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COMPARATIVE STUDY OF THE FUNCTIONAL AND RADIOLOGICAL OUTCOME OF INTRA-ARTICULAR TIBIAL PLATEAU FRACTURES TREATED WITH EXTERNAL FIXATION VERSUS OPEN REDUCTION INTERNAL FIXATION

Orthopaedics

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ABSTRACT

Tibial plateau fractures comprise a diverse group of injuries to a weight-bearing joint and schatzker's classification is the most widely used. Treatment principles for these injuries consist of minimizing secondary surgical insults while aiming for anatomic reduction and rigid fixation of the skeletal elements of the injury. We have studied 50 patients and divided alternate into group A for external fixation and group B for open reduction internal fixation and compared the clinical and radiological outcomes of intra-articular tibial plateau fractures treated with external fixation versus open reduction internal fixation. We have found that, the outcome was in group A, excellent in 20%, good in 58%, fair in 18% and poor in 4% patients, and in group B, excellent in 16%, good in 62%, fair in 18% and poor in 4% patients.

KEYWORDS

Tibial plateau fractures, external fixation, open reduction internal fixation

INTRODUCTION:

Tibial plateau fractures comprise a diverse group of injuries to a weight-bearing joint and are frequently associated with functional impairment.[1] These fractures occur due to a mixture of axial loading with varus or valgus applied forces resulting in articular depression, malalignment, and an increased risk of post-traumatic osteoarthritis (OA).[2] Schatzker's classification of tibial plateau fractures is the most widely used and was the first to make the distinction between medial and lateral plateau fractures, which divides these fractures into six types, I-III are lateral and less severe, described as low-energy fracture patterns. Types IV to VI, which is medial type IV and more severe bicondylar type V and shaft dissociated type VI patterns are described as high-energy fracture patterns.[3] Treatment principles for these injuries consist of minimizing secondary surgical insults while aiming for anatomic reduction and rigid fixation of the skeletal elements of the injury.[4] The most popular treatment has been open reduction and internal fixation (ORIF) with plating.[5] This technique is optimal for fracture visualization, reduction and fixation, but it requires extensive soft-tissue dissection, and other complications like joint stiffness, malunion, skin loss, OA, amputation, and even death. Other methods of treatment have been proposed to reduce the incidence of such complications, so external fixation (Ex-Fix), like Taylor spatial frame, Ilizarov external fixator, Hybrid external fixator were alternative interventions, which allowed for early and adequate initial weight-bearing without limitations associated with the skin condition, minimal soft-tissue disruption, correct deformity in multiple planes, and early knee range of motion (ROM). Ex-Fix is an additional method of treatment when ORIF is contraindicated due to severe trauma to the soft tissue, deficiency of bone stock, and bony comminution.[6] In our study, we are to compare the clinical and radiological outcomes of intra-articular tibial plateau fractures treated with Ex-Fix versus ORIF.

MATERIALS AND METHODS:

We have studied 50 patients and divided alternate into group A for Ex-fix and group B for ORIF, who present with intra-articular tibial plateau fractures in our hospital in a period of 1.5 years.

INCLUSION CRITERIA:

Patients age 18-65 years, unilateral and bilateral involvement, schatzker type II-VI high-energy fractures. Exclusion criteria: Open fractures, patients were not fit for anesthesia due to any co-morbidity, any pathological fractures.

Once the patient was admitted in the hospital, antero-posterior and lateral view X-rays were taken, above knee posterior slab was given for support. Analgesic and anti-inflammatory drugs were given with limb in elevation for avoiding excessive swelling. All associated injuries were treated respectively if present. Classifying fractures according to Schatzker's classification of tibial plateau fractures. The patients were thoroughly investigated, the affected knee was prepared. All patients were operated on under spinal anesthesia and tourniquet with all antiseptic precautions.

