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Technical Note

Management of displaced inferior patellar pole fractures with modified tension band technique combined with cable cerclage using Cable Grip System

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ABSTRACT

Introduction: We present a modified tension band technique combined with cable cerclage using Cable Grip System for the treatment of displaced inferior patellar pole fractures and report the knee functional outcome.

Patients and methods: The patients who had had operative treatment of a displaced inferior patellar pole fracture (AO/OTA 34-A1) between December 2013 and December 2015 were studied retrospectively. Eleven consecutive patients had had open reduction and internal fixation with the modified technique using Cable Grip System, of whom, five males and six females with an average age of 60.9 years (range, 29–81 years). All fractures occurred from direct fall onto the knee. The average time from injury to surgery was 6.1 days (range, 2–12 days). The range of motion (ROM) was measured in degrees by goniometry at postoperative intervals of 1, 2, 4, 12, and 48 weeks; Knee function was evaluated using the Rasmussen scores at final follow-up.

Results: No patients had nonunion, loss of reduction, migration of wire, irritation from the implant and fixation breakage during the follow-up period. Recovery of ROM was achieved at 12 weeks, with the average ROM at 1 week was 72° (range, 65°–78°), 86.4° (range, 78°–92°) at 2 weeks, 115.5° (range, 103°–122°) at 4 weeks, 129.6° (range, 122°–133°) at 12 weeks, 134.5° (range, 129°–139°) at 48 weeks after the operation. Concerning the knee function outcome assessment, all patients showed excellent results at final follow-up. The average Rasmussen scores was 27.9 out of 30 (range, 27–29).

Conclusions: The modified tension band technique combined with cable cerclage using Cable Grip System for displaced inferior patellar pole fractures can provide stable fixation with excellent results in knee function, allows for immediate mobilization and early weight-bearing, which is a simple and valuable technique in routine clinical practice.

Introduction

Inferior pole fractures of the patella account for approximately 5% of all the patellar fractures [1]. Because of the trauma mechanism, the inferior pole fractures of the patella are often comminuted and are associated with complete disruption of the extensor mechanism [2].The surgical goal of reconstruction of patellar fractures is to reestablish the extensor mechanism while simultaneously restoring articular congruency. There are several fixations for displaced inferior patellar pole fractures, including sutures and tension band wiring [3], separate vertical wiring [1] or augmented with Krachow sutures [4], wiring through screws [5], and the basket plate [6–8].

However, among the various surgical techniques, modified tension band wiring is still the most commonly used. The conventional method does not usually provide sufficient stability if the fracture is comminuted and may be associate with possible loss of reduction and soft tissue irritation due to breakage of wire and migration of Kirschner wire (K-wire) [9–13]. In addition, the inherent weakness of the bone and the size of the fragments prevent firm stabilization by ordinary wiring or screws. As titanium cables provide better fatigue resistance to functional loads applied to the knee post-operatively, compared to

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conventional wires, several authors have reported using the Zimmer Cable-Ready Cable Pin System, a combination of the interfragmentary screws and titanium cable for transverse patella fractures [12,13]. But 4.0 mm screws are not suitable for comminuted fractures.

We have developed a modified tension band technique using the Zimmer Cable Grip System (Zimmer, Warsaw, Indiana, US) combined with Ti-6Al-4V alloy cable (Tivanium®, Zimmer, Warsaw, Indiana, US) cerclage of the restored patella for the treatment of displaced inferior patellar pole fractures (Fig. 1). The aim of our study was to evaluate whether this simple procedure can provide a firm fixation to allow early functional exercise and get satisfactory results.

Patients and methods

The study was approved by the Institutional Ethics Committee in the hospital. We retrospectively identified consecutive patients with displaced inferior patellar pole fractures (AO/OTA 34-A1) (Fig. 2A and B) operated with the modified technique using Cable Grip System between December 2013 and December 2015. All operations were performed by the orthopaedic surgeons with the same qualification and experience.

There were 13 patients treated with the present technique. Among them, two patients were excluded because of multiple fractures from motor vehicle accidents. There were five males and six females with an average age of 60.9 years (range, 29–81 years). Four left sides, seven right sides. All fractures occurred from direct fall onto the knee. The average time from injury to surgery was 6.1 days (range, 2-12 days).

Surgical techniques

After anesthesia, the patient was placed in a supine position, a cushion was used under the ipsilateral hip to avoid external rotation of the leg, injured knee flexion of 30–40° was achieved by a cushion below. A pneumatic tourniquet was routinely applied.

