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Fracture of the fabella with radiologic and MRI

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SUMMARY

The fabella is an inconstant sesamoid bone. A handful of cases have been reported so far describing fabella fracture, usually involving high energy mechanism or stress fractures after total knee arthroplasty. This paper presents a fabella fracture in a man in his 40s after suffering a car crash, the clinical and radiographic presentation, treatment and complete recovery at 4-months follow-up.

BACKGROUND

The fabella, 'little bean', is an inconstant sesamoid bone located in the lateral head of the gastrocnemius that may sometimes be confused with loose intraarticular body.¹ The first case of a fabella fracture was published in 1932.² Since then only a handful of cases have been published.²⁻¹¹

CASE PRESENTATION

A healthy man in his 40s was brought to the emergency room after a motor vehicle accident. The man has been projected a few metres from his pick-up truck after it crashed and fell down a ravine. He recalls having his legs stuck beneath the driver's wheel, having both legs submitted to torsional forces before being projected. His main reports were bilateral knee pain. His right knee was painful in the posterior compartment, especially with knee extension. On observation, ecchymosis was present in the posterior medial compartment of the right knee (figure 1), without knee instability. The left knee presented instability, especially under varus stress. Neurological status was intact, distal pulses were present and a capillary refill time of <2 s.



Figure 1 Image of the posterior knee ecchymosis at the emergency room.



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Figure 2 Radiographic image of the fabella fracture (each fragment identified by an arrow).

INVESTIGATIONS

In the emergency room, standard knee X-ray was obtained. The presence of bilateral fabella bone was revealed. The right fabella showed an oblique radiolucent fracture line with dislocation of the fragments. The left knee presented medial compartment opening, with intact fabella (figure 2).

Elective MRI was obtained for further study, confirming the diagnosis of right fabella fracture, bone oedema of the tibial plateau and distal femur without additional ligamentous or meniscal injuries and no additional fractures (figure 3). The left knee presented posterolateral corner injury, both cruciate complete rupture and meniscocapsular injury of the posterior horn of the medial meniscus.

DIFFERENTIAL DIAGNOSIS

Other osseous, meniscal or ligamentous injuries may present similar clinical characteristics to fabella fracture, which include lateral meniscal tear, femoral or tibial fracture or injury to posterolateral knee structures. For these reasons, patients should be assessed with careful physical, radiographic examination and in selected cases additional studies as MRI or CT scans. In this case, the MRI confirmed the transverse fabella fracture and showed areas of bone oedema without additional ligamentous or meniscal injuries and no additional fractures in the affected joint.

TREATMENT

The patient was discharged from the emergency for follow-up at the orthopaedic office with an anti-inflammatory medicine prescription, rest, ice, crutches and varus/valgus stabilising orthosis for the left knee. The patient was instructed to mobilise the knee and perform weight bearing as tolerated. No physiotherapy was prescribed.

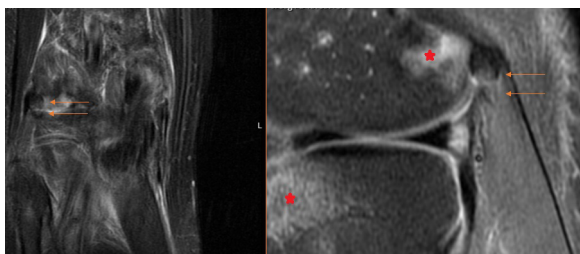


Figure 3 Magnetic resonance image of the fabella fracture (arrows) and tibial and femoral bone contusion (stars).



Figure 4 Radiographic image of the fabella after fracture consolidation (identified by an arrow).

OUTCOME AND FOLLOW-UP

At 4-month follow-up, the patient had no right knee reports, tolerated full weight bearing and full range of motion. Radiographic analysis was repeated at 6-month follow-up showing fracture consolidation (figure 4).