In group A, the Ex-Fix group, the patients were managed with a closed, percutaneous, or limited open reduction of the articular surface followed by the insertion of percutaneous lag screws to stabilize the articular fragment, no plates were used. A variety of techniques, including fracture table traction, use of a femoral distractor, and fragment manipulation with percutaneously inserted elevators or reduction forceps, were used. 1 hybrid fixator and 24 standard Ilizarov external fixator were applied in 25 patients, according to the method of Watson.[7-8] The knee ROM were examined following the completion of fixation. Partial weight-bearing was allowed on 3rd postoperative (post-op) day. At six weeks of post-op, full weight-bearing and strengthening were allowed. The external fixator was removed after 12 weeks of post-op.

In group B, the ORIF group, two surgical approaches were mostly used to reduce and internally fix proximal tibial plateau fractures; the anterolateral approach and the posteromedial approach. They were used in isolation for fractures on the lateral and medial side of the knee respectively, and together for patterns that involve both condyles. Intra-operative x-rays were taken before closing the wound. Physiotherapy was started within 36 Hours, regular dressing and stitches were removed after wound healed. Patients were called for followed up every 3 weeks for the first 12 weeks, then once a month for the next 3 months of both groups. In each visit, clinical, and radiological assessment were done according to Rasmussen's criteria.[9]

Figure 1

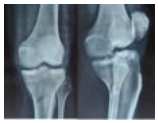

Figure 1(a) : pre-op x-ray AP and lateral view.

Figure 1(b) post-op x-ray of Ex-Fix

Figure 2

Figure 2(a) : pre-op x-ray AP and lateral view. **Figure 2(b) : post-op x-ray of ORIF**

RESULTS:

In our study, most of the patients in both groups belong to the middle age group. There were no significant difference age, sex, religion and occupation and mode of trauma in both groups. In group A, 36% patients were Schatzker type II, 28% Schatzker type III, 24% Schatzker type IV and 12% Schatzker type V and in group B, 36% patients were Schatzker type II, 12% Schatzker type III, 24% Schatzker type IV, 16% Schatzker type V and 12% were Schatzker type VI. In group A patients, no pain in 14 patients, 8 patients had occasional pain and 3 patients had pain in certain positions after final follow-up. In group B patients, no pain in 12 patients, 9 patients had occasional pain, 2 patients had pain in a certain position and 2 patients had pain after activity. The mean ROM on the final follow-up, group A was 112.4 degrees and group B was 112.0 degrees. Six patients have 10 degrees and two patients have 10-20 degree of loss of extension in group A and three-three patients have 10 degrees and 10-20 degree of loss of extension respectively, and only 1 patient had more than 20-degree loss of extension in group B.

Three patients had abnormal stability in 20^0 flexion in group A, and in group B, two patients had abnormal stability in 20^0 flexion, and one patient had abnormal stability in 20^0 extensions. Two patients had articular depression, each in both groups. In both groups, one patient had condylar widening in each group. 20% patients had pin tract infection and 4% patient had nerve injury in group A. 12% patients had superficial wound infection, 4% patient had deep surgical site infection and 4% patient had stiff knee joint. There were no cases of deep vein thrombosis (DVT), no pulmonary emboli, and compartment syndromes in both groups. Clinical, and radiological assessment done according to Rasmussen's criteria. Clinical outcome given in table 1, and radiological outcome given in table 2.

Table 1: Clinical assessment

Clinical Result	Group A	%	Group B	%
Excellent	5	20%	4	16%
Good	14	56%	15	60%
Fair	5	20%	5	20%
Poor	1	4%	1	4%

Table 2 : Radiological assessment

Clinical Result	Group A	%	Group B	%
Excellent	5	20%	4	16%
Good	15	60%	16	64%
Fair	4	16%	4	16%
Poor	1	4%	1	4%

The overall outcome was found in group A, excellent in 20%, good in 58%, fair in 18% and poor in 4% patients, and in group B, excellent in 16%, good in 62%, fair in 18% and poor in 4% patients.

