

EXTERNAL FIXATION IN OPEN TIBIAL FRACTURES

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SUMMARY : *In this article, the principles of treatment of open tibial fractures are reviewed. 44 patients with open fracture of the tibiae, who were treated with external fixation were retrospectively studied with emphasis on etiology, anatomical localization and the role of infection on union. The main cause of delayed union in these fractures have been found to be the presence of infection.*

Key Words : *Tibia Fracture, Open Fracture, External Fixation.*

INTRODUCTION

Treatment of an open fracture is a surgical emergency. The aim of treatment is to convert a contaminated wound into a clean wound, achieve bone union in a proper position and obtain a functional restoration (Sisk, 1987). Since Malgaigne's first external fixation of a patellar fracture (Green, 1981), external fixators have evolved to be one of the best methods in treating open fractures and offer several advantages (Aslanoğlu et al. 1984).

1. Maintains rigid stabilization of the fracture,
2. Enhances clinical evaluation and wound care,
3. Allows easy application of skin grafts and flaps,
4. Allows early mobilization and weight bearing,
5. Shortens duration of hospitalization and rehabilitation,
6. Application technique is easier.

The aim of this study is to review 44 patients with open tibial fractures and discuss the results ob-

tained in treating these patients with external fixators.

MATERIALS AND METHODS

This retrospective study evaluates 44 patients with open tibial fractures who were admitted to the Gazi University Medical School, Department of Orthopedics and Traumatology between the years 1986 and 1991.

The patients were evaluated according to Gustillo's classification of open fractures (Gustillo, 1976), (Table 1). The cause and anatomical site of the fracture were also noted.

Type 1. Small wounds of 1 cm or less caused by low velocity trauma.
Type 2. Wounds extensive in length and width but with little or no avascular or devitalized soft tissue and relatively little foreign material.
Type 3. Wounds of moderate or massive size with considerable devitalized soft tissue or foreign material or both, or traumatic amputation.

Table - 1 : Classification of open fractures. (Gustillo, 1976).

The patients were treated in the following manner as suggested by Burgess (Burgess et al. 1987; Bölükbaşı, 1990).

1. Treatment of life-threatening conditions,
2. Assessment of extremity viability,
3. Debridement and irrigation,
4. Repositioning of fractures and external fixation,
5. Soft tissue coverage,
6. Obtain bone union,
7. Rehabilitation.

Bilateral frames or external circular stabilizers were employed for external fixation of the fractures (Fig 1, 2). When necessary, minimal osteosynthesis was performed for internal stabilization.

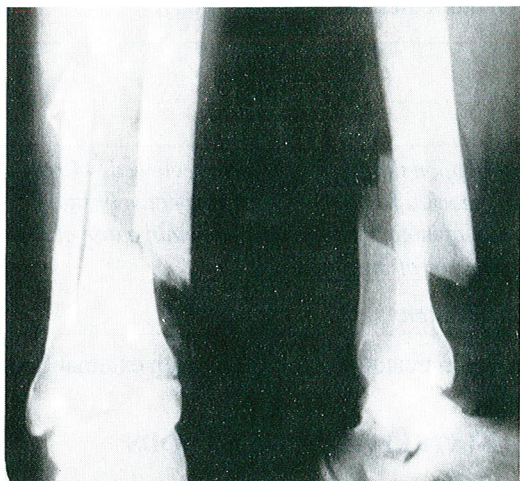


Fig. 1a :

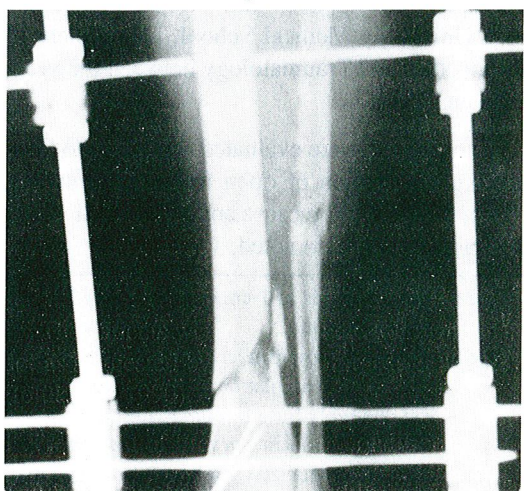


Fig. 1b

Fig. 1a, b : Radiographs of a patient with open tibial fracture.

