



Hybrid External Fixator a definitive management for Open Intra-articular tibial fractures

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Abstract

Introduction Intra-articular fractures of the tibia comprise 1 % of total lower limb fractures. It includes both the proximal and distal articular fractures most common mode being high velocity trauma. They pose a challenge because of minimal soft tissue covering around the bone per se and increased chance of compartment syndrome around the region due to low volume inside the compartment. The goal of management of these Intra-articular fractures are restoration of joint congruity by near anatomic reduction, stable fixation, early joint mobilization.

Material and Methods: This is a prospective interventional study conducted in the dept. of orthopedics at Dhiraj hospital during Dec 2019 to March 2021. 10 cases of intra-articular fractures of tibia involving tibial plateau and tibial plafond were included. All patients were treated by a combination of ring fixator with AO tubular fixation on the shaft of tibia. Both open as well as closed fractures were included in the study.

Results: There was complete union in all cases. 9 patients had excellent result and 1 had good result based on Hohl and Luck criteria for knee and IOWA score for ankle. The average time of union was 14 weeks post-operatively and gave excellent results in 90% cases.

Conclusion: Hybrid fixation can be a primary definitive management for Open intra articular tibial fractures. This technique also gives advantage of soft tissue protection and major complication like gross swelling, delayed wound healing can be prevented as early as possible. It also addresses the issue of joint stiffness developed after joint spanning external fixation.

Keywords: Hybrid fixators, Open Tibia fractures.

INTRODUCTION

Open Intra-articular fractures of the tibia comprise 1% of total lower limb fractures and such fractures are usually associated with extensive soft tissue damage. The thin soft tissue envelope that surrounds the tibia makes treatment of these fractures difficult. Proximal intra-articular fractures are often referred to as plateau fractures and Distal tibia fractures are often referred to as "plafond" fractures. In these fractures an anatomic realignment of the involved articular fracture in conjunction with a stable fixation is crucial. The main mechanisms of injury for intra-articular fractures of

tibia are either low-energy types secondary to rotational forces or high-energy trauma from axial loading of the articular surface causing multi-fragment implosion of cartilage and bone.

The goals of management of these Intra-articular fractures are restoration of joint congruity by anatomic reduction of the articular fragments, stable fixation thus allowing early joint movements and proper care of injured soft tissues and reducing chances of infection. The use of this technique allows anatomic

joint construction without the soft tissue stripping required for plate application. Soft tissue management is facilitated because there is no internal fixation to be covered. Early external fixators for intra articular fractures were joint spanning thereby limiting the joint motion. Early motion is thought to be the most important factor in promoting cartilage nutrition and healing.

Over the years, a number of treatment modalities have been used, with mixed results, ranging from traction to cast immobilization then open reduction and internal fixation. No treatment modality has produced consistently good results, nor has allowed both stable fixation and preservation of the remaining soft tissues. So this study is aimed to emphasize the advantages of hybrid external fixators over other modalities. This study prospectively evaluates the clinical and radiographic results of treating Open intra-articular fractures of tibial plateau and plafond using the technique of limited internal fixation combined with hybrid external fixation.

Material and methods

From Dec 2019 to March 2021, 10 cases of intra-articular fractures of the both proximal and distal tibia were treated by use of a combination of a ring external fixation and AO tubular fixator (Hybrid fixator).

Inclusion criteria were the presence of an open intra-articular tibial plateau or plafond fracture in patients of age over 18 years and the ability to walk without assistance before injury. Articular congruity was achieved by elevating the depressed fracture fragments percutaneously under IITV. Proximal small Intra-articular fragments were fixed with two to three 1.8 mm transfixion wires, duly tensioned and fixed with ring. The distal fragment was fixed with 5.0 mm Shanz pins. These pins were connected with 2-3 tubular rods which were ultimately connected to the ring frame. Reduction of the metaphysis to the diaphysis was achieved by indirect reduction technique, using the fixator. The whole frame was finally tightened.

