RING FIXATORS IN TREATMENT OF OPEN FRUCTURES TIBIAL PLAFOND

An Essay Submitted for Fulfillment of Master Degree in Orthopedic Surgery
Cairo University

BY

Mohamed Foad El Bayoumy
M.B.,B.Ch

Supervised by:

Prof.Dr. Hassan Magdy El Barbary
Professor of Orthopedic Surgery
Faculty of Medicine, Cairo University

Dr. Abo Bakr Zein
Lecturer of Orthopedic Surgery
Faculty of Medicine, Cairo University

Faculty of Medicine-Cairo University

2012

Acknowledgement

I would like to express my sincere thanks to ***Prof. Dr. Hassan El Barbary***, Professor of Orthopedic Surgery, Faculty of Medicine. Cairo university, for his great help and encouragement.

Sincere thanks and appreciation are to ***Dr. Abo Bakr Zein***, Lecturer of Orthopedic surgery. Faculty of Medicine. Cairo University, for his faithful advice and supervision through the work.

Sincere thanks and appreciation for Orthopedic Surgery Department for support .

Finally, I would like to thank my ***family.***

Contents

List of abbreviations

AO : Arbeitsgemeinschaft für Osteosynthesefragen.

AO – ASIF : association of the study of internal fixation.

AO – OTA: Orthopedic Trauma Association.

CT : Computed Tomography.

EF : External fixator.

HFS : Hanover Fracture scale.

ICLH : Imperial College London Hospital.

MRSA : Methicillin Resistant Staphylococcus Aureus.

MT: Muscle Tendon.

NISSA Score : Nerve injury, Skeletal injury, Shock, Age of patient.

NR : Neurovascular.

ORIF : Open Reduction and Internal Fixation.

TS : Trauma Score.

List of figures

List of tables

Abstract:-

Tibial plafond fractures are one of the most challenging to manage. The risk of complication is high. Complications results from either the injury or the treatment, or both. To decrease treatment related complications, management strategies have change significantly since 1990.

Tibial plafond fractures represent about 10% of all extremity fractures. Open tibial plafond fractures average from 12% to 56% of all tibial fractures and are two to four times more likely to be open medially than laterally.

Tibial plafond fractures' have been treated by a variety of method, including cast lag screw fixation, open reduction and internal fixation, and a variety of external fixators have been used .

More recently staged protocol has been advocated consisting of temporary external fixation spanning the ankle joint followed by open reduction and. internal fixation with plates and screws after the condition of the soft tissue has-improved. A variety of external fixation have been used. Traditional half pins fixators that allow spanning the ankle, articulated half pins fixators that allow ankle motion, half pins fixators that do not span the ankle and ring fixators that combined tensioned wires with half pins in tibial-diaphysis and do not span the ankle. Hybrid frames may be composed of rings proximally and distally (ilizarov, Monticell Spinelli) or may use a bar to connect the half pin proximally to a ring and wires distally. If there is any doubt about the condition of soft tissue, the safest course of treatment is external fixation or delayed open reduction and internal fixation after temporary external fixation, especially in higher energy injuries and open fractures.

Key word:
Fructures , Tibial ,Plafond ,Fixators, Orthopedic

Introduction

The terms tibial plafond, pilon fracture, and distal tibial explosion fracture all have been used to describe intraarticular fractures of distal tibia. The distal articular surface of tibia has been called a plafond, a French word originated from plat, meaning "flat", and fond, meaning "bottom". In English, plafon refers to an elaborate ceiling. One additional term for this fracture has been pylon; this originated probably as a misspelling of French pilon, but the French word pylon means abridge or stone archway. These terms encompass a spectrum of skeletal injury ranging from fractures caused by low energy rotational forces to those caused by high energy axial compression forces arising from motor vehicle accident, falls from height or gunshot injury. All tibial plafond fractures are severe injuries, but within this category there is a further wide spectrum of injury severity. High energy fractures frequently are associated with open wounds or severe, closed, soft tissue trauma. The fracture may have significant metaphyseal or articular comminution or diaphyseal extension. (1)

Those fractures are one of the most challenging to manage the risk of complications is high. Complications result from either the injury or the treatment of the injury, or both. To decrease treatment related complications, management strategies have changed significantly since 1990. (2)

Rapid axial loading, as in tibial plafond fractures, absorbs and then at failure releases more energy. The released energy is imparted to soft tissues. This energy which released, leads to the severe soft tissue injury resulting in tense swelling, fracture blisters, and complications of treatment. Articular surface and metaphyseal comminution, joint impaction, proximal displacement of talus and severe associated soft tissue injuries characterize axial loading tibial plafond fractures. (3)

Intraarticular fractures of distal tibia have been treated by a variety of methods, including plaster immobilization, traction, lag screws fixation, open

reduction and internal fixation with plates, and external fixation with or without limited internal fixation. A variety of external fixators have been used: traditional half pin fixators spanning the ankle ;articulated half pin fixators spanning the ankle; articulated half pin fixators that allow ankle motion, half fixators that don't span the ankle, and hybrid fixators that combine tensioned wires with half pins in the tibial diaphysis and don't span the ankle joint. Hybrid may be composed of rings both proximally and distally (Ilizarov, Monticell, spinelli) or may use a bar to connect the half pins proximally to a ring or rings and wires distally. (4)

