

Case Report

A Technical Tip to Treat the Intraoperative Lateral Cortex Fracture during a Medial Open-wedge High Tibial Osteotomy

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Abstract

Instability at the open-wedge osteotomy site due to disruption of the lateral cortex may contribute to displacement and may thus bring about delayed union or nonunion and recurrent varus deformity. Lateral cortex fracture in the medial open-wedge High Tibial Osteotomy (HTO) is an unstable situation, so surgeons can't achieve primary stability on the osteotomy site easily. To our knowledge, despite being a feared complication, there are few reports dealing with the treatment for intraoperative lateral cortex fracture in the literatures. So, we present a case of intraoperative lateral cortex fracture during an open-wedge HTO and a simple technical tip to achieve primary stability. The use of Schanz pin on the tibial shaft is simple, improves the stability during fixation of plate and can be used to prevent the hinge dislocation during open-wedge HTO. But meticulous surgical procedures may help to decrease the incidence of unintentional lateral cortex fracture.

Keywords: Knee; High Tibial Osteotomy; Open Wedge; Lateral Cortex Fracture; Schanz Pin

Introduction

Lateral cortex fracture is a potential technical complication of medial open-wedge High Tibial Osteotomy (HTO). Lateral cortex fracture may lead to instability at the osteotomy site, which may contribute to delayed union, nonunion and recurrent varus deformity [1]. To our knowledge, despite being a feared complication, there have been a limited number of studies addressing solutions to overcome this problem [2]. So, we present a case of intraoperative lateral cortex fracture during an open-wedge HTO and a simple technical tip to treat unintentional lateral cortex fracture.

Case Presentation

A 55-year-old woman presented with knee pain and intermittent effusions. She underwent conservative treatment but the knee pain persisted. After further radiological evaluation, lower extremity scanogram revealed that 6 degrees varus deformity and magnetic resonance imaging revealed that cartilage defect on medial femoral condyle and high signal within the posterior root of the medial meniscus. She was treated by subsequent medial open-wedge HTO internally fixed by plate and locking screws, preceded by a diagnostic arthroscopic evaluation of the knee joint, debridement of stable medial meniscal root tear and microfracture for the chondral lesion at medial femoral condyle. A medial parapatellar incision over the pes anserinus, which was partially detached anteriorly, was carried out. The osteotomy cut should be aimed to a point 3 cm below the joint line and intending to create a 1 cm lateral cortical hinge. The three-chisel technique (an osteotomy performed by inserting an osteotome between two osteotomes) was used to slowly open the site of osteotomy. But, when the chisels were inserted, third chisel was not ended 1 cm from the lateral cortical margin and the lateral cortex breakage was developed. The fracture involved an extension of the osteotomy line and was within the tibiofibular joint and was classified as type I [3]. The hinge dislocation and instability occurred during the osteotomy site was spread. So, plate could be not easily fixed.

The operative techniques were described below (Fig. 1). The plate was applied on the medial side of the tibia. The drill guide was applied on a hole located just proximal to the osteotomy site and the drill bit was inserted. The drill bit was maintained through a hole for temporary fixation and additional locking screws were inserted to the most proximal holes. A self-tapping Schanz pin was inserted from medial to lateral in the tibial shaft and can be used to maintain the calculated correction angle and avoid the hinge dislocation. After ensuring that the appropriate correction angle has been obtained, a standard cortical screw was inserted into the distal segment and further locking screws were inserted through more stab incisions. Finally, C-scans were taken to confirm whether the target alignment of the knee has been achieved. An artificial bone wedge was formed in a triangle pole equivalent to the size of the opening and then inserted into the osteotomy site. Irrigate all wounds copiously and close the skin and subcutaneous tissue in the routine manner after insertion of suction drain. Immediate postoperatively, the knee was locked in extension using an immobilization brace. Anteroposterior radiograph was checked after surgery (Fig. 2). Isometric quadriceps muscle exercises were started immediately and continuous passive movement exercise was started from 14 days after surgery. At 3 weeks after surgery, the patient had achieved nearly full range of knee motion. Patient was allowed to begin partial weight-bearing exercise with crutch 6 weeks after surgery and she could walk with full weight bearing with a cane 8 weeks after HTO. Anteroposterior view of the right knee 6 months post-operatively showed no grossly displaced osteotomy and no loss of correction (Fig. 3).

