Traumatic separation of osseous segments in a double-layered patella

Andreas Jørgensen a, Erik Brandt b, Anton Ulstrup a,∗

a Department of Orthopaedic Surgery, Holbæk Hospital, Smedelundsgade 60, 4300 Holbæk, Denmark
b Department of Radiology, Holbæk Hospital, Smedelundsgade 60, 4300 Holbæk, Denmark

A R T I C L E   I N F O
Article history:
Received 9 September 2017
Received in revised form 31 October 2017
Accepted 1 November 2017
Available online 10 November 2017

A B S T R A C T

INTRODUCTION: Double-layered patella is a rare intra-articular disorder associated with multiple epiphyseal dysplasia.
PRESENTATION OF CASE: We present a case of a 40-year-old man with acute pain in his left knee after a tackle during soccer play.
DISCUSSION: Clinical examination and radiographs confirmed the diagnosis of a bilateral double-layered patella with traumatic separation of the osseous segments on the affected left side. Surgical management comprised open arthrotomy and debridement of the bony interface. Stabilization was performed with tension cerclage, supported by a lag screw with excellent outcome at 12 months follow-up.
CONCLUSION: It is possible that micromovement in a double-layered patella can dispose to a traumatic coronal segment displacement. Osseous fusion of traumatic patellar segments can be achieved.

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1. Introduction

Double-layered patella is a rare intra-articular disorder, first described by Buttner in 1925 [1]. It is now considered pathognomonic for multiple epiphyseal dysplasia which is a fairly common genetically and clinically heterogeneous skeletal dysplasia disorder that affects more than 1 in 20000 individuals [2,8,9].

Symptoms vary from no pain to daily pain. The anterior segment of the patella is embedded in the patellar tendon while the posterior layer is intra-articular. This can dispose to movement between the bone segments in a double-layered patella which may be painful. Also, maltracking of the patella can be found with a double-layered patella [5,6]. Previous reports have described successful stabilization surgery with lag screws in young people with non-traumatic double-layered patella pain due to nonunion and instability [3,4,7]. This work has been reported in line with the SCARE criteria [11].

2. Presentation of case

A 40-year-old physically active man with no prior history of knee trauma or medical illnesses and with a normal stature sustained a tackle to his left knee during soccer, and complained of severe pain, swelling and motion impairment. He was admitted to the Emergency Department where the left knee was swollen and kept flexed with severe pain aggravated by palpation and on attempts to actively and passively move the joint. A groove at the central part of the patella was palpable. He was unable to extend the knee actively. The right knee had a distinct osseous enlargement at the anteroinferior part of the patella. Physical examination of the right knee revealed normal range of motion without instability.

Radiographs of the left knee showed a double-layered patella (Fig. 1). The anterior and posterior patellar segments were fused proximally. A horizontal fracture of the thinner anterior segment was seen. Radiographs of the opposite knee were obtained to confirm the diagnosis of double-layered patella (Fig. 2).

Open reduction and internal fixation through an anterior longitudinal incision was performed under general anesthesia. The joint was exposed with a medial parapatellar arthroscopy and a hemarthron was evacuated. Inspection revealed a coronal rupture between the two osseous segments. The surface of the junction was covered with fractured fibrocartilaginous tissue. Both the medial and lateral retinaculae were torn. The fracture site was debrided and decortication of the bony interface was performed. After reduction of the fracture, K-wires were inserted with tension cerclage wiring. Due to maltracking and tilting of the posterosuperior patella segment, further stability was applied by inserting a small fragment lag screw. Both techniques allowed for compression of the fragment (Fig. 3). Both retinaculæ were repaired.

The patient was mobilized in a fixed knee brace with full weight-bearing. After four weeks, active motion from 0–30° was allowed. The range of motion was further increased every other week until full flexion. The brace was removed after a total of 10 weeks, after which the patient had active physical therapy achieving a range of motion from full extension to soft tissue resistance in flexion. K-wire and cerclage removal was performed 10 months

* Corresponding author at: Department of Orthopaedic Surgery, Holbæk Hospital, Smedelundsgade 60, 4300 Holbæk, Denmark.
E-mail address: akustrup@gmail.com (A. Ulstrup).

https://doi.org/10.1016/j.jusc.2017.11.006
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after surgery due to pain over the proximal insertion of the K-wires. Intraoperatively, the lag screw was left to ensure sufficient stability. Radiographs after 12 months showed osseous fusion of the double-layered patella segments (Fig. 4) and the patient had regained pain free full range of movement of his left knee. Three years later, the patient was evaluated for anterior knee pain. X-rays showed a healed fracture with mild femoropatellar arthrosis. There was full range of motion and a conservative approach was decided upon.

