A Report of the first 20 cases using a Simple External Fixator

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Summary

The results of treatment using a locally-designed external fixator in 20 patients are presented. Open fractures were the main indications for external fixation. Pin tract infection occurred in 8 patients. Only 2 patients had unstable fixation which required removal of the device. One third of patients developed malunion exceeding 15 degrees and two thirds had joint stiffness after conversion to plaster cast. This external fixator is adequate in the treatment of most open fractures of the tibia. However, improved techniques of pin insertion and cast application upon removal of the external fixator may help to reduce the incidence of pin tract infections and malunion.

Key words: External Fixator

Introduction

External fixation have proven to be very useful in the management of limb trauma. The need for rigid fixation and dynamisation has produced complex and expensive designs of external fixators. Several workers have described external fixators that are cheap and easy to use.[1,2] One of the main authors have reported on a locally-designed external fixator that is simple and inexpensive..[3,4]

This report describes our experience with the use of this external fixator in the University Department of Orthopedics and Traumatology, General Hospital, Kuala Lumpur.

The external fixator consists of a single unilateral bar made of galvanized iron pipe and mild-steel nuts and bolts (Fig. 1). Bony fixation is achieved by means of 5mm Schanz pins. It was originally designed for 2 main purposes, namely:

1. An inexpensive external fixator which could be produced locally

2. Simple design to enable easy and rapid assembly and also allow junior doctors to learn the technique of open fracture fixation with a minimal amount of time and training.

This fixator serves these two purposes extremely well. It provides adequate rigidity to open fractures, even where there is comminution. It is uniplanar and soft-tissue friendly.

We have subsequently fabricated this external fixator out of stainless steel.

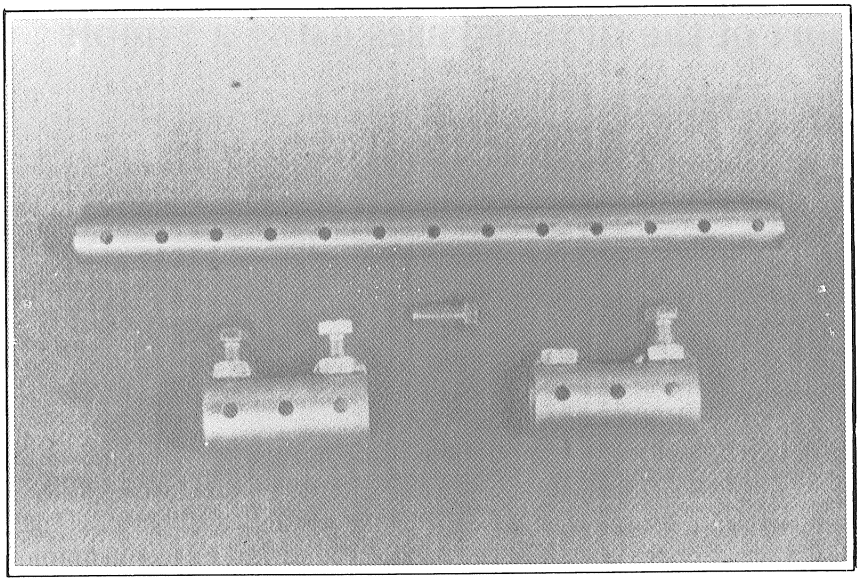

Fig. 1: Components of the local external fixator

Materials and methods

Case notes and radiographs of the first twenty patients treated with this external fixator were reviewed. The use of the fixator and the results of treatment were analysed. Open fractures were graded according to the classification by Gustilo and Anderson..[5] Bone healing occurred when there was clinical and radiological evidence of union and consolidation of the fractures.

Results

Age and Sex

All except three patients were male. Mean age was 34 years (range 14 to 68 years). Thirteen patients were between 10 and 40 years old; the remaining eight were above the age of 40 years.

