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Original Research Article.

Evaluation of the Treatment of Gustilo Iiia Open Tibial Shaft Fracture Transosseous Osteosynthesis Technique with Ilizarov External Fixator

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ABSTRACT

Background: Fractures of the tibial shaft are important for two reasons. The first is that they are common, the second is that they are controversial - and anything that is both common and controversial must be important. Fractures of the shaft of the tibia cannot be treated by following simple sets of rules. Because of its location tibia is exposed to frequent injury and it is the most commonly fractured long bone.

Objective: To evaluate the treatment of open tibial shaft fracture of Gustilo IIIA grade by Trans osseous osteosynthesis technique with Illizarov External Fixator as a primary and definite mode of treatment.

Methods: Clinical trial (Quasi Experimental study) from January 2009 to June 2010 (18 months) at National Institute of Traumatology and Orthopaedic Rehabilitation Purposive sampling was done according to availability of the patients and strictly considering the inclusion and exclusion criteria and sample size was 17 no of cases.

Results: 14 male and 1 female patient between 17 and 51 years were studied. Most common age group in this series were 26-35 year age group ((53.33%) and average age of the patients was 30 years with SD of ±8.67. Most of the patients were male and road traffic accident was the leading cause of injury (70.58%). Left side involved in (58.82%) most of the cases and 2 patients had bilateral fractures. Commonest site of the fractures were middle third (58.82%) of the tibia. Most of the fractures were comminuted type of fractures (47.05%). Most of the patients were operated on the day of admission and in some cases within 4 - 7 days of admission. Average duration of hospital stay was 8.06 days ranging from 1 day to 28 days. Total duration of treatment was average 186.66 days (26 weeks) highest 291 days (42 weeks) and lowest 140 days (20 weeks). Most of the patient had soft tissue healing by granulation tissue formation (35.29%). Others were treated by primary closure, Delayed primary closure, secondary closure, partial thickness skin grafting.

Conclusion: In this study the results of open tibia fracture (Gustilo IIIA) by Transosseous osteosynthesis technique with Ilizarov External Fixator has been found to be satisfactory. Though there were a few minor complications with the fixator the dynamisation and compressing ability of this stable frame provided good union without any second surgical procedure or bone grafting and prevented any malunion.

Key words: Gustillo IIIA, Open Tibial Shaft Fracture, Transosseous Osteosynthesis, Ilizarov External Fixator.

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INTRODUCTION

Fractures of the tibial shaft are important for two reasons. The first is that they are common, the second is that they are controversial - and anything that is both common and controversial must be important.[1] Fractures of the shaft of the tibia cannot be treated by following simple sets of rules. Because of its location tibia is exposed to frequent injury and it is the most commonly fractured

long bone. As one third of the tibial surface is subcutaneous through most of its length, open fracture is more common in the tibia than in any other major long bones. As any other open fractures open fracture tibia is an orthopaedic emergency. An open fracture of the tibia has been the most challenging problem of all long bone injuries.[2] A severe open fracture is the result of high energy injury. It is assumed to be contaminated and may threaten the survival of injured leg and occasionally life. Treatment of open fracture of tibia is difficult because of poor soft tissue coverage and blood supply of tibial shaft. Tibial fractures are also associated with high risk of infection, non-union and malunion. About 40 years ago Charnley (1961) said "We have still a long way to go before the best method of treating a fracture of the shaft of tibia can be stated with finality."

With the advent of motorized world the incidence of open fracture tibia is increasing day by day even in a developing country like Bangladesh. So every day in NITOR we get a good number of cases with open fracture tibia. The Gustilo I or II fractures are easier to be managed by plaster immobilization with window due to small wound size and stable fracture configuration and less comminution. But problem starts for Gustilo IIIA and IIIB fractures because they have larger wound, more comminution.

