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Original Research Paper

Orthopaedics

A COMPARATIVE STUDY OF FUNCTIONAL AND RADIOLOGICAL OUTCOME OF HIGH ENERGY PROXIMAL TIBIA FRACTURE USING ILLIZAROV EXTERNAL FIXATOR VS HYBRID EXTERNAL FIXATOR

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ABSTRACT

Background: In High energy proximal tibia fracture aim is to achieve adequate reduction and stability without significantly compromising the soft tissue integrity and vascularity . External fixator minimizes soft tissue dissection and minimize other complications.

Method: 60 patients' high energy proximal tibia fracture with cases were considered in the study. 30 patients were treated with Ilizarov external fixator and 30 patients were treated with hybrid external fixator. Results were analyzed both clinically and radiologically using Johner and Wruh's criteria.

Results: Mean time of union was 22 week in ilizarov fixator group and 34 week in hybrid fixator group. Pin tract infection occured in 6 patient (20%) in ilizarov fixator group and 4 patient in hybrid fixator group. Joint stiffness occured in 3 Patient (10 %) in ilizarov group and 10 patient in hybrid fixator group.Shortning occured in 2 patient (6.6 %) in ilizarov fixator group and 2 patient in hybrid fixator group. Overal results in ilizarov group were excellent in 23 patient (76.7%), good in 5 patient (16.67%) , fair in 2 patient (6.67%) while in hybrid group excellent in 16 patient(53.33%),good in 10 patient(33.33%),fair in 4(13.33%)patient.

Conclusion: External fixators are excellent modalities in treatment of high energy proximal tibia fracture with ilizarov method has advantage of early mobilization and early union but require long operative time and bulky framework on other hand hybrid fixator has simpler construct ,lesser operative time but has lesser stability , longer union time and longer immobilization time.

KEYWORDS : illizarov fixator ,hybrid fixator, proximal tibia fracture.

INTRODUCTION

Fractures of Tibia are very common in patients with trauma[1]. Open fractures of tibia are more common because of the subcutaneous location of bone and are prone to high rate of nonunion and Malunion because of precarious blood supply.

The primary objective in treatment of high energy tibial fractures are prevention of infection, maintenance of normal length, alignment and rotation of the extremity, minimizing additional damage to soft tissue and bone and hence preserving the remaining circulation and providing a mechanical environment which stimulates periosteal and endosteal responses favoring bone healing[2]. Tibia nailing though a commonly done procedure also has number of complications. Malunion occurs in up to 37% of tibia nailing procedures and is quite often found in proximal tibia fracture[3,4]. Severe comminution hinders the healing process further adding on to the complications. Intramedullary nail insertion is also shown to interfere with circulation in the diaphyseal cortex[5,6]. When the intramedullary blood supply is destroyed, it leads to necrosis of diaphyseal bone. The vascular system will reconstitute in 2 to 3 weeks, during which time the presence of dead bone and an open fracture wound may increase the risk for infection. Because of Less soft-tissue coverage of the tibia, plate fixation has typically been associated with an unacceptably high prevalence of wound complications, especially when it has been performed for more complex high energy fracture[7,8] . Periarticular fractures are challenging to treat because of articular comminution and relatively tight soft tissues around these areas[9] .Conventional open reduction of the fracture followed by plate and screw fixation has indeed produced good results especially in low energy fractures but in case of high energy complex fractures with significant comminution this doesn't hold good[10-12]. If complications arises, patients might have to undergo multiple procedures with a long stay in the hospital and may end up even having an amputation[13]. As a result, there has been a move towards external fixation. There are different ways by which these fractures are treated which includes traction, splinting, internal fixation and external fixation. Traction and casting leads to poor union rate, high rate of Malunion, non union and joint stiffness. Open reduction and internal fixation carries high risk of infection, wound complications and hardware problems especially in high energy trauma cases. External fixators in these fractures have provided an effective alternative with excellent results. The goal is to achieve normal axial alignment and to reduce displacement thereby regaining a stable, mobile and painless joint, while avoiding infections and wound complications[1]

MATERIAL AND METHODS

SOURCE OF DATA

The study was conducted from June 2018 to may 2021. All proximal tibia fracture with compromised skin condition cases were considered in the study. All patients with age group between 20-70 years including both males & females admitted in the Orthopedic wards Dr. S. N. Medical College & Attached group of hospitals were included in study.

STUDY DESIGN:

Prospective clinical observational study.

