ROLE OF EXTERNAL FIXATOR IN THE MANAGEMENT OF TYPE-II & III OPEN TIBIAL FRACTURE

Muhammad Ayaz Khan, Shah Wali Khan, Raja Irfan Qadir

Department of Orthopaedic,
Postgraduate Medical Institute,
Lady Reading Hospital,
Peshawar.

ABSTRACT

Objective: To Evaluate the role of external fixator in the management of open tibial fractures.

Material and Methods: This descriptive study of 30 cases was conducted in the Orthopaedic Department of Postgraduate Medical Institute, Lady Reading Hospital, Peshawar from September 1997 to September 1999. 28 male and 2 female patients presented with open tibial fractures due to high energy trauma with their mean age of 38 years. All the patient were evaluated for life threatening conditions as per ATLS protocol. After resuscitation, all the fracture were stabilized by applying AO external fixator device with skin and soft tissue care.

Results: The simple AO external fixator proved satisfactory and impressive result were obtained with this fixator. There were 33 open tibial fractures, out of these 13(39.9%) were type-II, 15(45.4%) type-IIIa and 5(15.1%) type-IIIb fractures. No case was associate with injury to main vessels. Most of our patients reached the hospital late, losing the golden period of initial 6 hours. Majority of the fracture healed with an average time of twelve weeks (11-40) weeks after injury. Pain tract infection was the most common complication (47.4%) seen our series due to ignorance of the patients and failure to attend the review clinic regularly.

Conclusion: External fixator is the best option for all open tibial fractures with severe soft tissue injuries and may be adopted in management of such fractures.

Key words: High energy trauma, Open tibial fractures, AO external fixator.

INTRODUCTION

No trauma surgeon can deny the frequency with which he encounters an open tibial fracture because of the anatomical location of this bone and its vulnerability to injury. Apart from road traffic accident firearm injuries are more common occurrence in this part of country due to local traditions and direct impact from Afghan war.[1] This means that high-energy deforming forces are applied directly on to the leg. Lack of subcutaneous tissues and asymetrical arrangement of muscles around the tibia make direct trauma more risky to the bone as well as to the skin and other soft tissues.[2]

The management of open tibial fracture has always been a challenging task for an orthopaedic surgeon, because he has to combat at two front simultaneously that is the management of soft tissues as well as the bone. The priority of an orthopaedic surgeon is to convert an open fracture into a close fracture and maintain the length of the bone.

Treating open tibial fracture with external fixator is cost effective and user friendly, which when applied to the tibia drastically eliminate the pain, enhance the mobility of the patient, decrease the hospital stay and enable him/her to even return to a remote area where his soft tissue insult can be looked after.

MATERIAL AND METHODS

This descriptive study was based on 30 cases with 33 open tibial fractures which was conducted from September 1997 to September 1999. All these patients were evaluated for life threatening conditions in the emergency department as per ATLS protocol. Brief history and physical examination was then performed. The open wounds were covered with sterile dressing and good I/V line secured. The fractures were splinted to relieve pain and prevent further soft tissue trauma. Good analgesics was given, prophylaxis against tetanus and intravenous antibiotics were administered after taking swab for cultures and sensitivity test. Patients were x-rayed in AP and lateral views including joint above and joint below. Patients were prepared for general anesthesia and emergency surgery. All the fracture were stabilized by applying A.O external fixator device with skin and soft tissue management.

MANAGEMENT OF SOFT TISSUES

All devitalized tissues, foreign bodies, dirt and debri were removed with large amount of normal saline. All the wounds were left open initially. Debridement was repeated after 24—48 hours, depending upon the condition of the wound. Delayed primary closure was done in 3 cases, split thickness skin graft (STSG) in 8 cases and two were allowed to healed by secondary intention. All these fractures were type II. In type III A fractures, STSG were done in 10 cases and local flaps in 2 cases. In type III-B, 3 were managed with local muscular flaps and 2 with vascularized flaps.

