Supracondylar Femur Fracture After Endoscopic Anterior Cruciate Reconstruction Using an EndoButton

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CASE REPORT

A 22-year-old healthy male presented intoxicated after an altercation. He had an obvious deformity of his left distal femur, with associated swelling and marked pain. The patient indicated that he had poor recall of the injury because of head trauma. He thought that he had been kicked in the knee, but was unsure of the exact mechanism of injury.

At the time of the initial assessment, there was a marked flexion deformity of the distal femur. The deformity was reduced and the lower extremity was placed in Bucks’ traction. Radiographs revealed a fracture of the supracondylar region of the left distal femur, with evidence of an EndoButton located at the anterolateral aspect of the distal femur at the site of the fracture (Fig. 1).

Five months before the fracture, the patient had undergone an ACL reconstruction. The reconstruction was performed using a quadrupled semitendinosus-gracilis autograft construct secured proximally with a closed-loop EndoButton. Review of the operative report indicated that there were no intraoperative complications, and that the femoral tunnel and EndoButton had been placed in the standard fashion. The patient’s postoperative course was unremarkable, and he attained all the expected rehabilitation milestones.

The radiographs demonstrated the femoral and tibial tunnels from the ACL reconstruction. The fracture seemed to pass through the exit point of the femoral EndoButton tunnel. The EndoButton itself was displaced from its expected site, located within the fracture, medial to the lateral cortex of the distal femur.

Open reduction and internal fixation was performed utilizing a 4.5 mm locking condylar plate (Synthes Canada, Mississauga, Ontario). Intraoperatively, the fracture was noted to pass directly through the exit of the EndoButton tunnel. The EndoButton was found within the fracture site (Fig. 2). Traction on the EndoButton did not reveal any evidence of pistoning, suggesting in-growth into the graft within the femoral tunnel. After removal of the EndoButton, and before fracture fixation, careful inspection of the fracture site revealed 2 other small holes. These holes seemed to have originated from 2 unsatisfactory passes of the 2.7 mm femoral guide pin through the anterolateral cortex, and were found within the fracture line.

Follow-up at 5 months postinternal fixation revealed him to be weight bearing without discomfort and symptoms of instability. Lachman and anterior drawer tests demonstrated approximately 5 mm of anterior tibial translation compared with the noninjured side. A firm end point was present with both tests.

DISCUSSION

Seven cases of femur fracture after ACL reconstruction have been reported in the literature.1–7 Of these, 3 involved fracture of the lateral femoral condyle, and 4 were described as a supracondylar fracture of the femur. Two of the four cases of supracondylar femur fracture occurred at the site of the extraarticular fixation, with 1 at the site of fixation of a ligament augmentation device and the other at the site of fixation of an iliotibial band tenodesis.3,4 The third case occurred through the femoral tunnel used for placement of a Gore-Tex prosthetic graft.5 The fourth case occurred as a result of multiple passes with a trochar pin.6

Reconstruction of the ACL using an EndoButton requires a 4.5-mm tunnel exiting the anterolateral cortex of the distal femur to allow for passage of the EndoButton. Positioning of the tunnel requires placement of a 2.7-mm guide pin into the intercondylar notch of the femur that exits the anterolateral cortex of the distal femur, often at the metaphyseal-diaphyseal junction. Correct placement of the guide pin is crucial, as femoral tunnel placement impacts the function and isometricity of the graft. Multiple perforations of the anterolateral cortex may result from repeated attempts to correctly place the guide pin.
Previous work on the effect of drill and screw holes have demonstrated that bone becomes weakened by such holes when subjected to torsional and bending forces. These holes act as stress concentrations, which lead to higher stresses being present at the site of the defect than would normally be present if the defects were absent. Wiener et al noted that the thermal necrosis induced by placement of a guide pin may result in slower bone remodeling, leading to the presence of the stress concentration for longer than expected periods of time. Additionally, the presence of the polyester loop of the EndoButton within the tunnel prevents bone remodeling at that site.

On the basis of the radiographic and intraoperative findings the defects in the femoral cortex persisted 5 months after the initial operative procedure. The clustering of the 2.7 mm guide pin holes and the 4.5 mm EndoButton tunnel, lead to high stress concentrations at the anterolateral cortex. The femoral tunnel was also noted to exit at the metaphyseal-diaphyseal junction, further contributing to the high stress concentrations at the fracture site. These factors in combination likely predisposed the patient to a fracture at lower than expected energy levels.

Although distal femoral fracture is a rare complication after endoscopic ACL reconstruction, this case demonstrates that the combination of multiple guide pin passes, the EndoButton femoral tunnel, and a femoral tunnel exit at the metaphyseal-diaphyseal junction, may lead to fracture at lower than expected energy levels. The case also demonstrates that the guide pin holes may be present for long periods of time after the initial reconstruction, and that the presence of the polyester EndoButton loop prevents bone remodeling at the tunnel site. On the basis of these findings, care should be taken not to perforate the anterolateral cortex of the distal femur more than is absolutely necessary. If guide pin placement is a concern, the pin should not be advanced through the anterolateral femoral cortex until the position in the notch of the femur is felt to be acceptable. An attempt should be made to create a relatively short femoral tunnel, with the tunnel exit located in the metaphysis of the distal femur. However, with this technique, care should be taken to ensure that there is sufficient bony support for the EndoButton.

REFERENCES


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