Case Report

Application of mesh plate for the treatment of an osteochondral fracture of the medial femoral condyle with medial wall fracture: A case report

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ABSTRACT

Osteochondral fractures of the medial femoral condyle accompanied by medial wall fracture are rare. Surgeons often have difficulty in selecting the most appropriate treatment, especially the plating technique for internal fixation since the available femoral locking plates are made to fit the femoral lateral condyle and there is no anatomical plate for the medial condyle. We, herein, report a case of a 44-year-old female patient who suffered from an osteochondral fracture of the medial femoral condyle accompanied by medial wall fracture treated by a low-profile mesh plate contoured to fit around the fracture site. Bone union was achieved at postoperative week 12 and the patient was able to return to her normal activities. At the 16-month follow-up exam, the patient’s functional and clinical outcomes were satisfactory. Her Oxford knee score was 47 points, and the Western Ontario and McMaster Universities Arthritis Index scores were 2 points for pain and 5 points for physical function. We believe that the mesh plate has several advantages. This is the first report of using a mesh plate for the femur, and we were able to achieve good results. We conclude that treatment with a mesh plate can be applied in well-selected patients with medial femoral condyle osteochondral fracture and has the potential to be applied to the treatment of fractures in various regions in the future.

Introduction

Distal femoral unicodylar fractures are rare injuries, accounting for <1% of all femoral fractures.1 These injuries are associated with injuries to the ipsilateral limb2 and often occur after avulsions, direct impact, shear forces to the knee during sports, or from dashboard trauma during car accidents.3,4 Comminuted femoral condylar fractures (including osteochondral fractures) are reported in the literature. However, in most cases, they are lateral condylar fractures,4 whereas comminuted medial condyle osteochondral fractures of the femur, which are associated with trauma, are very rare.5,6 According to the literature, open reduction and internal fixation are recommended for femoral medial condylar fractures with excellent long-term results.7 Furthermore, various treatments such as mosaicplasty and microfracture techniques are recommended for femoral condyle osteochondral fracture with excellent results.8,9

Some fixation methods have been proposed for articular fractures of the distal femur. For supracondylar and lateral femoral condylar fractures, lag screw fixation, conventional non-locking plates, and locking compression plates are commonly used. The most common femoral condylar plates are made to fit the femoral lateral condyle, but there is no anatomical plate for the medial condyle. Therefore, using calcaneal plates or proximal tibial plates intended for other sites are options for fixing medial femoral condylar fractures.2,10 In addition to these limitations, adequate fixation methods have not been established for medial femoral condyle osteochondral fractures.8,9 Here, we present a case involving a patient with comminuted medial femoral condyle osteochondral fractures fixed with a mesh plate. The patient’s clinical outcomes were satisfactory, and she was able to return to her normal activities.

Case Presentation

A 44-year-old woman presented to our facility with left knee pain after a fall. She had a swollen left knee and could not bear weight on her left leg. Based on radiography and computed tomography (CT), she was diagnosed with a medial femoral condyle osteochondral fracture and tibial eminence avulsion fracture (Figures 1 and 2). Her medical history included hypertension, and upon examination, no other co-morbidities were reported. Osteosynthesis was indicated for treatment.

Surgical technique

The surgical strategy was to repair the articular surface and medial condylar wall fragments. We fixed them with a buttress plate from the medial site because of the comminuted intra-articular fracture and depressed articular surface. Since the medial femoral condyle fragments were small, it was difficult to insert screws from a T-shaped buttress plate. In addition, the plate did not match the shape of the
medial condyle, resulting in an inaccurate buttress effect. Therefore, we selected a 2.4 mm/2.7 mm low-profile mesh plate (DePuy Synthes, West Chester, Pa, USA) and a 4.0-mm cannulated cancellous screw (CCS) for the procedure. A midvastus approach was used, and the fragments were reduced easily. When the bone fragment was reduced, the remaining bone defect was small and irregular in shape; hence, we did not perform a bone graft and temporarily fixed it using Kirschner wires (Figure 3). We cut the low-profile mesh plate, contoured it to fit around the femoral medial condyle, and laid it over the fracture site. After contouring, the plate was fitted with the curvature of the medial femoral condyle to decrease impingement. The final size of the plate contained 3 rows each, with 5 variable angle locking holes to avoid damaging the soft tissue, including the medial collateral ligament (MCL). Two locking screws were inserted in the proximal row and 5 in the distal row. The proximal row of locking screws was placed into the distal femur, and the distal row of locking screws was placed through the comminuted fragments. We inserted a 4.0-mm CCS through a comminuted fragment from outside the plate to gain further stability (Figure 4). Postoperative CT showed that none of the screws penetrated the knee joint. A Super FIXSORB screw (Teijin Medical Technologies, Osaka, Japan) was used to join the bone fragment at the anterior cruciate ligament attachment.

