

RESEARCH ARTICLE

TO EVALUATE THE OUTCOME OF ELASTIC NAILING ALONG WITH EXTERNAL FIXATOR IN OPEN TIBIA FRACTURES

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Manuscript Info

Abstract

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*Key words:-*EF External Fixator, TENS Titanium Elastic Nailing System **Background**: Open tibial fractures account for over 40% of all open fractures and are frequently accompanied by significant damage to soft tissues, including skin, muscle, and neurovascular structures . This article presents a intramedullary(TENS)- and external fixator technique. The purpose of this study is TO EVALUATE THE OUTCOME OF ELASTIC NAILING ALONG WITH EXTERNAL FIXATOR IN OPEN TIBIA FRACTURES".

Materials and Methods: Following ethical approval, thirty patients with tibial fractures were treated by the EF-TENs system between NOVEMBER 2019 and SEPTEMBER 2021. The follow-up studies included clinical and radiographic examinations. All relevant outcomes were recorded during follow-up.

Results: All 30 patients were assessed by follow-ups. According to the Anderson-Gustilo classification, there were 19 Type Grade II, 6 Type Grade IIIA and 5 Type Grade IIIB. All thirty patients were achieved follow-ups. All follow-up fractures united at last, but delayed union was observed in 5/30 patients. The average union time is 23.83+_4.47 weeks (range, 18–32 weeks). The main complication mentioned in this study was pin track infection, which occupied 6/30 cases. According to Johner–Wruhs'criteriaof tibial shaft fractures, 19 fractures had excellent, 5 had good, 5 had fair and 1 had poor results.

Conclusion: This study indicated that the outcome of elastic nailing along with external fixator, as a definitive intra- and extramedullary fixation technique, which was effective in treatment of open tibial fractures.

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Introduction:-

Over 40% of all open fractures occurs in tibia and are accompanied by significant damage to soft tissues, including skin, muscle, and neurovascular structures [1]. Therefore in tibia fractures serious complications can occur, such as infection, malunion, non-union and delayed union, adding to the incidence of readmission and reoperation [2, 3]. Thus, a timely and appropriate treatment management protocol that involves thorough debridement, curettage, acceptable reduction, early and stable fixation, repair of soft tissues, dressings and antibiotics administration has been widely accepted for reducing complications and increasing the chances of bony union [2, 4]. There has been treatment and fixation methods for open tibialdiaphyseal fractures which have evolved over many years but still remained controversial [4–6]. Damage control orthopaedics (DCO) with external fixation followed by definitive internal fixation with nailing or plating is a popular strategy for significantly decreased complications [7]. However,

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the secondary fixation procedure causes economic, physical, and psychological burdens, making the strategy less than ideal [7–9].

We studied the result of open tibia frature with limited external fixation and titanium elastic nailing in view of maximum preservation of vascular supply and conclusive environment for fracture healing and need of only one definitive surgery for open tibia fracture.

An **External Fixator** is a device placed outside the skin which stabilizes the bone fragments through wires or pins connected to one or more longitudinal bars/tubes.

One of the main characteristics of external fixators is skin penetration creating so-called pin tracks. Most of the disadvantages of external fixation are related to pin-track complications(10)

In this system, the titanium elastic nails can play a certain role in maintaining fracture rotational and linear stability with good elasticity and flexibility as possible.

Aims And Objectives:-

To Evaluate The Functional And Radiological Outcome Of Elastic Nailing Along With External Fixator In Open Tibia Fractures"

Material And Methods:-

The proposed study will be conducted in the Department of Orthopedics, NSCB MEDICAL College and hospital, after obtaining informed consent from the study subjects.

Design of study :

Prospective Study

Study Period : 2019 to 2021

Study Centre:

Department of Orthopaedics NSCB Medical College & Hospital Jabalpur (M.P.)

Source of data :

NSCB Medical College and Hospital Jabalpur.