Staged protocols have been advocated consisting of temporary external fixation spanning the ankle joint, followed by open reduction and internal fixation with plates and screws after the condition of the soft tissues has improved. (5)

Several factors must be considered when formulating a treatment plan. The mechanism of injury is whether high energy or, low energy, usually correlates with the extent of skeletal and soft tissue damage. The fracture type should be determined according to the amount and location of displacement and comminution and impaction and severity of the soft tissue damage and how much contamination of the open fracture.(6)

The ultimate goals of treatment of tibial pilon fractures are to obtain an anatomical articular reduction, restore axial alignment, maintain joint stability and achieve pain free weight bearing and motion, while avoiding infections and wound complications. If the articular surface is not reduced by ligamentotaxis, some forms of open reduction usually are indicated once the soft tissue has been recovered. Anatomical reduction often is more difficult to achieve after a delay of 2 to 3 weeks; however, surgical incisions through swollen, contused soft tissue can lead to wound breakdown and infection, which may require free tissue transfer or even result in amputation. External fixation accomplished the

fracture reduction through ligamentotaxis and allows the patient to be mobilized. (6, 7)

Some authors based their treatment on the severity of the soft tissue injury. **Tscherne** grades 0 and 1 were treated with plating and grades 2 and 3 open fractures were treated with external fixation. (8)

In the case of compound fracture the safest course of treatment is external fixation. Ring fixators provide greater preservation of the soft tissue and greater ease in spanning diaphyseal fracture lines than do plating. Unlike the spanning external fixator, the ring fixators confining the fixation to above the ankle joint has advantage, but tibiotalar and subtalar joints are not immobilized which theoretically should diminish stiffness in these areas, so with tibiotalar instability, these methods are not adequately stabilizing the fracture (7).

Aim of the essay:-

The aim of this essay is to review literature which assess the management of open fracture plafond by ring fixator and its advantages, disadvantages and indications and in management of gunshot plafond fractures, as well as comparing between the different modalities of management options.

Applied anatomy and biomechanics of fracture tibial plafond

Applied anatomy:-

The distal tibia articulates with the talus through a rectangular surface with irregular edges. The anterior and the posterior borders of articular surface diverge laterally so that the lateral part of distal tibial articular surface is articulated with the lateral malleolus, which extends approximately 1cm to 1.5cm beyond the tip of the medial malleolus.

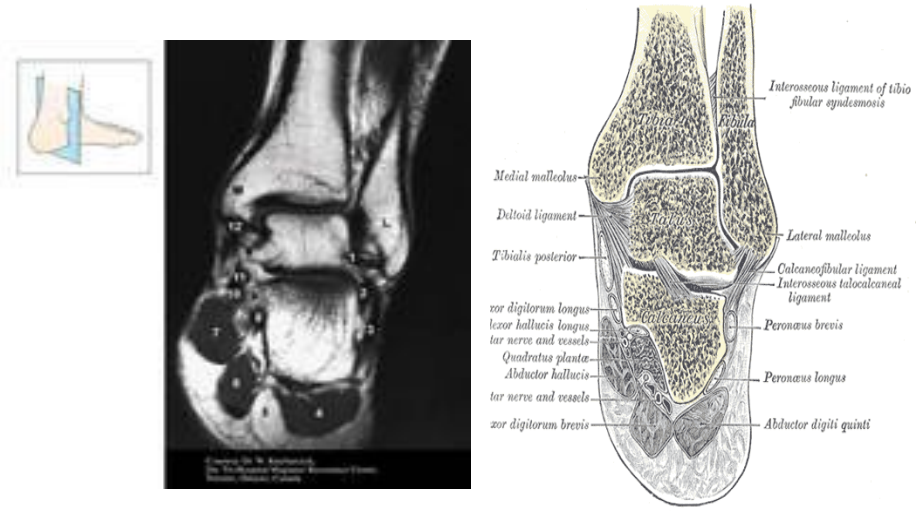

Fig. (1).coronal section and MRI Through ankle (9).

The tibia and the fibula at their distal ends met together to form the ankle mortise, which has also been referred to as the malleolar fork. The tibia and the fibula are linked distally by three layers of connective tissue:

1) The interosseous membrane runs steeply downward from tibia to fibula through the length of the bones. No transverse fibres of the interosseous membrane are found near the fibular notch of the tibia where the bones are in contact distally.

2) The direct contact zone of the distal tibiofibular joint is mostly filled with loose connective tissue as well as a synovial fold coming up from the ankle joint space. That there is no articular cartilage between the distal tibia and fibula confirms that there is no transmission of pressure between the two bones at this level.

