Arthroscopic Assisted Reduction and Internal Fixation of Tibial Plateau Fractures

A Systematic Review

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بسم الله الرحمن الرحيم

قالوا

سبحانك لا علم لنا
إلا ما علمتنا إنك أنت
العليم الحكيم

صدق الله العظيم

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List of Abbreviations

Abb.	Full term
ACL	Anterior cruciate ligament
AO	Arbeitsgemeinschaft fur Osteosynthesefragen
AP	Antroposterior
ARIF	Arthroscopic assisted reduction and internal fixation
CT	Computed tomography
DVT	Deep venous thrombosis
ER	Emergency room
KSS	Knee society score
K-wires	Kirschner wires
LCL	Lateral collateral ligament
MCL	Medial collateral ligaments
MRI	Magnetic resonance imaging
ORIF	Open reduction and internal fixation
OTA	Orthopaedic Trauma Association's
PMMA	Polymethyl methacrylate
RCTs	Randomized control trails
SOFCOT	Société Française de Chirurgie Orthopédique et Traumatologique
SSI	Surgical site infection
TKA	Total knee arthroplasty

INTRODUCTION

Tibial plateau fractures are intra-articular fractures presume a threat to knee function and are considered challenging for the surgeon. The treatment goal is as all articular fractures consists of anatomical reduction, stable fixation, early mobilization and the least surgical trauma[1].

In the 1970s management of proximal tibial fractures in general was conservative, which led to very poor radiological and functional outcome. Later on, rigid plate fixation with an extensive approach gained popularity but was usually accompanied by various complications such as infection which reached as high as 80%[2,3]. This opened the spectrum of less invasive techniques and the introduction of arthroscopic assisted reduction and percutaneous fixation (ARIF) which was first described by Caspari and Jennings in the 1985[4].

After the MRI became easier and more accessible, associated soft tissue injury as meniscal tears and ligamentous injuries were discovered to be high, this made the arthroscopic technique more popular in the past two decades[1].

The best management for unicondylar tibial plateau fractures remains controversial. Most studies over the past 10 years recommended operative management in case of articular surface depression of > 2-3 mm, valgus deformity of >5 degrees in lateral plateau and if any dislocation is found in the medial plateau[5,6].

Aim of the Study

This study aims to evaluate the outcome of arthroscopic assisted reduction and internal fixation in relation to the standard technique (open reduction and internal fixation (ORIF)) for tibial plateau fractures as regard the functional outcome and the incidence of complications.

The objective is to perform an updated systematic review of arthroscopic assisted reduction and fixation of tibial plateau fractures to assist the decision makers in selecting their method and provide intervention recommendations by the best available evidence by answering the following questions**:**

1- Which tibial plateau fracture type is better to be managed with ARIF?

2- Is the functional outcome of ARIF in these types is comparable to the standard ORIF?

3- How much is the frequency of complications following ARIF in comparison to ORIF?

And our hypothesis is to provide evidence based information showing that ARIF is suitable for the management of tibial plateau fractures Schatzker types 1,3 with functional outcome comparable to ORIF and lower complication.

REVIEW OF LITERATURE

1. Anatomy

The proximal tibia is composed of medial and lateral articular surfaces which act as weight bearing areas known as tibial plateau. These surfaces are not identical; They vary in shape and size. The medical plateau is larger in size, concave in shape and has denser subchondral area as it carries about 60 percent of the body weight[7]. While the lateral plateau is smaller in size, convex in shape and also higher than the medial plateau resulting in the varus noted in relation to the tibial shaft[8].

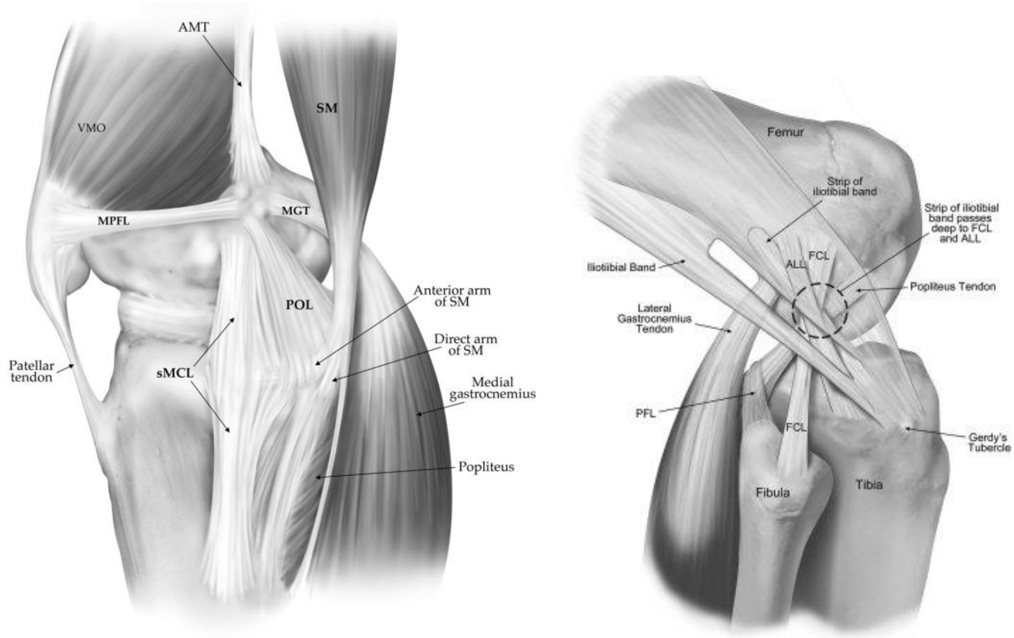
The difference between medial and lateral plateau renders the lateral plateau more vulnerable to fractures than the medial plateau fractures which is more commonly seen due to high energy trauma. The Tibia has a posterior slope of an average 5 degrees, sagittal slope vary from 0 to 14 degrees laterally and from -3 to 10 medially[8].