Nature of Injury

Trauma was the causative factor in all 20 patients. Eighteen patients sustained injury in road accidents. There were 7 were motorcyclists, 3 pedestrians, 1 motorist and 1 cyclist. The nature of road accident was unknown in 6 patients. The remaining two patients injured the lower limb after a fall.

Indications for External Fixation

All patients had external fixation to the lower limbs; the tibia was externally-fixed in 15 patients and the femur in four (Fig. 2). In one patient the device was applied across the knee.

Open fracture was the main indication for external fixation (Fig. 3). Thirteen (65%) were Type III fractrures. Fourteen (82%) of the seventeen open fractures involved the tibia. Two patients with closed fracture of the femur developed infection after plate osteosynthesis which required subsequent removal of implant and application of external fixator. Only one patient had external fixation for a closed fracture (malunited) of tibia. The fixator was applied across the knee in a patient with Type III fracture of the lower femur and ligamentous instability of the knee.

Thirteen patients had other fractures which did not require external fixation. Fractures in the ipsilateral limb occurred in five patients whilst two had involvement of the contralateral limb. The upper limb was fractured in four patients and the clavicle in two.

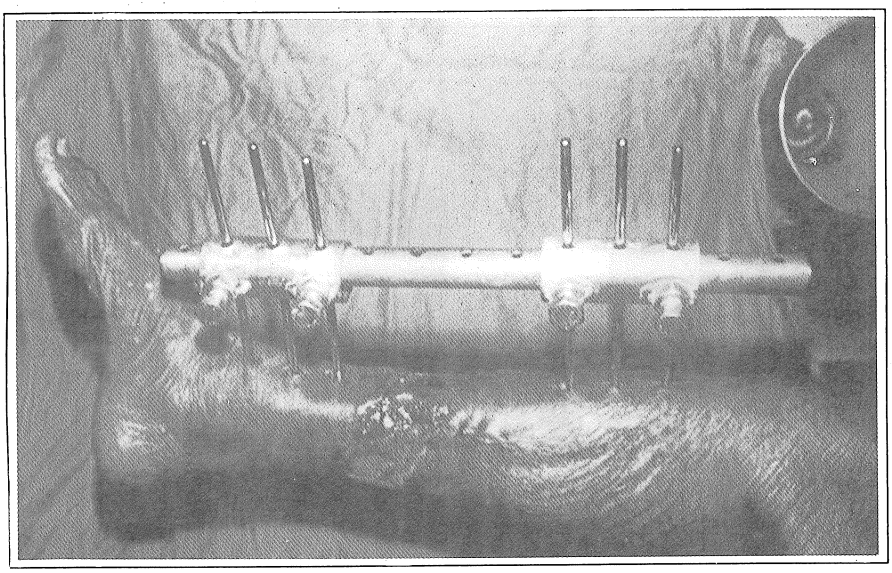

Fig. 2: Local external fixator applied on a compound fracture of the tibia

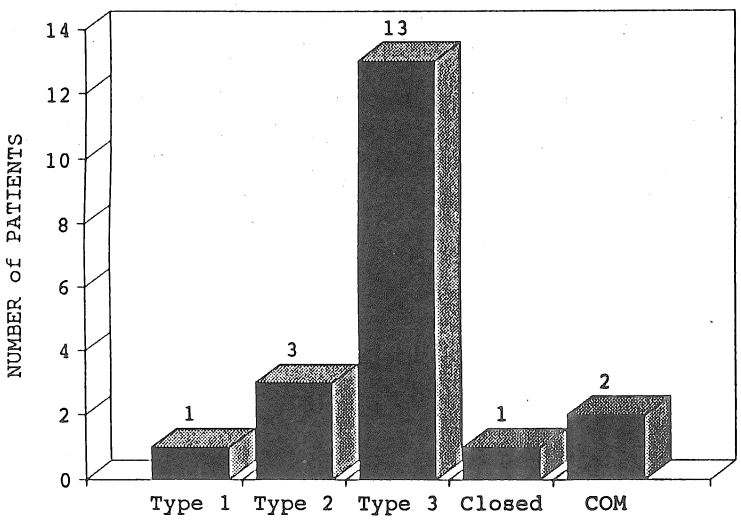

Fig. 3: Indications for external fixator

Six patients had other associated injuries. There were three head injury, one intra-abdominal injury (lacerated liver), one dental injury, one chest injury (lung contusion) and one with extensive soft-tissue degloving of the contralateral lower limb.

