



## Research

# A Novel Technique in Comminuted Patella Fractures: Minimally Invasive Percerclage Osteosynthesis Using Drainage Trocar

Parçalı Patella Kırıklarında Yeni Bir Teknik: Dren Trokarı Kullanılarak Minimal İnvaziv Periserklaj Osteosentez

İ Fırat Fidan<sup>1</sup>, İ Abdülkadir Polat<sup>2</sup>, İ Cengiz Kazdal<sup>3</sup>, İ Emre Bal<sup>4</sup>

<sup>1</sup>İstanbul Aydın University Faculty of Medicine, Department of Orthopedics and Traumatology, İstanbul, Türkiye

<sup>2</sup>University of Health Sciences Türkiye, Gaziosmanpaşa Training and Research Hospital, Clinic of Orthopedics and Traumatology, İstanbul, Türkiye

<sup>3</sup>Recep Tayyip Erdoğan University Faculty of Medicine, Department of Orthopedics and Traumatology, Rize, Türkiye

<sup>4</sup>University of Health Sciences Türkiye, İstanbul Fatih Sultan Mehmet Training and Research Hospital, Clinic of Orthopedics and Traumatology, İstanbul, Türkiye

### ABSTRACT

**Objective:** This study aims to describe a new technique for pericerclage application for comminuted patella fractures and to evaluate the clinical outcomes of patients who underwent this technique.

**Methods:** The clinical outcomes of 9 patients with AO/OTA C2 and C3 fractures and surgically applied percutaneous pericerclage using a drainage trocar were evaluated.

**Results:** Three of the nine patients included in the study were female, and 6 were male. Union was achieved for all patients. The mean Böstman score was 27.8 (24-30). The excellent clinical outcome was achieved in 7 patients.

**Conclusion:** In the surgical treatment of comminuted patella fractures, a drainage trocar can be safely used for percutaneous pericerclage, and satisfactory clinical results with stable fixation can be achieved.

**Keywords:** Patellar fractures, pericerclage, minimally invasive

### ÖZ

**Amaç:** Bu çalışma, parçalı patella kırıklarında periserklaj uygulaması için yeni bir tekniği tanımlamayı ve bu teknik uygulanan hastaların klinik sonuçlarını değerlendirmeyi amaçlamaktadır.

**Gereç ve Yöntem:** AO/OTA C2 ve C3 kırığı olan ve drenaj trokarı ile cerrahi olarak perkütan periserklaj uygulanan 9 hastanın klinik sonuçları değerlendirildi.

**Bulgular:** Çalışmaya dahil edilen dokuz hastanın üçü kadın, 6'sı erkekti. Tüm hastalarda kaynama sağlandı. Ortalama Böstman skoru 27,8 (24-30) idi. Yedi hastada mükemmel klinik sonuç elde edildi.

**Sonuç:** Parçalı patella kırıklarının cerrahi tedavisinde perkütan periserklaj için drenaj trokarı güvenle kullanılabilir ve stabil fiksasyon ile tatmin edici klinik sonuçlar alınabilir.

**Anahtar Kelimeler:** Parçalı patella kırıkları, periserklaj, minimal invaziv

**Address for Correspondence:** Fırat Fidan, İstanbul Aydın University Faculty of Medicine, Department of Orthopedics and Traumatology, İstanbul, Türkiye  
Phone: +90 507 747 99 04 E-mail: dfrirafidan@gmail.com ORCID ID: orcid.org/0000-0003-3490-7340

**Cite as:** Fidan F, Polat A, Kazdal C, Bal E. A Novel Technique in Comminuted Patella Fractures: Minimally Invasive Percerclage Osteosynthesis Using Drainage Trocar. Med J Bakirkoy 2022;18:427-432

**Received:** 23.03.2022  
**Accepted:** 14.11.2022

## INTRODUCTION

Patellar fractures account for approximately 1% of all fractures and commonly occur between 20 and 50 years (1-3). Although both direct and indirect trauma cause patella fractures, they usually occur because of direct trauma to the anterior aspect of the knee (1,4). The importance of patellar fractures is because the patella is an essential component of the extensor mechanism and increases the extensor force of the quadriceps tendon by acting as a lever arm during knee extension (1).

