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Case Report

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Bilateral central bipartite patella in an eight-year-old male: a novel variant challenging existing classification

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ABSTRACT

Bipartite patella is a rare developmental anomaly, often incidentally detected, with an incidence of 1-6% and bilaterality in approximately 50% of cases. The Saupe classification describes three fragment locations inferior, lateral and superolateral but central variants remain unreported. An 8-year-old male presented with right knee pain and swelling following trauma. Radiographs revealed a central bipartite patella. Imaging of the contralateral knee demonstrated a similar bilateral central pattern. There was no prior history of trauma, infection or functional limitation. Symptoms resolved within three days with conservative management and the patient regained full function. This case describes a previously unreported bilateral central bipartite patella, suggesting the need to expand current classification systems to include such variants and avoid misdiagnosis.

Keywords: Bipartite patella, Central patella, Saupe classification, Pediatric knee, Anatomical variant

INTRODUCTION

Bipartite patella is a developmental anomaly resulting from failure of fusion of secondary ossification centers during patellar development. Ossification of the patella typically begins between 3 and 5 years of age, and incomplete fusion may result in accessory fragments connected by fibrocartilage.[1] The reported incidence ranges between 1% and 6%, with approximately 50% of cases demonstrating bilateral involvement.[2]

Most cases remain asymptomatic and are incidentally detected on radiographic imaging, although symptoms may arise following trauma or repetitive microtrauma.[3] The most widely accepted classification system is the Saupe classification, which categorizes bipartite patella based on fragment location into three types: inferior pole (Type I), lateral margin (Type II), and superolateral pole (Type III), with the superolateral type being the most common.4 However, Saupe classification is limited by its inability to include atypical or rare fragment locations such as medial or central variants. To address these limitations, Oohashi et al proposed a modified classification incorporating both location and number of fragments, including bipartite and tripartite configurations.[1] Despite these advancements, central bipartite patella has not been described in existing literature or included in current classification systems. We present a rare case of bilateral central bipartite patella in a pediatric patient, highlighting its clinical significance and implications for classification systems.

CASE REPORT

An 8-year-old male presented with complaints of pain and swelling in the right knee following minor trauma. There was no prior history of significant injury, infection, intravenous medication uses or hospital admission. The patient had no pre-existing symptoms and was able to perform routine daily activities without limitation. On

clinical examination, mild swelling and localized tenderness over the patella were noted. Range of motion was mildly restricted due to pain, with no evidence of ligamentous instability. Radiographic evaluation of the right knee revealed a well-defined central lucent line dividing the patella into two distinct fragments. To exclude traumatic etiology, radiographs of the contralateral knee were obtained, which demonstrated an identical central bipartite configuration.

Figure 1: Clinical photograph demonstrating full extension of the right knee joint and full flexion of left knee joint.

Figure 2: Clinical photograph demonstrating full extension of the left knee joint and full flexion of right knee joint.

The bilateral symmetry, absence of prior symptoms and well-corticated margins confirmed a diagnosis of bilateral central bipartite patella, a rare anatomical variant.

The patient was managed conservatively with rest, analgesics, and activity modification. Symptoms resolved completely within three days, and the patient regained full, pain-free range of motion. At follow-up, the patient remained asymptomatic with normal functional status.

Figure 3: Anteroposterior radiograph of bilateral knees showing unfused physis of bilateral distal femur and proximal tibia.

Figure 4: Lateral view of bilateral knee showing bilateral central bipartite patella.

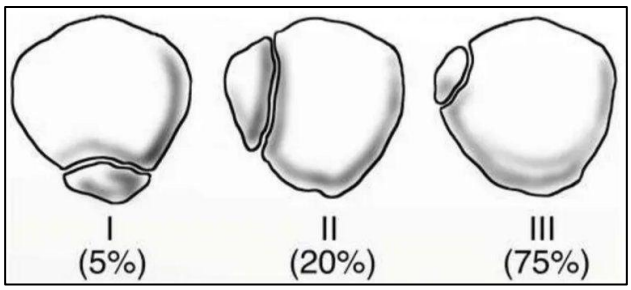

Figure 5: Diagrammatic representation of Saupe classification of bipartite patella showing: type I (inferior pole), type II (lateral margin) and type III (superolateral pole), with type III being the most common.

