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ROLE OF EXTERNAL FIXATOR IN THE MANAGEMENT OF TYPE 111 A&B OPEN TIBIAL FRACTURE

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ABSTRACT

BACKGROUND: *Open fractures of tibia are caused by high energy trauma and are virtually severely contaminated, which may threaten the limb and occasionally life. Its treatment is still controversial. The limb salvage is the initial aim but long term problems with infection, soft tissue coverage and union may result in serious disability. The established management of severe open fractures is immediate, aggressive debridement, lavage, stabilization of fracture and delayed wound closure.*
METHODOLOGY: *54 patients with 56 limbs of type 111A&B open tibial fractures were treated with AO external fixator as an definite treatment during the period of 2006-2009 in department of orthopaedic surgery& traumatology unit 11 of Liaquat university hospital Jamshoro & Hyderabad. .Modified Gustillo classification was followed. After multiple debridements and antibiotics early bone grafting and soft tissue cover applied. External fixator was removed after wound healing and good progress of bony union and PTB cast was applied and gradual full weight bearing started till union achieved. Patients were analyzed for time of union, rate of infection, pintract infection, non union and shortening.*
RESULTS: *Out of 54 patients 48 were male and 6 female (male female ratio 8:1), mean age was 31 years, mode of injury was RSA in 41 (75.9%), fall of roof, wall or bridge in 6 (11.11%), gunshot in 4(7.4%) and fall from height in 3(5.3%) .There were 24 cases of type 111A and 32 of type B fractures. Mode of injury was road side accidents 41(75.9%), fall of roof or wall 6(11.11%),gunshot injury 4(7.4%)and fall from height 3(5.55%) cases. Wound coverage done by local random pattern fasciocutaneous flaps in 32(57.14%), myocutaneous flaps in 3(5,55%), skin release incision 7(12.5%) and split thickness skin grafting in 14(25%).Cancellous bone grafting was done in 34(60.7%) cases. Average time of union was 21 weeks, Delayed union was in 12(21.4%), non union in 5(8.9%) and malunion in 2(3.5%)cases. Infection was in 5 (8.9%) and pintract infection in 19 (33.9%) cases.*
CONCLUSION: *Type 111 A&B Open Tibial fractures are surgical emergencies needs aggressive approach for surgical debridement, early stablization and soft tissue cover. AO external fixator is simple and safe to apply, cost effective , minimal invasive, needs less operating time and gives good access to soft tissue and can be used as definite and successful management of type 111 open tibial fractures confidently, combined with early bone grafting it gives excellent results. However they allow very little adjustment after application, without replacing the pins.*

KEY WORDS: Type111 A & B Open Tibial Fractures-AO External Fixator, Gustillo classification

INTRODUCTION

An open fracture is contaminated and usually results from a high energy injury, which may threaten the limb and occasionally life. The limb salvage is the initial aim, medium and long term problems with soft tissue cover; infection and union are all too common and result in serious disability.[1] The treatment of open tibial fractures remain controversial. The unique anatomy of the tibia having precarious blood supply and lack of soft tissue coverage of the shaft of tibia make these fractures vulnerable to non union and infection.[2] The established management of severe open fracture is based on the philosophy of aggressive repeated debridements, immediate intravenous antibiotics, stabilization of the fracture, early soft tissue cover and prophylactic bone grafting.[3].The initial management by external fixation is well established but other options includes immobilization in a cast, internal fixation with plates or intramedullary nailing.[2] It is not clear which is the best method of stabilizing

Gustillo grade 11&111 fracture .[1] External fixator has became accepted by most surgeons as the treatment of choice for open type 111 tibial fracture .[4] Externl fixators offers several advantages in the management of open tibial fractures. They offer acceptable stability for the fracture, minimal operative trauma and good access to the soft tissue 5.1 External fixator can be used for any configuration of tibial fracture and associated injury but due to the minimal soft tissue dissection during application and good access to the soft tissue, they are particularly useful in the management of type 111 open fracture.[6] The ease and speed of application , adjustablity of the frame, and minimization of blood loss with preservation of blood supply at the cutaneous and osseous level are advantages of external fixation technique.[7]. The use of external fixators is not without problems, inflammation of pin site, pin tract infection and thermal necrosis of the bone at the time of insertion and potential for malunion and nonunion are main problems.[6] The AO external fixator is very popular in treating type 111A&B open tibial fractures in our set up because of it is easily available ,cost effective, light weight, simple to apply ,least cumbersome, giving minimal operative trauma, and good access to the soft tissue and massive contamination. It is particularly useful in type 111A&B open fractures of tibia. We have conducted this study to determine the role of AO external fixator in the definite management of type 111A&B open diaphyseal tibial fracture.