A parapatellar approach was performed from 1 cm proximal to the patella up to the insertion of the patellar tendon. The fracture fragments were reduced with several bone reduction forceps. The reduction was checked radiologically by fluoroscopy and digital palpation.

Two 2.0 mm K-wires were drilled in the axial direction from the distal to the proximal pole through two small 5 mm longitudinal incisions paralleled in the patellar tendon extending proximally to the distal edge of the patella and passing through the quadriceps tendon. Once the reduction was confirmed by anteroposterior and lateral view fluoroscopy (Fig. 3A and B), two longitudinal incisions were made exactly beneath the two K-wires in the quadriceps tendon, extending distally to the proximal edge of the patella. One titanium cable (Tivanium® Ti-6Al-4V alloy titanium, 1.3 mm Diameter Cable, 889 mm Length) was passed adjacent to and behind the K-wires, the quadriceps, and patellar tendons. The cable was subsequently crossed over the front of the patella forming a figure 8 (Fig. 4). A tensioner crimper was used temporarily to stabilize the fragments, and the tension was increased to 60 N and locked when the quality of the reduction was confirmed by fluoroscopy.

A second titanium cable was inserted deeply and closely to the contours of the patella (Fig. 4), ending up in confirmation of a satisfactory reduction obtained by fluoroscopy (Fig. 3C and D) and palpating manually. After tightening the cerclage cable to 60 N by the tensioner crimper, the proximal pins of the two K-wires were bent 180°, shortened, turned towards and driven to the proximal edge of the patella through the incisions in the quadriceps tendons. The distal K-wires were cut 5–10 mm outside of the patella. The reduction and fixation were then one more time checked by fluoroscopy (Fig. 3E and F) before closure of wound. And a test of range of motion (ROM) was conducted immediately to assess the stability of the fixation, and it was assured that the passive flexion of the knee could be reached 120°.

A standard wound closure was performed in layers with use of #2 Vicryl® for the subcutaneous tissue and a subcuticular stitch for the skin.

Postoperative rehabilitation

No immobilization was necessary after the operation. Functional exercises were initiated 24 h after the surgery, including active circum-movements of ankle and contraction of quadriceps femoris. Active knee flexion and partially weight bearing as tolerated were permitted on the third postoperative day, without limitations for knee flexion or extension, and full weight-bearing without limitation was encouraged at 6–8 weeks after the surgery

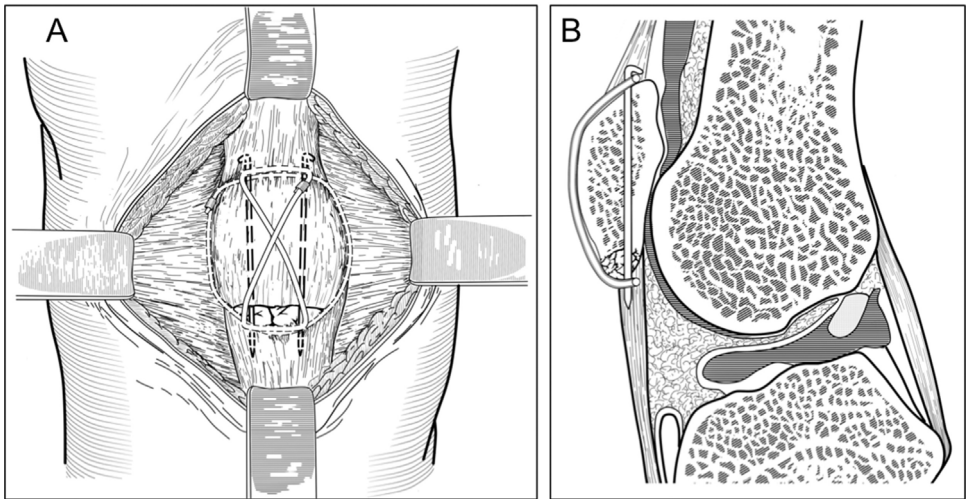

Fig. 1. Diagrams show that the displaced inferior patellar pole fracture was reduced and fixed by the modified tension band combined with cable cerclage using Cable Grip System. (A) anteroposterior and (B) lateral showing insertion of the cable through the quadriceps and patellar tendons, passing perpendicularly beneath the K-wires, below the quadriceps and patellar tendons, and attaching closely to the proximal contour of the patella.