

*Current problem cases***Incomplete avulsion of the femoral attachment of the posterior cruciate ligament with an osteochondral fragment in a twelve-year-old boy****M. Itokazu, T. Yamane, and S. Shoen**

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Summary. Isolated avulsion of the posterior cruciate ligament from the femoral attachment of the knee as a hyperextension injury is rare. We saw a young child with an incomplete avulsion of the posterior cruciate ligament that occurred after a blow to the anterior tibial surface of a flexed knee; the child revealed a lack of knee extension due to a pinch of the osteochondral fragment connected to the anterior band of the posterior cruciate ligament in the knee joint. Arthroscopic extirpation of a fragment was undertaken.

Case report

In August 1986, a 12-year-old boy fell from a height of 3 m and hit his right leg with the knee in flexion. There was immediate pain in the right knee, which rapidly became intensely swollen. He was unable to bear weight on the injured extremity. Later that day, the knee was examined by a physician who reportedly found an effusion and limited, painful motion of the right knee. Routine anteroposterior and lateral roentgenograms were interpreted as normal. The knee was immobilized in a posterior plaster splint and the patient was instructed to walk with crutches. Two months later he was able to resume athletics activities with slight knee pain. In June 1987, he noted lack of extension of the knee and consulted a physician again. On roentgenographic examination no bone abnormality was noticed (Fig. 1a, b). Three weeks later, the boy was seen by one of us. Examination showed no swelling of the knee but revealed a 20° loss of extension and a slight posterior laxity. However, the Lachman and pivot-shift tests were not positive. New roentgenograms and a notch roentgenogram showed an osteochondral fracture (Fig. 1c). A tentative diagnosis of osteochondral fracture with slight insufficiency of the cruciate ligament or avulsion of the anterior cruciate ligament was made, and the patient was admitted to Kinki University Hospital for surgical repair.

Examination of the right knee on admission showed pain on extension and a 20° loss of extension (Fig. 2d) but no tenderness in the soft tissues or at the joint line and no varus or valgus laxity. A pivot shift was not present, but a 1+ (0–5 mm) posterior drawer sign was elicited (Fig. 3c, d).

According to the tomogram (Fig. 1d), CT (Fig. 3b), and an arthrogram (Fig. 3a), and based on the extension disturbance of the knee joint, we felt that the chondral fragment with the posterior cruciate ligament might be pinched between the femoral condyle and anterior cruciate ligament.

Arthroscopic examination of the knee joint was performed with the patient under general anesthesia. An osteochondral fragment of the attachment of the medial intercondylar notch measuring 1 × 1.5 cm connected with an anterior band of the posterior cruciate ligament was seen (Fig. 2a, b). It was pinched between the femoral condyle and the anterior cruciate ligament during extension of the knee. The anterior cruciate ligament and menisci were intact.

Partial insufficiency of the posterior cruciate ligament was determined at the medial aspect of the femoral condyle, and slight posterior laxity was seen while the patient was under general anesthesia. The osteochondral fragment was extirpated arthroscopically, and the knee was then extended to 0° immediately. Two days later the boy was able to walk freely and did not complain of pain, subjective instability, restriction of motion, or limitation of activity. There was no Lachman sign, pivot shift, or anteromedial or anterolateral rotatory instability on testing. The posterior drawer test was the same as before the operation. The patient was able to participate in athletic activities without disability, and a postoperative roentgenogram of the right knee was normal (Fig. 4a, b).

Discussion

Ligament tears in children and teenagers are rare. Even though avulsion fractures of the tibial attachment of the anterior [1, 3, 5, 6, 12–14, 16, 17] or posterior [2, 10, 11] cruciate ligament occur infrequently as isolated injuries, avulsion of the attachment of the posterior cruciate ligament to the femur is seldom seen.