DISCUSSION:

In our study, we observed that there is some significant difference in the clinical and radiological outcome between the patients treated by Ex-Fix or ORIF. In recent studies, satisfactory results can be achieved with Ex-Fix. Newer techniques of Ex-Fix (hybrid or circular external fixators) provides adequate reduction and fixation while limiting the complications associated with ORIF.[10,11] In some studies, reported that fractures managed with this technique have good clinical, and radiological outcomes.[12,13]

Minimally invasive techniques of ORIF have now become popular, some reports suggest that the Less Invasive Surgical stabilization (LISS) plate system provides stable fixation of complex tibial plateau fractures while allowing an early ROM of the knee joint with better clinical, and radiological outcomes.[11-16] More limited surgical exposure with a second posteromedial incision has also been reported, resulting in a lower wound complication rate and better choice in patients with a large posteromedial fragment as a component of the bicondylar tibial plateau fracture.[17]

Hall et al.[18] in their randomized, controlled clinical trial had observed that patients in the Ex-Fix group were more likely to have returned to the pre-injury level of activity than those in the ORIF group at the six-month evaluation. Our comparative study between both groups supports this study.

The rate of complications, especially deep wound infection, is often a variable that orthopedics doctors have cited in favor of Ex-Fix over ORIF. Young and Barrack, Moore et al., and Mallik et al. were evaluated the complications of plate fixation.[19-21] Uhl et al.[22] reported in their study that post-op skin infection in 42% and osteomyelitis in 33% of patients treated with ORIF with dual plates. These complications have prompted the introduction of other alternative techniques for the treatment of these fractures.

In 2006, a randomized controlled trial by the Canadian Orthopedic Trauma Society (COTS) reported 20% deep wound infections in the patient group treated with ORIF with plating.[23] Buckle, et al., and Stamer et al. reported promising initial outcomes with dramatically decreased infection rates. In their study, only one deep infection in thirty-one patients was reported.[24-25]

In our study, in group A, 20% of patients were pin-tract infection, and in group B 12% were superficial wound infection and 4% deep wound infections which were lower than those reported in the study by Barei et al (8.4%)[26] and COTS (20%).[23] Pun et al. obtained a mean of 128.1 degrees of post-treatment knee flexion in his series of 22 patients treated with ORIF and all patients except one were able to return to their job at an average of 6.66 months.[27] The average knee ROM in the COTS was 109° in ORIF group and 120° in the Ex-Fix group.[23] In our study, final post-op ROM in group A was 112.4 degrees and in group B was 112.0 degrees. There was no significant difference in both groups. Ex-Fix had a rapid recovery from the injury than ORIF. This could be due to several various factors, including the aggressive rehabilitation program with earlier weight-bearing, the lower post-op complications rate, and the decreased soft-tissue dissection with decreased pain and swelling in the Ex-Fix group. Also, patients managed with the Ex-Fix lost significantly less blood, had a shorter hospital stay, and did not require as much operative time compared with those who had ORIF. It is evident that patients with significant co-morbid injuries, especially concomitant lower extremity injuries, would have a slower rehabilitation course, thus, impacting the final knee rating score. Mathur *et al* reported 27 closed tibia plateau fractures treated with ORIF, and found excellent Rasmussen score in 37% and good in 52% of cases. Bhavani Prasad et al(2015) reported 30 cases of tibial plateau fractures treated by various modalities, and observed excellent results in 33%, good in 50%, fair in 10 %, and poor in 6%of patients.[28,29] Chin et al presented 38.9% good/excellent, and 61.1% fair/poor results in his type V and VI fractures series in 18 patients treated with the fine-wire fixator.[30] In our study, the overall outcome was found in group A, excellent in 20%, good in 58%, fair in 18% and poor in 4% patients, and in group B, excellent in 16%, good in 62%, fair in 18% and poor in 4% patients.

CONCLUSION

In our study, we found that Ex-Fix may have some advantages in patient outcomes in terms of hospital stay, blood loss, infections and early weight bearing. But in ORIF group in those patients where near anatomic reduction was achieved with strong and stable fixation also did well. However, in the current scenario, the clear recommendation on whether Ex-Fix or ORIF is better in managing a particular complex tibial fracture is not clear. So in clinical practice, we should always prefer the proper fixation methods dictated by the fracture patterns and the degree of soft-tissue injury.

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