SAMPLING TECHNIQUE:

Consecutive sampling

SIZE:

A total 60 consecutive patients of proximal tibia fractures with high energy trauma who attended the casualty or O. P. D during the thesis period at Mahatma Gandhi Hospital &

Mathuradas Mathur Hospital Jodhpur (Rajasthan) will be included in study group.

INCLUSION CRITERIA

1. All patients with case proximal tibia fracture with compromised skin condition (blister on skin).
2. Compound severely comminuted proximal tibia fractures

EXCLUSION CRITERIA

1. Close proximal tibia fracture with good skin condition.
2. All distal tibia fractures

METHODS OF COLLECTING DATA:

The complete data is collected from the patients in a specially designed Case Record Form (CRF) by taking history of illness and by performing detailed clinical examination along with relevant investigations.

Finally, after the diagnosis patients are selected for the study depending on the inclusion and exclusion criteria. Post operatively, all the cases are followed up until fracture union occurs for a minimum period of 6 to 12 months. Results were analyzed both clinically & radiologically using Johner and Wruh's criteria.

History and Clinical Examination

Once the patient satisfies the Inclusion and exclusion criteria, detailed history taking and clinical examinations are done. History is taken to know the age, sex, time since injury, mechanism of injury, side involved, pre injury functional status and associated head and chest injuries.

Thorough skeletal survey was done to rule out associated injuries like head Injuries, chest injuries, pelvic injuries and fractures especially of the foot, femur and the upper limb.

Systemic examination was done to know whether the patient had any associated cardiovascular, neurological, renal or respiratory problems and if present that are dealt with inter departmental references taken to make patient fit for surgery.

Local examination was done to know whether it is a closed or an open fracture, condition of skin especially around the proximal tibia and distal tibia, bony deformity, neurovascular status of the limb, presence or absence of signs of compartment syndrome and clinical Evaluation of the fracture.

Radiographs were taken which included Chest X ray, Pelvis X ray, Thoraco lumbar spine X ray if it was a case of poly trauma and with at least 2 Projections, AP and lateral view of the affected leg which includes one joint above and one joint below the suspected fracture site. Then the fracture pattern is noted.

Open fractures were classified based on Gustilo Anderson's classification.[14,15,16] Closed fractures were classified based on Tscherne's classification[17]. Other investigations for Anesthesia fitness such as complete blood count, urine routine, random blood sugar, renal function test, liver function test, electrocardiogram, blood grouping and cross matching were carried out if found necessary.

After proper Pre-operative anesthetic evaluation the surgery was performed under spinal anesthesia. All subjects with open fracture were started on triple antibiotics which includes 3rd generation Cephalosporins, Metronidazole for Anaerobic bacteria and Aminoglycoside for gram negative bacterial coverage. All open wounds were given thorough wound wash with normal saline in the casualty as soon as the patient was received. Patients who required plastic surgery interventions were operated in the same sitting with plastic surgery procedures like flap coverage and SSG.

Radiological criterion:

During follow up, Radiographs of the affected limb is taken in antero posterior view and lateral view .The fractures were considered to be united when antero-posterior and lateral radiographs shows bridging callus in three of the four cortices.

Functional criterion:

Fracture was stable when stressed manually and the patients were able to walk after removal of the connecting rods. Fixator could then be removed under local anesthesia.

Patient's Leg length was measured clinically to assess Limb length discrepancy. Varus and Valgus angulation were assessed by full length x-ray of tibia in AP view, Procurvtum and Recurvatum deformity were assessed by full length x-ray of tibia in lateral view. Post op Rotational deformities were assessed clinically.

Movements at knee, ankle and subtalar joint were assessed clinically and compared to normal range of motion. Pain and strenuous Activities of patient were assessed and used in Johner and Wruh's criteria[20], which was used for final evaluation of the patients.

TABLE 1: JOHNER AND WRUH'S CRITERIA[18]

Criteria	Excellent	Good	Fair	Poor
Non union/Infection	None	None	None	Yes
Neurovascular injuries	None	Minimal	Moderate	Severe
Deformities				
Varus/Valgus	None	2-5	6-10	>10
Pro-Recurvatum	0-5	6-10	11-20	>20
Rotation	0-5	6-10	11-20	>20
Shortening	0-5mm	6-10mm	11-20mm	>20mm
Mobility				
Knee	Full	>80%	>75%	<75%
Ankle	Full	>75%	<75%	<50%
Subtalar	Full	>75%	<75%	<50%
Pain	None	Mild	Moderate	Severe
Gait	Normal	Normal	Mild limp	Significant limp
Strenuous activities	Possible	Limited	Severely limited	Impossible

OBSERVATIONS AND RESULTS

This is a Prospective Observational study consisting of 60 patients which is comprised of 48(80% of total) males and 12 (20% of total) females with a mean age of 39.66±11.32. Among the patient's right tibia was involved in 38(63.33%) patients and left in 22(36.67%) patients.