Duration on External Fixator

This is summarized in Fig. 4. The mean duration was 9.5 weeks (range 2 to 33 weeks). Application of the device was done primarily in nine patients. The remaining eleven patients had initial skeletal traction before the external fixator was applied, with a mean delay in application of 7.1 days (range

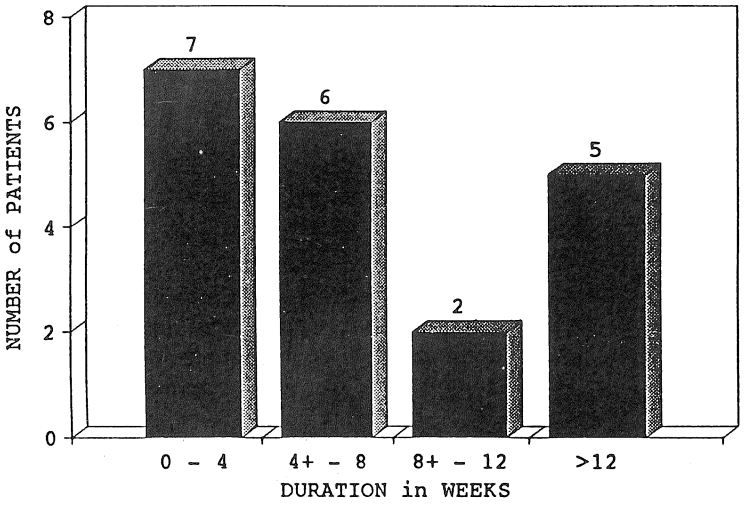

Fig. 4:
Duration on external fixator

4 to 30 days). The external fixator was removed and a plaster cast applied when wounds had either healed or were small enough to allow regular dressings on an outpatient basis. 35% of patients wore the fixation device for up to four weeks and another 30% wore the fixator between 4 to 8 weeks. Of those who wore the fixator more than 12 weeks, three had chronic osteomyelitis involving the fracture site (2 femur, 1 tibia). All but two patients were immobilized in plaster cast upon removal of the fixator.

Period of Hospitalization

The mean period of hospitalization was 8.3 weeks (range 2 to 25 weeks). Twelve patients (60%) stayed between 4 to 8 weeks. Only two patients were discharged within 4 weeks. Two patients stayed longer than 12 weeks; both had chronic osteomyelitis at the fracture site (1 femur and 1 tibia). Excluding two patients who underwent amputation, five patients were discharged with the external fixator.

Time to Bone Healing

In 12 patients the fractures united, excludin six who defaulted follow-up and two who had above knee amputations. Bone healing was achieved in an average of 7.2 months after injury (range 2 to 13 months). Fractures healed within six months in six patients and within 6-12 months in five patients. Type III fractures accounted for 50% in the former and 80% in the later. One patient with post-operative chronic osteomyelitis of the femur healed at thirteen months. The only patient with a closed fracture (malunited tibia) healed at two months.

Complications

This is summarized in Table I.

Pin-tract Infections

Eight of the twenty patients had pin-tract infections, of whom seven had Type III fractures. Four patients were on the external fixator for up to two months and the other four for more than four months.

Table 1
Complications

Type of Complication	Number	Percentage
Pin-tract Infection	8/20	40%
Instability	2/20	10%
Osteomyelitis	4/20	20%
Malunion	4/12	33%
Nonunion	3/12	25%
Joint Stiffness	8/12	67%

Stability of Fixation
Two patients required removal of the external fixator because of unstable fixation (1 femur, 1 tibia). Both were due to pin-tract infection with loosening of transfixion pins.

