellar avulsion and a review of the literature, we present the diagnostic and therapeutic particularities of this condition.

2. CASE PRESENTATION:

We present the case of an 11-year-old boy with no medical problems who was the victim of a sport accident. He felt a crunch when he was running. The patient presented bilateral knee pain and total functional impotence of both lower limbs. Clinical examination showed edema of both knees, predominantly in the right knee (Figure 1).

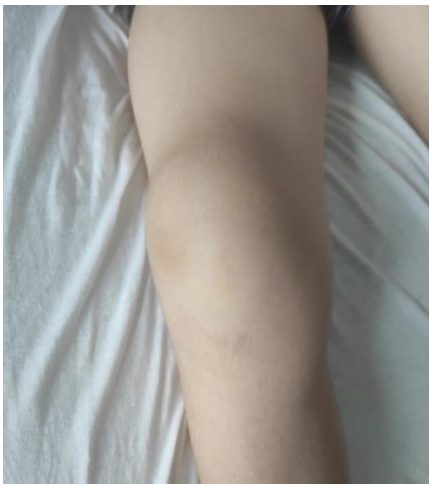

Figure 1: Clinical appearance of the right knee showing significant edema.

The child couldn't get his limbs off the bed. Palpation of both knees was painful and showed a loss of continuity at the base of insertion of the patellar tendon on the right patella. Standard radiography of both knees showed soft tissue swelling and bilateral patella alta without any evidence of fracture (Figure 2). Caton Deschamps index was 2,07 in the right knee and 1,93 in the left one.

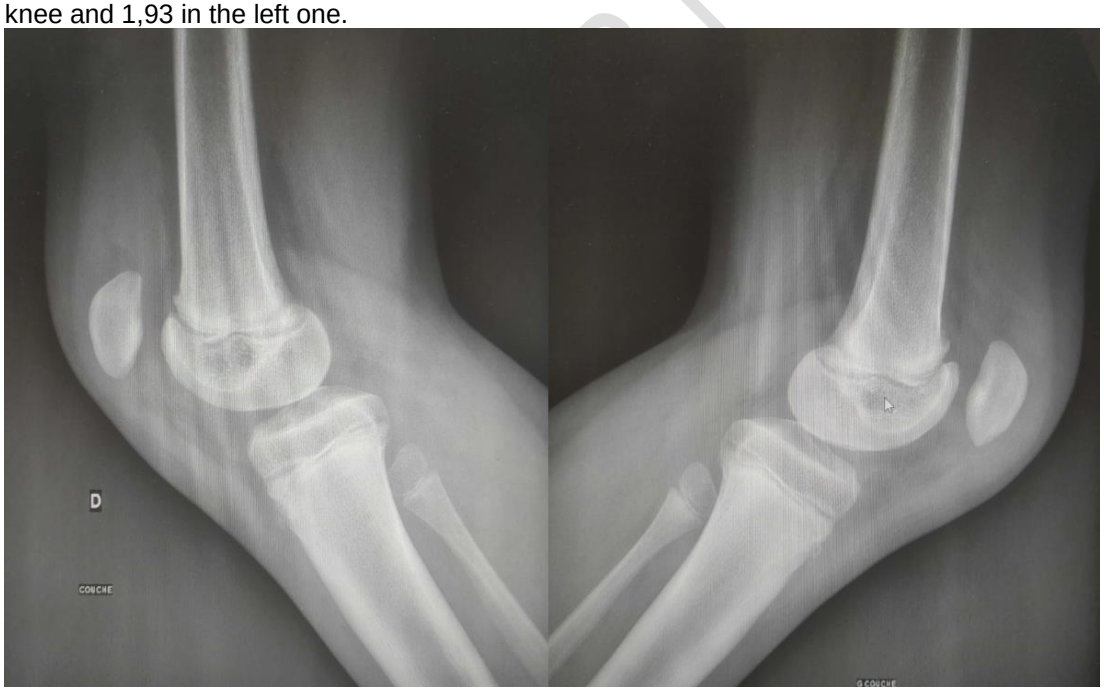

Figure 2: Standard x-ray of both knees in profile showing patella alta

An ultrasound of both knees was urgently requested and was not conclusive. It showed bilateral joint effusion especially in the right side.
MRI of both knees showed patella sleeve avulsion in the lower pole and extensive hemarthrosis. The gap was 6 mm in the right knee and 2 mm in the left one (Figure 3).