In developed countries where hospitalization time is 1-2 hour after injury and Operation theatre facility is available 24 hours these can be treated with intramedullary nailing with or without flap reconstruction but still with 9.5% to 50% infection rate.[3]

In our perspective it is not always possible to internally fix the tibial fracture within 72 hours. As a result chance of infection increases. So most of the patients are treated with unilateral external fixators (Hoffman type). But as anterior-posterior and torsional stiffness is less in unilateral external fixator and axial compression stiffness is more. Most of the patients end up with nonunion, malunion with rotational and angular deformity, joint stiffness and refracture.[4] It also requires late weight bearing, longer hospital stay and nosocomial infection. Most of the patients require a second method - either by plaster immobilization or a second surgery to correct the deformity and nonunion by intramedullary interlocking nail or by Ilizarov Ring fixator. This creates a socioeconomic burden for the patient and the hospital as well.

For the Gustilo IIIB injury where rotational flap coverage is required the unilateral fixator is acceptable at least for the time being. But for Gustilo IIIA fracture if an alternative treatment can be provided as and early and primary option that can stabilize the fracture and also leads to complete union without any second surgery and make the patient ambulant then it can reduce the economic burden for the patient and can be accepted as the choice of treatment.

To solve this problem Transosseous osteosynthesis by Ilizarov ring fixator seems to be a better option. Though the technique was developed by Prof GA Ilizarov in 1950 it has been exposed to western world in recent years by A.S.A.M.I group in Italy. Now in NITOR we are pretty much familiar with this technique as most of our teachers practice this technique. Usually the device is mostly used to treat infected nonunion, bone transport, limb length discrepancy and deformity correction. But in the 1st A.S.A.M.I international conference held in Dhaka. Prof. V.I Shevstov has shown many indication of Ilizarov technique among them treating acute fractures is one. Encouraged by these the topic has been selected.

Management of open tibial fracture is one of the most difficult job for an orthopaedic surgeon. Every day in NITOR we get a good number of cases with open fracture tibia. The Gustilo I or II fractures are easier to be managed by plaster immobilization with window due to small wound size and stable fracture configuration and less comminution. But problem starts for Gustilo IIIA and IIIB fractures because they have larger wound, more comminution. In developed countries where hospitalization time is 1-2 hour after injury and Operation theatre facility is available for 24 hours these can be treated with intramedullary nailing with or without flap reconstruction but still with 9.5% to 50% infection rate. In our perspective it is not possible to internally fix the tibial fracture within 8 hours as patient reaches after that period to the hospital and Clean OT facility is not available 24 hours. As a result chance of infection increases. So most of the patients are treated with unilateral external fixators (Hoffman type). But as anterior-posterior and torsional stiffness is less in unilateral external fixator and axial compression stiffness is more. Most of the patients end up with nonunion, malunion with rotational and angular deformity, joint stiffness and refracture. It also requires late weight bearing, longer hospital stay and nosocomial infection. Most of the patients require a second method - either by plaster immobilization or a second surgery to correct the deformity and nonunion by intramedullary interlocking nail or by Ilizarov Ring fixator. This creates a socioeconomic burden for the patient and the hospital as well. For the Gustilo IIIB injury where rotational flap coverage is required the unilateral fixator is acceptable at least for the time being. But for Gustilo IIIA fracture if an alternative treatment can be provided as and early and primary option that can stabilize the fracture and also leads to complete union without any second surgery and make the patient ambulant Then it can reduce the economic burden for the patient and can be accepted as the choice of treatment.

