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Araştırma

Anterior Midline Knee Incision Method is a Viable Solution for Schatzker Type V and VI Tibial Plateau Fractures

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ABSTRACT

Objective: *To reveal the clinical and radiological results of Schatzker Type V and VI tibial plateau fractures operated using classic anterior midline incision.*

Material and Methods: *A total of 17 patients (5 females, 12 male) were included in the study. The mean age was 44.8 years (actual age range 26–71 years). An anterior midline incision was used for all patients. Patients were clinically and radiologically assessed 6 months after surgery. Clinical results were evaluated using the visual analog scale, Hospital for Special Surgery (HSS) knee score, and range of motion. Radiological results were evaluated for the presence of bony union, medial proximal tibial angle (MPTA), posterior proximal tibial angle (PPTA), and step-off on the fracture line.*

Results: *Union was observed in all patients. Infection and neurological deficits were not identified. The mean HSS knee score was 92.7. According to the HSS score, one patient had a poor outcome. The mean flexion was 110.5°. The mean MPTA was 88.1° with the mean PPTA at 82.2°. Anatomic reduction was achieved in all patients.*

Conclusion: *A classic anterior midline incision and the elevation of the anterior horn of the menisci allow visualization of the whole plateau. Fracture reduction and fixation can be easily performed. This technique should be considered for tibial plateau fractures owing to its advantages.*

Keywords: *tibia fracture, plateau fracture, anterior approach, anterior midline incision*

ÖZ

Anterior Orta Hat İnsizyonu, Schatzker Tip V ve VI Tibial Plato Kırıkları İçin Uygun Bir Yaklaşımdır

Amaç: *Klasik anterior orta hat kesisi kullanılarak ameliyat edilen Schatzker Tip V ve VI tibial plato kırıklarının klinik ve radyolojik sonuçlarını ortaya koymak.*

Gereç ve Yöntem: *On yedi hasta (5 kadın, 12 erkek) çalışmaya alındı. Yaş ortalaması 44,8 (26-71) idi. Tüm hastalar için anterior orta hat insizyonu kullanıldı. Hastalar ameliyattan 6 ay sonra klinik ve radyolojik olarak değerlendirildi. Klinik sonuçlar görsel analog skala (VAS), HSS (Hospital for Special Surgery) Diz skoru ve eklem hareket açıklığı ile değerlendirildi. Radyolojik sonuçlar kemik kaynaması, medial proksimal tibial açı (MPTA), posterior proksimal tibial açı (PPTA) ve kırık hattında basamaklanma varlığı ile değerlendirildi.*

Bulgular: *Tüm hastalarda kaynama gözlendi. Enfeksiyon ve nörolojik defisit tespit edilmedi. Ortalama HSS diz skoru 92,7 idi. Bir hastada kötü sonuç elde edildi. Ortalama fleksiyon 110,5 dereceydi. MPTA ortalama 88,1 derece, PPTA 82,2 derece idi. Tüm hastalarda anatomik redüksiyon sağlandı.*

Sonuç: *Klasik anterior orta hat insizyonu ve menisküs anterior boynuzunun kaldırılması ile tüm platonun görüntülenmesini sağlanırr. Kırık tespiti ve fiksasyon kolayca yapılabilir. Bu avantajlarından dolayı, bu teknik tibial plato kırıklarının tedavisinde göz önünde bulundurulmalıdır.*

Anahtar kelimeler: *tibia kırığı, plato kırığı, anterior yaklaşım, anterior orta hat kesi*

INTRODUCTION

Tibial plateau fractures still present a variety of challenges in orthopedics. Good clinical results in fragmented tibial plateau are parallel to reduction quality. These fractures are generally high-energy fractures; therefore, soft tissue problems are common in the preoperative and postoperative periods. To avoid postoperative wound problems, minimally invasive techniques and anterolateral and posteromedial double incision approach has been generally preferred. However, in three planned radiological assessments, reduction quality when using the anterolateral and posteromedial method was almost 50% [(1)]. Concomitant cruciate ligament avulsions and meniscal tears can result from the use of these methods, resulting in a poor outcome. In addition, the posteromedial incision presents some disadvantages. First, the visualization of the articular surface is poor, particularly if there is a central depression or avulsion of cruciate ligaments. Second, knee flexion and external rotation maneuverability worsen the frac-

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ture displacement because of pressure exerted by the medial femoral condyle [2].