Between these two articular surfaces there is a non-articulating bony prominence called the tibial spine or eminence, serving as an attachment site for ligamentous structures as the Anterior cruciate ligament (ACL). Anteriorly there is the tibial tubercle where the patellar tendon is inserted and lateral to it there is the Gerdy's tubercle serving as the attachment of the iliotibial band. The fibula articulates with the tibia with a facet on the posterolateral cortex of the tibia but not considered as a part of the knee joint articulations[9].

Medially, on the posteromedial corner just below the joint line the semimembranosus muscle is attached, anterior and more distally is the pes anserinus (tendons of gracilis muscle and semitendinosus muscle). These structures must be identified and protected during the medial approach, also there is a broad area where the superficial and deep medial collateral ligaments (MCL) are inserted making the medial approach much harder with limited visibility to the medial plateau even after medial meniscal arthrotomy.

Laterally, the posterolateral corner consists of superficial and deep layers, the superficial layer consists of biceps femoris tendon and iliotibial band while the deep layer consists of lateral collateral ligament (LCL), popliteus tendon, arcuate ligament and popliteofibular ligament. The LCL is inserted in the head of the fibula leaving the lateral surface of the tibia free of attachment providing easier access to the lateral plateau with more visibility to the articular surface as shown in figure (1)[10].

The common peroneal nerve is covered by the biceps femoris muscle proximally and passes lateral to the head of the fibula where it divides. Posteriorly in the popliteal fossa runs the popliteal artery which is at higher risk usually due to knee dislocation.



Medial Lateral

Figure (1): Medial and lateral views of the knee [11]

2. Prevalence and Mechanism of injury

Tibial plateau fractures are caused by either high or low energy trauma[1].

Tibial plateau fractures prevalence varies from 1.66 to 2.0% in adults[12].

The fracture patterns and associated injuries can be linked to the mechanism of injury, there are three forces related to tibial plateau fractures; varus and valgus stress with or without axial loading. Valgus stress usually results in lateral plateau fracture with possibility of lateral meniscal tears and/or medial collateral ligament tear. Varus stress usually results in medial plateau fracture with medial meniscal tear and/or lateral collateral ligament tear. Axial loading results in more severe forms of injury resulting in more comminution or bicondylar fractures with high risk of ACL or PCL injuries[13].

3. Assessment

Initial assessment

Initial trauma survey should be done upon the patients arrival to the emergency room (ER) followed by radilogical and clinical assessment. Any urgent pathologies should be excluded before proceeding to any other step, neurovasular state should be examined. Looking for signs of compartement syndrome will change the management plan dramatically, an urgent four compartement fasciotomy should be perfomed, and any vascular injury should be managed with the vascular team with the possibily of external fixation. Blistering, severe abrasions, polytrauma are also indications for external fixation[14 - 17].

Radiological assessment

Radiology

Antroposterior (AP) and lateral plain x-ray views are the standard initial imaging for tibial plateau fracture, tibial plateau view (15 degree caudal view) can also be helpful showing the articular surface of the tibia[18].

But usually further assessment is needed using computed tomography (CT).

Computed tomography

CT scan is easy to access and became a routine examination once suspected tibial plateau fractures, the axial, sagittal and coronal views give us more details about the fracture morphology and used in most of the more recent classifications of the fracture. The three dimentional reconstruction has been used recently in preoperative planning as well, yet a study showed that it doesn't impact the surgeons preoperative plan[17 - 20].

Magnetic resonance imaging

Magnetic resonance imaging (MRI) is very useful in identifing associated soft tissue injuries with tibial plateau fractures as meniscal, and ligamentous tears, but it is still contraversary whether incorporating the management of these injuries improves the functional outcome or not [21].

4. Classification

One of the fundamental roles of any useful fracture classification is that it should guide the surgical approach and fixation, and should be reliable. As for most fractures there is not a single classification that encompasses all fracture patterns and can enable a surgeon to identify the specific approach and fixation