MATERIAL & METHODS

54 patients with 56 limbs of type 111A&B open diaphyseal fractures were treated in orthopaedic unit 11 of Liaquat University of Medical & Health Sciences Jamshoro Hyderabad during the period of September 2006 to 2009. Modified Gustilo classification was followed and AO External fixator was used for fracture stabilization. After initial resuscitation, primary wound care was provided in emergency room and wound was covered with sterilized dressing and than back slab applied. After giving i.v. fluids, i/v antibiotics and analgesics, initial base line investigations were done and patient was taken in operation theater. After thorough debridment, AO external fixator was applied. Next debridment was done after 24/48 hours depending upon the condition of wound. On second debridement remaining necrosed and devitalized tissues were excised. After multiple debridements as wound became neat and clean soft tissue cover along with bone grafting done. Bone grafting was impregnated in those cases where cortical bone defects

TABLE 1
FRACTURE TYPE & GENDER

Type Of Fracture	Number (Percentage)
TYPE 111A	24(42.8%)
TYPE 111B	32(57.1%)
Gender	
MALE	48(88.8%)
FEMALE	6 (11.1%)

TABLE NO. 2
MODE OF INJURY

Mode	Number (Percentage)
RSA	41(75.9%)
FALL FROM HEIGHT	3(5.55%)
GUNSHOT INJURY	4(7.4%)
FALL OF HEAVY OBJECT	6(11.11%)

TABLE III
SOFT TISSUE COVERAGE

Type of Coverage	Number (%)
LOCAL RANDOM PATTERN FASCIOCUTANEOUS FLAP	32(57.14%)
MYOCUTANEOUS FLAPS	3(5.35%)
SKIN RELEASE INCISION & SECONDARY SUTURES	7(12.5%)
SPLIT THICKNESS SKIN GRAFTING	14(25%)

TABLE NO IV
COMPLICATIONS

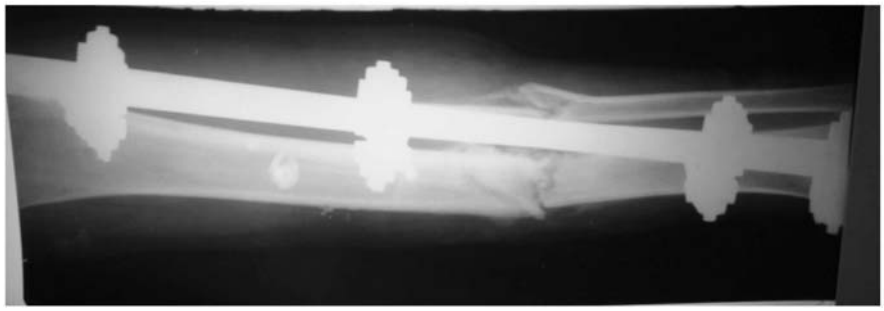
COMPLICATION	Number (%)
WOUND INFECTION	5 (8.92%)
DELAYED UNION	12(22,6)
NON UNION	5(8.9%)
MAL UNION	2(3.5%)
SHORTENING	2(3.5%)
PIN TRACT INFECTION	19(33.9%)

and gaps were present or when it was suspected that union will be delayed. Soft tissue coverage was provided by local random pattern fasciocutaneous flaps, myocutaneous flaps, skin release incisions and suturing ,and split thickness skin grafting. Patients was allowed for partial weight bearing walk with walker or crutches when good soft callous was visualized on X-Rays. The external fixator was removed when there was satisfactory wound healing and good progress of radiological union was achieved. After removal of fixation PTB cast was applied and gradual full weight bearing walk was permitted till union was achieved. Union was defined as ability of patient to walk without pain, radiological evidence of bridging callous and lack of pain ,and movements at fracture site when stress was applied. After removal of cast , active physiotherapy for regaining ankle and knee joints mobility were started till satisfactory range of movements achieved. Patients were assessed for time of union, infection ,pin tract infection, nonunion, shortening and malunion.