Sample size : 30open fracture of tibia

Inclusion Criteria:

-Diaphysealtibial fractures including polytrauma -Age group>18 year old -Open frcture type II, IIIA ,&IIIB according to Gustilo Anderson Classification

Exclusion Criteria

-Intraarticular Fractures of proximal/ distal tibia
-Non consent patients
-Burns over the entry portal
-Pathological fractures
-Assosciatedneuro vascular injury requiring repair
-Previous ipsilateral lower limb surgery
-Open fracture grade 1 and open fracture grade IIIc

Methodology:-

Each participant was explained in his/her language regarding his/her injury, investigation details, management protocol, alternative measures, anticipated outcome and probable complications related to surgery.

Preoperative Details:

A detailed history and thorough clinical examination were done. The pre-operative, intraoperative, postoperative and follow up data were recorded as performa of study.

Following investigations were done

- 1. Routine haematological investigations were done & preanaesthetic fitness were taken.
- 2. Radiograph of knee with leg and leg with ankle in anteroposterior and lateral view of injured leg
- 3. All patients were put on above knee slab or bohlerbraun splint according to the fracture.

Intraoperative Details:

Anaesthesia:

All patients underwent the surgery in spinal or combined spinal and epidural anaesthesia.

Surgical Procedure:

- 1. Patients was in supine position under general or spinal anaesthesia.
- 2. Scrubbing, painting and draping was done.
- 3. Thorough debridement and saline lavage was done of the wound
- 4. Stab incisions were made above and below the fracture site,
- 5. Then the bone was predrilled above and below the fracture site with drill bit.
- 6. Then schanz pins were introduced with the help of schanz pin introducer.
- 7. All schanz screws were threaded to the opposite cortex to guarantee stability under fluoroscopy.
- 8. Hollow connecting rod was connected to schanz pin with the help of AO clamps and T clamp .
- 9. With manual manipulation and under guidance of C- arm reduction of fracture was achieved.
- 10. AO clamps were tighten with the help of spanner.
- 11. After that, at lateral and medial aspect of the proximal tibia (at the level of apex of fibula), a 1-2 cm longitudinal incisions were made on either side and entry was made with the help of awl,
- 12. Two TENS nail of same size were inserted from entry sites in anterograde manner, passing the nail from the fracture site upto the distal end of tibia under C arm Guidance.
- 13. The nail was cut with ends was just outside the cortex and skin was sutured
- 14. Primary closure of wound was attempted or else left for secondary procedure or flap coverage and dressing was done .

Post Operative Protocol

Postoperatively x rays were obtained and limbs were kept elevated.

In case of persistent infections pus culture/swab culture was sent and antibiotics were changed accordingly. Daily debridement and dressing of wound was done. VAC dressing done to accelerate the healing process and also planned for split skin graft or muscular flap graft when required , this was done once healthy granulation tissue appeared.

On 1st Post-operative day: Ankle pump exercises and also given multitail/ slab to prevent ankle joint stiffness

On 2nd Post-operative day: Knee mobilization, Static Quadriceps strengthening exercises and Partial weight bearing was started with support of walker 1-2 weeks post-operatively: Full weight bearing was initiated with the support of the walker1 month post operatively :- Dynamisation of the external fixator done so that micromovements over the fracture site can be started which enhances the callus formation.

The external fixator was removed at outpatient days during the follow-up, when radiographs showed adequate bridging callus had formed.

Final results were evaluated according to Johner–Wruhs'criteria score (Table number 1)

Johner-Wruhs'criteria

	Excellent(left = right)	Good	Fair	Poor
Non union, osteomylitis,	None	none	none	yes
amputation				
Neurovascular	None	minimal	moderate	severe
disturbances				
DEFORMITY				
Varus/valgus	None	2-5	6-10	>10
Anteversion/recurvation	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	Normal	>80%	>75%	<75%
Ankle	Normal	>75%	>50%	,50%
Subtalar	>75%	>50%	<50%	
Pain	None	Occasional	Moderate	Severe
Gait	None	Normal	Insignificant limp	Significant limp
Strenous activities	Possible	Limited	Severely Limited	Impossible

