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Patellar Fractures: An Innovative Surgical Technique With Transosseous Suture to Avoid Implant Removal

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Abstract

Purpose. To describe a new surgical procedure and its outcomes: osteosynthesis with high-resistance sutures, avoiding metallic implants. Open sky osteosynthesis with Kirschner and cerclage wiring is the current gold standard for patella fractures. Favorable functional outcomes have been observed, although implant removal is required in many cases due to the prominent wires under the skin. New implants have been sought after to minimize the need for second surgeries. Methods. Eight patients, aged between 25 and 61 years, with a minimum follow-up of 24 months, were included in the present study. The surgical procedure consists of open reduction followed by internal fixation performing 3 longitudinal tunnels crossing double high-resistance sutures within these tunnels and suturing among them. Next, an anterior cerclage with parenchymal suture was performed. Results. During follow-up, no secondary fracture displacement was observed. No patient required or requested implant removal. Functional outcomes were equitable to other surgical techniques. Conclusion. Despite the relatively small number of patients, osteosynthesis with high-resistance suture presents as an acceptable alternative within patella fracture treatment, being safe and with similar functional outcomes when compared with other techniques. Furthermore, no second surgeries for implant removal were required during the present study.

Keywords

patellar fracture, high-resistance suture, osteosynthesis, implant removal, patellar cerclage

Introduction

Patella fractures are a type of injury, presenting a 0.5% to 1.5% incidence of all bone fractures.¹ ² A transverse fracture is the most common type of patella fracture, which often causes functional disability of the knee extensor apparatus with displacement of the fractured fragments.³ Surgical treatment is recommended when fragment displacement is ≥2 to 3 mm or when there is joint incongruence.⁴ In minor displacements, conservative treatment is an option with restriction mobilizers until the fracture’s consolidation.

Treatment of choice for several years has been open sky osteosynthesis with Kirschner wires (K-wires) and cerclage wiring, obtaining good functional outcomes. However, a significant number of side effects occur, mainly due to the discomfort that the implant may cause, which in most cases ends in a second surgery in order to remove such implants, reaching 40% of cases.⁵ This approach is associated with delayed wound healing, post-operative adhesions, knee stiffness, and prolonged work disability.⁶ ⁷ Additionally, symptoms and complications related to use of K-wires are common, including wire breakage and migration, with subsequent painful and prominent hardware in the knee, occasional loss of reduction, migration of fracture fragments, and soft tissue irritation.⁸ ¹²

During the past years, a change within stabilization technique of these fractures has been pursued in order to decrease the discomfort. To this end, cannulated screws substituted K-wires obtaining good, or even better, functional outcomes than the tension band.¹³ ¹⁶ Second, an attempt to substitute cerclage wiring with other implants

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has been made, without invalidating the figure-of-eight tension band wire. In this sense, high-resistance sutures have shown to be an excellent alternative, already in use by other authors, associated both to K-wires or cannulated screws.\textsuperscript{17-19}

The use of high-resistance sutures has shown very good outcomes in previous studies, used alone\textsuperscript{20-22} or combined with other types of fixation.\textsuperscript{9,17-19,23} Even the use of plates has been shown to be useful in patellar fractures.\textsuperscript{24}

The aim of the present study was to elucidate if stabilization with high-resistance sutures can be an alternative and safe method within treatment of patella fractures.

**Material and Methods**

The present study is a retrospective, single-center case series study. Eight patients were included, 7 females and 1 male, all amateur athletes (with Tegner score average of 6 [4-7]). The same orthopedic surgeon performed all surgeries, between January 2010 and January 2012.

Inclusion criteria were patients aged 18 or older and having been diagnosed with complete transverse patellar fracture (AO classification 34-C). Exclusion criteria were longitudinal patellar fractures, patients who had withdrawn from follow-up within the 24-month period, and patients with associated injuries (ie, cruciate ligaments or meniscus).

Five out of 8 fractures were comminuted fractures (AO 34-C3), whereas the remaining 3 were transverse fractures (AO 34-C1). Only one patient presented with open fracture. All surgeries were performed within 48 hours from the injury, except for the open fracture, which was operated on 1 week later.

**Surgical Procedure**

The patient is placed in supine position on a radiolucent table. A longitudinal midline incision is performed, identifying the fracture focus and washing it. Open reduction is controlled under fluoroscopy. Three longitudinal tunnels are made with a 2.5-mm drill bit (Figure 1). The synthesis implant used in all cases was Ultrabraid 2 mm, a nonabsorbable, braided polyethylene suture (Smith & Nephew, Andover, MA). A double high-resistance thread is crossed through each tunnel, performing a suture that unifies the 3 tunnels (Figure 2). No tension mechanism was required. Reduction and stabilization is checked under fluoroscopy. To complete, the osteosynthesis is reinforced with figure-of-eight cerclage through quadriceps tendon and patellar ligament with parenchymal closure meshed with polyglycolic acid, braided and absorbable (Safil 3 mm; Braun, Tuttlingen, Germany), as displayed in Figure 3. A brief case of the preoperative and postoperative X-rays as well as intraoperative picture is shown in Figure 4.

Regarding the aftercare, a cast mobilization is placed for a mean of 2.5 weeks (1-4 weeks), performing isometric exercises from day 1 postoperative, as well as full
weight bearing using crutches. A rehabilitation program is followed after the removal of immobilization, with active exercises of the extensor apparatus as well as passive movements in order to regain joint balance according to pain tolerance, this being the only limitation. Bracing or CPM (continuous passive motion) was not necessary in the current study. No differences in mobility restrictions were made with respect to wired osteosynthesis.

All patients included in the present study were informed that data concerning their case would be used for publishing, and the patients agreed to this. Oral and written informed consent was obtained from all of the patients.