Type	No. of patients	Procedures
II	3	Delayed primary closures
	8	STSG
	2	Secondary Intention
III-A	10	STSG
	4	Local muscular flaps
III-B	3	Local muscular flaps
	2	Vascularized flaps

TABLE – 1

MANAGEMENT OF BONE

All these fractures were initially stabilized by simple AO tubular external fixator. With this fixator a number of configurations is possible, of which the uni-lateral, uni-plannar

double rod is widely used. This fixator is less cumbersome and allow better wound access.

The fixator was applied under general anesthesia. At least 2 Shanz screws of 5 mm in diameter were placed in each fragment in the saggital plane. The safe corridors described by Behrens and Searls were used. Cruciate skin incision was given at the site of pin insertion. Holes were pre drilled with 3.2mm drill bit. Manual drilling was done rather than power to reduce osteonecrosis, which helps in the reduction of pin tract infection.[3] A distance of at least 3.5cm (Pin pitch) was kept between the 2 screws in each bony fragment. The distance between the clamps and the bone was kept at 5.5cm.[4]

POST OPERATIVELY MANAGEMENT

Post operatively the limb was maintained in elevation. First dressing was changed in operation theatre after 24—48 hours. Thereafter all wound dressing were done daily. Active exercise was allowed as soon as the pain subsided. Non-weight bearing walking with crutches was allowed after 1—2 weeks. Partial weight bearing was started gradually as tolerated by the patient. Pin sites were cleaned daily. During hospital stay patients were encourage to become fully responsible for the care of pin sites and fixator frame. The patients were followed for a period of 5 months to one year. At each follow up visit patients were evaluated both clinically and radiologically. The criteria for satisfactory position was varus or valgus of less than 5 degree, AP angulations of less than 10 degree, shortening of less than 1cm and rotational mal alignment of less than 10 degree.[5,6]

Pin tract infection was defined if the patient had pain, presence of discharge from the pin site along with a positive culture, or presence of pus through the pin holes even if there was no growth. This complication was managed with the standard treatment protocol. Ankle and knee joints movement were assessed and compared with un-affected side.

RESULTS

There were 28 were males (93.33%) and 2 females (6.6%). The youngest patient was 12 years and the oldest was 65 years with a mean age of 38 years. The left leg was involved in 14 cases (42.4%) and the right in 13 cases (39.4%). Bilateral tibial fractures were present in 3 cases (9.9%). There were 13 (39.9%) type-II and 15 (45.4%) type III-A and 5 (15.1%) type III B fractures.

Type of Fracture	No. of Patients	%
II	13	39.5
III-A	15	45.4
III-B	5	15.1

TABLE - 2

Firearm injuries were the most common mechanism in 14/30 (46.6%), followed by road traffic accident in 12 cases (40%), 3 had fall from height (10%) and one patient had bomb blast injuries (3.3%).

Mechanism	No. of patients	%
Firearm Injuries	14	46.6
R.T.A	12	40.0
Fall	03	10.0
B.B.I	01	3.4

TABLE - 3

The time elapsed between injury and arrival to the hospital varied from 6—48 hours. There was no single case associated with injury to the main vessels.

All patient reached the hospital differently, earlier within 6 hours and late within 48 hours. Ten patients reached within six hours, 16 reached between 6—24 hours

while four patients reached the hospital after 48 hours from the remote area. There were 30 fractures in 28 patients, which healed at an average time of 12 weeks (11—40 weeks) after injury. The mean healing time in external fixator varied with different type of fracture as per Gulstilo classifications.

Type	II	III-A	III-B
Healing Time (Range)	11—28 weeks	14—28 weeks	14—40 weeks
Healing Time (Mean)	16 weeks	18 weeks	26 weeks

TABLE – 4

The most common complication was pin tract infection. Out of 120 pin sites in 30 fractures 57 became infected, representing a pin tract infection of 47.4%. The most common pathogens were staph aureus and S. Epidermidus.

Seven cases (23.3%) of wound infections (two superficial and five deep) were recorded. Most of these infections were in type III-A and III-B fractures.

Angular mal union between five and 15 degrees occurred in two patients (6.5%). One patient had angulation of more than 15 degree. Shortening of less than 2cm and more than 1cm were recorded in three patients (10%). All these patients had high-energy trauma.

