CASE REPORT

Knee upside down

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Accepted 28 September 2017

SUMMARY

We present a case of a 19-year-old woman with a forced hyperextension trauma of the knee causing a posteromedial fracture, a medial meniscus root tear and rupture of the posterior cruciate ligament. The posteromedial fracture of the tibial plateau was treated operatively with open reduction and internal fixation. Anatomical reconstruction was achieved. Postoperative treatment included unlimited flexion and minimal weight bearing. After 3 months, the patient had minimal pain after weight bearing and returned to preoperative range of motion.

BACKGROUND

An isolated fracture of the posteromedial tibial plateau is rare. Similar cases are seldom reported in the literature. We present a case from our hospital and an overview of the literature.

CASE PRESENTATION

A 19-year-old woman presented to the emergency department of our hospital with a painful right knee,

Figure 2 Lateral radiograph of the right knee shows a semicircular fragment located posterior to the tibial plateau. There is a large joint effusion.

Figure 1 Anteroposterior radiograph of the right knee. The fragment is located on the medial side of the knee, suggesting that the fragment originates from the medial tibial plateau.

4 days after an incident where a friend jumped on her back which presumably caused a forced hyperextension trauma of the knee. She reported pain on the anterior and medial side of the right knee and inability to bear weight. There was no relevant medical history.

INVESTIGATIONS

Physical examination of the knee showed tenderness of the posterior and medial joint line and of the medial side of the patella. Full knee extension was possible and flexion was limited to 70°. Physical examination of the collateral and cruciate ligaments was too painful and therefore unreliable. There were no vascular or neurological abnormalities. The patient's body mass index is 37.5 kg/m².

IMAGING

Radiographs of the right knee showed a loose fragment of the posteromedial tibial plateau (figures 1 and 2). It is easy to miss this fracture if only anteroposterior views are available. CT confirmed the diagnosis of an oblique posteromedial tibial fracture with rotation and dislocation of the fragment

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To cite: van der Aart SGJ, Sonnega RJA, Hofstee D-J. *BMJ Case Rep* Published Online First: [please include Day Month Year]. doi:10.1136/bcr-2016-217714

Figure 3 CT of the right knee showing an avulsion fracture of the posteromedial tibial plateau with rotation and dislocation of the fragment. There is a large joint effusion and impaction fracture of the anterior medial femoral condyle.

(figures 3 and 4). A cortical irregularity of the medial femur condyle and effusion of the joint raised the suspicion of injury of the cruciate ligaments. An MRI scan was obtained because more extensive damage was suspected. The images showed a grade 2 sprain of the medial collateral ligament (MCL), a total rupture of the posterior cruciate ligament (PCL) and also a root tear of the medial meniscus (figures 5 and 6).

TREATMENT

To reduce and fixate the fracture, operative treatment was performed in prone position. A 10cm long posteromedial incision centred over the medial joint line is made. A deeper dissection is performed to visualise the fascia of the gastrocnemius muscle which is then opened. By way of blunt dissection underneath the medial part of the gastrocnemius muscle and

Figure 4 CT three-dimensional reconstruction of the tibial fracture. There is an impaction fracture of the anterior medial femoral condyle.

Figure 5 MRI (sagittal proton density) of the right knee showing a tear of the medial meniscus, posteromedial fragment of tibial plateau, bone contusion and impaction fracture of anterior medial femoral condyle.

between the semimembranosus and semitendinosus muscles the loose fragment becomes visual. The posterior capsule was also disrupted. In order to reduce the fracture anatomically the fragment had to be excised and then replaced and fixated with three Kirschner wires (K-wires). A three-hole one-third tubular plate was then placed over a K-wire and then fixated with one cannulated compression screw and two 4.5 mm cortical screws. Anatomical reconstruction was achieved and verified by image intensifier. Postoperative care includes unlimited flexion and minimal weight bearing for the time of 6 weeks.

OUTCOME AND FOLLOW-UP

At 3 months of follow-up our patient had minimal pain after weight bearing and returned to preoperative range of motion. Radiological consolidation has been achieved.

POSTOPERATIVE IMAGING

Postoperative radiographs show anatomical reduction of the tibial plateau fracture (figures 7 and 8) and a postoperative CT was performed to confirm adequate position of the plate and screws.

DISCUSSION

Over the past decades several articles have been published about posteromedial tibial plateau fractures. Still, no agreement has been reached about the aetiology of this type of fracture. The fracture often occurs in combination with tear or rupture of the anterior cruciate ligament (ACL), but as in our case, sometimes in combination with rupture of the PCL.

