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CASE REPORT

Osteosynthesis of a Periprosthetic Patella Fracture With a Locked Mesh Plate

Matthew Siljander, Sapan Gandhi, Denise M Koueiter, Patrick J Wiater

Matthew Siljander, Sapan Gandhi, Denise M Koueiter, Patrick J Wiater, Beaumont Health System, Department of Orthopaedic Surgery, 3535 W 13. Mile Road, Suite 744, Royal Oak, MI 48073, the United States

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Correspondence to: Patrick J Wiater, MD, Beaumont Health System, Department of Orthopaedic Surgery, 3535 W 13. Mile Road, Suite 744, Royal Oak, MI 48073, the United States.
Email: pwiater@mac.com
Telephone: +1-248-551-3140
Fax: +1-248-551-9520

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ABSTRACT

Periprosthetic patellar fractures continue to be associated with poor functional outcomes and low rates of bony union. We present a patient with a periprosthetic patellar fracture treated with a novel mesh locking plate technique. In this technique, Kirshner wires were used to help reduce the patellar fracture and an interfragmentary compression screw was placed. The fracture was then neutralized with a locked mesh plate compressed anteriorly onto the patella with cortical screws. By two months follow-up, the patient had return to preoperative knee range of motion, mild knee pain, and a Knee Outcome Score – Activities of Daily Living Scale of 88.6.

Key words: Periprosthetic; Patella fracture; Osteosynthesis; Mesh plate

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INTRODUCTION

Patellar fractures are the second most common periprosthetic fracture following total knee arthroplasty[1], with prevalence ranging from 0.2% - 21% in resurfaced patellae and 0.5% in unresurfaced patellae[2]. Most patellar fractures occur within one to two years following arthroplasty[3]. Treatment options are based on characteristics of the fracture and include non-operative management or operative treatment with open reduction internal fixation (ORIF), partial or total patellectomy, or component excision[4]. Case studies have reported the use of Steinmann pins[5] or sutures[6] for open fixation of patella fractures.

The most commonly used classification for periprosthetic patellar fractures was described by Ortiguera and Berry and takes into account both the stability of the patellar implant and extensor mechanism function[4]. Patellar fractures with stable implants and intact extensor mechanisms can be treated nonoperatively, and are associated with good outcomes[3]. Conversely, patellar fractures requiring surgical intervention are associated with a high complication rate with ORIF failure as high as 92%[3]. To our knowledge, there have been no reports in the literature of ORIF with mesh locked plating for periprosthetic patellar fractures.

CASE REPORT

A 65 year old female presented to the orthopaedic clinic after a mechanical fall and subsequent right knee pain. The patient has a BMI of 39.5 and a complex medical history including chronic obstructive pulmonary disease, hypothyroidism, multiple sclerosis, bipolar disorder, depression and anxiety disorder. She had undergone

a primary total knee arthroplasty (TKA) of her right knee 13 months prior at age 64. The patient also has a surgical history of left TKA, at age 61, with subsequent displaced left periprosthetic patellar fracture at age 62. The left periprosthetic patella fracture was operatively treated by another surgeon. During that procedure, the patellar button was found to be intact and the fracture was treated with partial patellectomy of the superior pole.

Before presentation for right knee pain, the patient had been ambulating with a walker with low level functional status at baseline. Radiographic evaluation demonstrated a minimally displaced transverse, proximal third patella fracture (Figure 1 A,B). On physical exam the extensor mechanism was intact. The patient was placed in a knee immobilizer and allowed full weight bearing. The patient returned to the office one month later and it was found that the patellar fracture had displaced greater than 10 mm (Figure 1 C,D). The patient now had increased pain and on physical exam the extensor mechanism was no longer intact. At this time the patient was scheduled for ORIF of her periprosthetic patellar fracture.

At the time of surgery, the patient was placed in the supine position. A small bump was placed under the ipsilateral hip to orient the patella superiorly. An anterior longitudinal midline approach was made extending from proximal to the superior pole of the patella to the distal extent of the tibial tubercle, utilizing the previous incision. The proximal, transverse fracture was irrigated and debrided. The patellar button was found to be well fixed. Only a small section of periosteum adjacent to the fracture line was elevated and the ends of the fracture were debrided to bleeding bone. Two partially threaded Kirschner wires were placed on the proximal and distal aspect of the primary fracture line and used as joy sticks for reduction of the fracture. The fracture was reduced and an interfragmentary compression screw was then placed from distal to proximal.

A Synthes (West Chester, PA, USA) 2.7 mm mesh locking plate was cut and bent to the contours of the patella (Figure 2A). The plate was positioned anteriorly on the patella using fluoroscopic guidance. The plate was compressed onto the patella with cortical screws until the periosteum invaginated through the patent spaces of the plate. Multiple unicortical 2.7 mm locking screws were placed after drilling to subchondral bone, measuring to avoid intra-articular penetration. The articular surface was then directly palpated through the capsular rent to confirm no screw penetration into the joint. Lastly, the pole of the quadriceps was neutralized using FiberWire® (Arthrex, Naples, FL, USA) tied to the mid-portion of the plate (Figure 2B). The fracture was stable through 90 degrees of flexion.