Delayed union was observed in six cases (20%). All these fractures were type III-A and III-B.

Non union was consider as movement at the fracture site on manipulation and no evidence of callus information after six months. One patient (3.3%) developed this complication. This fracture was highly communited, severely contaminated and was of the distal third of the tibia.

Ankle stiffness was observed in 12 cases (40%) but no knee stiffness was seen in any patient. All patients were able to sit cross-legged and eventually to squat.

Complications	No. of Cases n = 30	%
Pin tract infection	57/120	47.4
Wound infection	07	23.3
Mal union and Shortening	04	13.3
Delayed union	06	20
Non union	01	3.4
Joint stiffness (Ankle)	12	40

TABLE – 5

DISCUSSION

The external fixator in open tibial fractures not only solves the difficult problem of soft tissue injuries but at the same time provide a reasonable fixation for the bone to heal. With the AO external fixator it is possible to adhere to safe and effective external fixation techniques, avoid damage to vital structures, provide wound access and adopt the fixator so that it is bio-mechanically compatible with the fractures. As there were 20 type III-A & B fractures as a result of firearm injuries, so great attention was given to the care of soft tissue injuries. A higher incidence of open tibial fractures was noticed below 40 years of age (70%). This together with their higher male to female ratio (14:1) could be attributed to their increase activities. This is consistent well with other series of similar fractures treated by external fixator.[2,4,7] Firearm injury was the most common mechanism for these fractures (46.6%), followed by road traffic accident. Increase incidence of firearm injuries in our series is due to the mass influx of Afghan refugees into this part of the country and partly due to our local traditions. The average healing time was 20 weeks (11—40). This healing time is well comparable with the results published in the literature.[7,8,9,10]

Study	P.T.I	Mal-Union	Non-Union	Delayed Union
A. Ghaloo 1997	45.2%	–	–	25.7%
Thakur & Patakar 1991	45.5%	9.6%	–	–
M. Iqbal & J. Ahmed 1998	33.3%	–	13.3%	33.3%
S.M. Hay & M. Saleh 1997	10.4%	16%	06%	–
Abdul Rehman 1991	38.9%	38.9%	–	–
Our study	47.5%	17%	3.3 %	20%

TABLE – 6

The most common complication was pin tract infection. Loosening of pin has been considered the pre-disposing factor for pin tract infection.[11] Although we managed to prevent pin tract infections by low velocity drilling and keeping the pin sites sterile by application of pyodine soaked sterile guaze. We also educated the patient to maintain the sterility at the pin sites. Inspite of all this the pin tract infection was 47.7%, which may be attributed to the ignorance of the patient to take care of the sites and failure to attend the review clinics regularly. The pin tract infection in our study is comparable to the Asian,[2,4,10] while the incidence is less in European study.[12] Non-union was observed in only one case (3.3%). And that was in Gustilo type III-B. The decrease incidence of non-union in our study was early soft tissue cover and early weight bearing. Bone grafting was done for non-union with good functional out come. The incidence of delayed union in our study is comparable to those mentioned in the literature (Table 6).

Mal-union was observed in 17% of cases. The deformity, however result from either poor initial reduction or loss of reduction later on. None of these patients were further managed as they were united in acceptable position. Ankle stiffness was present in 12 cases (40%), which was due to lack of proper follow-up clinic visits, lack of physiotherapy and only verbal instructions to the patient for home. Functional deficit was minimal and no patient requested for further corrective surgery.

CONCLUSION

1. All open fractures should be considered as surgical emergencies and require an aggressive approach which include copious irrigation, extensive surgical debridment and high doses antibiotics.
2. External fixator is the best option for all open tibial fractures with severe soft tissue injuries (Type II & Type III) and may be adopted in the management of such fractures. This method of fractures stabilization is versatile, cost effective, satisfactory and reliable

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Address for Correspondence:
Dr. Muhammad Ayaz Khan,
Department of Orthopaedic Surgery,
Lady Reading Hospital,
Peshawar.