Except for fractures with no displacement and the extensor mechanism is preserved, patellar fractures are usually treated surgically (1). The goal of surgical treatment is to achieve reduction and initiate early motion. Numerous surgical techniques have been described for patella fractures, such as periclerage, osteosynthesis with plates and screws, tension band, and partial patellectomy (1,2). Regardless of the technique used, the soft tissues around the patella also play an essential role in instability (1,5). Repairing these tissues is as essential as the technique used (1). With the knowledge of the importance of soft tissue repair, different techniques for percutaneous fixation of comminuted patellar fractures have been defined (5,6).

This study aims to describe a new technique for periclerage fixation in percutaneous fixation of patellar fractures and to evaluate the clinical results of the cases in which we used this technique.

## METHODS

Patients who were surgically treated for patellar fracture between 2015 and 2018 and who underwent the percutaneous periclerage method were included in the study. Additionally, patient records were reviewed after approval by the Ağrı Institutional Ethics Committee (no: 24, date: 08.12.2020). After the patients had been informed by the physicians about the operations, informed consent forms were given to read and sign.

Nine patients were included in the study. The patients' age, gender, mechanism of injury, and surgical time were obtained from the medical records. Anterior-posterior and lateral radiographs of the injured knee of the patients at the first admission were used, and the fractures were classified according to the AO/OTA classification. Percutaneous periclerage was performed in all patients using the technique described below without a tourniquet, and osteosynthesis was achieved. All patients were allowed to press in full extension with a splint during the postoperative period. The active extension was allowed after six weeks.

Healing of the fracture was assessed by radiographs taken at routine follow-up visits. Additionally, patients were clinically assessed at the last follow-up visit using knee range of motion and the Böstman scoring system (2).

## Surgical Technique

After spinal anesthesia, patients were prepared supine on the radiolucent table. Thirty minutes before the incision, 2-g cephalosporin was administered to all patients. Tourniquet was not applied. After sterile dressing, the hematoma was aspirated from the suprapatellar region using a 50 cc injector. Then closed reduction was applied by extending the knee and using a weber clamp. First, an incision of about 1 cm was made from the superolateral corner of the patella. Next, the drainage trocar was inserted from the superolateral corner (Figure 1). To the superomedial corner inside the quadriceps tendon toward the superior border of the patella with a cerclage wire inserted into the tube (Figure 2) and exited from the superomedial corner. Then the trocar re-entered the superomedial exit point, advanced along the patella's medial border, and removed from the inferomedial corner. Next, the trocar was advanced along the inferior border of the patella through the patellar tendon by the same approach and removed from the inferolateral corner of the patella. Then the same procedure was performed along the lateral edge of the patella (Figure 3), and the trocar was removed from the superolateral corner, the first entry site with the cerclage wire inside the tube (Figure 4). Next, the



**Figure 1.** Application of a cerclage-loaded drain trocar with a mini-incision from the superolateral corner of the patella



**Figure 2.** Percutaneous transfer of the cerclage to the medial side with the help of a drain trocar and tube



**Figure 3.** After the patella is passed from its medial and inferior edge, the cerclage is moved back to the superolateral corner

cerclage was tightened to compress the patella and knot in the superolateral corner (Figure 5). Next, the reduction was checked fluoroscopically (Figure 6a, b). The skin was closed primarily (Figure 7). A demonstration of the pericerclage method with the closed technique is shown (Figure 8).

### Statistical Analysis

Statistical analysis was performed using the IBM SPSS version 23.0 software (IBM Corp., Armonk, NY, USA). Descriptive data are expressed as mean and median (minimum-maximum) for continuous variables and in number and frequency for categorical variables.