To solve this problem transosseous osteosynthesis by Ilizarov ring fixator seems to be a better option. In a poor country like Bangladesh financial consideration must be taken into account before starting any study. For an average size Ilizarov External Fixator with four rings construct it costs 4000 taka. If Olive wires are used then the cost is more. But for most of the fractures an average four ring construct is enough. So patient had to spend more or less taka 4000 to purchase the Ilizarov External Fixator. Comparing with unilateral external fixator (price 2000 taka) this seems to be more initially. But the unilateral external fixator is never the final and definite treatment. There are lots of complication with the unilateral external fixator and for that a second surgery is needed which costs hospital admission again involving more expenditure. With unilateral external fixator patient can't bear weight earlier. So their hospital stay is prolonged and leads to prolonged abstinence from their job. This also causes financial loss to the patient. With Ilizarov External Fixator Tucker et al (1992) found that 25 % less time is required for union so this is an extra advantage with this method.[5]

METHODOLOGY

This prospective study of 21 cases of open tibia fractures in 19 patients was done with Ilizarov External Fixator at National Institute of Traumatology and Orthopaedic Rehabilitation, Dhaka. At first 21 cases of open tibia fractures were included in the study but due to various reasons 3 of these patients were not available

for final follow up and 1 patient were excluded from the study due to bony exposure which is of Gustilo IIIB type. So finally 17 cases were studied.

The period of study was between January, 2009 to June, 2010, and follow up period were between 7 months to 1 year.

RESULTS

Causes of Injuries

Road Traffic Accident was the major cause of the injury.

Occupation of Patients

People of different occupations were found to be injured in this study. Almost all type of people suffered the injury.

Side of Injury

In this study patient's injury was predominantly on the right side

Hospital Stay

Longest Hospital stay in series was 28 days and shortest was 1 day and Average 8.06 days with SD of ±7.09 days.

Duration of Treatment

Longest duration of treatment for a patient before full weight bearing without any support was allowed was 291 days and lowest was 140 days and mean 186.65 days with standard deviation of ±36.60 days

Incidence of Complications

No neurovascular injury occurred in this series during insertion of percutaneous wires. No leg length discrepancy was observed. Common complication was mild equinus deformity of ankle and mild restriction of movement.

Evaluation of the results of management of tibial fractures, especially open tibial fractures are very difficult because soft tissue, bone, adjacent joint movements all contributes to the final outcome of the result. Bony unions take much longer time than any other bones in the body. Most difficult part of evaluation is the limited study period for these type of study.

To choose standard parameter for analysis of result is a difficult procedure in open fracture of tibia-fibula due to lack of standard literature.

Tucker fixed the following criteria for evaluation of treatment of open and unstable tibial fractures by Ilizarov External Fixator.[5]

This criteria was used for the evaluation of the result of this study without any modification. Excellent and good results were taken as acceptable results

Patients were evaluated after removal of fixator and advised to come monthly for follow up and to evaluate the treatment results according to criteria set above. Patients grading usually improved in subsequent follow up at least for 1st three to six months. But adequate times for follow up was not available due to time limitation of the study period.

Final Result of Treatment

Final result of the study was analyzed by observing the results of the treatment of 17 legs in 15 patients. 3 cases of initial 21 cases were not available for final follow up and 1 case were later excluded from the study. Excellent and good results were accepted as satisfactory result of the study.

Evaluation of Final Results

Final result of the study was difficult to compare with other studies as none of them were done with only Gustilo IIIA type. This study comprises all type of open fractures including Gustilo I an II. The outcome of Gustilo I and II type will not be similar to Gustilo IIIA type. Still the results are more or less equal to them.

Table 1: Causes of Injuries in this series

Cause of Injury	n	%
Road Traffic Accident	12	70.58
Social Violence (Physical Assault)	2	11.76
Occupational Injury (Agricultural)	3	17.64

N=17

Table 2: Types of occupations of the victims in this series

Type of Occupation	n	%
Student	4	26.66%
Farmer	2	13.33%
Laborer	2	13.33%
Service	2	13.33%
Businessman	3	20%
Housewife	1	6.66%
Driver	1	6.66%
N=15		

Table 3: Side of Injury in this series

Side of Injury	n	%
Right side	5	33.33
Left side	8	53.33
Bilateral	2	13.33

Table 4: Length of Hospital Stay in this series

Length of stay (week)	n	%
< 1 week	9	60.00
< 2 weeks	4	26.67
< 3 weeks	1	6.67
< 4 weeks	1	6.67