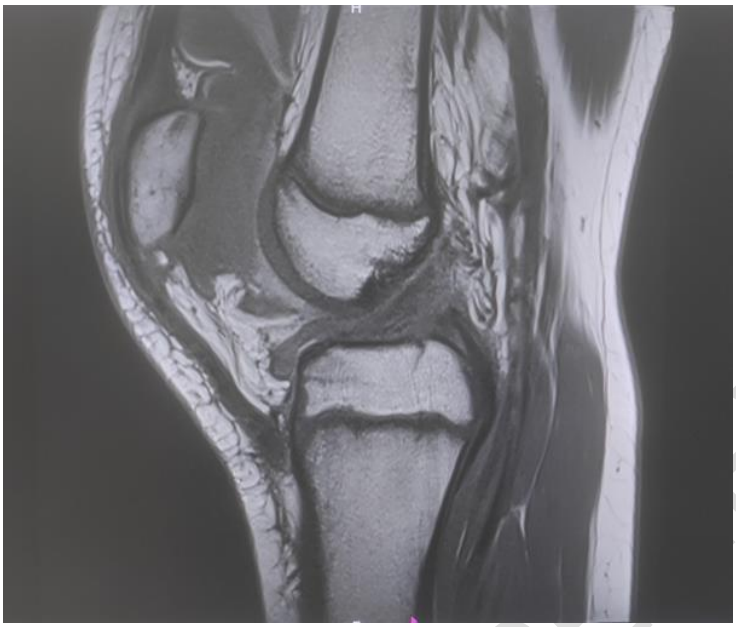

Figure 3: MRI of right knee showing patella sleeve avulsion

The child underwent surgery on both knees ten days after the trauma. The patient was positioned supine during the procedure. An anterior approach was used for both knees. On the right side, there was a lower polar separation of the patella. Reinsertion was performed using osteosuture and tension band technique with mersuture and two parallel K-wires. On the left side, an incomplete and less significant lower polar separation was found, which was treated with osteosuture only (Figure 4).

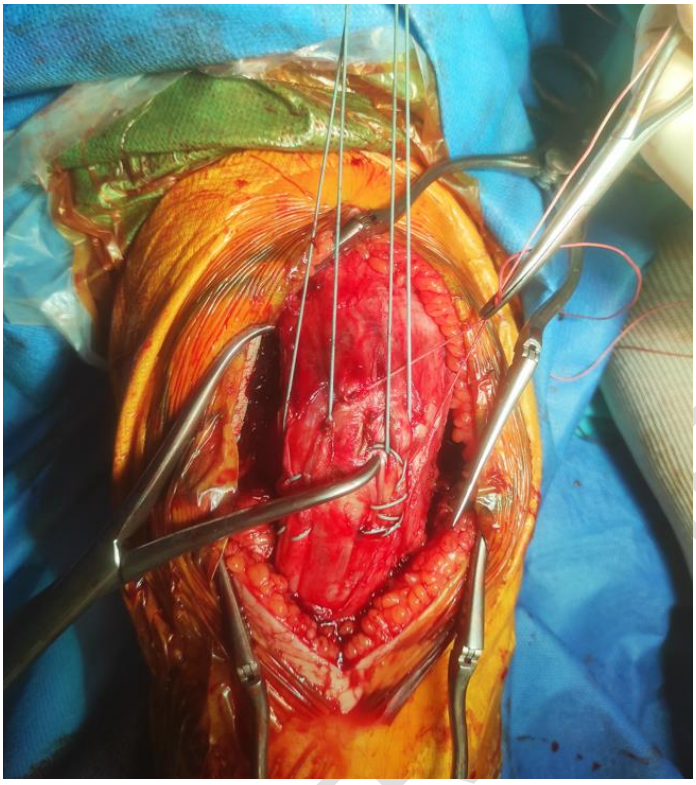

Figure 4. Intraoperative photo showing reinsertion by osteosuture of patella sleeve avulsion

Both knees were immobilized by two splints in extension for four weeks. Weight bearing was allowed in the immediate post-operative period. Rehabilitation began 2 weeks postoperatively.
After three months, the child had no pain, but he presented arthrogenic muscle inhibition with active knee extension deficit in the right knee. 18 months following the surgical intervention, the child presented a complete recovery without pain. However, standard radiography showed nonunion in the inferior pole of the right patella.