Postoperative management
Range-of-motion training was started postoperatively. Partial weight-bearing was allowed at 4 weeks postoperatively and full weight-bearing at 6 weeks. The patient returned to deskwork 3 months postoperatively. Bone union was achieved at postoperative week 12 (Figure 5). The final follow-up was performed at 1 year and 4 months postoperatively. At follow-up, the patient’s Oxford knee score was 47 points, and the Western Ontario and McMaster Universities Arthritis Index results were 2 points for pain and 5 points for physical function. Her visual analog scale score (providing a range of scores from 0 to 100) was 0 at rest and 9 during movement. Her knee extension angle was 0°, and her flexion angle was 140°. Finally, she reported a few complications, including irritation during walking and movement. The patient provided informed consent for the publication of this report and associated images.

Discussion
We used a mesh plate for medial femoral condylar comminuted fractures with good functional outcomes. Initially, we considered the possibility of using an absorbable pin or headless screw to fix the fracture. However, the medial wall fragments were small and comminuted, so we decided to use plate fixation, which is more reliable in maintaining the articular surface in the correct position. It was also determined that reconstruction of the medial wall would be difficult with mosaicplasty or microfracture techniques. Therefore, we believe that the mesh plate can be an alternative option for medial femoral condylar fractures. Since there are no anatomical plates specifically designed for the femoral medial condyle, plates intended for other sites must be used when plate fixation is required. In recent years, using mesh plates has become more widespread. There have been several reports of their use in various areas, including the talus, patella, scapula, greater tuberosity of the humerus, and manubrium sterni.

A mesh plate has several advantages. First, the mesh plate is 3-dimensional and has many angle locking screw holes, allowing for more screw insertion options. This can help preserve the vascular system necessary for bone healing by minimizing damage to the peristeum. Additionally, the mesh plate can be bent and cut to fit a variety of bone shapes. In the present case, the curvature of the other plates did not match the surface of the femoral medial condyle. However, we were able to bend the mesh plate, thereby minimizing the damage to the MCL attachment site, and inserted the locking screws in the most appropriate direction.

On the other hand, the disadvantages the mesh plate should also be considered. First, the mesh plate is thin and rigid; therefore, it loads is less resistant to strong, as evidenced by the reported uses. For example, mesh plates have not been used for upper or lower extremity fractures where mechanical strength is required. A plate extension to the shaft may be a good option for better resistance to the axial load in the case of a comminuted fracture with a large wall fragment. Therefore, mesh plates alone should not be used in treating fractures where mechanical strength is required, and postoperative rehabilitation should be performed carefully. Another disadvantage of mesh plates is that they are more invasive than arthroscopic surgery. Especially in cases of complicated soft tissue injuries, arthroscopic surgery such as microfracture techniques may be an option. In our case, a mesh plate was used because there was no severe soft tissue injury.

This is the first report on using a mesh plate in a case of medial femoral condyle osteochondral fracture with medial condyle wall fragments. Our treatment was very successful. Mesh plates have many advantages and can potentially be applied in treating various fractures sites if their disadvantages are properly considered.

Conclusion
Our treatment of a medial femoral condyle osteochondral fracture with a mesh plate was successful. However, this technique should be applied to well-selected patients. In the future, biomechanical studies

HIGHLIGHTS
- Distal femoral medial condylar fractures are rare and without an anatomical plate for treatment.
- This case report describes a patient with femoral medial condylar fracture who was treated with a low-profile mesh plate, which allowed for more screw insertion options and was easy to manipulate, providing versatility.
- The patient had a good recovery with almost full range of motion, and the results indicate that this plate may become an important implant option in treating distal femoral medial condylar fractures.
Figure 2. a-f. (a-c) Preoperative 3D-dimensional computed tomography scan showing medial femoral condylar fracture and anterior cruciate ligament avulsion fracture. (d) Coronal view of computed tomography scan showing tibial eminence avulsion fracture. (e-f) Axial view of computed tomography scan showing comminuted medial femoral condylar fracture. Medial femoral condylar wall fragment was also comminuted.

Figure 3. a, b. (a) An intraoperative photograph. (b) Fragments are reduced and fixed temporarily by Kirschner wire.

Figure 4. a, b. (a) The mesh plate was cut and bent to follow the medial condyle curvature. (b) A cannulated cancellous screw was inserted beside the mesh plate.
and comparative clinical studies of mesh plates are warranted to establish an optimal treatment method.

Informed Consent: Informed consent was obtained from the patient.

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