ILIZAROV EXTERNAL FIXATOR

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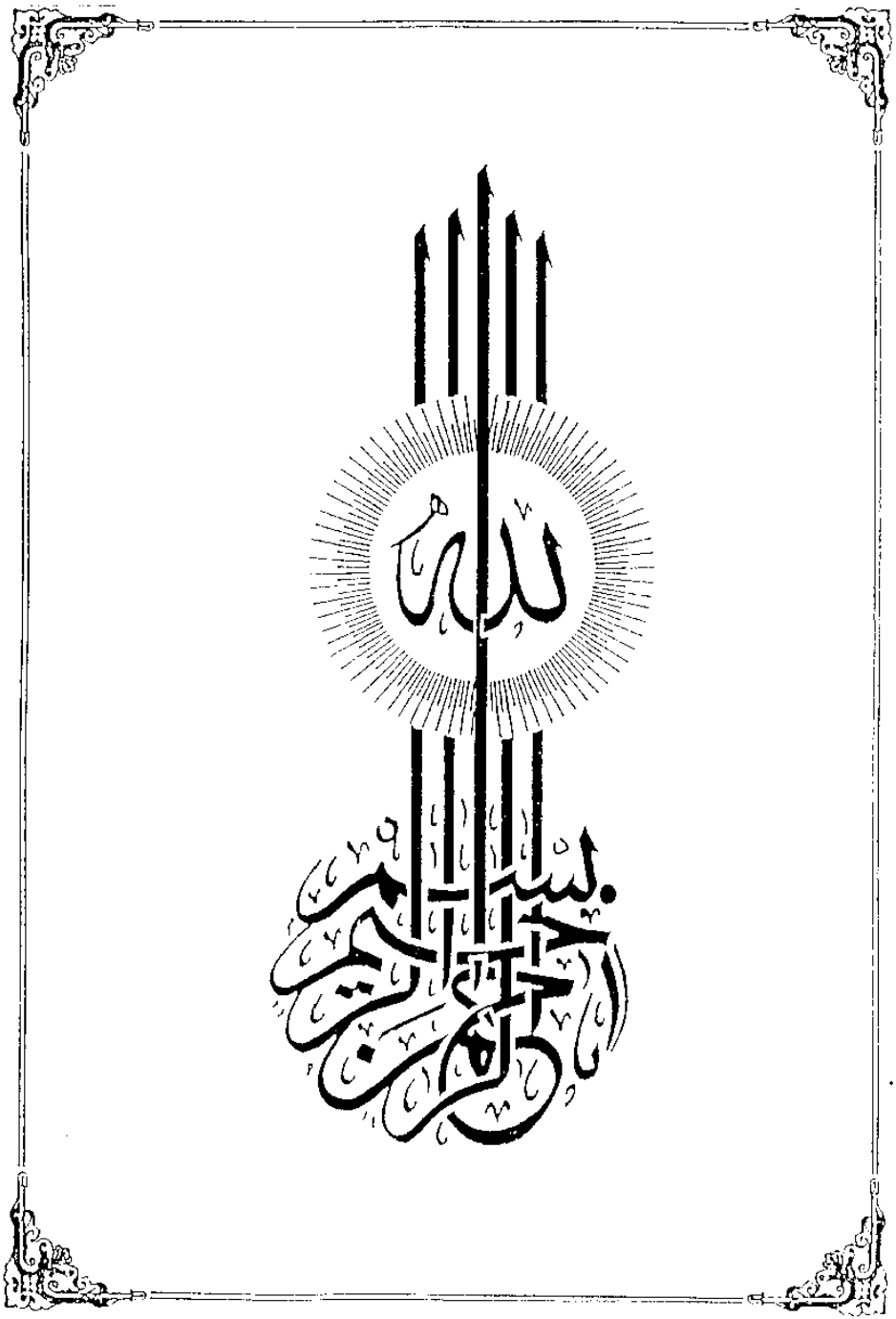

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INTRODUCTION

INTRODUCTION

External fixation is a method of skeletal immobilization that uses percutansus pins placed in the bone and linked with external connectors.