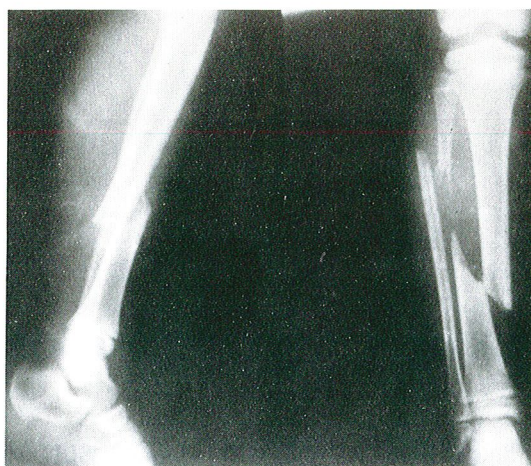


Fig. 2a

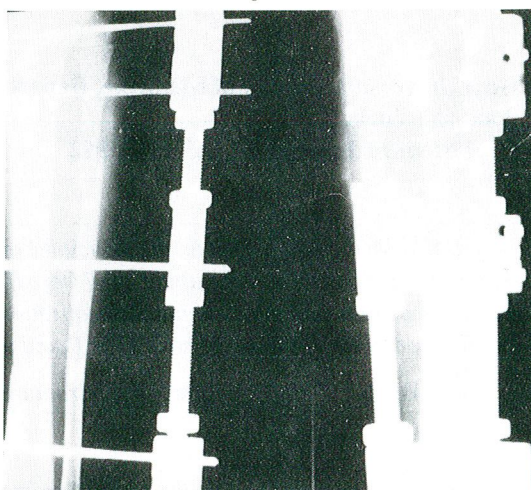


Fig. 2b

Fig. 2a, b : Radiographs of a patient with open tibial fracture.

The periods of fracture healing were noted for each patient.

Postoperatively, the patients were allowed to walk with partial weight bearing, as soon as possible.

RESULTS

The average age of the patients was 34.4 (8-71 years) and 7 (15.9 %) were women 37 (84.1 %).

8 (18.2 %) patients had Gustillo type 2 and 36 (81.8 %) had type 3 open tibial fractures.

Table 2 demonstrates the cause and Table 3, the anatomical site of the fractures.

In 40 patients bilateral frames were used as external fixators. External circular stabilizers were used in 4 patients. Minimal osteosynthesis was per-

Traffic accident	33 cases	(% 75)
Fall from height	5 cases	(% 12)
Labor accident	3 cases	(% 6.5)
Others	3 cases	(% 6.5)

Table - 2 : Classification of open tibial fractures according to their cause.

1/3 proksimal shaft fracture	6 cases	(13.6)
1/3 midshaft fracture	26 cases	(% 59.2)
1/3 distal shaft fracture	8 cases	(% 18.1)
Segmental fractures	4 cases	(% 9.1)

Table - 3 : Classification of open tibial fractures according to their localization.

