

Simultaneous Patellar Fracture and Patellar Tendon Avulsion Following Arthroscopic Anterior Cruciate Ligament Reconstruction: A Case Report and Literature Review

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Arthroscopic reconstruction of the anterior cruciate ligament (ACL) using the middle third of the patellar tendon is an effective method for treating ACL insufficiency. Donor site morbidities are usually mild. This article presents a case of simultaneous patellar fracture and patellar tendon avulsion that occurred 8 weeks after this operation. Such a case has rarely been reported. Theoretically, an accelerated rehabilitation protocol after ACL reconstruction may increase patellar stress and the potential for patellar fracture. However, it is still very important because complications such as arthrofibrosis, muscle atrophy, and patellofemoral pain may outweigh the chance of patellar fracture if adequate rehabilitation is not performed. (*Chang Gung Med J* 2003;26:592-7)

Key words: patellar fracture, patellar tendon avulsion, anterior cruciate ligament reconstruction, patellar bone-tendon-bone graft, accelerated rehabilitation program.

Donor site morbidities after harvesting the middle third of the patellar tendon for anterior cruciate ligament (ACL) reconstruction are usually mild.⁽¹⁾ Serious complications such as simultaneous patellar fracture and patellar tendon avulsion are very rare.⁽²⁻⁴⁾ This article presents a case with complications of a transverse patella fracture and patellar tendon rupture which occurred 8 weeks after arthroscopic ACL reconstruction using the middle third of the patellar bone-tendon-bone as an autograft.

CASE REPORT

A 30-year-old man sustained a twisting injury to the left knee when he missed a step and subsequently developed progressive pain, swelling, and a sensation of knee giving way. Physical examination revealed that the left knee was moderately swollen, with a range of motion of 0° to 130°. Other pertinent

findings included a positive McMurray test, a positive anterior drawer test, a positive pivot shift test, and a positive Lachman test. According to above examinations, simultaneous ACL and meniscus tear were highly suspected. Conservative treatments with physical therapy and oral NSAIDs were unsuccessful. Therefore, arthroscopic ACL reconstruction using the middle third of the patellar tendon and partial lateral meniscectomy were performed. A 10-mm-wide patellar bone-tendon-bone autograft with a 25 × 10-mm bone plug on each end was harvested. There were no donor site complications intraoperatively. The postoperative course was uneventful. The patient then entered an accelerated ACL rehabilitation program that enhanced early range of motion, early closed kinetic chain exercise, and early weight bearing on the affected leg.⁽⁵⁾

Past history revealed that he had received ACL reconstruction of the right knee from an unrelated

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accident 2 years previously, and no complications of patellar bone-tendon-bone autograft were noted.

Approximately 8 weeks postoperatively, while performing carioaca exercises, he accidentally twisted the operated leg. A loud "pop" followed by severe knee pain and swelling was noted. He was unable to bear weight on the left leg. Physical examination of the left knee revealed moderate swelling and a decreased range of motion. There was a palpable gap associated with crepitus over the patella. The neurovascular status was intact, and the ACL was stable. Radiographs of the left knee revealed a displaced transverse fracture of the patella (Fig. 1). Open reduction and internal fixation of the patellar fracture were performed. During surgery, an additional injury of rupture of the patellar tendon was noted. The lateral one-third of the remaining patellar tendon was completely avulsed from the tibial insertion (Fig. 2). The medial one-third of the patellar tendon was intact. The anterior cruciate ligament was grossly intact and no other intra-articular injuries such as meniscal tear or chondral fracture were found. The patellar fracture was repaired with 2 cancellous screws and a tension circlage wire. The avulsed patellar tendon was repaired to the tibial bone with # 5 Ethibon sutures through multiple drill holes. Postoperatively, the left knee was immobilized in a cast splint with the knee at 20° for 3 weeks. The patient first ambulated without placing any weight on the operated leg for 3 weeks, followed by partial weight bearing for additional 3 weeks; then progressive weight bearing was allowed as tolerated. Active and passive ranges of knee motion were initiated at 4 weeks postoperatively. Quadriceps and hamstring strengthening exercises were performed immediately after surgery.

Four months postoperatively, the knee was pain free with a satisfactory range of motion of from 0° to 130°. Radiographs of the left knee showed satisfactory healing of the patellar fracture (Fig. 3). Ultrasonography study revealed good healing of the patellar tendon (Fig. 4). The latest examination performed 2 years postoperatively revealed that the injured knee was completely asymptomatic, and the patient was able to resume activities of daily living including recreational sports at the preinjury level. The Lysholm score⁽⁶⁾ was greater than 95, and the Tegner activity level⁽⁷⁾ was 6. The isokinetic test revealed no side-to-side difference of thigh muscle

