

# Patellar Avulsion Fracture

Rohan Potla <sup>1</sup>, Tovah Williamson <sup>2</sup>, Sidhartha R. Ramlatchan <sup>3</sup>, Rohan K. Mangal <sup>4</sup>, Latha Ganti <sup>5, 6</sup>

Review began 09/19/2023

Review ended 10/01/2023

Published 10/08/2023

© Copyright 2023

Potla et al. This is an open access article distributed under the terms of the Creative Commons Attribution License CC-BY 4.0., which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

1. Biomedical Sciences, University of Central Florida, Orlando, USA 2. Medicine, University of Central Florida College of Medicine, Orlando, USA 3. Chemistry, Drexel University, Philadelphia, USA 4. Medicine, University of Miami Miller School of Medicine, Miami, USA 5. Medical Sciences, The Warren Alpert Medical School of Brown University, Providence, USA 6. Emergency Medicine & Neurology, University of Central Florida College of Medicine, Orlando, USA

**Corresponding author:** Latha Ganti, latha\_ganti@brown.edu

---

## Abstract

We report on the case of a 52-year-old male who sustained a transverse patellar fracture after tripping on uneven pavement. These fractures can be easy to miss on anteroposterior views, highlighting the importance of multiple radiographic views of the knee. Examination of the knee is also important, as initial clinical appearance can be benign. These fractures are most often seen in adolescents, which makes the current case somewhat unusual.

---

**Categories:** Emergency Medicine, Orthopedics, Sports Medicine

**Keywords:** kirschner wire, open reduction and internal fixation (orif), patella fracture, avulsion fracture, patella

## Introduction

The patella is a critical bone in the articulation between the quadriceps and patellar tendons and serves as the lever for the extensor mechanism of the knee [1]. Overall, patellar fractures are rare, comprising only 1% of all skeletal fractures [2]. Patellar avulsion fractures are injuries in which a fragment of the patella detaches from the main bone due to the excessive pull of the quadriceps tendon or patellar ligament. They are relatively rare compared to other types of patellar fractures. They often occur in adolescents and young adults, with a higher prevalence in males [3]. The reason for the predilection for younger age is that bones are still developing in adolescents, and also because they are more involved in contact sports that lend themselves to forceful contractions of the quadriceps such as in jumping or kicking.

On radiographs, lateral views are useful to assess the displacement of the patellar fragments [4]. The management of patellar avulsion fractures depends on the size of the fracture fragment, the degree of displacement, and the patient's age [5,6]. Conservative management is generally reserved for small, non-displaced fractures, and consists of immobilization, protected weight-bearing, and physical therapy. Larger, displaced fractures or fractures in younger patients often require open reduction and internal fixation (ORIF) to reattach the fragment using screws, wires, or sutures, which are thought to reduce surgical time [7]. Physical therapy is crucial in both conservative and surgical management to regain strength, mobility, and function of the knee. Complications of patellar avulsion fractures are those common to many orthopedic fractures, including nonunion or malunion, knee stiffness [8], hardware that is painful [9], migration of wires [10], patellar instability, and chondral damage. In some cases, patellar instability can lead to recurrent patellar dislocation or subluxation, and damage to the cartilage can lead to osteoarthritis over time.