DISCUSSION

A literature review was conducted on PubMed and Embase using the words ‘fabella fracture’ on 19 May 2023, having identified 15 cases, summarised in table 1.²⁻¹³ Most patients are middle aged involved in high energy trauma. Most cases healed uneventfully after 2–4 months of conservative treatment with no sequelae. Only two cases reported surgical treatment, one of which was a closed fracture submitted to of fabella excision¹⁰ and the other an open fracture submitted to surgical debridement and fabella retention.⁴ All studies diagnosed the fabella fracture on plain radiography. Additional studies were conducted in six cases (three CT scans, two MRI scans and one ultrasound scan). Regarding the MRI scans, besides the fabella fracture, Zhou *et al* identified tibial plateau contusions and Barreto *et al* edema-like changes within the bone marrow and within the proximal fibres of the lateral head of gastrocnemius and bone contusions at the femoral condyles, tibial plateau and the fibular head.^{2,5} Our MRI scan revealed homolateral (right knee) bone contusions at the tibial plateau and distal femur and most importantly and unlike the previous studies, a contralateral (left knee) anterior cruciate ligament rupture and posterolateral corner injury, as suspected by the clinical instability. All cases confirmed the transverse fabella fracture as seen on the radiographic images and no other significant lesions. The posterior medial knee ecchymosis and pain was the clinical finding that directed our attention to the posterior knee structures on the radiography. We do not consider the ecchymosis as being caused by the Fabella fracture, rather as a result of high-energy trauma applied on the posterior knee. Perhaps the same energy distributed across the posterior knee resulted in a Fabella fracture laterally, with a contained ecchymosis behind the fascia and a more superficial soft tissue injury on the medial rather than lateral posterior knee. The bone contusions and gastrocnemius oedema are of little consequence to the treatment of the fabella fracture and the fracture line is seen more clearly on plain radiography than on MRI as such, we believe that plain radiography suffices for the diagnosis and treatment of bony fabella fractures although an MRI scan may be useful if there is clinical suspicion for ligamentous,

Table 1 Literature review and summary of the main findings of cases of fabella fracture

Article	Year	Sex	Age	Laterality	Injury mechanism	Clinical presentation	Imaging
Buruian <i>et al</i>	2023	M	40s	Right	Motor vehicle accident	Echymosis and pain at popliteal space, especially during knee extension.	X-ray, MRI
Ashraf ²	2022	M	38	Left	Motor vehicle accident	Posterior lateral condyle tenderness	X-ray
Zhoua <i>et al</i> ³	2017	F	38	Left	Struck by an electromobile	Posterolateral knee pain.	X-ray, MRI
Christian <i>et al</i> —case 1 ⁴	2016	F	68	Right	Following total knee arthroplasty (TKA), on the same day after surgery. 10° preoperative valgus.	TKA recovery was not hindered. Discharged at 7 days postoperative.	X-ray
Christian <i>et al</i> —case 2 ⁴		F	63	Right	Following TKA, on the 45th day after surgery. Same day X-ray showed apparently normal fabella. 23° preoperative valgus.	TKA recovery was not hindered. Discharged at 3 days postoperative.	X-ray
Cherrad <i>et al</i> ⁵	2015	M	21	Left	Struck by an automobile	Parapatellar internal non-articular wound measuring 2 centimetres. Diffuse left knee pain aggravated by mobility and palpation.	X-ray, CT scan
Barreto <i>et al</i> ⁶	2012	F	21	Left	Car accident—direct knee trauma	Diffuse left knee pain, which was aggravated by passive extension and palpation, mostly around the posterolateral corner.	X-ray, ultrasound, MRI
Gregory <i>et al</i> ⁷	2011	F	55	Right	Struck by an automobile	Deformity of his right lower extremity and right knee and thigh pain.	X-ray, CT scan
Joseph <i>et al</i> ⁸	2010	M	65	Right	Motor vehicle accident	Multitrauma patient was intubated on arrival. No complaints were reported.	X-ray, CT scan
Stavroula <i>et al</i> —case 1 ⁹	2005	M	63–70	–	Stress fracture after TKA	Knee pain 4 months, 4 years and 9 years after TKA. Pain at rest and exacerbating by movement. 2 patients had knee effusion and altered gait.	X-ray
Stavroula <i>et al</i> —case 2 ⁹		F					
Stavroula <i>et al</i> —case 3 ⁹		F					
Paul <i>et al</i> ¹⁰	1998	M	50	Right	Noncontact mechanism of injury: twisting knee injury of hyperextension and varus stress	Tenderness over posterolateral side.	X-ray
Joseph <i>et al</i> ¹¹	1977	M	13	Right	Direct blow to the anterolateral knee during soccer game, after 5 months	Discomfort to the posterolateral knee when attempting to straighten and swelling in the posterolateral aspect of the knee.	X-ray
Levowitz <i>et al</i> ¹²	1955	M	30	Left	Knee crushed between two cars	Oedema and tenderness on medial side. Slight pain to movement.	X-ray
Sagel <i>et al</i> ¹³	1932	M	67	Left	Crushing injury	–	X-ray
Article	Year	Sex	Age	Laterality	Associated knee injuries	Fabella fracture treatment	Recovery (months)
Buruian <i>et al</i>	2022	M	40s	Right	Partial anterior cruciate (ACL) ligamentous injury, bone contusion. Posterolateral injury of the contralateral knee.	Conservative. Anti-inflammatory medicine, rest, ice, crutches and varus/valgus stabilising orthosis for the left	4
Ashraf <i>et al</i> ²	2022	M	38	Left	-	Conservative. Independent home programme, knee immobiliser, crutches.	-