In some fragmented tibialplateau fractures, even the two-incision technique is not enough to achieve reduction; therefore, different incisions are needed. This is particularlythe case when there is a fragmented segment in the posterior colon of the tibialplateau. In this case, a posterior incision is suggested to place a buttress plate by the Arbeitsgemeinschaft für Osteosynthesefragen (AO) group [3]. Although it has lost popularity in recent times, the anterior midline incision method that was described by Perry is a feasible alternative for fragmented tibialplateau fractures [4]. Many surgeons use this approach in total knee arthroplasty. The anterior midline incision provides improved visualization of the fracture and also allows the reduction of posterior fragments. The aim of the presentstudy was to evaluate the clinical and radiological results of Schatzker.

Type V and VI tibial plateau fractures operated on using the anterior midline incision method.

MATERIAL and METHODS

The study included 17 patients (5 female, 12 male) having Schatzker Type V and VI tibial plateau fractures with surgery using an anterior midline incision. Five right and 12 left knees underwent surgery. All patients were operated by the same surgical team.

Surgical Technique

Patients were placed under general or spinal anesthesia and laid in a supine position with both knees at a 90° flexion. A pneumatic tourniquet was applied to the affected leg to provide a better view of the part of the leg being operated on and to reduce bleeding. An anterior midline skin incision was made with special care to lift the subdermal tissues and muscle fascia as a whole flap (Figure 1). As a result of the fracture pattern, a medial or lateral parapatellar incision was chosen. The transverse intermeniscal ligament was cut beside the anterior cruciate ligament, and the anterior horn of the meniscus was elevated. The meniscus, capsule, and periosteum were lifted as a whole flap (Figure 2). The patella was retracted laterally very gently to expose the whole tibial plateau surface together with the fracture line, chondral structures, and ligaments in the knee. If the anterior cortex was fractured, collapsed fracture fragments were reduced with the aid of an impactor or curette from between the fracture line. If the anterior cortex was solid, an impactor or curette was inserted through a metaphyseal window. Defects caused by collapsed fragments were filled with spongious allograft, and the fracture line was supported. A proximal tibial buttress plate was inserted (Figure 3). If there was not enough stability at the medial side, a second plate was also inserted from the same incision. After inserting plates and screws to assess the length and reduction quality of the screw, anteroposterior and lateral fluoroscopy imaging was obtained (Figure 4). While closing the arthrotomy, the elevated horn of the meniscus was sutured in the correct place using waterproof sutures. If sufficient soft tissue for suture was not found, stitches were passed through holes in the tibia made using a 2.0 drill. A hemovac drain was inserted into the joint space, and the extensor retinaculum and subdermal and dermal layers were closed.

Figure 1. An anterior midline skin incision with special care to lift the subdermal tissues and muscle fascia as a whole flap

Figure 2. The meniscus, capsule, and periosteum lifted as a whole flap

Figure 3. Insertion of the proximal tibial buttress plate

Figure 4. Anteroposterior and lateral fluoroscopic views

Table 1. Demographic distribution of patients

		Mean	±SD	n (%)
Age (years)	47.52	13.54		
Time to surgery (days)		8.47	4.47	
Follow-up (months)		21.58	9.26	
Side	Right			5–29.4
	Left			12–70.6
Schatzker	Type V			13–76.5
	Type VI			4–23.5

Table 2. Clinical and radiological results of patients

	Mean	±SD	Min	Max
Bone union (weeks)	10.59	1.66	81	14
VAS	1.17	1.50	0	6
HSS knee score	92.71	13.30	44	100
ROM(°)	110.59	12.73	75	125
MPTA(°)	88.11	1.11	85	89
PPTA(°)	82.23	1.82	78	84

After surgery, all patients began active movement with a hinged brace allowing flexion but protecting them from varus and valgus stresses. Patients were mobilized for 4 weeks without applying any load. Between 4 and 6 weeks post-surgery, partial loading was initiated. After 6 weeks, full load was applied.