N=15

Table 5: Duration of treatment of patients (in days)

Highest	291 days (42 weeks)
Lowest	140 days (20 weeks)
Average	186 days (26 weeks)

Table 6: Incidence of complication in the series

Complication	n	%
Limb related complications		
Nonunion	1	5.88
Restriction of ankle ROM	3	17.65
Restriction of Knee ROM	2	11.76
Leg length discrepancy	1	5.88
Angulation	1	5.88
Rotation	0	0.00
Deep Infection	1	5.88
Neurovascular injury	0	0.00
Ilizarov External Fixator related complications		
Pin tract infection	9	52.94
Wire breakage	4	23.53
Ring breakage	1	5.88
Transfixion breakage	3	17.65

Table 7: Location of Fracture

Location	%
Proximal 1/3	11.76
Middle 1/3	58. 82
Lower 1/3	29.41

Table 8: Configuration of fracture in this series

Fracture Type	n	%
Linear	2	12
Comminuted	10	59
Segmental	5	29

Table 9: Evaluation of treatment of open and unstable tibial fractures

Excellent	Fracture union
	Full knee motion
	75% of ankle motion
	No leg length discrepancy more than 1 cm
	No angulation greater than 7°
	No rotation greater than 15°
	No infection.
Good	Fracture union and one criteria above missing
Fair	Fracture union & two above the criteria missing
Poor	Nonunion or three of the above criteria missing