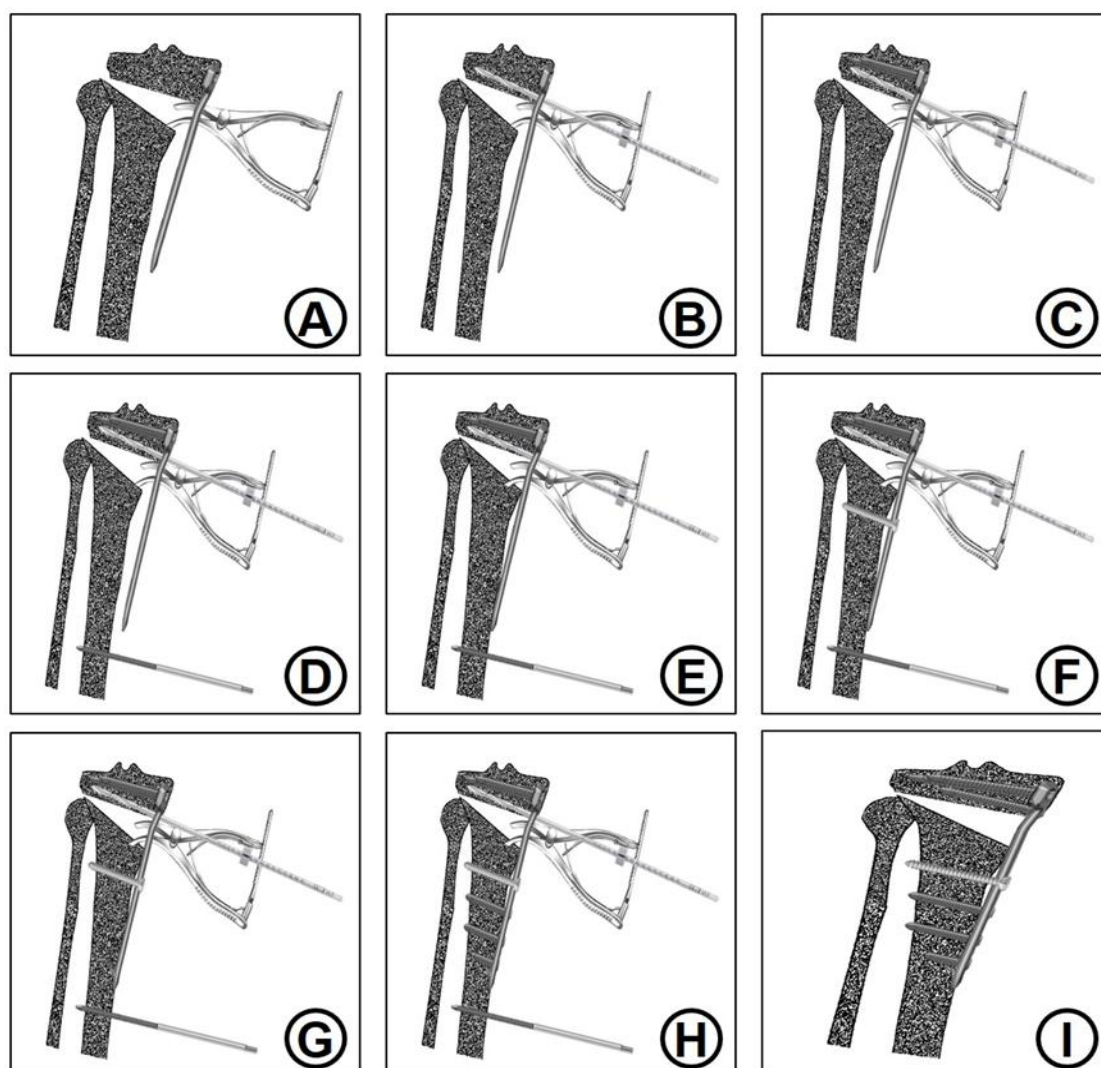


Figure 1: Operative techniques. (A) locking plate applied on the medial side of the tibia; (B) temporary fixation using drill bit; (C) proximal segment fixation using locking screws at the most proximal holes; (D) Schanz pin inserted to the tibial shaft; (E) pulling the Schanz pin to reduce hinge dislocation and to prevent more displacement; (F) distal segment fixation using cortical screw; (G) approximate the plate to the tibial shaft; (H) final fixation using locking screws; (I) change drill bit to locking screw.



Figure 2: Immediate postoperative radiographs. (A) standard knee AP image shows well-reduced intraoperative lateral cortical fracture; (B) tibia AP image shows insertion site of Schanz pin (circle).



Figure 3: Radiographs on the 6th postoperative month. (A) standard knee AP image shows bony union at the fracture site; (B) tibia AP image shows healing of insertion site of Schanz pin.

Discussion

Many previous studies have reported lateral cortex fractures during the open-wedge HTO procedures. In the open-wedge group using the Puddu plate, Raaij, et al., have reported that 15 of 43 patients (35%) had a lateral cortical fracture [4]. In the study using TomoFix plate, Takeuchi, et al., reported that fractures around the lateral cortical hinge were observed in 26 of 104 knees (25%) and all were found either during surgery or on radiographs taken just after surgery [3]. Stoffel, et al., reported that after the fracture of the lateral cortex, the stability at the osteotomy site is dramatically disrupted both axially and torsionally [5]. Furthermore, intra-operative lateral cortex fracture in the medial open-wedge technique is an unstable situation, so surgeon can't achieve primary stability on the osteotomy site easily.

