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Original Research Article

To Determine the Comparative Radiological & Functional Outcome & Complications of the Acute Open Tibial Fractures Treated with Primary Ilizarov External Fixator and AO External Fixator

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Abstract

Aim: Comparative study of functional and radiological outcome in management of type IIIB tibial fractures by AO and ilizarov external fixator

Methods: This Randomized**,** comparative study conducted in the Department of Orthopedics, ESIC Medical College, Bihta, Patna, Bihar, India. 50 patients satisfying the inclusion criteria have been treated by Ilizarov technique and 50 patients treated by AO external fixator

Results: In our study ASAMI bone results & functional results was Excellent (24%), Good (72%) & Poor (4%) in AO group, whereas in Ilizarov group Excellent (64%), Good (32%) & Poor (4%).

Conclusion: Ilizarov external fixator being minimally invasive procedure interferes less with the blood supply. The construct is ring fixator, safe, stable (three-dimensional stability) and enable the patient early Weight bearing after surgery and high union rates, even in highly comminuted fractures.

Keywords: ASAMI, Ilizarov, Tibial Fractures.

Introduction

Tibial shaft fracture is a common injury worldwide and management of open tibial fracture remains a challenge for the orthopaedic surgeon. The annual incidence is 26% per 100,000 populations with a mean age of 37 years, male population are affected more due to road traffic accidents and contact sports [1]. Fracture pattern and severity of soft tissue damage varies according to energy of trauma. Tibial shaft fractures usually occur in association of soft tissue damage [2]. Its anteromedial surface is subcutaneous which is responsible for high incidence of open fracture. Insufficient blood flow and lack of soft tissues in antero-medial aspect of tibia contribute to open fracture with increased incidence of non-union and development of infection [3]. Their treatment, prognosis, and outcome are mainly determined by the mechanism of injury, presence of comminution, soft tissue injury and displacement [4].

Treatment of open tibial fractures has controversy among the orthopedic surgeons[5]. Severe open fractures should

be managed in specialist units experienced in the management of such injuries [6]. Treatment option include conservative treatment with cast immobilization, Intramedullary nailing, Open reduction and internal fixation with plate, minimally invasive plate osteosynthesis (MIPO) techniques with limited periosteal stripping and soft-tissue dissection.

In developing countries, lack of education, poor socioeconomic backgrounds, delay in presentation and appropriate planning for surgery add further to complicate the situation. As open tibial fractures are prone to infection which may end in delayed union, non- union, prolong hospital stay, multiple surgeries and ultimate results in increased morbidity. Currently, external fixation is most commonly used in the temporary management of open fractures followed by internal fixation but can also be used as a definitive method of fixation [7]. Duration of temporary external fixator is 4 weeks but at least 2 weeks are required for soft tissue healing [3].

A variety of external fixators are available: simple uniplanar frames that are attached with half-pins and clamps, multiplanar fixator that may improve stability, and the most complex ring fixator with fine wire attachments and Ilizarov techniques [8]. Ilizarov have advantage to allow early mobilization, weight bearing with decreased morbidity and hospital stay as compared to temporary stabilization which ultimately requires a second procedure for definitive fixation with Intramedullary nailing or plate fixation [5].

Material and methods

This Randomized**,** comparative study conducted in the Department of Orthopedics, ESIC Medical College, Bihta, Patna, Bihar, India

Cases satisfying the inclusion criteria were included. According to the hospital statistics, an average number of 50 patients satisfying the inclusion criteria have been treated by Ilizarov technique and 50 patients treated by AO external fixator. Cases will be randomized by simple random sampling.

Inclusion criteria

Patients between 18-60 years of age Fresh, Open Tibia fractures (type IIIB) were included in this study.