Patients were clinically and radiologically assessed every month, and final scores were recorded at 6 months. Clinical results were evaluated using visual analog scale (VAS), Hospital for Special Surgery (HSS) knee score, and range of motion (ROM). Results of ≥85 were considered perfect, 70–85 were good, 60–69 were moderate, and <60 was considered bad. Radiological results were evaluated for the presence of bone union, medial proximal tibial angle (MPTA), posterior proximal tibial angle (PPTA), and step-off on the fracture line (Figure 4). Bone union was evaluated as the presence of continuation of at least three cortices. Six months after surgery, a lack of bone union was assessed as nonunion. MPTA between 85° and 90°, PPTA between 77° and 84°, and <3 mm step-off were accepted as anatomic reduction.

RESULTS

Of the patients included in the study, 3 sustained their injuries by falling from a height and 14 sustained their fractures in traffic accidents. According to Schatzker's classification, 13 patients were Type V and 4 patients were Type VI. In addition to plateau fractures, 2 patients had calcaneal fractures in the other extremity, whereas 1 patient had a patella fracture in the other knee. Table 1 shows the demographic distribution of patients.

The mean follow-up time was 21.5 (7–45) months. Radiological healing was provided for all patients. Mean duration of bone union was 10.5 (8–14) weeks. In all patients, anatomic reduction was achieved according to radiological assessment criteria. The mean MPTA was 88.1°(±1.1°)with the mean PPTA at 82.2° (±1.82°).According to HSS scores, 15 patients showedperfect result, 1 patient showed-0good result, and 1 patientshowed bad result. The mean VAS score was 1.17 (±1.5) with the mean HSS score at 92.7 (±13.3).The patient with clinically bad results had aVAS score of 6, an HSS score of 44, and

a knee flexion of 75°.No patient was observed to have flexion contracture. The mean flexion angle was 110.5° (75°–125°). One patient had persistent pain in daily activities, whereasall patients were able to return to work. No patient developed problems with wound location. No patient developed any infection, and no incision problems developed. No patient was observed to have symptoms related to meniscus lesion. No patient required a second surgical intervention. Table 2 shows the clinical and radiological results of the patients.

DISCUSSION

Schatzker Type V and VI plateau fractures are multi-fragmented fractures with concomitant menisci and ligamentous injuries. Full anatomic reduction of the fracture, fixation, and appropriate alignment is necessary to provide a stable, functional and pain-free knee. To ensure appropriate reduction and fixation, a clear view and intervention to the fracture line are necessary. We obtained satisfactory results with the anterior midline knee incision method in the present study. Reduction quality was perfect in all patients, and clinical results were also perfect or good, except for one patient. Karas and colleagues operated on 27 patients using the anterior incision, elevation medial, or lateral horn of the meniscus methods as described by Perry [4,5]. After an average 26-month follow-up, they reported no mechanical symptoms, no wound problems, and at the second inspection arthroscopy, all menisci were healed [5]. By contrast, Barei et al. [1] found that 8.4% of the deep wound infections and 7% of the patients needed knee manipulation when they were operated for tibial plateau fractures using the combined anterolateral and posteromedial approach.

The anterior incision and meniscal detachment for tibial plateau fractures was first described by Perry in 1982 [4]. He recommended the use of this incision for depressed central fragments and avulsions of cruciate ligaments [4]. All the patients in the series healed perfectly clinically and radiographically. After Perry's study, Fernandez et al. [6] also presented their eight patients series with bicondylar tibial plateau fracture, and they used the anterior incision and elevation of tibial tubercle method. Even elevation of tibial tubercle on its own, using only screws and external fixation, meant that they faced no wound problems and achieved a ROM between 120° and 140°.