**Figure 4.** Moving the cerclage from the superolateral corner to the starting point



**Figure 5.** Knot tying by ensuring the tension of the cerclage wire

## RESULTS

Nine patients (three women, six men) comminuted patellar fractures underwent closed reduction and fixation using the surgical technique we described. The mean age of the patients was 47.4 (29-67) years. The mechanism of injury was direct trauma in all patients. There were no accompanying fractures. All the patients had closed fractures. According to the AO classification, five patients had 34C2 fractures, and four had 34C3 fractures. Surgical treatment was applied to the patients an average of 2.4 days (1-6) after the injury (Figure 9 a-d).

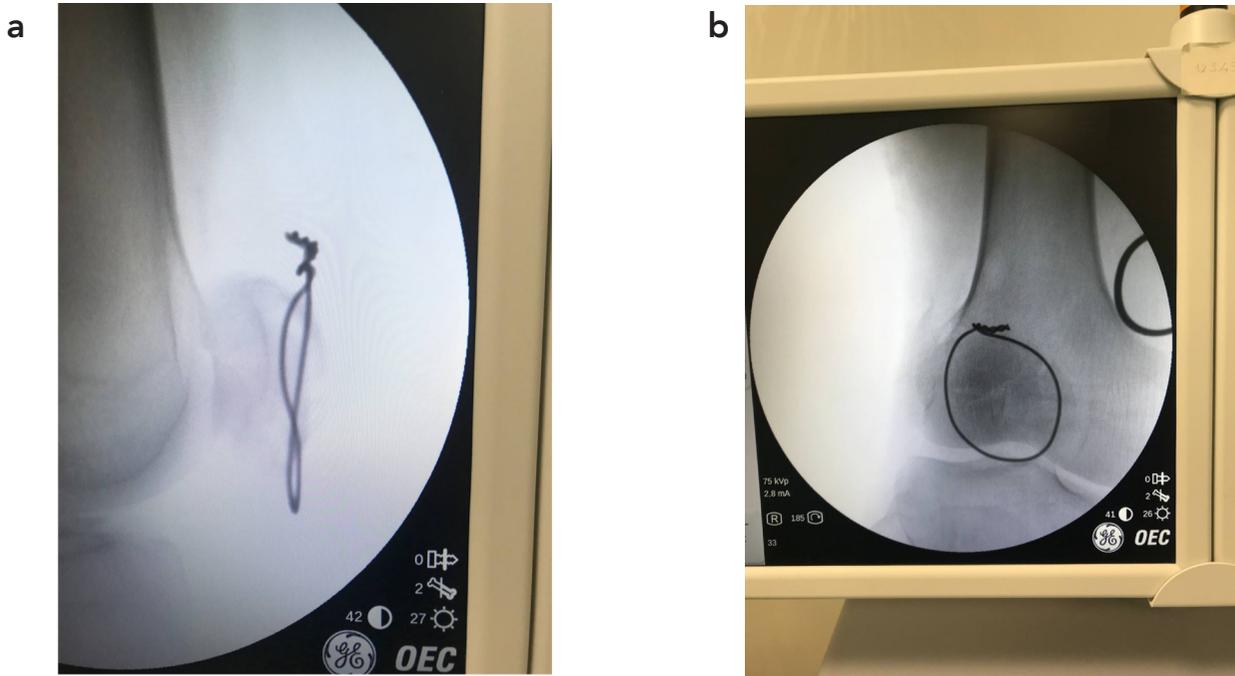


Figure 6. a, b. Fluoroscopic control after the procedure



Figure 7. Primary closure of incisions

The mean operative time was 50 (35-90) minutes. The mean follow-up time was 16 (12-27) months. None of the patients experienced early soft tissue problems or infections. No loss of reduction or implant failure was observed. Union was achieved for all patients. In 2 patients, the implant was removed due to the development of implant irritation. In these two patients, no complications occurred after implant removal.

