Original Research Article

Arthroscopically assisted fixation of tibial plateau fractures

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Abstract

Background: Fractures of the tibial plateau constitute approximately 1% of all fractures and generally occur as a result of trauma. Like other intra-articular fractures, tibial plateau fracture is challenging for orthopedic surgeons. ***Aim:*** The aim of our study was to evaluate the results of tibial plateau fractures treated by arthroscopicy assisted fixation. ***Materials and Methods:*** Our prospective study involved 31 adult patients (21 male and 10 females) operated between august 2012 to june 2015 with age group between 18-70 year. We classified the fracture with schatzker classification. There were type I(n=7), type II(n=12), type III(n=9) and type IV (n=3) fractures. All patients underwent arthoscopically assisted fixation of Schatzker I– IV tibial plateau fractures. Accompanying injuries like meniscus tears, ACL tear, collateral ligament Injury were noted. Duration of surgery, hospital stay, partial and full weight-bearing, post surgical complications were also recorded. The follow-up period was range 12–96 months and evaluation of patients was recorded according to Rasmussen's clinical and radiologic criteria. ***Results***: Most of injuries in our study were due to road traffic accident i.e. 67.74% (n=21). According to Rasmussen's criteria, there were 64.52% excellent (n=20) ,29 % good (n=9)and 6.45% fair (n=2) clinical results and 55%excellent (17), 35.48 % good (n=11) and 9.68 % fair (n=3) radiologic results at final follow up. There were no immediate post-surgical complications directly associated with the arthroscopy and also no implant failure, non-union or malunion. Union had been achieved in all patients without any additional procedure. According to Ahlbäck classification,no severe osteoarthritis found in any case. ***Conclusion***: Arthroscopically assisted treatment of tibial plateau fractures can be accepted as an effective, semi-invasive surgical method with a low rate of complication for the treatment of tibial plateau fractures. It also helps in diagnosis of other associated intra-articular injuries and facilitates early rehabilitation with excellent functional outcome.

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INTRODUCTION

Fractures of the tibial plateau constitute approximately 1% of all fractures5 and generally occur as a result of trauma.[1] Like other intra-articular fractures, tibial plateau fractures are challenging for orthopedic surgeons.[2] The severity of the tibial plateau fracture depends on the energy applied to the limb. The higher the energy to the limb, the more severe and complex the fracture is[3]. Most of the time fracture is associated with fracture blisters, compartment syndromes, disruptions of the menisci or ligaments, or injuries to adjacent nerves and blood vessels[4,5]. Up to 47% of knees with closed tibial plateau fractures have injuries of the menisci and up to 32% have complete or partial tears of the ACL.[4,5,6] Radiographic evaluation must include anteroposterior, lateral, and 2 oblique views to assess the slope of the tibial plateau and the degree of articular depression.[7] However, measurement of the amount of depression of the fractured tibial plateau using standard radiographs may be difficult and inaccurate. CT scanning is the standard for evaluating bony injury including

articular depression and MRI is the standard for evaluating associated soft tissue injury, such as meniscal, ligamentous or chondral injury. Diagnostic arthroscopic evaluation allows direct visualization of the menisci, cruciate ligaments and articular surfaces. In addition to its diagnostic role, arthroscopy may be useful for treatment for tibial plateau fractures.[8,9,10] Treatment options includes conservative treatment, external fixation, open reduction–internal fixation (ORIF) with plate and screws and arthroscopically assisted percutaneous osteosynthesis (AAPO). The goal of the fracture treatment is restoration of the joint surface and stable fixation to allow early joint motion and weight bearing. Ligamentous stability and preservation of the menisci are also important for a longlasting result. But these aims are difficult to achieve with these treatment options[11,12]. External fixators can cause permanent joint stiffness, pin tract infection. Open reduction and internal fixation with single or double buttress plates can leads to infection, delayed union, non-union as it usually requires extensive stripping of the tenuous soft tissue[13,14]. Thus difficulty in achieving precise reduction using conservative methods and the higher morbidity, complications associated with traditional surgical applications led to the development of semi-invasive techniques[10,15]. The arthroscopic diagnosis and surgical treatment, initially used in the 1970s as a diagnostic tool and later as a standardized method of treatment with several advantages compared with other techniques .These advantages include: better visualization of the articular surfaces, better reduction of the fracture, better anatomical restoration of the joint surface, possibility to assess and treat the associated intra-articular ligamentous and meniscal injuries, to remove loose fragments, to achieve stable fixation with the least amount of soft-tissues dissection, low risk of complications and morbidity, and shorter hospital stay with faster recovery of joint motion[10,15,16,17,18]. The aim of our study was to evaluate clinical, radiological and functional outcome of tibial plateau fractures treated with arthoscopic assisted fracture fixation.