Table 10: Final results of study

Type of Results	n	%
Excellent	8	47.05
Good	6	35.29
Good	2	11.76
Poor	1	5.88
N=17		

Acceptable results (Excellent and good) = 82.35%

Unacceptable results (Fair and Poor) = 17.64%

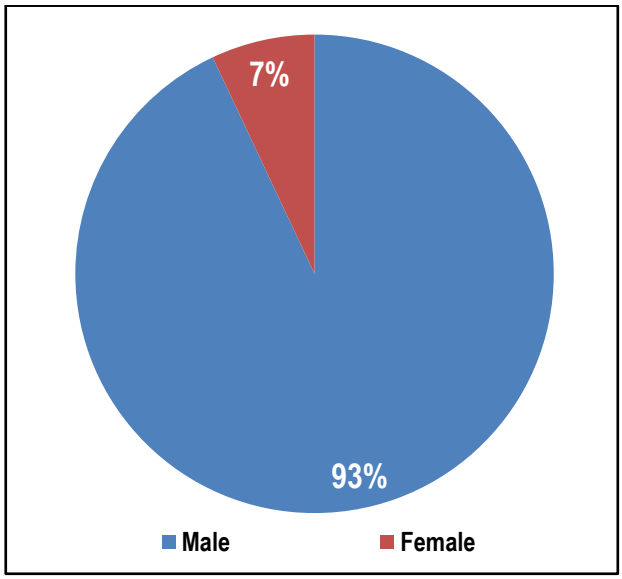

Figure 1: Sex Distribution

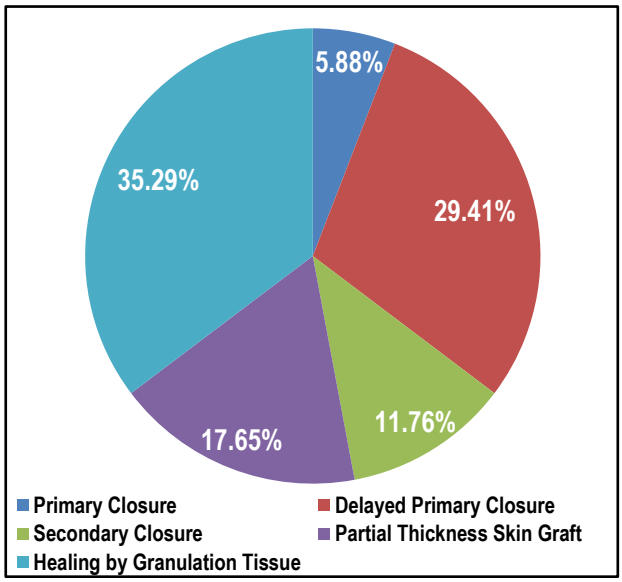

Figure 2: Healing of soft tissue in this series

DISCUSSION

The goal of acceptable treatment of open tibial diaphyseal fractures include maintaining normal length, alignment, rotation of the extremity, minimizing additional damage to the soft tissues and bone, preserving the remaining circulation and providing a mechanical environment that stimulates periosteal and endosteal responses favorable in bone healing and above all control of infection and soft tissue coverage. A simple plan that does not place the patient in significant risk of infection, allows functional use of the extremity while bone healing occurs can be an acceptable option. But as there is much difference and variation in individual cases of open fractures of tibia and fibula it is very difficult to manage all the cases by a single treatment method.

So, no single treatment regimen, open or closed, operative or non-operative, is suitable for the treatment of all the tibial fracture cases. The goal of the study was to examine the application of the Ilizarov method for treatment of severe open tibial fractures not to hail the Ilizarov method as a single answer.

Comparing the various methods of stabilization (Catagni, 1991) it was noted that cast treatment respects the vascularity of the fracture fragments but doesn't achieve greatest stability and early weight bearing cannot be permitted. In open fractures, there is no place of treatment by cast (Gustilo, 1993) as wound care is not possible. Open fractures treated by plate and screws achieve stability but this is not possible in extensively comminuted fractures e.g. Gustilo IIIA fractures. It does neither respect vascularity nor does it allow weight bearing.[6,7]

On the other hand recent reports suggests high infection rates even when plates are used selectively to stabilize grade III tibial fractures (Behren et al, 1986).[8] Intramedullary fixation by interlocking nail when properly done, allows early weight bearing but reaming compromises intramedullary blood supply and presents unacceptable high risk of infection in grade III fractures (Edwards et al, 1988). These objections have been corroborated by several centres that have experienced major infection up to 40% of cases fixed with reamed nails. Nailing is also difficult or impossible in comminuted fractures.[9] Traditional external fixation respects the vascularity of fracture fragments and allows early joint movement but early weight bearing is not possible. Problems related to the larger pins are frequently encountered and fixation

may provided insufficient mechanical stability (Catagni, 1991). In a prospective study described that weight bearing was delayed for at least eight (8) weeks in plate fixation and two (2) weeks in traditional external skeletal fixator. But in Ilizarov frame weight bearing is possible from the 1st and 2nd post-operative day. Early weight bearing enhance healing by axial loading (Goodship et al, 1991).[6,10] Transosseous osteosynthesis technique involves a non-invasive operation without the problems of blood loss and transfusion, while providing stability and allowing weight bearing.

Age Incidence

In this study most of the victims were between 26-35 years (53.33%) and average age of patients was 34.1 years. In the previous study of Ilizarov External Fixator in NITOR (Haq, 1996) and with external fixator (Islam, 1989) the highest incidence were also the same age groups. Average age was slightly higher than the current study. In the study of Edwards et al (1988) also showed that severe open tibial fractures occur mostly in 25-40 age group (46.32%)

Causes of Fractures

Road traffic accidents were found to be most common cause of open tibia fractures in 70.58%. In the study of Haq (1996) the incidence of road traffic accident was 81.81% and in Islam's study (1989) it was 76.92%. So other forms of injury increased like occupational injury and physical assault. Gustilo (1993) described also road traffic accident as the commonest cause of open tibial fractures. Social violence was identified as next cause of open fractures.[11-13] These are also high energy trauma.