3. Discussion

When patients with a double-layered patella suffer from non-traumatic patellar pain, we find it likely that this is because there is a chronic nonunion involving the whole width of the two patella segments. Thus, the patella tendon itself would not be sufficient to stabilize a nonunion during movement of the knee under various strains. This could lead to pain from patellar bony instability. With an incomplete, and therefore stable nonunion, the patella tendon could be a strong stabilizer with less or no pain. A systematic review of the literature resulted in five cases describing surgery of a double-layered patella [3–5,7,10]. Surgery in those cases was performed in younger patients due to non-traumatic pain caused by maltracking and subluxation between the two patella segments. The methods used were open arthroscopy and fusion of the patella segments with lag screws or excision of the posterior part. The operative methods resulted in excellent healing results with pain free motion.

Radiographically, a fracture displacement should be obvious but a CT scan or an MRI scan may provide further details in mapping the fracture pattern for operative planning and for diagnosing associated injuries. An MRI scan of the knee can evaluate the status of the patellofemoral cartilage in relation to the alignment of the tibial tubercle to the trochlear groove. This can be relevant in interpreting from what source any preoperative double-layered patellar pain emits, that is from osseous malalignment of a complete desegmentation and/or instability due to functionally deficient soft-tissue tendon attachments to the patella [6].

There is no previous study reporting a displaced fracture of the segments in a double-layered patella. This surprised the authors, since a double-layered patella is a well known and not extremely rare entity. Stabilization with transosseous K-wires, cerclage and at least one lag screw seems to be a safe surgical method. The retinaculae should be repaired as well.

4. Conclusion

The patient was not genetically investigated for epiphyseal dysplasia so the bilateral radiographical and peroperative findings alone pointed to that reasonable possibility. Our patient achieved a satisfactory result within a year with development of some femoropatellar arthrosis four years after the fracture. He sustained
his injury after low-energy trauma. It is possible that micromovement in a double-layered patella can dispose to a traumatic coronal segment displacement. A treatment guideline pertaining to operative technique is difficult to establish due to the rarity of the fracture. Total osseous fusion of the two patellar segments was achieved.

**Author contribution**

Andreas Jørgensen (AJ), M.D., Erik Brandt (EB), M.D., Anton Ulstrup (AU), M.D., FEBOT, wrote the article. AU, AJ and EB interpreted all relevant data, acquired all data and have each substantially contributed to the study’s conception and design. All three authors can approve the submitted version and can take public responsibility for the contents of this manuscript.

**Funding source**

No outside funding or grants were received in preparing this study. This research did not receive any specific grant from funding agencies in the public, commercial or not-for-profit sectors.

**Ethical approval**

Permission to use patient information has been granted by Dr. Ole Maagaard Christensen, M.D., Head of the Department of Orthopaedic Surgery at Holbæk Hospital.

**Conflicts of interest**

The submitted manuscript is a case report and original work. It has not been published before and it is not being considered for publication elsewhere in its final form either printed or electronically and it has not been previously published. The idea, planning and layout of this text material solely rest with the authors who have all read and approved the contents, Dr. Jørgensen being the first author. All the authors have contributed to the acquisition of relevant literature, the study design and concept, the collection of data and drafting of the text material. Each author believes that the manuscript represents honest work.

The content will not be referred in news media or the like prior to publication and there are no economic, ethical or other conflicts of interest involved in the writing of this article including the authors, their immediate families, and any research foundation with which they are affiliated, including receiving royalties, stock or stock options, consultant agreements, or ownership from or with any commercial entity related to the subject of this work.

**Consent**

The described patient gave his informed consent to the writing of this case report in an anonymized form.

**Registration of research studies**

In Denmark, case reports involving one patient with no further treatment of investigations related to the article do not have to be registered in a database.

**Guarantor**

Dr. Anton Ulstrup, Department of Orthopaedic Surgery, Holbæk Hospital, Smedelundsgade 60, 4300 Holbæk, Denmark.

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**Fig. 3.** Postoperative X-ray of the left knee showing the reduced and internally fixed fracture.

**Fig. 4.** X-ray of the left knee after 12 months showing osseous fusion of double-layered patella segments.
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