MATERIALS AND METHOD

From Aug 2012 to June 2015 consecutive 31 adult patients (21 male and 10 female) who suffered tibial plateau fractures were studied prospectively. Fractures were classified according to standard classification described by Schatzker and colleagues and recorded in patient specific injury charts. Indications for surgical intervention included any varus instability of the medial tibial plateau fracture found in full extension, lateral plateau fractures having a varus or valgus instability greater than 10° and an articular displacement >3mm or a condylar widening >5mm.Biplanar radiographs of both knees i.e. Anteroposterior (AP) and lateral radiographs of injured and uninjured knees were taken for evaluation fracture. Three-dimensional computed tomography (CT) scans were also ordered to understand exact fracture patterns and depression in proximal tibia fractures. Surgery was delayed until the swelling of extremities subsided and skin condition was operable. After informed consent, most patients had surgery on the third day after admission to hospital (range 1–7 days).

Technique

All cases were operated in the supine position under spinal anesthesia and with digital pneumatic tourniquet applied to proximal thigh region. A complete clinical evaluation of the knee for ligamentous stability was performed under anaesthesia and a radiographic evaluation using image intensifier was done before arthroscopy. The standard anterolateral and anteromedial portals for knee were used for the inspection of the space joint, haematoma and loose body evacuation and diagnosis of concomitant ligament and meniscal lesions . The depressed articular surface was elevated with osteotome and the resulted bony defect was filled with bone substitute before the fixation.the fixation done with lateral standard locking plate in each case. Autograft was routinely used when the bone graft was necessary. Continuous passive motion was applied day after surgery and the active knee flexion begun at 48 hours following the surgery. A functional position brace was used for 4-6 weeks if the fractures were severe comminuted, and a hinged knee brace was used for 12–16 weeks if the anterior cruciate ligament (ACL) was injured. We used first-generation cephalosporin for antibiotic prophylaxis for 24 hours, starting just before the administration of anesthesia. The length of surgery and the duration of hospital stay, partial and full weight bearing were recorded for each case. Patients were followed up for a period ranging from 12–96 months. Patients underwent follow-up at 6-week intervals in outpatient clinic. All cases were evaluated for clinical and radiological outcome using the criteria proposed by Rasmussen in patient specific follow up charts. Post-surgery complications (wound dehiscence, haematoma, infection etc.) and late complications (migration of the ostheosynthesis material, pseudoarthrosis, malunion or nonunion, late sepsis, stiffness etc.) were also recorded.

RESULTS

Our study included consecutive 31 patients (21 male and 10 females) who suffered tibial plateau fractures with Male to female ratio 2.1:1. Mean age of patient was 45 yrs (range 18 to 70 years). There were 90.32% (n=28) closed fractures and 9.68% (n= 3) had open fractures (n= 2 with Gustillo and Anderson Grade 1 and n=1 with Gustilloand Anderson Grade 2). Most of patients i.e. 67.74% (n=21)

cases suffered tibil plateau fractures due to motor vehicle accidents. remaining 20 percent patients had history of fall and 12 percent had assault. For study purpose and to evaluate management of fractures , injuries were classified accodrding to classification proposed by Schatzker and collegues (Table 1). The average length of stay in hospital was 7 (range 4–14) days. Duration of surgery varied from 40 to 90 mins (60 minutes) In most patients we encouraged partial and full weightbearing by the sixth and tenth weeks, respectively. The range of motion in the injured knee was 115°–135° compared with a range of motion of 135°–140° in the non-injured knee. We observed no difference in the range of motion between both sides at end of follow up . We determined osteoarthritis according to the study by Ahlback(19%),We observed no changes inclining towards severe osteoarthritis. We detected mild changes in 3 patients (14%) and moderate changes in 2 patients (10%) but affection of routine activity and work activity was in minor degree in these patients . There were no immediate post-surgical complications, including infection, compartment syndrome or deep vein thrombosis, directly associated with the arthroscopy and also no late complications like implant failure, non-union, malunion. Union had achieved in all patients without any additional procedure. No ligamentous instability was found at the last follow-up visit. All the patients were satisfied with the treatment. Based on the criterion described by Rasmussen,10 there were 20 excellent (65%), 9 good (29%) and 2 fair (6%) clinical results, and 17 excellent (55%), 11 good (35%) and 3 fair (10%) radiologic results.