Osteomyelitis
Four patents developed osteomyelitis; three involved the tibia and in one patient both the tibia and femur were involved. All infections occurred in patients with open Type III fractures. Above knee amputation was performed in two patients; one had uncontrolled infection with diabetes mellitus and the other had ipsilateral chronic osteomyelitis of both the femur and the tibia with sciatic nerve injury.

Non-union and Malunion
Three patients developed infected non-unions, excludingtwo who had existing infected non-union of the femur after plate osteosynthesis. All were Type III fractures involving the tibia and all subsequently united with bone graft.

Of twelve patients in whom the fractures united, five had no malalignment. Four had angulation exceeding 15 degrees in a single plane. One occurred in the femur and three in the tibia.

Joint Stiffness
Of twelve patients in whom the fractures united, four had normal movements of the knee and ankle joints. Eight developed stiffness of either one or both joints. In six patients, restriction of joint movement was mild (less than 50% of normal). The other two patients had gross restriction of joint movement; fracture united at eleven months in one patient and at thirteen months in the other.

Discussion
Trauma to the lower limbs remain the major indication for external fixation. A large proportion is due to road accidents and most involve males in the second to fourth decades of life. Amongst the major lower limb bones, the tibia is the most vulnerable to severe injury, especially in motorcyclists. The majority of patients had sustained open Type III fracture of the tibia. More than 50% of patients had other fractures while a smaller amount had other injuries. External fixation in these patients simplify nursing care and treatment of associated injuries.

Stability of fixation of the external fixator was adequate in 90% of our patients. Stable fixation alleviates pain and risk of further movement at the fracture site. Only in 2 patients did instability occur and this was due to pin-tract infection that resulted in loosening of bone fixation. The unilateral frame provides some degree of elasticity as was evidenced by the formation of good external callus in patients that did not have infected non-union.[6]

Immediate application of external fixator has been shown to shorten the time to bony union compared to primary skeletal traction.[7] However, the high turnover of such patients in our setup and the concomitant shortage of external fixator devices necessitated the initial use of skeletal traction in 55% of patients. The severity of wounds permitted only 28% of patients to be discharged with the external fixator.

The overall incidence of pin-tract infections was 40%, with the incidence for the tibia being 25%. Others have reported pin-tract infections for the tibia in the range of 9-17%.[2,8,9] The main reason for the high incidence in this series is the delay in admission and subsequent delay in debridement of the fractures. Except for two patients in whom the external fixator had to be removed, pin-tract infections were mild and resolved with regular dressings. This series supports the view that this complication has no relation with the duration of external fixation.[10] Protection of skin and soft tissues during pin insertion and the use of pre-drilling should help to decrease the risk of pin-tract infection.[8-11]

Malunion exceeding 15 degrees occurred in 33% of patients and joint stiffness in 67%. Malunion appears to be an inherent problem in single-bar systems where fractures are associated with severe comminution and bone loss.[1,12] Angulation has been shown to increase in the plaster cast after the external fixator is removed.[9] The majority of patients in this study were put on plaster cast upon removal of the external fixator, which is also a predisposing factor in the development of joint stiffness.

Conclusion

This locally-designed external fixator is well-suited to treatment of open fractures, which form an important portion of the workload in any Malaysian orthopedic unit. It gives good access to wound management and facilitates treatment of associated injuries. It is cheap and simple to use. It is not totally rigid but is clinically stable and provides the necessary element of elasticity in bone healing. However, a better technique of pin insertion and cast application upon removal of the external fixator may help to reduce pin-tract infections and malunion. A more intensive physiotherapy programme would help to reduce the high incidence of joint stiffness. Finally, its low cost has allowed early discharge of patients from hospital, without fear of losing expensive equipment.

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