Exclusion criteria

We excluded Patients who are not willing to provide informed consent, Closed Tibia fractures, **Pathological**

fractures, Type I, IIIA & IIIC fractures, Intra Articular Fractures, Floating knee and Polytrauma patients

Procedure

After obtaining written informed consent will be taken from the patients fulfilling the inclusion and exclusion criteria. Demographic data, history, clinical examination and details of investigations will be recorded in the study proforma after admission. Preoperative work up done, and patients will be divided into two groups based on method of treatment they will get. These patients will be randomized by simple random sampling and treated with Ilizarov and AO Biplanar external fixator. Early wound swab taken. All patients were started on triple antibiotics which includes 3rd generation Cephalosporins, Metronidazole for Anaerobic bacterial coverage and Aminoglycoside for gram negative bacterial coverage. All wounds were given thorough wound wash with normal saline in the emergency room as soon as the patient is received. Patients who required plastic surgery interventions were operated in the same sitting with plastic surgery procedures like flap coverage and SSG, if the wound was less contaminated. Frames will be removed after clinico-radiological union.

The follow up would be for one year. Initially for every 3 weeks in first 6 weeks for wound care, every 6weeks for one year and assessed by Radiological evidence of union of fracture and Functional assessment

by Patient's Functional and Bone results are assessed based on ASAMI (Association for the study and application of the methods of Ilizarov) criterion and complications. The data will be recorded in the appropriate proforma.

Data collected was tabulated. Continuous variables were expressed as mean+/- SD and analysed within the groups using repeated measured ANOVA. Intergroup comparison will be done using unpaired 't' test. Categorial variables will be expressed as percentage or proportion and analysed using Chi square test.

Results

In our study most of the cases are observed in patients of age group 50 to 60 years, they Occupy 32 %, and 28 % cases were observed in age group 40-50 years age and 18% of cases were observed in 30-40 age group occupying the lowest. Hence most of the fractures were observed in 30-40 age groups. Mean Age in AO group is 45.3 +/- 11.6 years and Ilizarov group is 42.15 +/- 12.8 years with male preponderance in the Gender Distribution of both Groups, being 90 % and 90 % in Group A and B, respectively. According to our study males are more prone to fractures when compared to females.

Subjects in our series are more affected on right side (70 %) when compared to left side (30 %). In AO group majority of fractures were 42B3 (42%) & 43A3 (34%) and

Table 1: Demographic details

Variable	**AO Group (N =50)**	**Ilizarov Group(N=50)**
Age (years)	45.3 +/- 11.6	42.15 +/- 12.8
Sex	M : F = 45 : 5	M : F = 45:5
Side	R : L = 35: 15	R : L = 33 : 17
Ankle spanning	6	2
Duration on fixator(weeks)	23.85 +/- 3.2	25.1 +/- 5.9
Secondary procedures	10	2
Radiological union time	23.84 +/- 3.3	25.9 +/- 5.6

Table 2: ASAMI score – BR (Bone results & functional results)

ASAMI Score -fixation	AO external	Ilizarov technique	Total	Chi square	p value
BR - 48 WKS					
Excellent	12	32	44		
	24%	64%	44%		
Good	36	16	52		
	72%	32%	52%	6.91	0.037
Poor	2	2	4		
	4%	4%	4%		
Total	50	50	100		
	100.0%	100.0%	100.0%		

Table 3: Distribution of complication

Complications	AO external		Ilizarov technique		Chi square	p value
	n	%	n	%		
Pin tract infection	26	52	11	22	3.88	0.08
Pain	18	36	21	42	0.11	0.75
Stiffness	13	26	8	16	0.63	0.43
Limb length Discrepancy	6	12	3	6	4.12	0.38
Deformity/Malunion	11	22	6	12	0.79	0.67
Nonunion	3	6	3	6	0	1

42A3 (18%) 41A3 (6%). Ilizarov group majority are 43A3 (26%), 14% fractures of each 41A3, 42A1, 42A3 & 42C3 and 41A2 (12 %), 43A1 (6%).