Schatzker Type V and VI plateau fractures are always a challenge to repair. Many different treatment strategies have been used, particularly to expose the proximal fragments by direct posterior, and posteromedial incisions in combination with osteotomy of the anterolateral plateau and fibula can be preferred [7-11]. Many previous studies have produced encouraging results. It must be stated that there are certain essential requirements for operating on a Schatzker Type V or VI plateau fracture. These include a good view of the entire tibial plateau, grafting of depressed areas, and reduction of tibial metaphysis in both anterior and lateral aspects. Post-traumatic arthritis is one of the major concerns at follow-up. In some cases, patients need a total knee arthroplasty as early as 13 or 14 months postoperatively [12]. Total knee arthroplasty undertaken after fracture of the tibial plateau shows worse results than arthroplasty without a fracture, and the most important complications are infection and wound problems [13-15]. The blood supply in the skin of the anterior knee region is predominantly from medial to lateral area [16]. After two incisions using the posteromedial and anterolateral approach, the blood supply between these incisions gets interrupted. A third incision using the direct anterior parapatellar approach for knee arthroplasty could result in necrosis of flaps between incisions.

Chang et al. [17] placed four to five anti-glide plates in bicondylar four-quadrant tibial plateau fractures with two incisions. Although these plates are required for reduction, if arthritis progresses in these fractures, one incision is not adequate and does not allow the surgeon to remove implants and to perform a knee arthroplasty. As a result of repeated multiple incisions, stiffness and infections will likely occur, and this should be avoided if possible. With an anterior midline incision, we were able to see the entire tibial plateau, graft the depressed parts, and perform a good reduction even in the posterior quadrants. If arthritis developed during the follow-up period, we were able to remove all implants and perform an arthroplasty from the same incision. In patients with fragile scars, an excision of the scar could also be performed.

The anterior midline approach is the most commonly used incision in knee surgery, including total knee arthroplasties [18]. The pearl of this approach is that the anterior incision has to make use of the fascia cutaneous flap method to avoid marginal necrosis of the skin. One of the drawbacks of this approach is the need for the elevation of the anterior horn of the menisci when used for tibial plateau fractures. However, as shown by Padalinam and Karas, arthroscopy was performed on patients while also executing implant removal. Previous studies have reported that the meniscus was intact and stable in all patients [5,19]. The blood supply to the anterior horn of the meniscus was good, and the load on the anterior meniscus was low; thus, the healing capacity of the anterior meniscus was good overall [20,21]. However, the repair of the menisci to the exact point where the detachment occurred is extremely important to not lose the hook stress of the menisci. We observed no postoperative symptoms of a meniscal tear. A second limitation is placing a posterior antiglide plate. Although reduction is possible with this incision, placing a posterior plate cannot be achieved. Fractures with posterolateral or posteromedial fragmentation require pulling screw from anterior to posterior to achieve the fixation.

The aim of all approaches is to better observe the joint and fracture line, thus ensuring anatomic reduction and fixation. Each approach has advantages and disadvantages. The most significant advantage of the anterior midline incision is that the whole tibial plateau is laid out entirely. No matter how the fracture line and fragments have collapsed, fractures and chondral, meniscal, and ligament lesions in other parts of the knee can be clearly observed without requiring any extra dissection or osteotomy. During reduction, it is possible to see how much the joint surface is raised, and whether reduction has been achieved. The anterior midline incision reduces the need for fluoroscopy to a minimum. In bicondylar fractures, advantages include the option for plates on either side through the same incision, without any neurovascular risk or requirements for additional incision–osteotomy and the possibility of the same incision being used for knee prosthesis if arthritis develops in the future.

Our study has some limitations. It is a retrospective study with low number of cases. Duration of follow-up is not sufficient for the ratio of patients that progress to developing arthritis. There was no arthroscopy performed postoperatively to evaluate the menisci healing. Although arthroscopy was planned for the patient with bad results, the patient refused it.

In conclusion, in Schatzker Type V and VI plateau fractures, the anterior midline incision and detachment of the meniscus from the anterior allows the whole plateau to be visible for reduction with direct assessment of the chondral surface, meniscus, and cruciate ligaments. This approach is a viable alternative in fragmented tibial plateau fractures with good clinical and radiological results.

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