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Original Research Article

A Randomized, Comparative Assessment of Functional and Radiological Outcome in Management of type IIIB Tibial Fractures by AO and Ilizarov External Fixator

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Abstract

Aim: To determine the comparison of radiological & functional outcome & complications of the acute open tibial fractures treated with primary ilizarov external fixator and Ao external fixator.

Material & Method: This is a randomized, comparative study conducted on Patients of either sex with open tibial fractures satisfying inclusion criteria admitted in the Department of Orthopaedics, over a period of 2 years. Patients satisfying the inclusion criteria have been treated by Ilizarov technique and other patients treated by AO external fixator in the previous 2 years. Cases will be randomized by simple random sampling.

Results: Subjects in our study are more affected on right side (60 %) when compared to left side (40 %). In AO group pin tract infections were seen in 42.8 % (n-15) and in Ilizarov group pin tract infections were seen in 14.2% (n- 5).

Conclusion: Because the Ilizarov external fixator is a minimally invasive technique, it has a lower impact on the blood supply. The ring fixator is a safe, stable (three-dimensional stability) design that allows the patient to walk immediately after surgery and has a high union rate, even in heavily comminuted fractures.

Keywords: Proximal tibial fractures, Ilizarov method, External fixation

Introduction

Tibia being the most common fractured long bone with recorded incidence of 17-21 per 100000 population, represents 2% of all fracture and 36.7% of all long bone fractures in adults.[1]Epidemiological studies have shown that open fracture

comprises 23.5% of all tibial shaft fracture.[2]The common causes of fracture are road traffic accident (62.2%), falls (18.7%), sports (7.4%) and direct blows (8.3%).[3] The lack of the muscular covering over anteromedial aspect of the tibia and poor blood supply predispose open tibial fractures to certain complications. They present with a 10–20 fold increased risk of developing infection than open fracture in any other anatomical areas[4]and a non-union rate as high as 28% has been reported in the literature.[5, 6]

Fractures of the articular surface of the tibia, even in fractures with minimal joint extension, are usually the result of a high-energy direct blow [7]. Because of the type of trauma involved and the relatively high frequency of major soft-tissue injuries [8] the complication rate is high, regardless of treatment [9]. The relatively large surgical incisions that are used for internal fixation also add a considerable risk of soft-tissue complications [10].

Gavril A. Ilizarov devised Ilizarov technique of treatment in open tibial fractures. Despite of technical difficulties, Ilizarov method is now used worldwide for treatment of open fractures.7 The construct is ring fixator, safe, stable and enable the patient early Weight bearing after surgery and high union rates, even in highly comminuted fractures.[11]The Ilizarov method relies on distraction osteogenesis and advantages compare to AO external fixator is its relative stability (angular, rotational, and alignment) and immediate post-operative weight bearing which is difficult in AO external fixators. Use of thin k-wires (1.5mm&1.8mm) offers minimum traumatic effects on bone when compared to AO external fixator. The efficiency of treatment in Ilizarov is higher than AO external fixation.[12]The purpose of study is to compare Ilizarov technique and AO External fixation in open tibial fractures in terms functional and radiological outcome.

Material & Method:

This is a randomized, comparative study conducted on Patients of either sex with open tibial fractures satisfying inclusion criteria admitted in the Department of Orthopaedics over a period of 2 years. Patients satisfying the inclusion criteria have been treated by Ilizarov technique and other patients treated by AO external fixator in the previous 2 years. 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:

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 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, Metranidazole 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 6 weeks 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 analyzed within the groups using repeated measured ANOVA. Intergroup comparison will be done using unpair't' test. Categorical variables will be expressed as percentage or proportion and analyzed using Chi square test.

Results:

In our study most of the cases are observed in patients of age group 51 to 60 years. Hence most of the fractures were observed in 31-40 age groups. Mean Age in AO group is 44.6±11.4years and Ilizarov group is 40.21±10.2 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 (60 %) when compared to left side (40 %). **[Table 1]**

In our study ASAMI bone results & functional results was Excellent (22.8%), Good (65.7%) & Poor 11.4%) in AO group, whereas in Ilizarov group Excellent (60%), Good (34.2%) & Poor (5.7%). Ilizarov has good Functional scoring when compare to AO group most common complications encountered were Pin Tract Infections, pain, stiffness, limp.**[Table 2]**

In AO group pin tract infections were seen in 42.8 % (n-15), pain in 25.7% (n-9), stiffness 20% (n- 7), limb length discrepancy in 11.4% (n- 4), deformity 17.1% (n- 6), Non-union 5.7%(n-2), limp 30% (n- 6). In Ilizarov group pin tract infections were seen in 14.2% (n- 5), pain in 28.5 % (n- 10), stiffness 14.2% (n- 5), limb length discrepancy in 5.7% (n- 2), deformity 8.5 % (n- 3), Nonunion 2.8% (n-1).**[Table 3]**

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 mal-union.