3. DISCUSSION

The incidence of patellar fractures in children is low (1 to 6.5%). Only 5% occur at one of the two poles in the form of an avulsion fracture [2, 3]. Bilateral sleeve fractures of the patella are extremely rare.

Patella sleeve avulsion is specific to children under 16 years old. It occurs mainly in boys. The sex ratio is approximately 3:1 [4].

This anomaly occurs acutely and is often the result of an indirect mechanism (brutal eccentric contraction of the quadriceps muscle) following a jump, for example [1]. This mechanism was responsible for bilateral avulsion rupture in our case (Table 1).

Table 1. showing cases of bilateral sleeve patella avulsion in literature compared to our case

Cases reports	Gender + age	Mechanism	Treatment
Usami S et al. 2023 [5]	Male 11 year-old	Feeling crack when he performed a take-off jump while playing tag	ORIF : suture anchors
Tangjiang Li and al. 2022 [6]	Female 10 year-old	Falling on her knees while running	Kirshner wires + cerclage with stainless-steel wire
Jia-Yi Shao and al. 2020 [7]	Male 13 year-old	Feeling weakness in both knees + falling in the ground while running	Three transosseous tunnels + orthocord suture
Shazaan F Hushmendy and al. 2017 [8]	Female 9 year-old	Falling with hyperflexed knees while running	Fiber wire suture
Stephen Paul Guy and al. 2011 [9]	Male 11 year-old	Jumping vertically straight up and down while playing on the trampoline	Three transosseous tunnels + cerclage wire
Our case. 2024	Male 11 years old	Feeling a crunch while running	Osteosuture + pins

The main clinical presentation is pain and active extension deficit of the knee. Palpation may show an ascension of the patella or a depression in its lower limb.

In our case, the child couldn't do active extension of his leg and presented a loss of continuity in the inferior pole of his right patella.

Standard knee radiography can show knee effusion, patella alta and sometimes bone tearing which is not detected in our case.

Ultrasound may be useful in the absence of a radiographically visible fracture fragment. It can show cartilaginous tearing and estimate the degree of separation which was not the case in our situation. Visualization of soft-tissue all around can show edema, fluid, and hyperemia.

MRI is golden standard for positive diagnosis and allows a better description of the chondral lesion. In our case, we were able to visualize clearly the bilateral sleeve avulsion and to calculate the displacement.

It is necessary to know the differential diagnoses such as Sinding-Larsen-Johansson disease characterized by chronic pain at the lower pole of the patella [4], Osgood Schlatter disease characterized by pain at the point of inferior insertion of the patellar tendon [10] and avulsion fracture of the tibial tubercle occurring in adolescents at the end of growth [11].

Failure to diagnose a patellar sleeve fracture is very critical because it can be responsible for ectopic bone formation, knee instability or quadriceps atrophy and weakness leading to reduced extension of the knee [12].

Non-operative treatment is based on cast immobilization in extension and indicated for fractures with displacement of less than 2 mm noted on standard radiographs [13]. Surgical treatment is indicated in cases of fractures with displacement greater than 2 mm, the presence of extensor lag or joint incongruity [14].

The goal of surgical treatment is to restore tension of the extensor system and to have good joint congruence.

However, Surgical management may be associated with complications, such as nonunion, patella alta, ischemic necrosis of the patella and wound infection [15]. In our case we observed at 18 months follow-up a radiological nonunion in the inferior pole of the right patella despite good mobility of the knee.

Different techniques were used like suture anchor and transosseous tunnel repair associated or not with partial patellectomy and tendon advancement [16].

Literature has shown that suture anchor construct has greater resistance to gap formation, greater peak force to failure, reduced incision size and reduced operative time compared to transosseous techniques [17, 18].

Some studies used absorbable intraosseous suture anchors with cerclage [19]. Cerclage technique reinforce suture, adds additional strength to resist displacement forces and allows early mobility [19]. In our case, we did a tension band in the right patella with K wires and mersuture to strengthen our osteosutures.