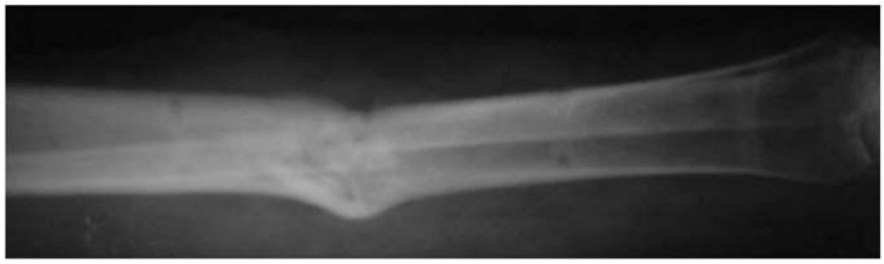
RESULTS

54 patients with 56 type 111A&B open fractures were included in this study and were followed (Fig 1 & 2). Out of 54 patients 48 were male and 6 female having male female ratio 8:1. The mean age was 31 years (ranging from 8 to 65 years). There were 24 patients of type 111 A and 32 of type 111B fractures Table I. Mode of injury was road side accidents in 41(75.95%), fall of roof or wall or bridge in 6(11.1%), gunshot in 4(7.4%) and fall from height in 3 patients (5 .55) Table II. Usual time of wound coverage was from 1 to 3 weeks according to condition of wound. Wound coverage done by local random pattern fasciocutaneous flaps in 32 cases (57.14%), myocuttaneous (gastrocnemius 2 and soleus 1) flaps in 3 cases (5.35%), skin release incision and secondary suturing in 7(12.5%) cases, split thickness skin grafting in 14 cases (25%) Table III. Cancellous bone grafting from iliac crest was done in 34 cases (60.7%). Average time of fixator removal was 15 weeks (9 to 23 weeks). Additional fixation was done in 3 cases (5.35%) (Additional screw fixation done in 2 cases and plate fixation in distal fibula in 1 case). Average time of union was 21 weeks (13 to 30 weeks). Delayed union was in 12 cases (22.6%). There was infection present in 5 cases (8.9%)(superficial in 3 cases and deep in 2 cases) one case of deep infection went in nonunion and other in delayed union. Commonest organism was staph aureus. Pin tract infection was in 19 cases (33.9%).Non union was in 5 cases (8.9%) . Out of 5 cases of non union 3 were fixed with DCP and bone grafting ,1(1.78%) was fixed with interlocking intramedulary nail and bone grafting and remaining one which was case of infected nonunion fixed with illizrov external fixator. Shortening was present in 2 cases (3.57%), one has gunshot injury with missing