Most common mechanism of injury is road traffic accident comprising of 52 (86.6%) patients, fall from height comprising of 4(6.67%) patients and assault 4 (6.6%) patients. There were 46 closed (76.67%) and 14 open (23.33%) fractures. Among 60 patients 54 of them had no comorbidities and rest 6 had one or the other comorbidity.

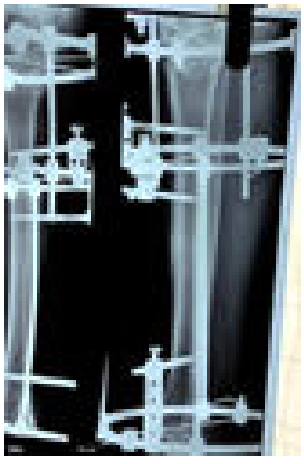
Fracture union was achieved in all cases with Maximum period of 48 weeks on hybrid minimum being 13 weeks. Post operatively, all the cases were followed until fracture union occurred for the minimum period of 6 months to 12 months. In our study pin tract infection was observed in 6 patient with ilizarov and 4 patient with hybrid external fixator, knee stiffness was seen in 4 patient with ilizarov and 7 patient , shortening was seen in 4 patient 2 in each category.

Results were analyzed both clinically & radiologically using Johner and Wruh's criteria. We obtained excellent result in 23 (76.67%), Good in 5 (16.67%) and Fair in 2 (6.67%) patients.

CASE 1: Proximal tibia fracture treated with Ilizarov

PRE OP

POST OP



3 MONTH POST OP

AFTER REMOVAL IN FOLLOW UP

CLINICAL OUTCOME RECENT FOLLOW UP

Case II: Proximal tibia fracture treated by hybrid fixator

Pre-Op

Post-Op

After Union

CLINICAL OUTCOME RECENT FOLLOW UP

DISCUSSION

Fractures of tibia are very common in patients with trauma. Their treatment[1], prognosis and outcome are mainly determined by the mechanism of injury, degree of comminution, soft tissue injury and displacement. Fractures produced by indirect trauma have a better prognosis than those produced by direct trauma[19,20] The risk of delayed union and nonunion in closed[1,21] and open treatment is increased with comminution[22]. Open fractures have a higher infection rate than closed fractures[23] and the rate increases with the increasing severity of the soft tissue injury[24] Minimally displaced fractures allow more simple treatment than displaced fractures. Therefore, high-energy injuries have added to the number and complexity of fractures of long bones, especially those of tibia and so have the treatment modalities addressing them.

Treating such kind of fractures is a big challenge for the orthopedic surgeons. Open reduction and internal fixation with plates have produced an excellent result only in low energy fractures with less soft tissue damage. There are many surgeons who use minimal invasive technique for plating these fractures. However, most of these surgeries end up in deep infection and extensive skin necrosis.

During the follow up range of motion of both knee, ankle and subtalar joint was checked and the range of motion of both knee, ankle and subtalar joint was found to be near normal in our study. No cases with significant deformities in sagittal or coronal plane and no rotational deformities were noted in our study. In our study most common complication observed was the pin tract infection, all were treated successfully with dressing alone with betadine-soaked gauze pieces and resolved by oral antibiotics alone.

There were 3 patients who developed stiffness of knee, they had to undergo physiotherapy for the stiffness. Among 60 patients 5 patients had a post-operative shortening.

Table 2: Comparing fracture type

Fracture Type	Ilizarov Group	Hybrid Group
Close	22	24
Open	7	7

Table 3: *Comparing results of a study (Johner and Wruh's criteria)*

Outcome	Ilizarov Group	Hybrid Group
Excellent	23	16
Good	5	10
Fair	2	4
Poor	-	-

Table 4: *Comparing complication of surgery in our study*

Complications	Ilizarov Group	Hybrid Group
Pintract infection	6	4
Knee stiffness	4	7
Shortening	2	2

Table 5: *Comparing Time (in weeks) of union in our study*

	Mean Time of Union (In weeks)
Ilizarov Group	22
Hybrid Group	34

CONCLUSION

Ilizarov external fixator have advantage of early post op mobilization higher stability of construct and earlier union rates while due to bulky framework lead to incompliance among patients. Hybrid fixator even though provides advantage of lesser framework and better patient compliance but significantly limits post op mobilization and delays union time.

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