Location of Fractures

In this study most fractures occurred in the middle 1/3rd of the shaft of the tibia (58.58%) followed by lower 1/3rd (29.41%). In the study of Haq (1996) most common location of fracture was the lower 1/3rd (36.31%). But in Islam's study (1989) the most common location of fracture is middle third (45.15%).[11,12] Though there is some statistical difference between these two studies but eventually it was found that common area of fracture is lower and middle 1/3rd of the shaft. Fractures of the lower 1/3 are associated with complication like delayed union and non union due to lack of blood supply in this area.

Configuration of Fractures

In this study most of the fractures were comminuted as only Gustillo IIIA fractures was chosen for study. Most of them are high velocity injury with comminuted fractures (47.05%) followed by segmental fractures (29.41%). In various text books and publications, it was described that (Apley and Solomon, 1993: Gustilo, 1993) common cause of open tibial fractures is direct high energy trauma. Direct high energy trauma results comminution of bone.[13] Treatment of comminuted fractures is difficult by plate and also by I/M nailing. Closed comminuted fractures can be treated by cast treatment but in open fractures only choice is any type of external fixator.[14] Comminuted fractures have a slower healing rate. Nonunion or delayed unions are common.

Hospital Stay

Hospital stay was one of the most important parts of the study. Average hospital stay of the patients of this study is 8.06 days. In the previous study of Haq (1996) it was 50.28 days and in Islam's study (1989) average hospital stay was 9 weeks (63 days). In this study minimum hospital stay was 1 day and maximum 28 days. In Haq's study (1996) minimum hospital stay was 15 days and maximum hospital stay 120 days.[11,12]

The average hospital stay in this study is much shorter than the previous study. The probable reasons are following.

(1) Preoperative hospital stay: In this study an average sized Ilizarov External Fixator was kept available in sterile condition with preconstructed frame. So In some cases definite surgery was done within 4 hours of hospital admission. The unavailability of the fixator was explained as a cause for delay in the study of Haq (1996). But with a little initiative this was overcome. Those whose operation could not be done on the first day were arranged on the next day. As these were done in the ground floor OT there was no time schedule delay.

(2) Postoperative hospital stay: Post-operative hospital stay was much shorter in this study comparing with the previous study. In Haq's study (1996) all type of Gustilo fractures including GIIIB fractures were included. So naturally these takes more time than IIIA. Also at that time surgeons were not familiar with the device. They wanted to follow up the patient after application of Ilizarov External Fixator.[11]

But in the present situation we are pretty much familiar with the technique and once the bone is stabilized by definite surgery the soft tissue care was done on OPD basis by regular dressing and later skin grafting or secondary closure if required. In some cases patients were discharged on the day after admission and none of them had any problem in soft tissue healing. Those with longer hospital stay had concomitant injury which took time for recovery. Even in 2 bilateral tibia fractures total hospital stay was not more than 2 weeks.

So in this technique hospital bed occupancy was reduced which allowed other more injured patient to have the chance to get a bed. In a poor country like ours this is an extra advantage.

Soft Tissue Healing

Soft tissue healing is one of the most important factors in treatment of open fractures. Specially in leg. But with Ilizarov External Fixator in Type IIIA fractures all the wounds healed without any complication. Some tidy wound were closed primarily, in other cases wounds were managed by delayed primary, secondary closure, granulation tissue formation or by partial thickness skin grafting where large area was denuded. Patients who required flap coverage were excluded from the study in the first day as they fall in GIIIB category. The patient with Ilizarov External Fixator was mobilized earlier and encouraged to bear weight. That helped earlier soft tissue healing.

Duration of Treatment

This chapter was named duration of treatment, not duration of fracture healing because healing of fracture means bridging of fracture fragments with callus, but support or immobilization of the fracture fragments require much longer time after that. Unsupported full weight bearing and activities require consolidation of the fracture healing, require much longer time after radiological healing of the fracture. In this study fixator fixation continued till consolidation of the fracture. No support was given to the limb after removal of fixator. Only some rehabilitative physiotherapy was required after removal of fixator.