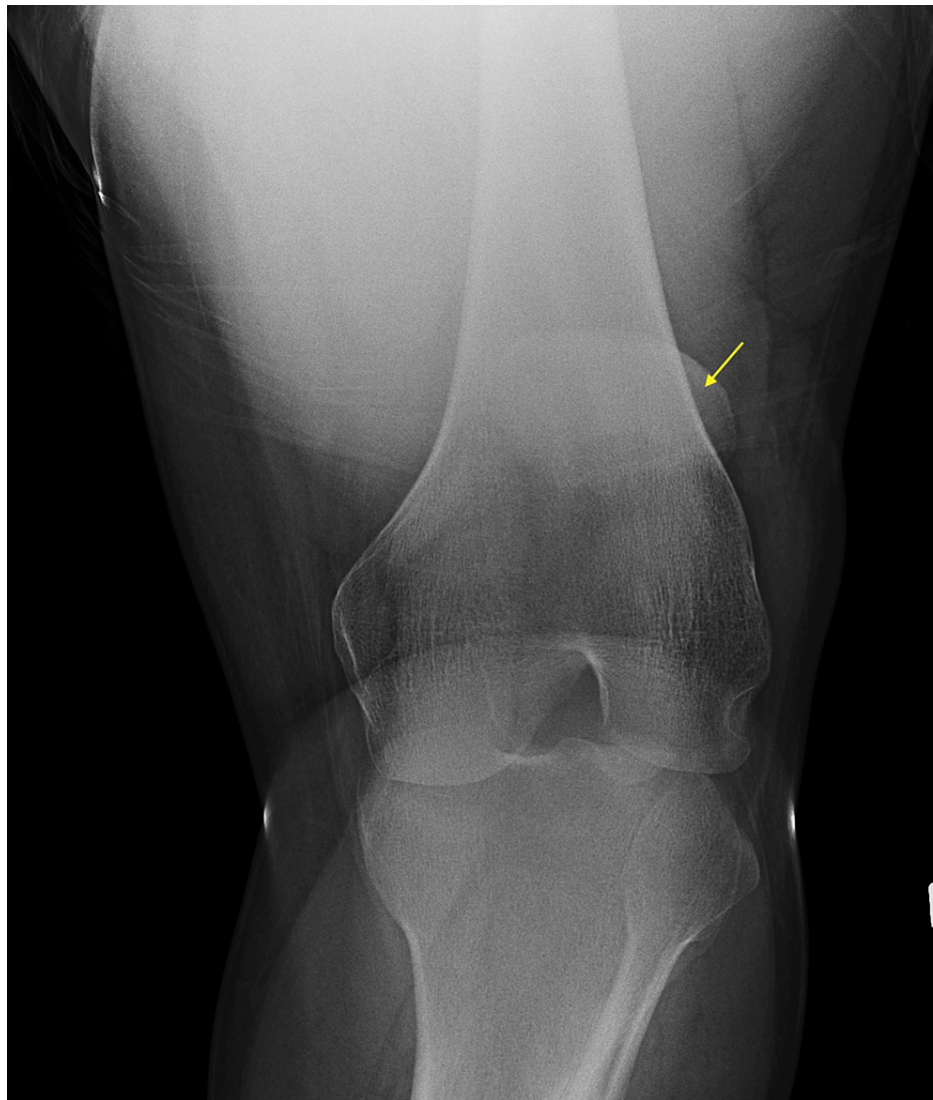
## Case Presentation

A 52-year-old male presented to the Emergency Department due to knee pain. He had tripped on uneven concrete, landing on his left knee. His vital signs were a temperature of 98.7°F, pulse of 92 beats per minute, blood pressure of 161/92 mmHg, respiration of 18 breaths per minute, and oxygen saturation of 97% on room air. The patient did not have any other complaints. He did not injure any other part of his body. Physical examination of the knee revealed impaired ability to fully extend the knee or perform a straight leg raise. While there was no open wound, ecchymosis over the anterior knee at the site of impact was present. The patient did not have a sensory deficit. Palpation of the knee revealed a divot that corresponded to the gap between the fracture fragments. Radiographs of the knee revealed a transverse patellar avulsion fracture on lateral view with over 56 mm between the fracture fragments (Figure 1).



**FIGURE 1: Radiograph of the lateral view of the left knee demonstrating patellar fracture with 56 mm of distraction of fracture fragments**

Notably, the fracture was barely noticeable on the anteroposterior view (Figure 2).



**FIGURE 2: Radiograph depicting an anteroposterior view of the patella (arrow)**

The patient was given intravenous ketorolac for analgesia. Orthopedics was consulted. The fracture was repaired using a tension band in a "figure-of-eight" configuration. The patient followed up with physical therapy as an outpatient and was doing well at a two-week follow-up.