The wound was sutured after thorough debridement. In cases where closure was not possible skin grafting was done as a secondary procedure. Passive and active range of motion (ROM) exercises for knee and ankle were started as early as 1st day post-operatively. Partial Weight bearing was encouraged after stable fixation.

Fixator was removed by 10-12 weeks after appearance of radiological signs of union. Hinge knee brace in plateau tibia fractures and Patella tendon bearing cast in plafond tibial fracture was given for further 4 weeks and patients were advised full weight bearing. All the patients were followed-up and evaluated both clinically and radiographically.

RESULTS.

There were 3 closed, 2 open grade II and 4 open grade III fractures according to the Gustilo-Anderson Classification⁽⁵⁾. Associated fibula fracture were seen in 6 patients (60%). The fracture union took place in all cases. Union of the fracture was assessed clinically by stability without pain and radiographically, by the evidence of bridging callus. The average time of union was 14 weeks post-operatively. The fixator was removed after radiographic evidence of bridging callus at the end of 8 weeks in most of the patients. Knee range of motion ranged on an average from 0°-120° and Ankle range of motion ranged on an average from 0°-30°. 9 patients had excellent result and 1 patient had good result based on Hohl and Luck criteria for knee and IOWA score for ankle after final follow up.

Discussion

Intra-articular fractures of tibia, especially Open and compound injuries, are complex problems. Such injuries are usually associated with soft tissue injury and marked comminution of articular surfaces. Use of transarticular fixators in Intra-articular fractures may lead to joint stiffness, thus affecting the ultimate functional outcome.

The importance of the soft-tissue envelope in the healing of Intra-articular fractures of tibia has been analyzed in the literature and a correlation of poor results with severely damaged soft-tissues has already been established. High energy trauma is considered as a major cause of poor results in the treatment of tibial plateau fractures.

Different methods for treating these complex injuries have been proposed, including limited open reduction and stabilization with percutaneous screws, open reduction and internal fixation and indirect reduction and application of a hybrid external fixation device.

Internal fixation, despite the advantages of direct visualization, proper and stable reduction of the

articular surface as well as the acute repair of soft tissue injuries, presents serious disadvantages, including skin or soft-tissue necrosis caused by surgical manipulations on an already damaged soft-tissue envelope and the high rate of infection, which may compromise the final result. The external fixation as a definite treatment for the patient with multiple osseous and soft tissue injury. The goal of surgical treatment of these Open Intra-articular fractures is to provide stable fixation, thus allowing early joint motion, and to obtain articular congruity in just one step and provide definitive treatment.

Early joint motion is probably the single most important factor in promoting cartilage nutrition and healing. Inter-fragmentary compression and articular congruity was achieved by the use of olive wires from opposite directions. Use of a ring in the Intra-particular region helped in achieving stable fixation and In addition allowed early joint motion. This helped in achieving good to excellent clinical outcome 90 % fractures in our study showed excellent results. These results are comparable to those in the scarce studies on the hybrid fixator reported in the literature ^(1,6,7).

Complication rate, Infection and especially pin tract infection were reduced by use of small diameter K-wires with the circular frame near the joint reduce. Stability of the construct is not affected by the combination of a ring frame with a tubular frame⁽⁸⁾. Few hybrid external fixate long and multi-stepped procedure In this study, we have used a unique combination of Ilizarov type ring fixator with an AO type tubular fixator using a universal single adjustable clamp of AO type.

Hence, we suggest use of a hybrid external fixator intra-articular tibial fractures, especially resulting from high-energy trauma.

Conclusion

Hybrid fixation can be a primary definitive management for Open intra articular tibial fractures. This technique also gives advantage of soft tissue protection and major complication like gross swelling, delayed wound healing can be prevented as early as possible. It also addresses the issue of joint stiffness developed after joint spanning external fixation

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