Ilizarov external fixator is a Ring fixator, we used 4 Rings construct in 72% of cases and 3 Rings in 28% of cases. In AO external fixator we used BIPLANAR external fixator in all cases. In AO group 6 pins construct were 31 (62%), 5 pins -16(32%) & 7 pins - 4(6%). In Ilizarov group majority were 8 pins construct 41 (82%), 9 pins - 6(12%), 6 pins -3(6%). Mean duration on Fixator was 23.85 +/- 3.27 weeks in AO group, and 25.1 +/- 5.1 weeks in Ilizarov group.

In our study ASAMI bone results & functional results was Excellent (24%), Good (72%) & Poor (4%) in AO group, whereas in Ilizarov group Excellent (64%), Good (32%) & Poor (4%). Ilizarov has good Functional scoring when compared to AO group most common complications encountered were Pin Tract Infections, pain, stiffness, limp.

Discussion

Open high energy tibia shaft fractures are notorious for complications including infections, non-unions, soft tissue coverage and involve large volume of young active individuals.

Inan et al. in 2007 compared ilizarov with un-reamed intra-medullary tibia nailing and reported 21.5% malunion with Ilizarov the rate of pin site infection 27.4% which was higher than our results.9 Ganji et al in 2011 observed no differences regarding the mean time for union, malunion and re-fracture either with Ilizarov or AO external fixator for the treatment of open tibia fractures[10].

Pin tract infections were easily managed by oral antibiotics and local Neomycin skin ointment, stiffness was improved by extensive physiotherapy, pain was managed with analgesics and reassurance. Limb Length Discrepancy (shortening) was less than 2cm, which was corrected by shoe rise. No case developed deep Infection, or Unacceptable malunion.

Table 4: AO Group

Parameter	**Our study**	**Sm. Esmaeilnejad et al.[10]**	**Sanaullah et al.[11]**	**Mehtab Piwani et al.[12]**
Mean age (years)	45.3+/-11.6	31.3+/-10.9	32 +/- 15	34.7 +/- 5.8
Union time (weeks)	23.84+/-3.3	23.4+/-8.5	23.4	20.6
Non-Union (%)	6	11.7	7	3.3
Malunion (%)	24	18.3	7	3.3
ASAMI Score (%)	96	65		-
PTI (%)	52	24	31	66

Table 5: Ilizarov Group

Parameter	Our study	**Sm. Esmaeilnejad et al.[10]**	**Naveed Wani et al.[13]**	**Laishram Birendro singh et al.[14]**
Mean age (years)	42.1+/-12.8	32.3+/-11.2	36.4	39.1
Union time (weeks)	25.9+/-5.6	21+/-7.4	24.9 +/-5.1	24.5
Non-Union (%)	6	10	0	0
Malunion (%)	12	10	0	15
ASAMI Score (%)	96	87		-
PTI (%)	22	31	25	33.3

Tibia is most common bone to be fractured in polytrauma. Invariably fractures of tibia are complex in nature as it is subcutaneous in whole of its length. External fixators are the mainstay of treatment in open fractures.

AO and Ilizarov are types of external fixators. Ilizarov technique is cost effective, primary and definitive treatment and offer acceptable stability for the fracture, minimal operative trauma and good access to soft tissues and offers high union rates. AO external fixator is simple and safe to apply can be used in management of open tibial fractures. Ilizarov external fixator is a very good modality in treating such kind of fractures where internal fixation can lead to disasters. Ilizarov external fixator being minimally invasive procedure interferes less with the blood supply. The construct is ring fixator, safe, stable (three dimensional stability) and enable the patient early Weight bearing after surgery and high union rates, even in highly comminuted fractures. Radiological Union time is almost same in both techniques. Bone loss, Malunion, Nonunion, and limb length discrepancy can be addressed with this fixator simultaneously along with fracture treatment because of its versatility. Pin tract infection is the most common problem faced, higher with AO External fixator than Ilizarov technique, however this can be treated successfully.

Conclusion

Ilizarov external fixator being minimally invasive procedure interferes less with the blood supply. The construct is ring fixator, safe, stable (three-dimensional stability) and enable the patient early Weight bearing after surgery and high union rates, even in highly comminuted fractures.

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