FIG 1
THE OPEN TIBIAL SHAFT FRACTURE, GUTILO TYPE III B

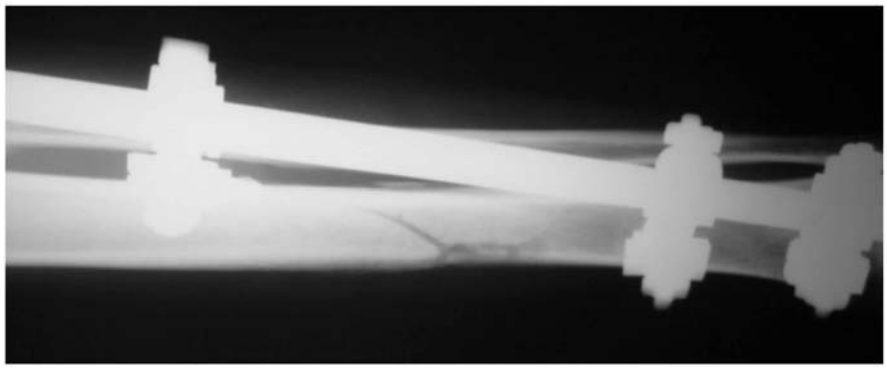


A EXTERNAL FIXATION

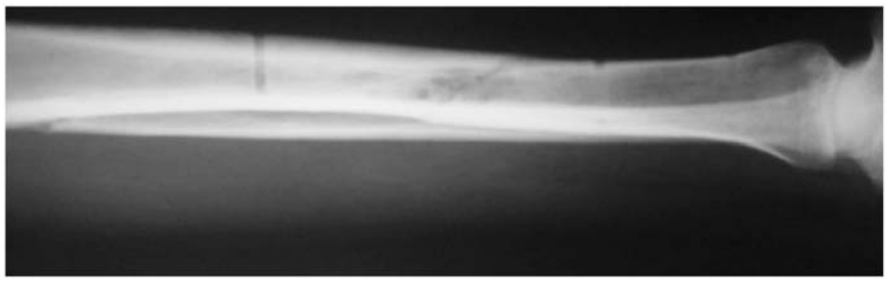


B FIXATOR REMOVED AFTER GOOD HEALING ACHIEVED WITH BONE GRAFT

FIG 2
THE OPEN TIBIAL SHAFT FRACTURE, GUTILO TYPE III A



A) EXTERNAL FIXATION



B) FIXTOR REMOVED AFTER GOOD HEALING ACHIEVED

fragments. Malunion was present in 2cases (3.57%) (One patient after removal of fixator removed the PTB cast himself at home and started walking without support and reported after 6weeks with varus angulation) Table IV.

DISSCUSSION

Open tibial fractures were previously treated by closed reduction and casting with window creation at the fracture wound site, for care of the soft tissue. This method was associated with high rate of complicatins like malunion, non union, infections Introduction of external fixator revolutionalized the management of open fracture and this was particularly true with regard to the high velocity trauma sustainded in road traffic accident and firearm injuries (Arshad Bashir 2009).[8] Management of such injuries require care of contaminated soft tissue injuries involving skin, muscles and neurovascular structures, and treatment of fracture. With AO external fixator it is possible to adhere to safe, effective and biomechanicaly stable external fixation which provides access for definite wound care. There was highest incidence of open fractures in younger age group having mean age 31 years (ranging from 8 to 65years). S. Gopal etal (2000). [9] reported mean age 37 years in his series of 84 patients, Fisher M D and his collegues (1991) [3] observed mean age 32 years in his series. M.I.Iqbal etal (1996) [10] has reported male female ratio 9:1 in his series of 40 patients and Makhdoom A. etal (2006) [11] studied 68 patients with male female ratio 7.5:1. There were 54 patients in our serial having 48 male (88.8%) and 6 female (11.1%) with male female ratio 8:1. Males are involved more in our serial which is also comparable to other local series because of our social set up where females are confined to homes, so they are less exposed to the risk of open fractures.