But there have been a limited number of studies addressing surgical solutions to manage intraoperative lateral cortex fracture. Paccola and Fogagnolo treated the intraoperative lateral cortex fractures by fixing the osteotomy site with percutaneously inserted partially threaded 6.5 mm cancellous screw and a washer after indirect reduction. Kazimoğlu, et al., suggested that additional plate and screw fixation for lateral cortex disruption during medial open-wedge HTO has the best biomechanical properties under axial loading [2,6]. In the mechanical studies, angle-stable implants provide superior primary stability compared to the non-angular stable plate when the lateral cortex is injured [6,7]. Unlike the internal fixation using the plate and screws without angular stability to each other in previous study, we used the plate was anchored with screws. So, we could minimize the risks of early loss of reduction and avoid the need of the additional fixation.

There have been some reports addressing surgical techniques to prevent lateral cortex fractures. Jacobi, et al., have proposed using a temporary external fixator using 3 mm pins to compress the lateral hinge during the opening the osteotomy site to prevent lateral cortical fracture [8]. Han, et al., reported that the osteotomy site should be within the "safe zone", as it prevents lateral fractures and instability of the osteotomy hinge [9].

During the surgical treatment of the femoral metaphysis fractures, the distal fragment could be brought into proper alignment to the plate using a Schanz pin as joystick [10]. In similarly, a Schanz pin facilitates intraoperative handling and gives primary stability until the osteotomy is definitely fixated with the locking plate.

Conclusion

When unintentional lateral cortex fracture occurs, we suggest the use of Schanz pin on the tibial shaft. This technique is simple, improves the stability during fixation of locking plate and can be used to prevent the hinge dislocation during open-wedge HTO. But meticulous surgical procedures may help to decrease the incidence of lateral cortex fracture.

Conflict of Interest

The authors have no conflict of interest to declare.

References

1. Miller BS, Dorsey WO, Bryant CR, Austin JC. The effect of lateral cortex disruption and repair on the stability of the medial opening wedge high tibial osteotomy. *Am J Sports Med.* 2005;33:1552-7.
2. Paccola CA, Fogagnolo F. Open-wedge high tibial osteotomy: a technical trick to avoid loss of reduction of the opposite cortex. *Knee Surg Sports Traumatol Arthrosc.* 2005;13:19-22.
3. Takeuchi R, Ishikawa H, Kumagai K, Yamaguchi Y, Chiba N, Akamatsu Y, et al. Fractures around the lateral cortical hinge after a medial opening-wedge high tibial osteotomy: a new classification of lateral hinge fracture. *Arthroscopy.* 2012;28:85-94.
4. Van Raaij TM, Brouwer RW, De Vlieger R, Reijman M, Verhaar JA. Opposite cortical fracture in high tibial osteotomy: lateral closing compared to the medial opening-wedge technique. *Acta Orthop.* 2008;79:508-14.
5. Stoffel K, Stachowiak G, Kuster M. Open wedge high tibial osteotomy: biomechanical investigation of the modified Arthrex Osteotomy Plate (Puddu Plate) and the TomoFix Plate. *Clin Biomech.* 2004;19:944-50.
6. Kazimoğlu C, Akdoğan Y, Sener M, Kurtulmuş A, Karapinar H, Uzun B. Which is the best fixation method for lateral cortex disruption in the medial open wedge high tibial osteotomy? A biomechanical study. *Knee.* 2008;15:305-8.
7. Agneskirchner JD, Freiling D, Hurschler C, Lobenhoffer P. Primary stability of four different implants for opening wedge

- high tibial osteotomy. *Knee Surg Sports Traumatol Arthrosc.* 2006;14:291-300.
8. Jacobi M, Wahl P, Jakob RP. Avoiding intraoperative complications in open-wedge high tibial valgus osteotomy: technical advancement. *Knee Surg Sports Traumatol Arthrosc.* 2010;18:200-3.
 9. Han SB, Lee DH, Shetty GM, Chae DJ, Song JG, Nha KW. A "safe zone" in medial open-wedge high tibia osteotomy to prevent lateral cortex fracture. *Knee Surg Sports Traumatol Arthrosc.* 2013;21:90-5.
 10. Rohilla R, Singh R, Magu NK, Devgan A, Siwach R, Sangwan SS. Simultaneous use of cannulated reamer and schanz screw for closed intramedullary femoral nailing. *ISRN Surg.* 2011;2011:1-8.

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