In recent case reports, Mayer and Micheu [9] and Sanders et al. [15] showed that hyperextension injury to the posterior cruciate ligament of the knee caused the ligament to be avulsed from its femoral attachment with a chondral fragment. Their cases revealed severe laxity (posterior drawer: more than 3+) and subluxation of the knee joint, together with other soft tissue injuries, which were operatively repaired. A careful review of the literature showed no report of isolated avulsion of the anterior band of the femoral attachment following a violent blow to the anterior tibial surface of a flexed knee as in our patient.

The mechanism of this injury is not entirely clear. In experiments on adult cadavers, Kennedy and Grainger [8] studied the site of rupture of the cruciate ligament.

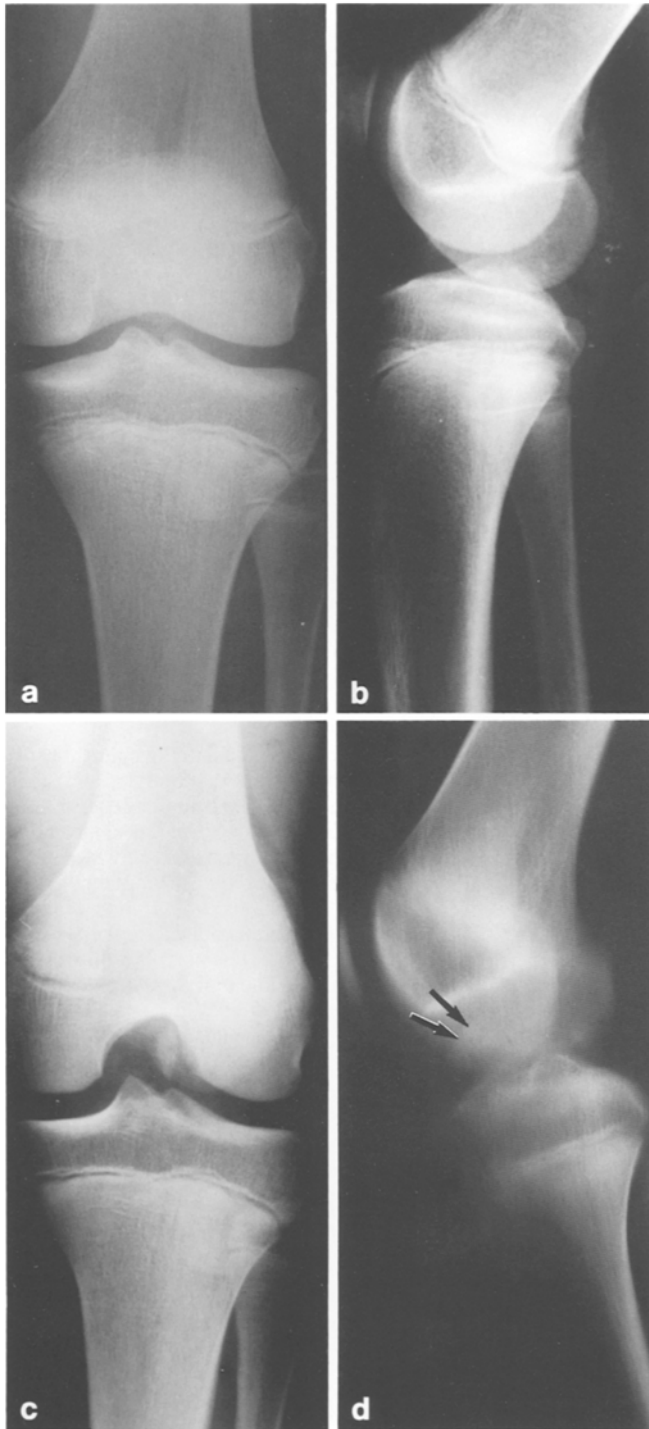


Fig. 1. a, b Routine roentgenograms of the knee revealed no injury to the bone. c Notch roentgenogram demonstrated osteochondral avulsion fracture as if from the lateral femoral condyle. d Lateral tomogram demonstrated osteochondral fracture