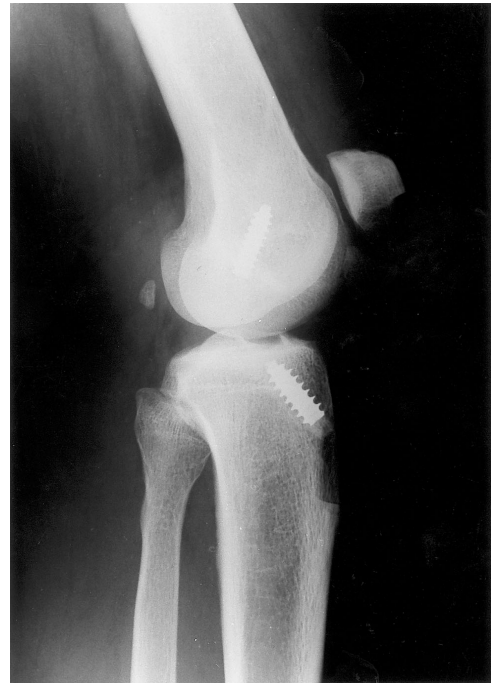


Fig. 1 Lateral radiograph of the left knee showing a transverse fracture of the patella.

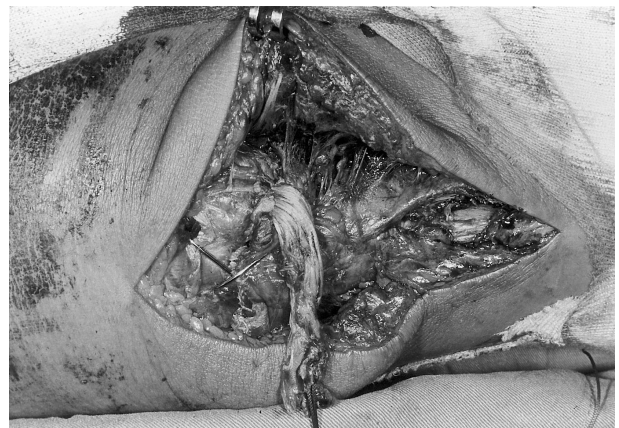


Fig. 2 Intraoperative finding showing that the lateral half of the remaining patellar tendon has been avulsed from the tibial tuberosity.

strength and endurance. Examination of the left knee revealed no pain and no swelling. The range of motion was 0° to 135°. The Lachman test, pivot shift test, and the anterior drawer test were all negative, and the extensor mechanism was intact.

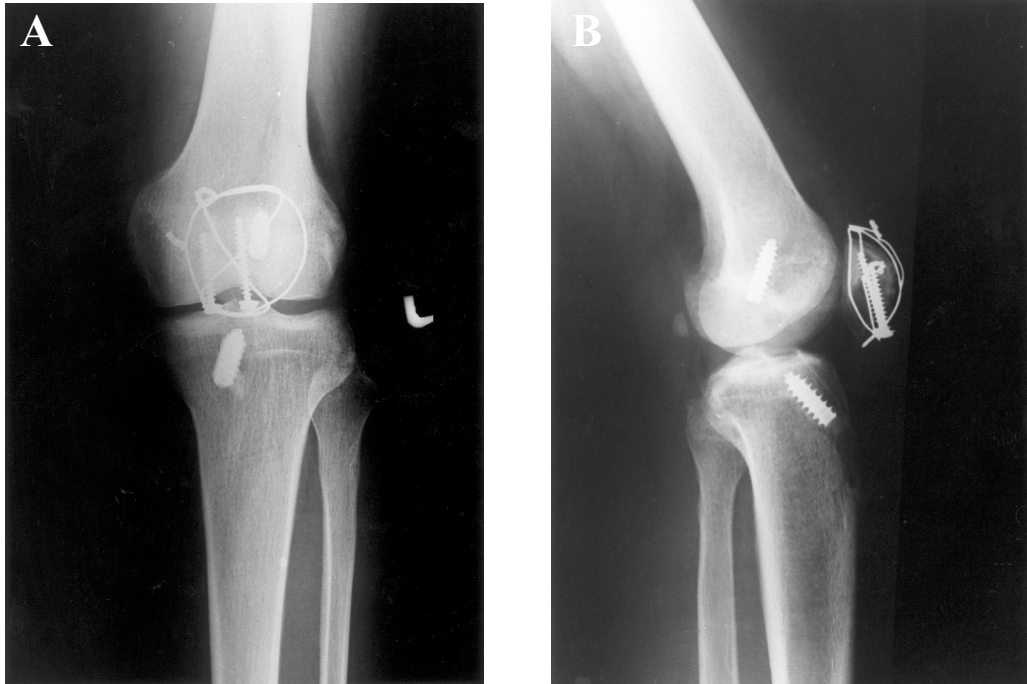


Fig. 3 (A) Anteroposterior and (B) lateral radiographs of the knee taken 4 months postoperatively showing complete healing of the fracture.