Table 1: Demographic details

Variable	AO Group (N =35)	Ilizarov Group(N=35)
Age (years)	44.6±11.4	40.21±10.2
Sex	M : F = 17 : 3	M : F = 18:2
Side	R : L = 11 : 9	R : L = 10:8
Ankle spanning	5	1
Duration on fixator(weeks)	21.62±2.8	22.7±5.8
Secondary procedures	6	1
Radiological union time	21.78±2.6	22.9±5.3

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

ASAMI Score - BR – 48 WKS	AO external fixation	%	Ilizarov technique	%	Total	%	p value
Excellent	8	22.8	21	60	29	41.4	0.261
Good	23	65.7	12	34.2	35	50	
Poor	4	11.4	2	5.7	6	8.5	
Total	35	100	35	100	70	100	

Table 3: Distribution of complications

Complications	AO external fixation	%	Ilizarov technique	%	p value
Pin tract infection	15	42.86	5	14.29	0.551
Pain	9	25.71	10	28.57	0.390
Stiffness	7	20	5	14.29	0.342
Limb length Discrepancy	4	11.43	2	5.71	0.289
Deformity/Malunion	6	17.14	3	8.57	0.521
Non union	2	5.71	1	2.85	1

Discussion:

Piwani et al[13] and Beltsios et al [14]where mean age were 34.75 years and 36 years respectively. There were 31 (77.5%) male and 9 (22.5%) female patients in our study which is comparable to the findings of Pal et al[15] and Memon et al[16] where maximum cases were male(80%).

Patzakis and Wilkins[17] further confirmed, that the greatest determining factor was the timing of antibiotics and not the delay of debridement for more than 12 hrs. Naique et al[18]compared debridement of compound fractures within 6 hrs and between 6 and 24 hrs and excluded any difference in infection rates. Lastly, an extensive literature review by Crowley et al[19] investigating the time to debridement, showed that the 6 hrs rule needs to be re-evaluated.

Conventional radiographs alone are not able to define union in internally fixed fractures with sufficient accuracy to enable their use as end-points of fracture healing. Generally, deciding when a fracture can be regarded as “healed” is difficult. In a recent study, Corrales et al. [20] reported a lack of consensus with regard to the definition of fracture healing. The surgeon’s ability to judge fracture union using chronological radiographs following internal fixation is estimated to be correct in approximately 70% [21]. The use of traditional external fixation methods, such as manual testing of fracture stability and/or pain response to weight-loading with the frame dis-assembled, can be added to the evaluation of the radiological healing. These tests could therefore be used to assess whether the fracture has healed sufficiently to allow the safe removal of the fixator and full, unprotected weight-bearing. Using these criteria, we had no refractures or increased deformities.

Schanz screw design of Limb reconstruction system is such that it provides more stability to fixator. The use of 6mm tapering narrow pitch screw increases pin-bone interference and pull

out strength.[22]This large diameter pins have higher resistance to bending and it reduces stresses at the bone-pin interface[23] of fixator system and ensures that no flexion of screw occurs at the screw-cortex interface under normal functional loads.[24] This absence of screw flexion minimize the likelihood of osteolysis and subsequent osteitis at these sites. This explains low incidence of pin tract infection and pin loosening.

The sliding clamp of LRS allows insertion of 3 schanz screws which can be locked and thus provides more stability. In addition to that, the swiveling clamp allows correction of mal-alignment of fracture ends without disturbing the screw position. In case of more proximal or distal 1/3rd fracture with short segment on one side, the use of T clamp allows more secure fixation of short segment and prevents any mal-alignment. Milnar et al [25] showed that tibial malunion are associated with increased incidence of osteoarthritis of knee and ankle joint.[26]

Conclusion:

Because the Ilizarov external fixator is a minimally invasive technique, it has a lower impact on the blood supply. The ring fixator is a safe, stable (three-dimensional stability) design that allows the patient to walk immediately after surgery and has a high union rate, even in heavily comminuted fractures.

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