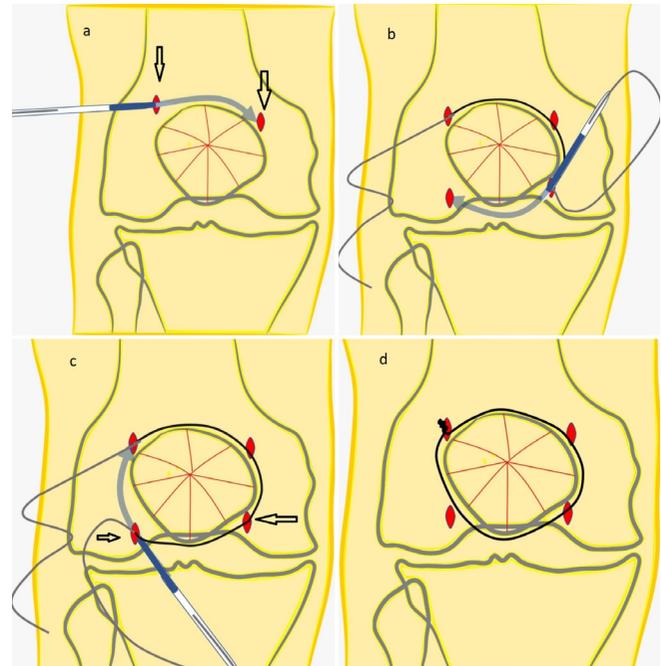
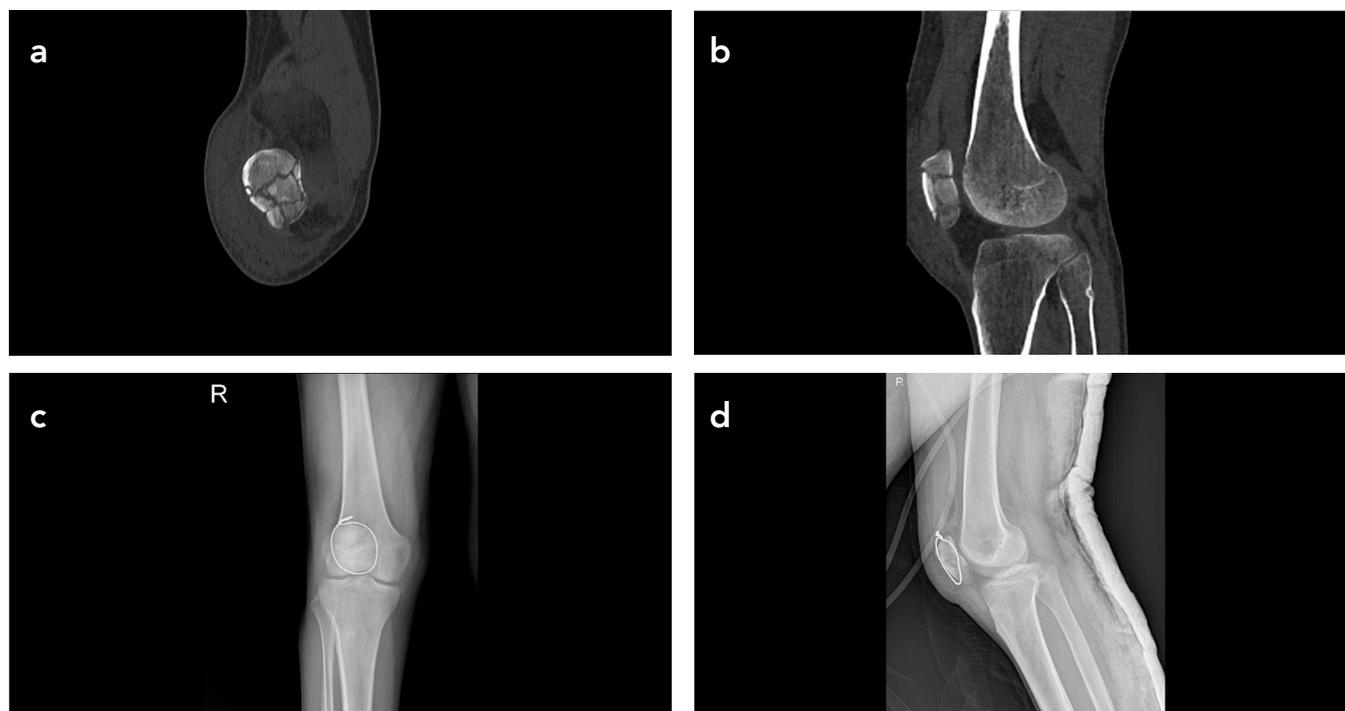


