External Fixation Versus Internal Fixation For management of BicondylarTibial Plateau Fractures

A Systematic Review

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ABSTRACT

Background:

Although external fixation and ORIF are associated with different complication profiles, both are acceptable strategies for managing bicondylartibial plateau fractures. Bicondylar fractures are heterogeneous injuries, with a high risk of complications of treatment. Whatever method of stabilization is chosen, the principles of stabilizing these high-energy injuries are soft tissue care, accurate articular surface reduction and maintenance, whilst achieving satisfactory length, rotation and alignment. The choice of treatment should be dictated by the soft tissues and fracture configuration.

Objective: to compare whether external fixation provides better outcome and fewer complications when compared to open reduction internal fixation for bicondylartibial plateau fractures Schatzker type V type VI

Materials and Methods: Searches were conducted using the following databases: The Cochrane Library, MEDLINE, PUBMED. Using the following keywords: proximal tibia tibial plateauSchatzker type V type VIbicondylar , comminuted ,complex, Ilizarov, external fixation for published studies from 2000-2017.

The initial literature search identified 234 articles which were assessed for possible inclusion.

Results: Our study included 9 studies with 595 knees with bicondylartibial plateau fractures, 297 cases underwent external fixation and 298 cases underwent ORIF. Our results shows statistically significant increased incidence of postoperative infection and osteoarthritis of knee joint in cases underwent external fixation.

Although in MCkee et al. and Ahearn et al. the incidence of reoperation was higher in ORIF group, our results showed that external fixation group showed a non-statistically significant higher reoperation rates than ORIF group; 24.8% and 21.1% respectively.

There are two considerations as regard these results in our study. In Guryel et al. 45 cases underwent external fixation with no reported cases of postoperative infections, also it showed that 79 cases underwent ORIF with no reported cases postoperative osteoarthritis of knee joint. In Ahearn et al. 21 cases underwent external fixation with no cases reported that needed reoperation.

Also our results showed that in contrast to the increased rates of knee osteoarthritis and knee stiffness in cases underwent external fixation, the number of cases which underwent TKA is higher in ORIF group and this result may be due to higher incidence of infection in the external fixation group.

So we concluded that ORIF has lesser incidence of complications than external fixation in cases of bicondylartibial plateau fractures. Although orthopedics surgeons should be mindful the complications and the subsequence procedures after surgery, both external fixation and ORIF are acceptable strategies in managing complex tibial plateau fractures.. Meanwhile, future multicentered, randomized, controlled studies should be implemented to test these outcomes.

Conclusion: Tibial plateau fractures are challenging and technically demanding fractures to treat, even by experienced trauma surgeons.we concluded that ORIF has lesser incidence of complications than external fixation in cases of bicondylartibial plateau fractures. Although orthopedics surgeons should be mindful the complications and the subsequence procedures after surgery, both external fixation and ORIF are acceptable strategies in managing complex tibial plateau fractures. In clinical practice, we should select proper fixation based on the fracture patterns, soft-tissue condition as well as the injury stages.

Keywords: Proximal tibia, tibial plateau, Schatzker type V type VI, external fixation

INTRODUCTION

The tibial plateau fractures, especially in high-energy trauma due to extensive soft tissue damage, have a therapeutic modalities. There are various management options, open reduction and internal fixation is one of the most commonly used treatment, but there are different complications like wound problems, infection, deformities, and stiffness.[1,2]

Displaced bicondylar tibial plateau fracture (Schatzker type V and VI) remain relatively rare at an estimated 1% of all adult fractures and 10–30% of all tibia fractures.[3–6]They have a bimodal distribution determined by mechanism, magnitude of energy and quality of bone stock.[7]

Albuquerque et al found a peak incidence among male patients and in the fifth decade. The same study showed a rate of 22.6%associated injuries.[8] Moreover, intra-articular tibial plateau fractures have a significant impact on knee function. Mehin et al reported an incidence of post-traumatic end-stage osteoarthritis of13% at 10 years.[9] Equally, a five-fold increase in the likelihood of needing a total knee arthroplasty compared with the general population has been shown.[10]

However, as complex tibial plateau fractures associated with severe soft tissue damage, ORIF often led to higherrate of

complications over the past two decades.[11] Despite the evolution of treatment strategies and quality of fixation implants, a poor outcomes were reported continuously.[12]

Adequate fixation and early motion were important for a good prognosis and satisfied postoperative rehabilitation, so fine-wire external fixation, like Taylor spatial frame, Ilizarov circular frame ,Monticelli-Spinelli circular fixator were good alternative interventions, which allowed for early and adequate initial weight bearing without limitations related to skin condition, was considered as an ideal method to these cases, who cannot use internal fixation due to trauma of the soft tissue envelop, deficiency of bone stock, and bony comminution.[13,14]

Overall, there is still a conflict over which surgical method is superior to the other, and there is no defined gold standard technique for these fractures. Therefore, the study aimed to compare the functional, radiological, and clinical outcomes of bicondylar tibial plateau fractures treated by external fixation versus internal fixation and reached a conclusion on which treatment modality was better than the other.