Continued

Table 1 Continued

Article	Year	Sex	Age	Laterality	Associated knee injuries	Fabella fracture treatment	Recovery (months)
Zhoua <i>et al</i> ³	2017	F	38	Left	Tibial plateau contusions.	Medication, rest, immobilisation and physical therapy.	–
Christian <i>et al</i> – case 1 ⁴	2016	F	68	Right	–	Regular TKA rehabilitation.	–
Christian <i>et al</i> – case 2 ⁴		F	63	Right			
Cherrad <i>et al</i> ⁵	2015	M	21	Left	–	Surgical debridement. Symptomatic treatment for pain and antibiotics.	3
Barreto <i>et al</i> ⁶	2012	F	21	Left	Avulsion fracture of the medial aspect of the medial femoral epicondyle. Bone contusion. Lateral gastrocnemius head muscle oedema.	Conservative—symptomatic treatment for pain.	3
Gregory <i>et al</i> ⁷	2011	F	55	Right	Lateral tibial plateau and fibula fracture, lateral meniscus injury.	Conservative.	4
Joseph <i>et al</i> ⁸	2010	M	65	Right	Left supracondylar femur, left bicondylar tibial plateau and right lateral tibial plateau fractures.	Conservative	–
Stavroula <i>et al</i> – case 1 ⁹	2005	M	63–70	–	–	Regular TKA rehabilitation.	4 months. 2 other patients submitted to revision surgery, asymptomatic after 1 year and mild pain.
Stavroula <i>et al</i> – case 2 ⁹		F					
Stavroula <i>et al</i> – case 3 ⁹		F					
Paul <i>et al</i> ¹⁰	1998	M	50	Right	–	Early range of motion and subsequent strengthening exercises	2
Joseph <i>et al</i> ¹¹	1977	M	13	Right	–	Surgical treatment: ‘the tendon of the lateral head of the gastrocnemius was incised and the fabella was identified and removed. It was in two pieces joined by fibrous tissue’.	12**
Levowitz <i>et al</i> ¹²	1955	M	30	Left	–	6 weeks of ambulation with crutches without weight bearing.	2
Sagel <i>et al</i> ¹³	1932	M	67	Left	Intercondylar fracture of the femur	–	–

tendinous or meniscal injury. Our patient performed an MRI for both knees as he presented instability of the contralateral knee. The MRI examination was requested in the acute phase, when accurate clinical evaluation of the right knee was not possible due to diffuse pain, as such, we opted for MRI of both knees at the same time rather than possibly in sequential order to exclude associated soft tissue injuries. To diagnose a cartilaginous fabella, an MRI or ultrasound scan may be necessary as they are not seen on plain radiographic images. Embryologically, the fabella develops as a cartilaginous nodule in the fetus influenced by genetic factors (Sox9+/Scx+ activation through transforming growth factor β (TGF β), BMP2 and BMP4) and ossifies under compressive load on the lateral gastrocnemius tendon by endochondral ossifications.^{14 15} The ossification pattern of the fabella can vary among individuals, with some having a fully ossified fabella and others having a partially or completely unossified fabella, which may influence

the fracture lines.¹⁶ Another relevant factor to consider is the prevalence of the Fabella bone, which varies widely with the ethnic group.¹⁷ The reported prevalence ranges from 3%–87% and with an increasing rate, 3 to 5 times over the last 100 years.¹⁸ Matroushi *et al* reviewed 813 knee radiographs and 119 MRI in an Omani population for the presence of the fabella, reporting a 24.1% radiographic prevalence rate and a 20.2% MRI prevalence rate and significant association with age. The lower incidence in the MRI group was explained by the prevalence of younger patients in the group. The authors suggested that genetic and cultural factors such as diet and mechanical stimuli such as continuous kneeling for praying may influence the prevalence rate.¹⁹ The prevalence of the fabella bone in Portugal, the country of origin, of the patient is unknown but estimated at 8.7%–31.3%, as in other western populations.²⁰ This lack of data in the literature may provide an interesting direction for further studies.

Patient's perspective

I am pleased that I no longer have knee pain and am able to work at a local grocery store.

Learning points

- ▶ Fabella fractures are rare injuries and may be missed on initial radiologic evaluation.
- ▶ Posterolateral knee pain and high-energy mechanism should raise suspicion.
- ▶ Conservative, symptomatic treatment results in good clinical outcomes.

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Case reports provide a valuable learning resource for the scientific community and can indicate areas of interest for future research. They should not be used in isolation to guide treatment choices or public health policy.

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