They were able to avulse the posterior ligament from its femoral attachment by a posterior shearing force on the tibia with the knee in about 45° of flexion in one of 13 specimens. In the other 12 specimens this force resulted in tibial or femoral fractures. Hyperextension almost uniformly produced avulsion of the tibial attachment. Girgis et al. [4] and Hughston [7] showed that the poste-

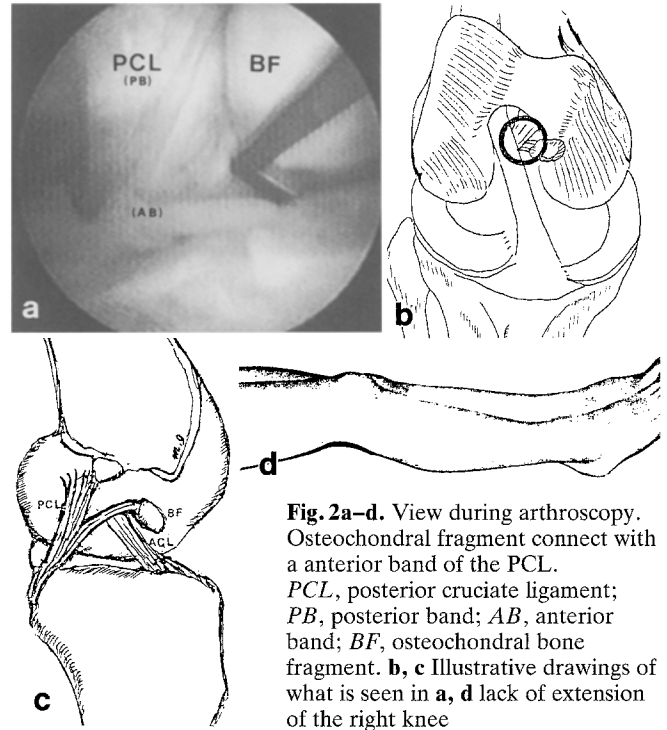


Fig. 2a-d. View during arthroscopy. Osteochondral fragment connect with a anterior band of the PCL. PCL, posterior cruciate ligament; PB, posterior band; AB, anterior band; BF, osteochondral bone fragment. b, c Illustrative drawings of what is seen in a, d lack of extension of the right knee



Fig. 3. a Medial oblique arthrogram showing oval fragment (arrows). b Osteochondral fragment shifting laterally on CT view (arrows). c, d Anteroposterior stress roentgenograms showing slight (0-5 mm) posterior laxity of the tibia

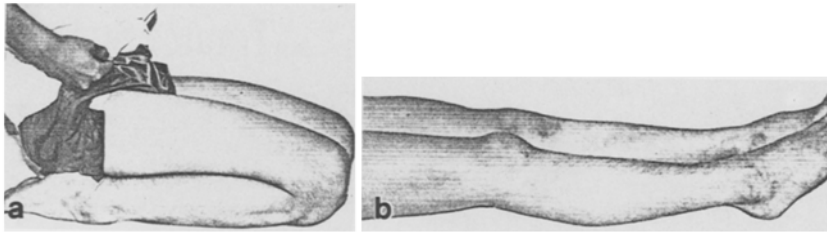


Fig. 4a, b. Full range of motion of the knee after operation

rior cruciate consists of two parts, and anterior portion, which forms the bulk of the ligament (anterolateral band), and a posterior part, which is shorter and thicker and runs oblique to the back of the tibia (posteromedial band). On functional analysis, the former band became tight and the latter became loose in flexion of the knee joint. These anatomical findings are consistent with those in our clinical studies. Severe injury to the knee in pediatric patients more commonly produces fractures and epiphyseal injuries than ligament injuries. When there is evidence of a severe injury and no bone injury is noted on the initial roentgenogram, an accurate diagnosis can be made only with a notch roentgenogram, a tomogram, and CT. We suggest that arthroscopic examination is also useful for the differential diagnosis in these cases, and if the patient does not show gross cruciate insufficiency, operative repair of the cruciate ligament, as in our case, is not required.

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