Results

Eight patients were included in the present study with a mean age of 44 years (25-61).

Mechanism of fracture was falling during daily life activities in 6/8 patients and during sports activities in the remaining 2/8. None of the cases had a history of road traffic accident. An anatomical fracture reduction was observed in all cases with fluoroscopy during and after surgery, with no joint step-offs or gap. The osteosynthesis material is X-ray transparent. During follow-up, only 1 patient presented loss of reduction, and bone cutting by the suture was not observed. Fracture consolidation was observed at a mean period of 6.2 weeks (ranging between 4 and 8 weeks).

No patient experienced any kind of pain secondary to the implant, making implant removal unnecessary in all cases.

Within the patients included in the present study, no infection of the surgical site was observed.

From the initial 8 patients who underwent surgery, 1 patient was lost to follow-up at 3 months. The 7 patients who completed the follow-up period have completely regained their pre-injury physical activity.

Regarding the side effects observed in the present series, 1 patient presented 6 weeks postoperative to the emergency room due to an accidental fall, causing fracture mobilization and a consequent articular step-off of 2 mm. However, articular step-off had no clinical impact and did not require a new surgery. The patient was performing unlimited physical exercise 9 months postoperative.

Regarding the patient lost to follow-up, he presented painful flexion limitation and articular balance with maximum extension at 0° and flexion at 80°, at the 3-month follow-up visit, and subsequently failed to present at all remaining follow-ups from then on.

A third patient presented patellar tendinosis due to excessive weight while performing quadriceps exercises. The tendinosis was corrected with a modification of the exercise program (eccentric exercises and less weight), allowing the patient to return to normal life and physical activity.

Discussion

The present study shows that treatment of patellar fractures with high-resistance sutures is a safe and valid alternative to the more common surgical procedures such as K-wires or screws.

Kumar et al5 analyzed the magnitude of the problem that implant intolerance implies, as well as the need for implant removal in a second surgery. Within a sample size of 63 cases, the authors observed that one third required implant removal for implant-related symptoms, increasing the percentage up to 40% in the group younger than 60 years. The timing of implant removal was a mean of 11 months (range 3-20). Conclusions as in Kumar’s study show the necessity of developing new treatment strategies within patellar fractures in order to avoid implant-related complications and second surgeries. No case of revision surgery due to implant failure was observed in the present series.

A common question that arises is regarding the effectiveness of high-resistance sutures, questioning whether high-resistance sutures are as hardwearing as the wiring. Wright et al23 performed a biomechanical study in order to answer the cited question. The authors compared the strength and stiffness of a double-strand with FiberWire...
(Arthrex Inc, Naples, FL), single-strand FiberWire, and a single stainless 1.8-mm steel wire. FiberWire is a braided polyblend suture, and the authors concluded that FiberWire was more resistant than steel, both single- or double-strand, and an in vivo study was justified and would likely result in greater patient satisfaction and decreased reoperation rates. Wright et al only analyzed transverse fracture, although their results could probably be extrapolated to comminuted fractures. In fact, during the present study, no displacement secondary to implant tear was observed. Within the present series, we have used a similar material to that of Wright’s, obtaining excellent outcomes without material failure.

Other study groups\(^{17,19}\) found it convenient to associate high-resistance sutures to K-wire or cannulated screws, replacing the classical wire. They reported good functional outcomes; however, a high index of implant removals was still observed. No case of implant removal was observed in the present series.

Gosal et al\(^9\) conducted a study comparing 2 fixation systems, one metallic and the other nonmetallic, showing higher infection rates in the metallic group and less morbidity in the nonmetallic group and recommended the use of nonmetallic material. More recently, Mao et al\(^{22}\) obtained better results (due to lower number of problems) with a nonmetallic material.

Meanwhile, Heusinkveld et al\(^{25}\) performed a comparative study of different systems of both metallic and nonmetallic fixation, obtaining similar results between systems.

Based on the aforementioned, our aim was to go further, convinced that the sole use of high-resistance sutures to repair patellar fractures would achieve a sufficient stable osteosynthesis and thus allow good functionality, without affecting rehabilitation programs. Furthermore, our hypothesis was that this implant would not present discomfort and second surgeries for implant removal could be avoided. Regarding the type of fractures, we considered to dismiss longitudinal fractures given that it could be a high risk to perform the longitudinal tunnels following the same direction than the fracture lines.

Some limitations of our study must be considered when reviewing the present work. Ours is a single-center study with a relatively small sample of patients. However, minor complications have been observed (tendinosis, new traumatism) and these were conservatively treated and unrelated to the type of osteosynthesis performed. No patient described discomfort secondary to implant that would require specific treatment. Regarding the patient with tendinosis, we do not believe that the tendinosis has any relationship with the new technique, rather than with the physical therapy following surgery, as symptoms were solved by adding eccentric exercises to physical therapy.

Second, no control group was used in the present study, as all surgical patellar fractures have been treated with this technique since January 2010.

Another aspect would be to evaluate the importance of the placement or orientation of tunnels and the type of suture. Further studies should be performed to elucidate which of these aspects play a more important role.
Finally, further randomized and controlled studies should be performed to draw clearer conclusions.

Conclusion
In conclusion, given the above results, osteosynthesis with high-resistance suture cerclage is a potential alternative treatment of patellar fractures. The technique can be defined as feasible as it offers advantages over other techniques that require implant removal, although further experience needs to be studied to fully define its role.

Author Contributions
Study concept and design: Xavier Cuscó, Ramón Cugat
Acquisition of data: Oscar Buezo, Roberto Seijas, Pedro Álvarez-Díaz
Analysis and interpretation: Oscar Ares, Andrea Sallés
Study supervision: Oscar Ares, Roberto Seijas, Xavier Cuscó

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References