Table 1

Schatzker's Facture classification for tibial plateau	*Number of patients*
Type 1	
Split	n=7
Type2	
Split -Depression	n=12
Type 3	
Cetral depression	n=9
Type 4	
Medial plateau	n=3
Type 5	
Bicondylar Fracture	Excluded from study
Type 6	
Dissociation of metaphysic from diaphysis	Excluded from study

DISCUSSION

Fractures of the tibial plateau constitute approximately 1% of all fractures. As tibial plateau fracture involves the major weightbearing knee joint the standard of treatment for tibial plateau fractures is an anatomic reduction in the articular surface with stable fixation to allow early recovery of range of motion. It is also important to avoid ligamentous laxity in order to prevent late knee instability[1,2]. The treatment of tibial plateau fractures can be nonoperative or operative .Generally, operative treatment is advised for fractures with articular step-off and/or separation more than 3–5 mm and varus/valgus instability more than 10°[20,21]. Arthroscopically assisted percutaneous fixation, which was first recommended by Caspari and Jennings[22,23]. Arthroscopic procedures used in the treatment of certain types of tibial plateau fractures have good results .Although some authors believe that Schatzker type V and VI are not suitable for minimally invasive treatment (24), Buchko *et al.* and Roerdink *et al.* even advocate the use of arthroscopy assisted management in some Schatzker type VI fractures[25,26]. Knee arthroscopy is very helpful in the detection and treatment of associated intra-articular lesions. The advantages of AAPO include the direct vision of the intra-articular fracture, a more accurate reduction, lower morbidity compared with ORIF, better assessment and immediate treatment of intra-articular soft tissue lesions, prevention of soft-tissue complica-tions and the possibility of washing out the joint content, including chondral debris and hematoma[22,23,25,26]. Fowble and colleagues[27] reported that the results of the arthroscopic treatment were superior to ORIF. They pointed out that there was a higher percentage of anatomic reduction, lower rates of complication and a shorter delay to full weight-bearing among patients who underwent AAPO than among those who had ORIF. In the open reduction, arthrotomy with extensive soft tissue release is needed and this may lead to joint stiffness, increased pain, diminished muscular sense and potential wound complications. Arthroscopy allows minimal soft tissue dissection with a lower rate of these complications. Some authors demonstrated[16,25] a faster and more complete recovery of motion and shorter hospital stay. Fowble *et al.* [25] reported on 23 patients with joint depression and split d e p ression fractures. A r t h roscopic assisted reduction and internal fixation was used in 12 patients and open reduction and internal fixation was used in 11 patients. The outcome in terms of length of hospital stay, time to full weight-bearing, and rate of anatomic reduction was superior in arthroscopic reduction and internal fixation group. Ohdera and colleagues[27] reported no difference in the duration of surgery, the range of motion in the knee and clinical results between patients who had AAPO and those who had ORIF; however, they noted faster and easier rehabilitation among those who had AAPO. Lubowitz and colleagues(28) reported that AAPO of selected tibial plateau fractures allows anatomic reduction and rigid internal fixation with less morbidity than ORIF.

Based on Rasmussen's clinical and radiologic criteria, we obtained satisfactory results (clinical 94% and radiological

90%) . there were 20 excellent (65%), 9 good (29%) and 2 fair (6%) clinical results, and 17 excellent (55%), 11 good (35%) and 3 fair (10%) radiologic results. We observed mild or moderate osteoarthritis in 5 patients (24%). These results are comparable with other series. Scheerlinck and colleagues[28] reported 92% satisfactory rates that demonstrated a joint line narrowing rate of 28.9%. Hung and colleagues[29] found 93.5% satisfactory results. The concomitant intra-articular soft-tissue injury rate has been reported to be between 52% and 72%.(7,15) In our study, 22 patients (71%) had soft-tissue lesions. The reported incidence of meniscal lesions associated with tibial plateau fractures ranges from 14% to 50% [2,3,7,15,17,23,24,25,27]. There seems to be no apparent correlation with a specific fracture type . Cruciate ligament injuries are reported in between 5% and 32% of cases[21, 23,24, 25,26]. patients had a meniscus lesion (42%) and two patients (6%) had an anterior cruciate ligament injury,in which one patient sustained a combined, complete rupture of the anterior cruciate and medial collateral ligament. All the fractures healed without angular deformity or ligamentous laxity. In addition, we observed no complications, including infection or compartment syndrome, related to arthroscopy. In conclusion, AAPO can be accepted as an effective, semi-invasive surgical method with a low rate of complication for the treatment of tibial plateau fractures. And it also helps in diagnosis of other associated intra-articular injuries and facilitates early rehabilitation. It also give a better final outcome when compared with conventional arthotomy.

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