50 year old male Gustilo Anderson II fracture distal one third tibia with proximal one third fibula(right)

Pre operativexray

Figure 1:-





2 month follow up xray4 month follow up xray



5 month follow up

9 month follow up







Knee Flexion

Ankle Dorsiflexion



Ankle Planter Flexion



Figure 5:-

Standing Position

Results:-

All thirty patients were achieved follow-ups.According to the Anderson-Gustilo classification, there were 19 Type Grade II, 6 Type Grade IIIA and 5 Type Grade IIIB (Table number 2). The average union time is 23.83+4.47 weeks (range, 18-32 weeks), All follow-up fractures united at last, but delayed union was observed in 5/30 patients. Malunion was existed in 1/30 case. The most common complications in this study was pin track infection, which occupied 6/30 cases, one deep infection presented, which were all successfully treated with the use of oral antibiotics and dressing . The external fixator was removed with a mean time of (20.06+2.25) weeks. As to the function of knee and ankle, respectively, only 1/32 patient suffered with the restricted ROM of ankle, one with the restricted ROM of knee due to elastic nail impingment.

According to Johner and Wruhs'(11)classification of tibial shaft fractures, 19 fractures had excellent, 5 had good, 5 had fair and 1 had poor results.

Discussion:-

The treatment of tibia fractures can be challenging because of the limited soft tissue, the subcutaneous location, and the poor blood-supply. The main goals of treatment in tibial fractures are a minimum of soft tissue injury in order to preserve the vulnerable soft tissue coverage and relatively accurate reduction and stable fixation. In this study, we presented a intra and extramedullary fixation technique: percutaneous external fixator augmented with titanium elastic nails (EF-TENs system). Compared with single external fixator, the External fixator- TENS system, preserves the advantages of single external fixator in open fractures, but also increases the accuracy in reduction and enhances the stability with the augmented elastic nails through closed reduction. Moreover, Although intramedullary nailing had satisfactory results in the management of closed tibialdiaphyseal fractures, the EF-TENs system may avoid following complications and situations in IMN: (1) knee pain, (2) more hidden blood loss, whether reamed or unreamed, (3) in open tibial fractures, such as Grade II or Grade III, because the intramedullary nailing had larger diameter than elastic nails, which increases the possibility of intramedullary contamination. The preliminary results of this new treatment option are promising. The mean time to union in our series was 23.83+ 4.47 weeks weeks (range, 18-32 weeks), which are comparable to K.-K. Tu et al 2015 (12)in his study found that the average union time is 23.7 weeks (range, 14-32 weeks). Therefore, the preservation of the soft tissues and external fixator augmented with TENS are effective and given satisfactory results, by giving contributions to fracture reduction and improves linear and rotational stability. And gradual dynamisation of the external fixator contributes to the fracture union by micromovement at the fracture site. Therefore for this reasons, the external fixator was removed with a mean time of 20.06+_ 2.25 weeks (range, 17-23 weeks), which takes relatively less time than that reported in others studies just with external fixator [13,14]. In our study we found that pin tract infection was the most common complication 20%(6 out of 30 patients) and delayed union occurred in 16.7% (5 patients out of 30), restricted ankle movement occurred in 3.3% (1 out of 30 patients), malunion, deep infection, tens nail impingement and restricted knee movement occurred in 3.3% each which are comparable to K.-K. Tu et al 2015 (12)

Conclusion:-

As this is a single staged procedure with percutaneous and minimal invasive surgical technique, which can achieve bone stability by enhancing the fixation system stability with augmented titanium elastic nails through closed reduction, which lowers the risk of nonunion and mal union, preserves the endomedullary blood supply, less hidden blood loss, decreasing the possibility of intramedullary contamination, prevents further soft tissue damage . Furthermore gradual dynamization could be achieved and bone healing was enhanced subjected to micromovement.

Due to one staged fixation operation it also avoids converting fixation to IMN(intramedullary nail)/ plates fixation therefore decreases the further hospital stay.

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