Figure 6: Illustration of modified Oohashi classification of bipartite and tripartite patella showing types superolateral bipartite, lateral bipartite, superolateral+lateral tripartite, superolateral tripartite patella.

DISCUSSION

Bipartite patella is a well-recognized developmental anomaly resulting from failure of fusion of secondary ossification centers during skeletal maturation. The patella typically ossifies between 3 and 5 years of age, and accessory ossification centers may persist due to incomplete fusion, resulting in bipartite or multipartite patella.[1]

The reported prevalence ranges from 0.2% to 6%, with bilateral involvement seen in approximately 43-50% of cases.[2] Despite its relatively common radiological presence, only a small proportion of patients (approximately 2%) become symptomatic, usually following trauma or repetitive microtrauma that disrupts the fibrocartilaginous synchondrosis.[3-5] The Saupe classification, introduced in 1921, remains the most widely used system for categorizing bipartite patella based on fragment location. It describes three types: type I (inferior pole), type II (lateral margin), and type III (superolateral pole), with type III being the most common, accounting for nearly 75% of cases.[4] However, several limitations of this classification have been highlighted in literature.

Firstly, the existence of Type I bipartite patella has been questioned, as inferior pole fragmentation may represent other pathological entities such as Sinding–Larsen–Johansson syndrome or stress fractures rather than a true developmental variant.[1] Secondly, Saupe classification does not account for atypical fragment locations such as medial or central variants, nor does it include multipartite configurations.

To address these shortcomings, Oohashi et al proposed a modified classification system incorporating both the number and location of fragments, categorizing bipartite and tripartite patellae more comprehensively. Their large series demonstrated that the majority of cases remain superolateral, while lateral and tripartite variants are significantly less common.[1] However, even this refined classification fails to incorporate central variants, highlighting a persistent gap in classification systems.

Rare atypical presentations have been described in literature, including medial bipartite patella and tripartite configurations, emphasizing that accessory ossification centers can occur outside classical Saupe locations.[4] These reports support the concept that bipartite patella represents a spectrum of developmental variations rather than a fixed anatomical pattern.

The present case is unique as it demonstrates a bilateral central bipartite patella, which, to the best of current knowledge, has not been previously reported. The central location of the accessory fragment challenges the conventional understanding of patellar ossification patterns, suggesting that accessory centers may arise in atypical positions not accounted for in current classifications.

The bilateral symmetry observed in this case strongly supports a developmental origin rather than traumatic etiology. This distinction is clinically important, as bipartite patella can often be misdiagnosed as patellar fracture, particularly in pediatric patients presenting with acute symptoms following trauma.[6] Radiographic features such as smooth, well-corticated margins and symmetric bilateral involvement help differentiate bipartite patella from acute fractures.[3] From a clinical standpoint, most cases of bipartite patella are asymptomatic and require no intervention.[7] When symptoms occur, they are typically managed conservatively with rest, activity modification, and nonsteroidal anti-inflammatory drugs.[8] Surgical intervention, including fragment excision or lateral release, is reserved for persistent symptomatic cases refractory to conservative treatment.[9]

In pediatric populations, management requires additional caution due to the presence of open physes and ongoing skeletal development. Conservative management remains the mainstay, with excellent outcomes reported in the majority of cases.[10] The rapid resolution of symptoms in our patient further supports the benign nature of this variant and reinforces the role of conservative treatment.

Additionally, imaging modalities such as bone scintigraphy and MRI have been studied for differentiating

symptomatic from asymptomatic bipartite patella. However, bone scintigraphy has limited specificity, as increased uptake may be seen in both symptomatic and asymptomatic cases.[11] Therefore, clinical correlation remains essential in decision-making. This case underscores the need to expand current classification systems to include central variants of bipartite patella. Recognition of such atypical presentations is essential not only for accurate diagnosis but also to avoid unnecessary interventions, particularly in pediatric patients.

CONCLUSION

Bilateral central bipartite patella represents a previously undescribed anatomical variant with a benign clinical course. Recognition of this entity is essential to avoid misdiagnosis as traumatic or pathological lesions. Current classification systems should be expanded to include central variants to improve diagnostic accuracy.

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