AIM OF THE WORK

A systematic review to compare whether external fixation provides better outcome and fewer complications when compared to open reduction internal fixation for bicondylar tibial plateau fractures

Study design: Randomized controlled trials - Retrospective studies

Population: Patients with bicondylar tibial plateau fractures (schatzker type 5 and 6)

Intervention: All types of external fixation

Comparison: Standard ORIF

Outcome: 1- functional outcomes 2-Post operative complications

Time: From 2000 To 2017

REVIEW OF LITERATURE

Bicodylar Tibial Plateau fractures(schatzker type V,VI)are complex intra-articular injuries with implications for articular congruity, cartilage integrity and extra-articular structures [15]. Associated complications include compartment syndrome, soft tissue damage, secondary osteoarthritis(OA), and persistent knee instability. Conservative treatment is rarely appropriate for these injuries [16]. Management aims are anatomic reduction of the articular surface, restoration of axial alignment, and stable fixation to prevent secondary displacement of the fracture fragments[3]. A commonly employed technique is open reduction and internal fixation (ORIF), using a plate and screws through either an extended anterior incision or through multiple smaller incisions to preserve the soft tissue envelope. High-energy bicondylar fractures are often already accompanied by soft tissue damage, and ORIF in this setting is associated with wound complications like skin necrosis and infection [11].

Soft tissue considerations may also delay operative fixation and/or contraindicate ORIF altogether. In addition, there is evidence to suggest that once alignment is restored,

residual articular incongruity may not impair long-term functional results following these injuries.[17–21]

The objectives of surgical treatment include restoration of articular surface preservation of soft tissues and correction of anatomic alignment in the lower extremities and stable fixation that allows for early mobilization [22, 23].

To date, the commonly used treatment strategies include external fixation with Ilizarov circular frame or other kind of circular frame, open reduction and internal fixation(ORIF), a combination of external and limited internal fixation (hybrid technique). Open reduction with dual buttress plate fixation is the classic treatment modality which is favoured by AO/ASIF [11, 17] and biomechanically proven as the ideal fixation for stability requirement of fragments both from lateral and medial side [18–21].

However, extensive soft tissue dissection of the fracture zone will compromise the biological conditions for fracture healing and increase the risks of wound complications[18,22]. With the improvement of modern locking plating system and the minimally invasive percutaneous osteosynthesis (MIPO) techniques, unilateral locking plate fixation becomes a good alternative for the treatment of

complex tibial plateau fractures. Several studies have compared the biomechanical strength of unilateral locked screw plate and double plating for the treatment of bicondylar tibial plateau fractures and showed no statistically significant difference between these two fixation methods [20, 24, 25]. However, the problem of secondary loss of reduction especially happening in the medial component or posteromedial fragment has been found in some clinical articles [26–28]

Anatomy:

Surgical and applied anatomy of tibial plateau

The tibial plateau represents the entire proximal end of the tibia and is composed of medial and lateral weight bearing articular surfaces. The 2 articular surfaces are asymmetric both in size and concavity as well as relative density and strength. [29]

The medial tibial plateau is the larger of the two, is concave in both planes, is covered with hyaline cartilage and carries about 60% of the knee's load and consequently has increased subchondral bone and a stronger, denser plateau when compared with the lateral.

The lateral plateau is smaller, weaker, convex in both sagittal and coronal planes, and is also covered in hyaline

cartilage. Due to this relative weakness combined with the natural valgus carry angle of the lower extremity, fractures of the lateral tibial plateau are more common.[30]

There are many bony prominences serve as attachment sites for tendonous structures and are located in close proximity of the tibial plateau:

- The tibial spines are between the plateaus. The medial and lateral tibial spines serve as attachment points for the anterior and posterior cruciate ligaments as well as the menisci.
- The tibial tubercle is found anterolaterally about 3 cm below the articular surface. This site serves as a point of attachment for the patellar tendon.
- Further lateral on the proximal tibia is Gerdy's tubercle where the iliotibial band inserts. (fig.1).