In present study road side accidents remained the most common cause of open diaphyseal fracture, 41 patients(75.9%) out of 54 patients. Comparing to others, C.M.Brown etal [4] had 90% and Shahid Sultan 1993 [12] had 87.6% patients with road traffic accidents in their serials. This is because of ignorance of traffic rules, increase in number of vehicles, high speed, busy schedule, urgency to reach the destination and poor condition of roads in our society, are main reasons for road traffic accidents. Modified Gustillo classification was followed in our study. There were 24(42.8%) cases of type 111A (Fig 2 a,b) and 32(57.1%) cases of type111B fractures (Fig I, a,b). Comparing with others M.J.Iqbal etal 1996 [10] reported series of 31 patients out of whom 9 (28.8%) were of type 111A and 21 (67.2%) were of type 111B .Khalique A, Siddiqui 1995 [13] studied 48 patients out of whom 30 (61.22%) were type 111B open fractures. S. Gopal etal 2000 [9] reported 84 open fractures of tibia out of which 79 (94%) were type 111B. This shows the incidence of high energy trauma causing type 111B open fractures are more common. Soft tissue coverage procedure are performed to provide a close wound to promote revascularization of injured bone and soft tissue. The type of flaps used for coverage of soft tissue defects generally is chosen on the basis of anatomical consideration, specifically the location of the defect on the leg, the size of defect and availability of local tissue for coverage. In present study out 56 cases 32(57.1%) required soft tissue coverage by local random pattern fasciocutaneous flaps, 3cases (5.3%) by myocutaneous flaps, 7 cases (12.5%) by skin release incisions and secondary suturing and 14 cases (25%) by split thickness skin grafting. Comparing with others Fischer and his collegues [3] reported 43 patients of type 111B open fracture, out of whom 12 (27.9%) covered with local muscle rotation flaps, 12 cases (27.9%) were covered with free flaps and remaining 19 cases(49%) with split thickness skin grafting. Shahid Sultan 12 had 32 cases of type 111 open fractures of tibia, he reported 11cases (34.3%) of local flaps, 8 cases (25%) of split thickness skin grafting, primary suturing in 9 cases(28.1%) and primary wound closure in 3 cases(9.3%). This shows the pattern and severity of soft tissue injury, and the choice of soft tissue coverage on the basis of anatomical consideration and location of defects.The early cancellous bone grafting is done in open fractures for to fill the bone gaps and cortical bone defects having loss of cortical apposition and delayed bone grafting is done when fracture shows no progressive formation of callous on X-Ray after twelve weeks. It gives stability to bone ends, promotes osteogenesis and shorten time of bone healing. We have done early cancellous bone grafting in 34 cases (60.7%) along with soft tissue coverage in most of cases at same time. Fischer [3] and his collegues attempted early bone grafting in 72% cases, C.M.Brown [4] reported in 62.7% cases and A. J. Thakar & J. Patnakar 1991 [14] reported early bone grafting in 60.3% cases of type 111B fractures of tibia. Our results are comparable to national and international studies.

The mean time of bone union was 21 weeks (ranging from 13 to 32 weeks) in our study. Nila C. etal (2004) [15] achieved union in mean time of 16-20 weeks, Ayaz khan (2004) [16] in 20 weeks and Thakar AJ 14 in 20 weeks. All had severe open fractures treated with AO external fixator. We agree with Behren [5] (1983) that early bone grafting (with in 30 days after injury) in severe open fractures significantly decrease in fracture healing time. There was wound infection in 5 cases (8.9%) superficial infection in 3 and deep in 2 cases (Staph. Aureus was commonest organism), both deep infections developed non union. Pankaj Kumar and his collegues (2004) [17] and Pedro AA etal (1997) [18] found 0% infection, S. Gopal etal [9] found 9.5% and Shahid Sultan (2001) [12] 13% infection rate their serials. The lower rate of infection was because of awareness in patients to reach early at tertiary hospital and understanding of surgeon to perform early aggressive debridement, early stabilization and early soft tissue.

Pin tract infection is the most common complication of external fixation, there were 19 cases (33.9%) of pin tract infection in this study. Pedro A. A. 1997 [18], Nila C 2004 [15] and M. Ayaz Khan 2004 [16] observed 20.5%,11.4% and 47.4% in sequence pin tract infection rates in their serials.

The non union is main complication of external fixator, many authors called external fixator a machine of nonunion. We had 5 cases (10.7%) of non union, all achieved union later with secondary procedures. Leong C.M. and his collegues 1999 [19], M J Iqbal etal 1996 [10] and M.Ayaz Khan etal 2004 [16] reported 14.2%,9.6% and 5% in sequence rates of non union in type 111 open tibial fractures in their serials.

CONCLUSION

Type 111 A&B Open Tibial fractures are surgical emergencies needs aggressive approach for surgical debridement, early stablization and soft tissue cover. AO external fixator is simple and safe to apply, cost effective , minimal invasive, needs less operating time and gives good access to soft tissue and can be used as definite and successful management of type 111 open tibial fractures confidently, combined with early bone grafting it gives excellent results. However they allow very little adjustment after application, without replacing the pins.

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