The semimembranosus tendon has a complex insertion on the proximal tibia. It is divided into five arms: the anterior arm, direct arm, inferior arm, capsular arm and oblique popliteal ligament. The direct arm attaches to the posteromedial aspect of the tibia and has a low signal intensity on MRI. The semimembranosus tendinous insertions and its relationships with the

Figure 6 MRI (sagittal proton density fat suppression) of the right knee showing joint effusion, tear of the medial meniscus, posteromedial fragment of tibial plateau, bone contusion and impaction fracture of anterior medial femoral condyle.

posterior medial capsule, medial meniscus and posterior oblique ligament are important structures contributing to the stability of the posterior medial corner of the knee.¹ Isolated fractures of the posteromedial aspect of the tibia plateau are, to our knowledge, never reported in the literature. These fractures are combined with additional meniscal and ligamentous injuries depending on the trauma mechanism.

Yao and Lee presented two cases of posteromedial tibial fractures in combination with ACL rupture and medial meniscal tears. In both cases, the MCLs had a normal appearance on MRI. Despite the fact that the MCL appears normal, they state that the most likely mechanism of injury is external rotation and abduction as in a classic ACL rupture.²

Vanek presented a similar case which led to a small experimental study to reproduce the trauma mechanism and concomitant injury. They applied varus stress on the tibia in 60°–80° flexion in 19 cadaver knees. In all the knees the ACL ruptured with a loud crack. Sixteen knees showed fractures of the posteromedial tibial plateau after dissection. Several attempts to avulse bone by a violent pull on the semimembranosus tendon failed.³

In a review of the literature about avulsion fractures of the knee by Gottsegen *et al*, the authors emphasise that injuries of the posteromedial corner of the knee are uncommon and a small avulsion fracture at this site is easily missed. The fracture is very difficult to detect when the avulsed fragment is not displaced. It is obvious that further evaluation by way of CT or MRI is warranted if an avulsion fracture is seen or suspected on radiographs. Proposed causes of posteromedial tibial fractures involving the semimembranosus tendon insertion include external rotation and abduction of a flexed knee, varus force applied to the flexed knee and a valgus force applied to the extended knee,⁴ the latter being the mechanism involving injury of the PCL.

Al-Humadi *et al* described an injury which is quite similar to our case. A concrete block struck the anterolateral side of

Figure 7 Postoperative radiographs of the right knee. Anatomical reduction of the tibial plateau has been achieved. A three-hole one-third tubular plate is used with one cannulated compression screw (proximal) and two 4.5 mm cortical screws (distal).

the patient's knee which caused a posteromedially directed force. This led to a posteromedial avulsion fracture of the tibial plateau, PCL rupture and tear of the posterior horn of the medial meniscus. They think the mechanism of this semimembranosus-mediated avulsion fracture is caused by a high tension, static contraction of the semimembranosus muscle resisting a valgus and hyperextension load. They also propose an alternative mechanism of injury; disruption of the PCL followed by torsion and axial loading on the tibial plateau could have resulted in the described pattern of injuries.⁵ This similar type of trauma results in similar injury as in our case. Our case shows a disrupted posterior capsule. Suggesting forced extension and axial loading, rather than strong contraction of the semimembranosus muscle, results in this posteromedial tibial plateau fracture.

In a more recent paper, Khoshnoodi *et al* present a case of a young man who had a hyperextension and valgus trauma to his knee while playing football. The patient was diagnosed with a semimembranosus avulsion fracture of the posteromedial tibial plateau which was associated with a PCL tear, a medial meniscus tear and posterior capsular avulsion. The mechanism of injury is considered a severe hyperextension-valgus trauma. However, additional fractures may suggest that other forces leading to the avulsion contributed in this case.⁶

This case report describes a trauma of the knee with a combination of a posteromedial tibial fracture, a medial meniscus root tear, sprain of the MCL and total rupture of the PCL. There are

Figure 8 Three-dimensional reconstruction of a CT of the right knee showing adequate position of the fragment with osteosynthetic material in place.

different types of mechanisms reported in the literature causing a posteromedial tibial plateau fracture. We believe that the trauma mechanism in our case consists of hyperextension and valgus force to the knee, resulting in posterior tibial translocation and axial loading on the tibia. Further evaluation by way of CT or

Learning points

- ▶ Small avulsion fractures seen on radiographs can be a sign of severe injury of the knee joint.
- ▶ A forced hyperextension trauma of the knee can cause extensive intra-articular damage.
- ▶ Posteromedial fractures of the tibial plateau are often called avulsion fractures but the trauma mechanism in our case and other cases suggests that axial loading and posterior tibial translocation are probably the cause.

MRI is recommended if an avulsion fragment of the posteromedial tibia is seen or suspected on radiographs. Extensive injury of the knee can be easily overlooked by initial radiologic imaging.

Contributors SGJA, gathering and selecting information; organising material; analysing material; literature search; writing the report; submission process. RJA, saw potential of case; helped in analysing material; literature search; helped in writing the report; reviewing and redrafting. DJH, saw potential of case; patient care (diagnostics, treatment follow-up); gathering information; helped in writing the report; reviewing and redrafting; manuscript submission.

Competing interests None declared.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

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