Figure 8. A schematic view of the technique. a. Cerclage-loaded drain trocar is advanced from the first incision in the superolateral corner from the superior edge of the patella to the medial. Arrows show the incision sites. b. Passing the cerclage from the medial side to the inferolateral side, close to the inferior edge of the patella, with the incision made from the inferomedial side. c. Transfer of the cerclage wire to the superolateral with an incision from the inferolateral corner. d. Schematic view after knotting in the superolateral corner

The mean Böstman score was 27.8 (24-30). Excellent results were obtained in 7 patients and good results in 2 patients. According to the Böstman score, two patients with good results were patients who developed implant irritation.



**Figure 9.** a-d. Preoperative and postoperative radiological images of a 47-year-old male patient

## DISCUSSION

The goal of treating patellar fractures is to reduce the patellofemoral joint and maintain continuity of the extensor mechanism (1). Therefore, surgical treatment is recommended except for fractures with minimal displacement and preservation of the extensor mechanism. Many methods have been described for surgical treatment (1,5-11). Inserting a cerclage wire around the fractured patella is a commonly used and effective method (1,5). The cerclage wire can be used in both open and closed techniques (5,6). This technique shows that percutaneous osteosynthesis can be achieved by passing the cerclage wire, drainage trocar, and tube around the patella. All patients achieved the union, and excellent functional results were observed except for two patients.

The patella is a sesamoid bone. Its function is to provide mechanical advantage by prolonging the force generated by the quadriceps muscle and changing the direction of this force via the patellar tendon (12). The most crucial advantage of percutaneous osteosynthesis of patellar fractures is that the joint's range of motion can be more easily preserved in postoperative rehabilitation because the soft tissues around the patella are protected (1,5,6,11). During the extension, in addition to the patellar and quadriceps tendon, the iliotibial band vastus lateralis also contributes to the extension mechanism in the vastus medialis (12). It is also crucial for the extension that the patella moves stably

in the femoral groove. It is also essential to protect the medial patellofemoral ligament, medial patellomeniscal ligament, medial patellotibial ligament responsible for patella stability, vastus lateralis, lateral fibrous tissue, and iliotibial ligament responsible for lateral stability (12). Since soft tissue dissection is not performed, the surrounding soft tissues are protected, and their damage is prevented. According to the result, excellent results were obtained. This technique, which we used with the closed method, helps preserve the range of motion in the postoperative period since no soft tissue dissection is performed.

Although using cerclage alone is unthought to provide adequate stability in patellar fractures (13), circumferential cerclage wire fixation is suitable for treating a comminuted patellar fracture (14). Additionally, it has been reported that it can be used alone in comminuted patellar fractures (15). In our study, there were no stability problems in any patient.

Implant irritation is a common complication after patellar fracture (1). Lazaro et al. (16) reported that 37% of implants had to be removed after symptomatic irritation. In cases where K-wires were used, implant irritation was reported twice more frequently than cannulated screws (17). The implant was removed in 2 cases due to irritation in our series. In 3 cases, implant irritation occurred at the superolateral corner where the knotted cerclage wire. We believe that the superficial incision may have increased the irritation. In 2 cases, the cerclage wire was removed through

two superolateral and inferiomedial incisions. No additional incision was required, and no complications occurred.

The limitations of our study: the small number of cases and the lack of a comparison group.

## CONCLUSION

We think better results can be obtained if more extensive case series are compared with this procedure and other techniques. Additionally, controlling the reduction with only fluoroscopy creates a limitation, and combining the technique with arthroscopy will provide a better reduction opportunity.