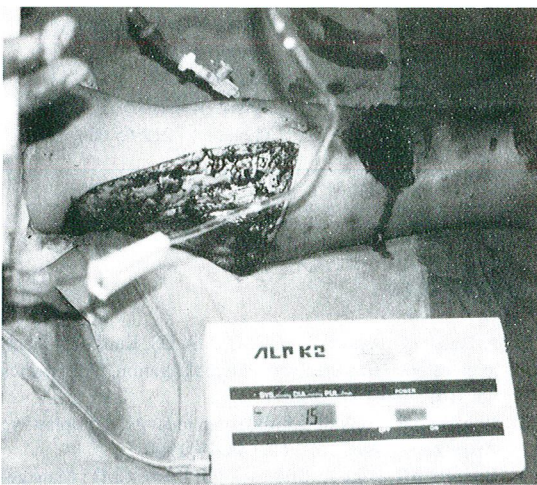


Fig. 3

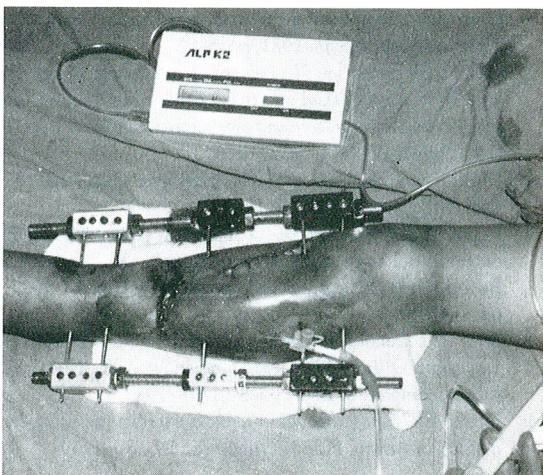


Fig. 4

Fig. 3, 4 : Measurement of intracompartmental pressure in a child with open tibial fracture pre and postoperatively.

formed in 14 (31.9 %) patients.

One patient developed a severe infection and

necrosis and the leg had to be amputated. One patient died because of adult respiratory distress syndrome. This patient was a severely injured one and had multiple organ failures. These two cases were excluded.

Fracture site at tibia	Healing time (weeks)
1/3 proksimal	21
1/3 midshaft	19
1/3 distal	21
Segmental fractures	22

Table - 4 : Average healing time according to the fracture site.

4 patients had head injuries and 11 had fractures of the femur or pelvis as accompanying injuries.

Local wound infection developed in 7 (16.6 %) patients. They were all treated with debridement and parenteral antibiotics. In 3 of these cases (7.1 %) bone grafting was necessary and electrical stimulation was used in 2 patients. In those cases union was achieved the mean period for union was 30 weeks.

In the 35 cases with no infection (83.3 %), the average healing time was 18 weeks.

Pin tract infection developed in 6 (14 %) patients. These patients were treated with local and systemic antimicrobial agents, and in one patient, the external fixator had to be removed in order to control infection.

In 9 of the cases (% 21), wound defects were treated with split thickness skin grafts.

In 2 cases which showed clinical signs of compartment syndrome and high intracompartmental pressures, fasciotomy and decompression was applied (Fig 3, 4).

The average time of external fixation was 12 weeks (range 6-24 weeks). In 30 patients, after removing the external fixators a short leg walking cast was used for an additional average period of 10 weeks.

The average time of healing according to the fracture site are given in table 4.

DISCUSSION

Tibial is the most common site of open fractures (Nicoll, 1974). In our series, the most common cause of open tibial fractures is traffic accidents, accounting for 75 % of the cases. This is important because these are frequently associated with multiple injuries, comminuted fractures, segmental bone loss-

ses and an increased probability of infection (Russell, 1991). Five of our patients had associated cranial injuries or fractures of other long bones or pelvis and one patient with multiple injuries died because of adult respiratory distress syndrome.

Most of the patients who were treated with external fixators had Gustillo type 3 and some with type 2 open fractures. The reason for this is that type 1 open fractures are successfully treated in the emergency ward with the application of casts and proper wound care.

The most frequent site of open fractures was found to be the mid-shaft of the tibiae. In this part of the tibiae, application of external fixators is both easy and effective.

Bilateral frames were used in 40 patients and besides being effective, they have the advantage of being inexpensive. External circular stabilizers have been used in a limited number of patients, and the advantages they offer are well known (Tucker, 1989). Although we routinely avoid using internal fixation in open fractures, open reduction and minimal osteosynthesis is a justified method for very unstable fractures.

According to Nicoll (1987) the important factors affecting outcome of open fractures are :

1. The amount of initial displacement,
2. The degree of comminution,
3. The presence or absence of infection,
4. The severity of soft tissue injury excluding infection.

The main problems in external fixation of open fractures are nonunion infection and pin tract infections.

In our series, 7 patients developed wound infection at the fracture site and 6 patients had pin tract infection. It was relatively easy to control pin tract infections and in only one patient the external fixator had to be removed. The main problem was in patients with wound infection and in these patients the time for fracture healing rose to an average of 30 weeks, opposed to 18 weeks in non-infected open fractures. Perhaps there are other factors intervening but infection appears to be the main factor (Nicoll, 1987). Nicoll also states that the localization of the fracture site does not effect fracture healing and we agree with this opinion with the results shown in

Table 4.

In conclusion, type 2 and 3 open tibial fractures are successfully treated with external fixation, furthermore we believe it to be the ideal method of stabilization. The main problem in treating these fractures is the development of infection which delays the period necessary for fracture healing.

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