In this study average treatment duration was 186.65 days with SD of ±36.60 days. In Haq's study (1996) the average treatment period was 207.72 days. In the study of Schwartsman (1992) the average healing time was 5.6 months (168) days and in the study of unstable open and closed tibial fractures by Ilizarov method Tucker et al (1992) showed average healing time 25.6 weeks

(179.2 days).[15] Sidharthan et al (2006) has showed the average fracture healing time were 4.5 months.[16]

But all the above mentioned study was done on all type of fractures (GI, GII and GIII) and in some studies it included closed cases. So it is difficult to assess and compare this particular type of fracture.

Complications

No treatment modality is free from complications. But with this technique complications were temporary and mostly fixator related. The complications that could be faced are following:

Neurovascular Injury

This is one of the dreaded complications that may occur during insertion of the wires. But fortunately none of my patients had any of them. The chance of this complication is more with conventional unilateral external fixators that uses wide pins.

In Ilizarov External Fixator wires are 1.8 mm in diameter. If placed in safe corridors has little chance to injury neurovascular structures. Even if they are approximated it can slide the neurovascular bundle if low RPM drill is used. If after passing the second cortex the wire is advanced by hammering even it penetrates any vessel it will be sealed off as the wires are like hypodermic needles.[6]

Pintract Infections

This was the most common complication in this study and also in other study. Any external fixator has this. Loss of tension of the wires or loosening of any connection of the frame result undue movement in wire skin interface in Ilizarov system. This results irritation of skin and soft tissue injury and ultimately leads to pin tract infection. When pin tract infection occurred correction of tension and frame tightening was done and antibiotic were advised. All these were superficial infection and healed after removal of the fixator.

Nonunion

In this study one of the cases was found to be non-united even after 9 month. It was a segmental fracture and fibula united before the tibia. So it prevented compression of the fracture site. Also there was infection present that made the problem worse. In the study of Schwartsman et al (1992) one case united after 13 months (390) days without any bone graft by reapplication of fixator and continued compression and distraction.[15]

According to methodology of Ilizarov non-union should not occur in any patient undergoing treatment in Ilizarov frame. Frequent nonunion occur in patients treated with conventional external fixators and more frequently bone graft is required for prevention of nonunion.[17]mIn the study of Haq (1996) nonunion was 9.90% which is higher than the present study 5.88%. No bone graft was required in this study and also in the study of Haq (1996).[5]

Restriction of Movement

In this study 11.76% had some degree of limited knee movement and 17.65% were found to have decreased motion of Ankle. These improved with further follow up. So this could be evaluated better if each patient could be followed up upto 1 year after fixator removal. This can be prevented by proper physiotherapy which we lack in our country. Those who started early weight bearing also had less stiffness.

Leg Length Discrepancy

1 patient (5.88%) had 2 cm Leg length discrepancy. This is due to massive comminution which required compression at fracture site. In severe cases it can be corrected by osteotomy and distraction.[5]

Angulation and Rotation

No rotation was found but 1 case (5.88%) had significant angulation of 15° recurvatum. The angulation and rotation can be corrected any time of fixator treatment before consolidation by adjustment of frame. (Catagni, 1991).

But this case was missed due to poor quality of X-ray in early period. Careful follow up and good quality X-ray could have prevented these deformity. In the study of Karlstorm (1983) 45% had angulation more than 5 degrees in the frontal plane or 10° in the sagittal plane.[18]

Infection

In this study deep infection was encountered in 5.88% cases. Infection of bone and soft tissue occurred at fracture site. In the study of Haq (1991) the incidence was 11.1%. Reduction of incidence of infection can be done by early treatment and proper follow up of basic technique of open fractures. In this study most of the patients came to the hospital after 8 hrs (Golden hours) of injury. Treatment of open and closed unstable tibial fractures and their complications have been reported by many authors.[17,18] They stated that transfixed bone and muscle have been associated with upto 39% infection rate, 26% of which became chronic. Incidence of infection is much less in the series treated in Illizarov frame (10%) and none of those became chronic. Chronic infection due to transfixation of muscle and bone didn't occur in this study also. Deep infection was treated by rest, analgesic and antibiotic with regular dressing of wound.[5]

Bone Graft

Bone grafting was employed in 50% cases (Stienfield et al, 1988) and 58% of cases (Clancey, 1978) in treatment of open fractures by external fixators in two different series. Another study showed bone graft in 60% cases required for union in treatment of open fractures by conventional external fixators (Karlstrom and Olerud, 1983).