3) The distal tibia and fibula are attached by both anterior and posterior tibiofibular ligaments. With a thickness of about 4 millimetres, the anterior tibiofibular ligament is the weaker of two; the posterior ligament can be as thick as 6.3 millimetres. The posterior ligament always consists of two parts; a thin plate about one millimetres separated by a narrow recess from an underlying 6 millimetres component. Stressing of distal tibifibular joint particularly in the position of dorsiflexion causes predominantly stretching of the posterior ligaments(fig. 1,2),(9).

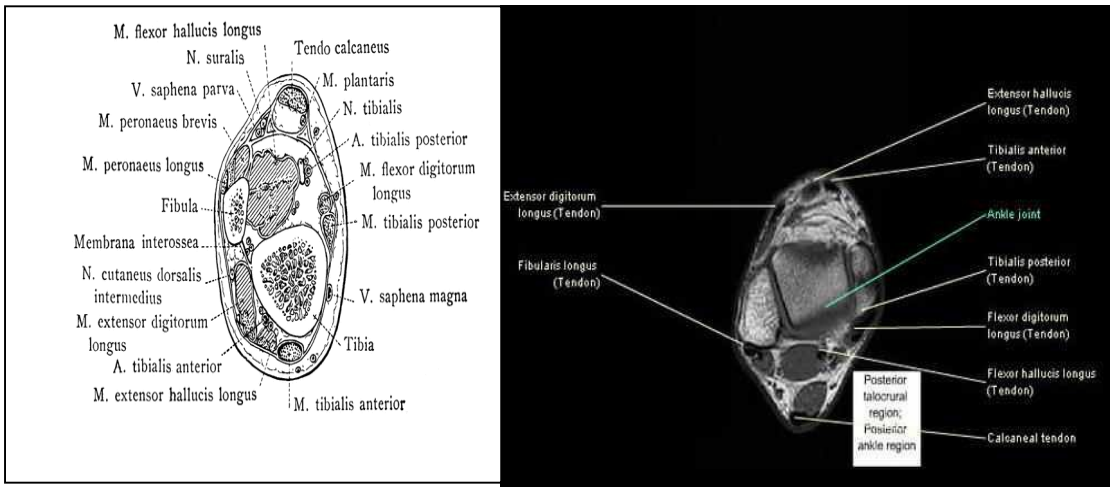

Fig. (2) Transverse section and MRI through ankle (9).

Lower end :

The lower end of the tibia is rectangular in section. Medially the surface is subcutaneous, with the great saphenous vein and nerve crossing above the medial malleolus. Anteriorly the bare bone is crossed by the tendons of tibialis anterior and extensor hallucis longus and the anterior tibial neurovascular bundle and extensor digitorum longus.

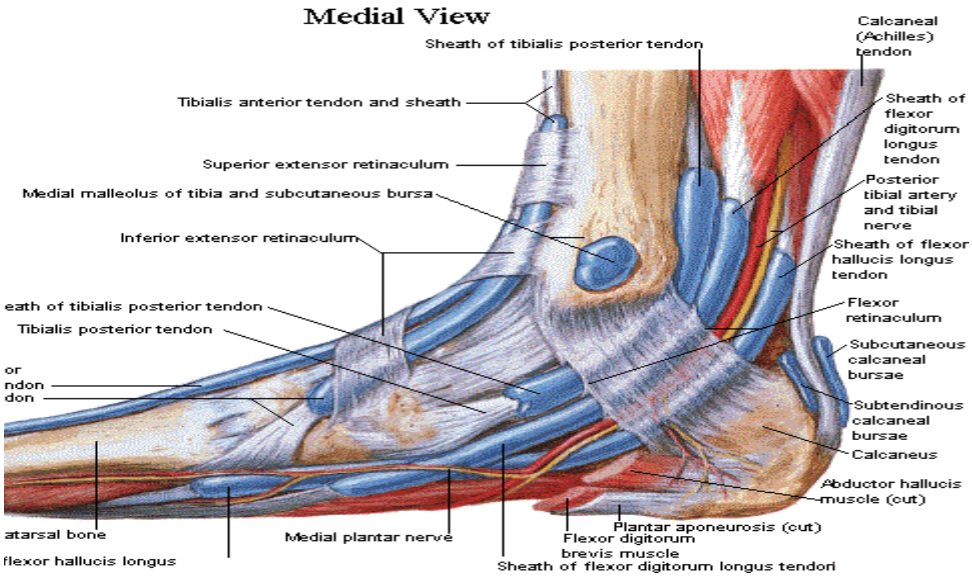

Fig (3).The anatomy of the medial side of the ankle (9).

There may be a facet (the squatting facets) just above the articular margin. Laterally the surface is triangular between the ridges that diverge from the lower end of the interosseous border; this triangular area gives attachment to the strong interosseous ligament. The lower part of this surface articulates with the fibula as a synovial upward continuation of the ankle joint. Posteriorly there is a groove behind periosteum at its margins. The tendon of tibialis posterior, in its synovial sheath, is lodged here, bridged by a band of fibrous tissue. Alongside it, the tendon of flexor digitorum longus crosses the bone, while on the fibular side the posterior surface has the lower end of the fleshy belly of flexor hallucis longus in