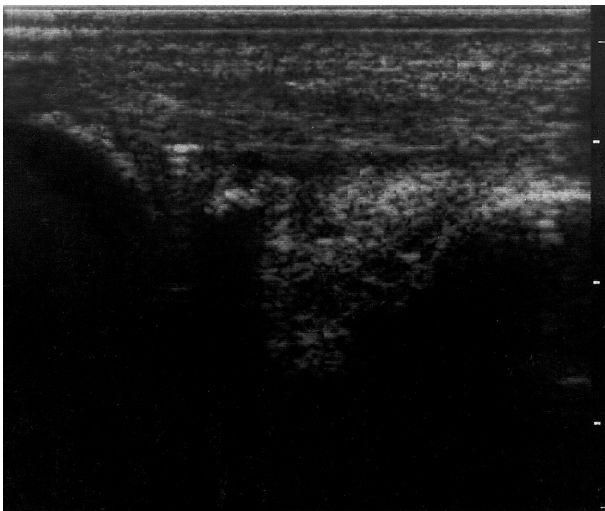


Fig. 4 Ultrasonography of the left knee performed 4 months after the operation showing good healing of the avulsed patellar tendon.

DISCUSSION

A tendon graft from the middle third of the patellar tendon with bone blocks from the patellar

and tibial tuberosity and rigid internal fixation with interference screws is the most popular type of ACL reconstruction.⁽⁸⁾ Removal of the bone creates a defect in the patella, which rarely shows radiographic evidence of new bone formation, and such a defect poses a potential risk of fracture due to increased stress on the patella.⁽⁹⁾ Several cases of patellar fracture⁽¹⁰⁻¹⁷⁾ or patellar tendon rupture^(18,19) after patella bone-tendon-bone harvesting have been reported in the literature. However, only 3 cases of combined patellar fracture and rupture of the patellar tendon have been reported.⁽²⁻⁴⁾ In our case, even though the patient was doing well for 8 weeks after surgery, it is likely that the patellar fracture was surgically related.

Patterns of patellar fracture are related to the mechanism of injury. Direct fractures resulting from impaction forces delivered to the patella during falls or motor vehicle collisions (dashboard injuries) are typically stellate or comminuted.⁽¹⁵⁾ On the other hand, indirect fractures resulting from tensile stress across the extensor mechanism are typically displaced transverse fractures occurring in the middle and lower body of the patella.^(2,13,14) Excessive tensile stress may also cause rupture of the patellar tendon

in addition to patellar fracture. Our case showed combined transverse patellar fracture and patellar tendon avulsion. This was likely caused by a forceful twisting injury which first caused the patellar fracture, and then patellar tendon avulsion as the injury force continued.

An accelerated rehabilitation program after ACL reconstruction may enable the knee to recover in almost half the time of traditional protocols.⁽⁵⁾ Some protocols call for squatting exercise, plyometric exercise, and return to running in as early as 8-10 weeks. Theoretically, a rapid exercise program may increase the patellar stress and the potential for patellar fracture. However, the risk of arthrofibrosis, patellofemoral pain, and muscle atrophy of the knee may outweigh the chance of patellar fracture after ACL reconstruction if adequate rehabilitation is not performed.^(10,16) Yet, precautions should be taken to prevent patellar fracture from an accelerated rehabilitation program by limiting the exercise threshold. A sudden forceful contraction of the quadriceps in a knee with poor neuromuscular control may be a contributing factor to fracture of the patella. Emphasis only on increasing the strength in a knee with poor neuromuscular control may produce excessive forces on the patella, the articular structure, or the graft. Therefore, initial rehabilitation should also emphasize on neuromuscular control. Various exercise regimens have been studied which improve neuromuscular control. Of these, high-repetition/low-resistance closed kinetic chain exercises and agility exercises seem to produce the most desirable effects.^(5,20)

High-repetition/low-load closed kinetic chain exercises create axial loads that can simulate the peripheral afferent receptors and increase the muscle response. Agility training can improve reaction time. Such exercise programs have been found to restore neuromuscular control by improving control of the proximal and distal components and by restructuring the movement patterns that provide the guiding function in a knee with poor proprioception after an anterior cruciate ligament deficiency. Furthermore, a patient's experiences, capabilities, and functional requirements should also be taken into consideration when designing a rehabilitation program. Sole emphasis on high-stress exercise in every patient who receives ACL reconstruction surgery may not be universally suitable.

Surgical interventions are indicated in patients

with a displaced fracture of the patella and rupture of the patellar tendon. There are reports stating that the final outcomes of patellar fracture following ACL reconstruction caused no discernible differences in patients without complications.^(11,17) The surgical result of this case was also satisfactory.

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發生於十字韌帶重建手術術後的臏骨骨折及臏骨腱斷裂： 病例報告及文獻回顧

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利用臏骨腱當做十字韌帶重建手術的來源已十分普遍。被取走臏骨--臏骨腱--脛骨移植片的膝蓋併發症通常並不嚴重。這篇文章報導一位術後八週發生臏骨骨折及臏骨腱斷裂的嚴重病例。這在文獻中非常罕見。理論上，加速型十字韌帶重建手術術後的復健可能會增加臏骨骨折的機率。但是，它仍然是重要且必需施行的。因為，唯有積極的復健才能減少其他諸如關節攣縮、肌肉萎縮等，更嚴重的併發症產生。(長庚醫誌 2003;26:592-7)

關鍵字： 臏骨骨折，臏骨腱斷裂，前十字韌帶重建手術，臏骨--臏骨腱--脛骨移植片，加速型復健計劃。

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