In the study of Islam (1989) bone grafting was employed to stimulate fracture union or to treat nonunion. In this study no bone grafting was done to stimulate bone healing or to treat nonunion. Treatment of tibial fractures by Ilizarov technique did not require any bone grafting in other two studies (Tucker et al, 1992 and Schwartsman et al, 1992). Ilizarov technique if properly practiced does not require any bone graft. Bone defect can be treated by internal transport of bony fragments with in the same bone. (Catagni, 1991). Delayed union or nonunion can be stimulated by intermittent axial compression and distraction.[6]

Bone graft from a healthy area of the body definitely results another cause of morbidity or suffering of the patients. Greatest advantage of Ilizarov system is the avoidance of bone graft

Technical Consideration

All the apparatus used in the study were made in the local mechanical workshop in Dhaka city except the K-wires. Though all the modifications and facilities of the Ilizarov technique were not utilized but essential components of the system were manufactured. Olive wires were especially useful for fixing oblique fractures. It also gave increased stability to the bone. In was used in some cases and the results are better.

These were not used in the study of Haq (1996) and he recommended its use. Locally made mechanical wire tensioner was used for tensioning the wires as it is the most important part of the surgery. Manual wire tensioning was very difficult and strenuous and was done in the study of Haq (1996) and he

recommended the use of mechanical wire tensioner. There is another tensioner available with dynamometer which is costly but saves time. In this study no bone transport or lengthening was done. So there is no role for graduated telescopic rod. Simple connecting rods were enough for fixation and minor compression. In some cases posts with shcanz screw was used.

Cost and Effectiveness

Though Ilizarov system is known to most of the orthopaedic surgeons of Bangladesh as an expensive apparatus but actual experience of this study is different. Initial cost of the 4 ring construct was 4000 taka which was made locally. Comparing to a uniplanar external fixator (2000 taka) it is not much more. External Fixator needs early removal and required further surgery or cast immobilization. If the frame could be reused the cost could be reduced. A long leg cast costs Tk 300-500 which needs frequent change due to soiling. Cost goes upto 4-5 times to the end of the treatment. More over patient can't bear weight on the injured leg with cast and for bilateral fracture tibia patient becomes totally nonambulant. Treatment cost of plates and nails are not less than 5000 taka and they risk the chance of infection. When Ilizarov External Fixator are used no blood transfusion required. High dose of antibiotic for phophylaxis of infection for operative trauma is not required. So, treatment cost becomes low. Moreover patient can return to their work with the fixator in situ. That reduces the loss of earning for the patient. It also counts in the cost effectivity.

Final Result of Treatment

After Analyzing the final result it was found that 82.55% cases had acceptable results and among them 47.05% was excellent and 17.64% had not reached acceptance. Analysis of the results was done on the basis of Tucker (Tucker et al, 1992) criteria. In that study unstable tibia both closed and open were studied and showed 75% excellent result and follow up period was prolonged. But in this study of open fracture GIIIA type the results are not comparable to any study. And with further follow up period the stiffness of knee and ankle would resolve. So the number of excellent results would be more.

CONCLUSION

In this study the results of open tibia fracture (Gustilo IIIA) by transosseous osteosynthesis technique with Ilizarov External Fixator has been found to be satisfactory. Though there were a few minor complications with the fixator the dynamisation and compressing ability of this stable frame provided good union without any second surgical procedure or bone grafting and prevented any malunion.

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