## Discussion

Avulsion fractures of the patella in adults more commonly originate at the patellar tendon, though the most common origin overall is at the inferior pole of the patella, as seen in the pediatric population [11]. The patient in question, a white male in his early 50s, was reported to work in construction and fell on uneven pavement. There are multiple classification types for patellar fracture, which include but are not limited to descriptive classifications based on fracture pattern. The Ortiguera and Berry classification evaluates stability and suggests operative management depending on the type and the AO/OTA (Arbeitsgemeinschaft für Osteosynthesfragen) classification is based on the articular involvement [4].

This case can be classified as a 34-A (extra-articular) avulsion fracture, minimally a type IIIa Ortiguera and Berry classification (loose patellar component with reasonable bone stock), which typically requires surgical management [4]. Patellar avulsion fractures normally occur in pediatric populations due to an increased ratio of the strength of tendon and muscle to osseocartilaginous structures; however, the mechanism of injury and patient circumstances potentially explain the uncommon patient demographics in this case.

During the primary evaluation, a good history of injury mechanism, as well as a physical exam of the knee stability and assessment of extension/flexion are important steps. Imaging of patellar fractures is typically plain radiographs primarily. Lateral knee radiographs are more useful than anteroposterior view radiographs

in evaluating the pathology of the knee due to the difficulty of discerning structures that are superimposed [12]. A 2022 study showed similar outcomes and a high number needed to treat (NNT) with the addition of oblique views, and avoiding such views was discussed to reduce radiation load and hospital costs [13]. Additional CT imaging is useful in optimizing management, especially prior to surgical interventions [2]. MRI can be useful in understanding articular and tendinous involvement in patellar fractures [5].

For displaced fractures greater than 2-3 mm of step-off and greater than 1-4 mm fracture gap, surgical management is required to restore extensor function. ORIF was indicated in this patient due to loss of extensor function [5]. Patellar fractures of this nature can be managed with a variety of surgical techniques and material components, the most common being the modified anterior tension band technique which uses an 18-gauge stainless-steel wire in a figure-of-eight configuration around two K-wires (Kirschner wires). Additional cerclage around the patella is recommended for comminuted fractures [14]. Other materials can be used, such as ultra-high-molecular-weight polyethylene (FiberWire), which has been shown to have better outcomes in certain types of fractures [15,16]. A recent randomized controlled trial discussed the use of headless screws in cadaver knees and showed comparable outcomes to cannulated screws for fixation strength and subfailure fragment displacement. Headless screws can improve long-term outcomes in patients as the screw head can lead to adjacent structure erosion; however, additional studies are needed to confirm efficacy.

## Conclusions

Patellar avulsion fractures in the adult population are uncommon, but knowledge of proper evaluation and management is nevertheless valuable. This 52-year-old male presented with a closed transverse patellar avulsion fracture with no articular involvement, seen best on lateral plain radiograph. He required ORIF, which was done with the traditional AO method with a stainless-steel wire and two K-wires. Other patellar fracture types can be managed conservatively, and awareness of classifications, methodology, and differences in treatment are paramount.

## Additional Information

### Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

**Concept and design:** Latha Ganti, Tovah Williamson, Rohan Potla, Sidhartha R. Ramlatchan, Rohan K. Mangal

**Acquisition, analysis, or interpretation of data:** Latha Ganti, Rohan Potla, Sidhartha R. Ramlatchan, Rohan K. Mangal

**Drafting of the manuscript:** Latha Ganti, Tovah Williamson, Rohan Potla, Sidhartha R. Ramlatchan, Rohan K. Mangal

**Critical review of the manuscript for important intellectual content:** Latha Ganti, Tovah Williamson, Rohan Potla, Sidhartha R. Ramlatchan, Rohan K. Mangal

**Supervision:** Latha Ganti

### Disclosures

**Human subjects:** Consent was obtained or waived by all participants in this study. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