## ETHICS

**Ethics Committee Approval:** Additionally, patient records were reviewed after approval by the Ağrı Institutional Ethics Committee (no: 24, date: 08.12.2020).

**Informed Consent:** After the patients had been informed by the physicians about the operations, informed consent forms were given to read and sign.

## Authorship Contributions

Surgical and Medical Practices: F.F., A.P., Concept: F.F., A.P., C.K., E.B., Design: F.F., A.P., C.K., Data Collection or Processing: F.F., A.P., C.K., E.B., Analysis or Interpretation: F.F., A.P., E.B., Literature Search: F.F., A.P., C.K., E.B., Writing: F.F., A.P., C.K., E.B.

**Conflict of Interest:** No conflict of interest was declared by the authors.

**Financial Disclosure:** The authors declared that this study received no financial support.

## REFERENCES

- Schuett DJ, Hake ME, Mauffrey C, Hammerberg EM, Stahel PF, Hak DJ. Current Treatment Strategies for Patella Fractures. *Orthopedics* 2015;38:377-84.
- Boström A. Fracture of the patella. A study of 422 patellar fractures. *Acta Orthop Scand Suppl* 1972;143:1-80.
- Melvin JS, Mehta S. Patellar fractures in adults. *J Am Acad Orthop Surg* 2011;19:198-207.
- Carpenter JE, Kasman R, Matthews LS. Fractures of the patella. *Instr Course Lect* 1994;43:97-108.
- Matsuo T, Watari T, Naito K, Mogami A, Kaneko K, Obayashi O. Percutaneous cerclage wiring for the surgical treatment of displaced patella fractures. *Strategies Trauma Limb Reconstr* 2014;9:19-23.
- Zhai Q, Yang J, Zhuang J, Gao R, Chen M. Percutaneous cerclage wiring for type 34-C patella fracture in geriatric patients. *Injury* 2020;51:1362-6.
- Wardak MI, Siawash AR, Hayda R. Fixation of patella fractures with a minimally invasive tensioned wire method: compressive external fixation. *J Trauma Acute Care Surg* 2012;72:1393-8.
- Lee YM, Chung KJ, Hwang JH, Kim HK, Yoon YH. Results of tension band wiring and additional circumferential wiring in treatment of comminuted patella fracture. *J Korean Fract Soc* 2014;27:206-12.
- Wang F, Luo TD, Chen C, Xie Y, Lin Z, Zeng D, et al. The modified anterior ellipsoidal cap titanium cable tension band for comminuted patellar fractures. *J Orthop Surg (Hong Kong)* 2019;27:2309499019874018.
- Hung LK, Chan KM, Chow YN, Leung PC. Fractured patella: operative treatment using the tension band principle. *Injury* 1985;16:343-7.
- Buckley R, Moran CG, Apivatthakakul T. *AO principles of fracture management*, 3rd ed. Stuttgart: Thieme Publishers; 2018.
- Kaufer H. Mechanical function of the patella. *J Bone Joint Surg Am* 1971;53:1551-60.
- Burvant JG, Thomas KA, Alexander R, Harris MB. Evaluation of methods of internal fixation of transverse patella fractures: a biomechanical study. *J Orthop Trauma* 1994;8:147-53.
- Sun Y, Sheng K, Li Q, Wang D, Zhou D. Management of comminuted patellar fracture fixation using modified cerclage wiring. *J Orthop Surg Res* 2019;14:324.
- Curtis MJ. Internal fixation for fractures of the patella. A comparison of two methods. *J Bone Joint Surg Br* 1990;72:280-2.
- Lazaro LE, Wellman DS, Sauro G, Pardee NC, Berkes MB, Little MT, et al. Outcomes after operative fixation of complete articular patellar fractures: assessment of functional impairment. *J Bone Joint Surg Am* 2013;95:e96 1-8.
- Hoshino CM, Tran W, Tiberi JV, Black MH, Li BH, Gold SM, et al. Complications following tension-band fixation of patellar fractures with cannulated screws compared with Kirschner wires. *J Bone Joint Surg Am* 2013;95:653-9.