Through a controlled laboratory study realized on 2021, anchors fixation showed similar strength profiles and less tendon gapping with cyclic loading compared to transosseous sutures in the treatment of comminuted fracture of the distal pole of the patellar by partial patellectomy and patellar tendon advancement [16].

The functional prognosis is generally good or even excellent if the diagnosis was made early and adequate surgical treatment was initiated quickly [16].

We propose this algorithm to clarify the initial diagnosis and managment of sleeve patella avulsion fracture in children (Figure 5).

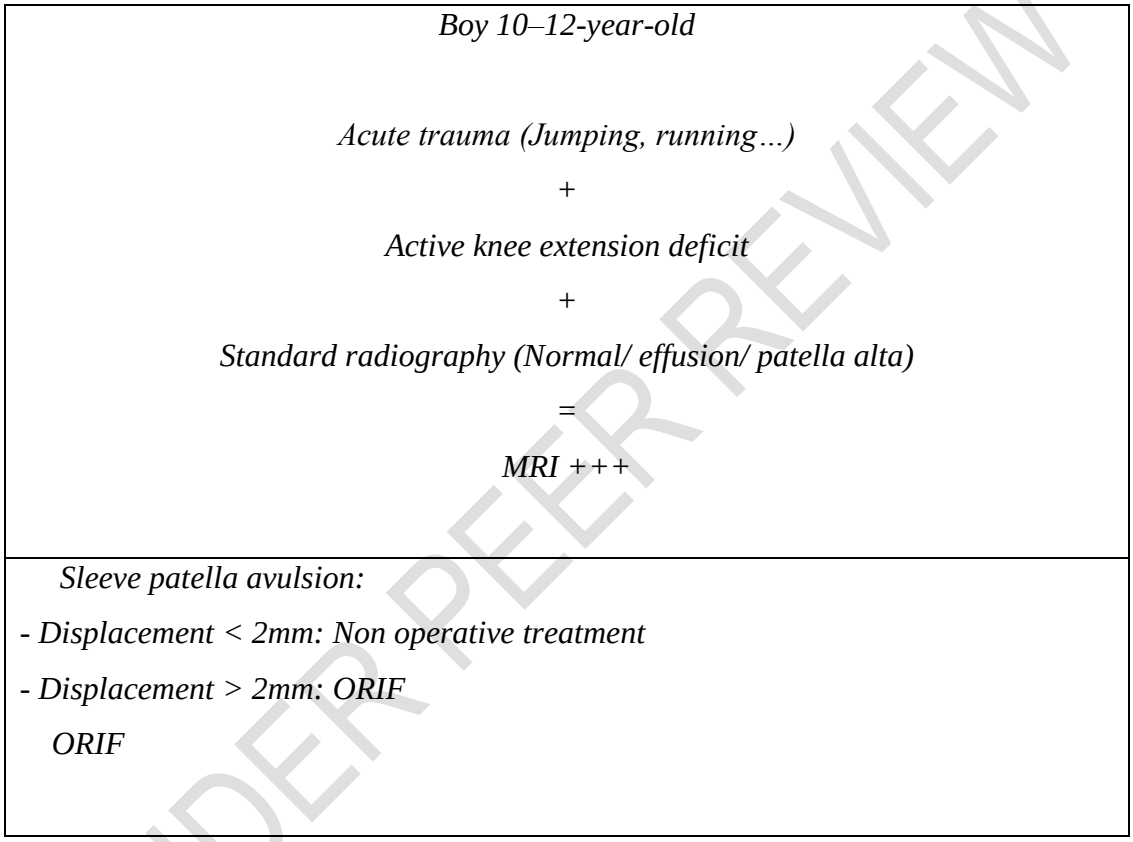

Figure 5. Diagnostic and therapeutic simple algorithm of sleeve patella avulsion

CONCLUSION

Patella sleeve fracture is a diagnosis that requires a high index of suspicion, especially in children who presented acute knee pain preceded by an eccentric contracture of the quadriceps muscle. It is important to make this diagnosis promptly and act accordingly, because a delay or misdiagnosis will result in severe permanent

disability to the affected child. Open reduction internal fixation (ORIF) is generally recommended because it yields good functional results.

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