## References

1. Scolaro J, Bernstein J, Ahn J: Patellar fractures. Clin Orthop Relat Res. 2011, 469:1213-5. [10.1007/s11999-010-1537-8](https://doi.org/10.1007/s11999-010-1537-8)
2. Luo TD, Marino DV, Pilson H: Patella fractures. StatPearls [Internet]. StatPearls Publishing, Treasure Island, FL; 2023.
3. Bradko V, Stoll WT, Haruno LS, Rosenfeld SB, McKay SD: Two cases of combined patellar tendon avulsion from the tibia and patella. SICOT J. 2018, 4:17. [10.1051/sicotj/2018014](https://doi.org/10.1051/sicotj/2018014)
4. Kong AP, Robbins RM, Stensby JD, Wissman RD: The lateral knee radiograph: A detailed review. J Knee Surg. 2022, 35:482-90. [10.1055/s-0041-1741391](https://doi.org/10.1055/s-0041-1741391)
5. Melvin JS, Mehta S: Patellar fractures in adults. J Am Acad Orthop Surg. 2011, 19:198-207.

- [10.5435/00124635-201104000-00004](#)
6. Boström A: Fracture of the patella. A study of 422 patellar fractures . *Acta Orthop Scand Suppl.* 1972, 143:1-80. [10.3109/ort.1972.43.suppl-143.01](#)
  7. Huang S, Zou C, Kenmegne GR, Yin Y, Lin Y, Fang Y: Management of comminuted patellar fractures using suture reduction technique combined with the modified Kirschner-wire tension band. *BMC Surg.* 2023, 23:251. [10.1186/s12893-023-02153-w](#)
  8. Smith ST, Cramer KE, Karges DE, Watson JT, Moed BR: Early complications in the operative treatment of patella fractures. *J Orthop Trauma.* 1997, 11:183-7. [10.1097/00005131-199704000-00008](#)
  9. Cottino U, Abdel MP, Hanssen AD: Chronic extensor mechanism insufficiency in total knee arthroplasty (TKA). *Curr Rev Musculoskelet Med.* 2015, 8:368-72. [10.1007/s12178-015-9292-9](#)
  10. Choi HR, Min KD, Choi SW, Lee BI: Migration to the popliteal fossa of broken wires from a fixed patellar fracture. *Knee.* 2008, 15:491-3. [10.1016/j.knee.2008.06.005](#)
  11. Merrow AC, Reiter MP, Zbojniec AM, Laor T: Avulsion fractures of the pediatric knee. *Pediatr Radiol.* 2014, 44:1436-45; quiz 1433-6. [10.1007/s00247-014-3126-6](#)
  12. Bradley AT, Adler JA, Curtis DM, Nwando D, Gayed MJ, Wallace SJ, Athiviraham A: Are oblique views necessary? A review of the clinical value of oblique knee radiographs in the acute setting. *West J Emerg Med.* 2022, 23:939-46. [10.5811/westjem.2022.8.56453](#)
  13. Lazaro LE, Wellman DS, Pardee NC, et al.: Effect of computerized tomography on classification and treatment plan for patellar fractures. *J Orthop Trauma.* 2013, 27:336-44. [10.1097/BOT.0b013e318270dfe7](#)
  14. Xie X, Zhu Y, Wang Y, Zhan Y, Eladio SS, Luo C: Multi-planar fixation of displaced, multi-fragmentary patella fractures in elderly patients with anterior locking plates and cerclage wires: Preliminary results. *Eur J Orthop Surg Traumatol.* 2023, 33:2253-60. [10.1007/s00590-022-03415-8](#)
  15. Shimasaki K, Uesugi M, Kobayashi T, Tanaka H, Ichimura H: Inferior pole sleeve fracture of the patella in an adolescent: A case report. *Cureus.* 2023, 15:e33494. [10.7759/cureus.33494](#)
  16. Ponnamaneni D, Mangal R, Stead TS, D'Souza D, Ganti L: Patellar fracture repair using FiberWire. *Cureus.* 2023, 15:e44282. [10.7759/cureus.44282](#)