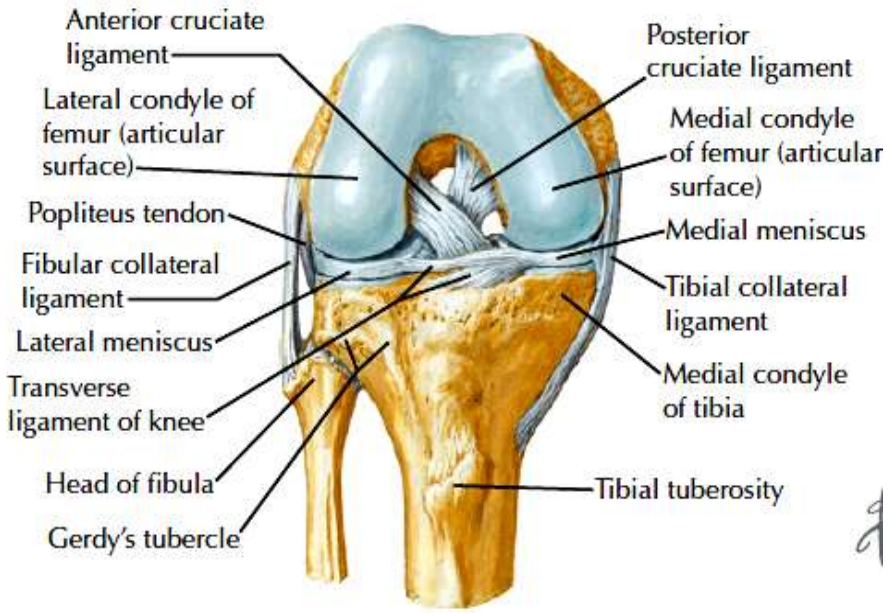

Figure (1): Knee anterior view[31]

The proximal tibia and fibula form an articulation covered in hyaline cartilage. The medial (tibial) collateral ligament inserts into the medial proximal tibia and along with the lateral (fibular) collateral ligaments protect against varus and valgus instability, while anterior and posterior cruciate ligaments afford anterior-posterior stability. (Fig. 2)

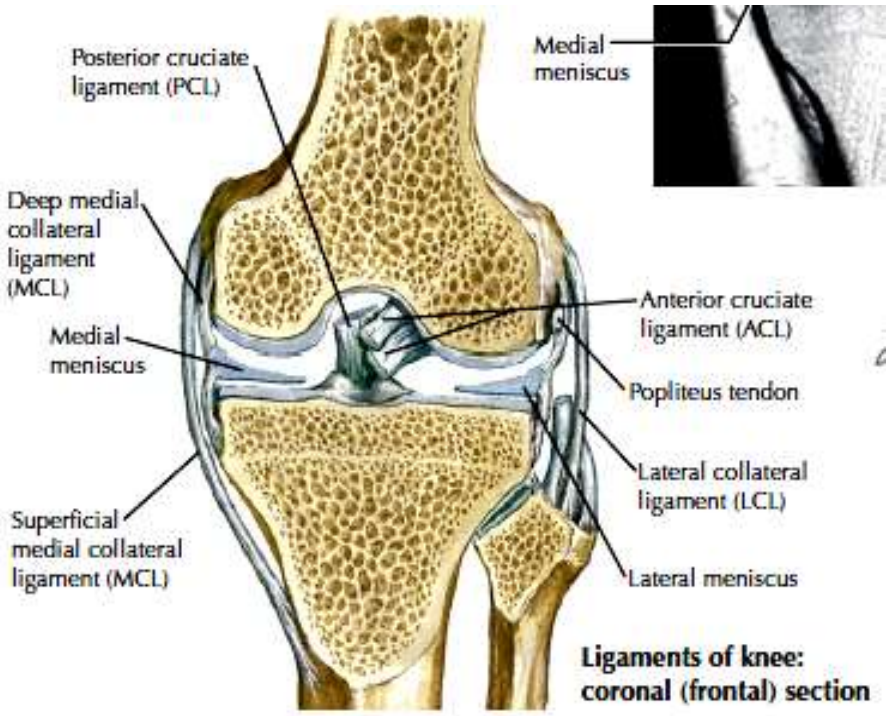

Figure (2): Ligament of the knee[31]