Postoperatively, the patient was mobilized weight bearing as tolerated in a hinged knee brace locked in extension. After 2 weeks, progressive unrestricted range of motion exercises were started under the supervision of a physical therapist. The knee brace was continued for use during the early ambulation period but then became optional. Beginning at 5 weeks postoperatively, the patient began to wean off of the knee immobilizer, and at two month follow-up the patient was no longer using it. At two months, radiographs demonstrated stability of the construct with no increase in fracture gapping (Figure 3). Patient-reported outcome scores were obtained at one and two month postoperative visits. The patient's SF-36 physical component score increased from 17.4 to 22.7 and her SF-36 mental component score decreased from 52.8 to 41.2. Her Knee Outcome Score- Activities of Daily Living Scale (KOS-ADLS) increased from 68.6 to 88.6. By two months postoperatively, her right knee range of motion was from 0 degrees to 115 degrees, which was within 2 degrees of her contralateral side. She rated her right knee as 100 percent as compared with her pre-injury functional status, and subjectively felt like her right knee was again her "strong" knee.

Figure 1 Radiographs at initial presentation for right knee pain following a mechanical fall demonstrated a nondisplaced transverse, proximal third patella fracture (A, B). One month later it was found that the patella fracture had displaced greater than 10 mm (C, D).

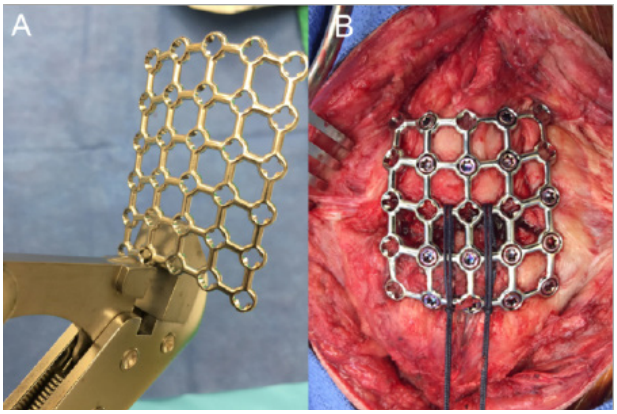

Figure 2 A 2.7 mm mesh locking plate was cut and bent to match the shape and the contours of the patella (A) and placed anteriorly (B). The pole of the quadriceps was neutralized on a short cephalad segment using suture tied to the mid-portion of the plate (B).

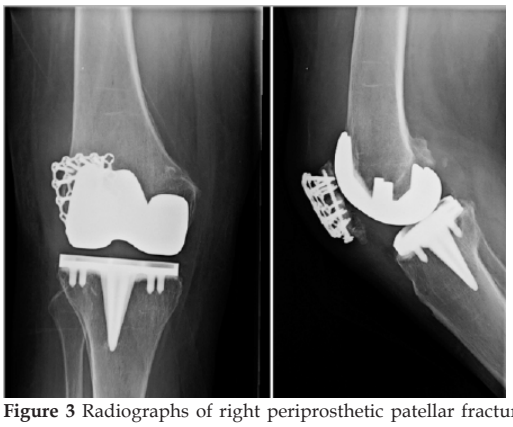

Figure 3 Radiographs of right periprosthetic patellar fracture fixation at two months follow-up.

DISCUSSION

Management of periprosthetic patellar fractures has been associated with poor outcomes and low rates of bony union[3,4,7]. Various operative techniques have been described including ORIF with tension banding, partial or total patellectomy, and a nest technique with Steinman pins[4-6]. Achieving osseous union remains a significant challenge in the management of periprosthetic patellar fractures[4].

The mesh locked plating is a suitable technique for patellar fracture fixation for several reasons. The plate is low-profile and has an open mesh design, allowing for soft tissue herniation through the plate, further decreasing the prominence of the plate. The open spaces in the plate also allow the anterior soft tissue flaps to heal directly to the periosteum potentially minimizing wound problems. Additionally, the plate has many points of fixation useful particularly in comminuted fractures and periprosthetic fractures with limited bone stock. This specific plate was chosen because of the ability to span the surface of the patella and serve as a cerclage type implant, to avoid the need for a partial patellectomy even in fractures with a comminuted inferior pole.

We have had success at our institution treating native patellar fractures with mesh locking plates, with functional outcomes higher than those previously reported in literature for tension banding or partial patellectomy. At two months, this patient already had a KOS-ADLS above the mean value, of 81, of our native patellar fracture cohort of 12 patients obtained at an average follow up of 16 months. This patient's SF-36 scores, however, were markedly lower than those in the native patellar fracture cohort, likely affected by the patient's significant comorbidities including multiple sclerosis.

While plate fixation of patella fractures has not been described for periprosthetic patella fractures, recent case series of native patella fractures treated with plate fixation have been published[8-11]. Taylor et al in 2014 reported on 8 patients treated with anterior patellar plating, with union achieved in all patients and no reoperations for hardware complications[8]. Lorich et al reported on 9 patients treated with patellar mesh plating with mean KOS-ADLS score of 84, no cases of non-union and only one reoperation for symptomatic hardware[9]. Singer et al in 2017 reported on 9 patients treated with mesh plating with no cases of non-union or reoperation[10]. The only published study comparing patellar plating to tension band fixation found plating was associated with statistically higher KOS-ADLS scores and significantly lower incidence of anterior knee pain[11].

Biomechanical studies have also shown plating has superior fixation as compared with tension banding with decreased fracture gapping[12-14]. This likely presents clinically as failure of fixation. Smith et al found 22% of patella fractures treated with tension band wiring displaced greater than 2 mm, in a series of 49 patella fractures[15]. In this case, we have described a novel technique of mesh locked plating for fixation of a periprosthetic patellar fracture. This type of fixation has been shown to be effective for native patellar fractures, but can also be applied to periprosthetic patellar fractures.

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