External fixation provides rigid fixation of the bones in cases in which other forms of immobilization are inappropriate. This is most common in severe open types II and III fractures in which cast or traction methods would not permit access for management of the soft tissue wounds and in which exposure and dissection to apply an internal fixation appliance would devitalize and contaminate large areas and might significantly increase the risk of infection or loss of the limb it self (Sisk, 1983). Additionally external frixation can provide compression, neutralization, or fixed distraction of the fracture fragments and allows direct surveillance of the limbs and wound status, including wound healing, neuro vascular status, viability of skin flaps and tense muscle compartments. With external fixation associated treatment, e.g. dressing changes, skin grafting, bone grafting and irrigation, is possible without disturbing the fracture alignment or fixation. Immediate motion of the proximal and distal joints is allowed. This facilitates reduction of oedema and nutrition of articular surfaces and retards capsular fibrosis, joint stiffening,

muscle atrophy and osteoporosis. The extremity can be elevated without pressure on the posterior soft tissues. The pins and frames may be suspended by ropes from over head frames on the bed, facilitating oedema resolution and relieving pressure on the posterior soft tissue part. Early patient mobilization is allowed. With rigid fixation the limb can be moved and positioned without fear of loss of fracture position. In stable, uncomminuted fractures, early ambulation is usually possible, this may not be the case if these fractures are treated by traction or casting. Use of external fixation also allows mobilization of some patients with pelvic fractures. Insertion of pins can be performed under local anaesthesia. If necessary. If a patient's general medical condition is such that use of a spinal or general anaesthetic is contraindicated, the fixator can be inserted under local anaesthesia, although this is not optimal. Rigid external fixation can be used in infected, acute fractures, or non unions. Rigid fixation of the bone fragments in infected fracture or in infected established non unions is a critical factor in controlling and obliterating the infection. This is rarely possible with casting or traction methods, and implantation of internal fixation devices is often ill advised. Modern external fixators, in such instances, may provide rigidity not afforded by other methods (Sisk, 1983).
On the other hand, with external fixation meticulous pin insertion technique and skin and pin tract care are required to prevent pin

tract infection. The pin and fixator frame may be mechanically difficult to assemble by the uninitiated surgeon. The frame may be cumbersome, and the patient may reject it for aesthetic reasons. Fracture through pin tract may occur during insertion or after removal. Refracture after frame removal may occur unless the jamb is adequately protected until the underlying bone can again become accustomed to stress. The equipment is expensive. The non-compliant patient may disturb the appliance adjustments. Joint stiffness may occur if the fracture requires that the fixator immobilize the adjacent joint. This is most common with fractures involving the proximal or distal limits of the bone, with the major fragment affording insufficient pin purchase and dictating a set of pins and frame above the joint (Sisk, 1983).

Generally external fixation device has many indications. Indications may be considered in two categories:- Accepted and possible indications.

I- <u>Accepted Indications :-</u>

1- Severe types II and III open fractures. 2- Fractures associated with severe burns. 3- Fractures requiring subsequent cross-leg flaps, free vascularised grafts, or other reconstructive procedures. 4- Certain fractures requiring distraction e.g., those associated with significant bone loss or those in paired bones of an extremity in which maintenance of equal length of the paired bones is important. 5- Limb lengthening. 6- Arthrodesis. 7- Infected fractures or non unions.

II Possible indications:-

1- Certain pelvic fractures and dislocations.

2- Open, infected pelvic non unions. 3- Reconstructive pelvic osteotomy. 4- Fixation following radical tumor excision with autograft or allograft replacement. 5- Femoral osteotomies in children. Use of this method eliminates the necessity of subsequent removal of such internal fixation appliances as plates and screws. 6- Fractures associated with vascular or nerve repairs or reconstructions. 7- Limb Reimplantation. 8- Fixation of multiple closed fractures. External fixation may be an alternative in poly-traumatized patients with fractures that could be managed singly by traction, casting or open reduction and internal fixation but that may be difficult to immobilize in combination. 9- Correction of congenital Joint contractures or congenitally webbed joints.

10- Supplement of nonrigid internal fixation e.g. in comminuted fractures in which major fragments have been immobilized by kirschner wires, or screws, but are not sufficiently rigid for definitive immobilization. 11- Ligamentotaxis. Certain intra-articular fractures may be treated by external fixation using traction by the fixator on the capsular and ligamentous structures about the joints. 12- Fixation of floating knee fractures. External fixation of ipsilateral femoral and tibial fractures not suited for open reduction and internal fixation will allow early

knee function. 13- Assessment of knee ligament stability with fractures of the upper tibia or lower femur in patients in whom the integrity of knee ligaments may be difficult to assess. When knee ligament repair or reconstruction is required with associated fractures, an external fixator may be used to immobilize the fracture as well as the ligament repair (Sisk, 1983).

HISTORICAL REVIEW

Historical Review

The immobilization of fracture fragments by the insertion of pins connected externally by plaster, metal devices or other appliances is not a new concept. In the past two centuries external fixation has enjoyed long periods of enthusiastic use alternating with intervals of total disrepute (Sisk, 1983).

In 1840 Malgaigne developed a device for the immobilization of a fracture of the lower extremity. The apparatus consisted of a simple metallic pin that was inserted into the displaced osseous fragment and attached to metallic band. The latter was adjusted by the use of a belt (Fig. 1a). In 1843 Malgaigne developed a clamp for immobilization of the patella (Fig. 1b). In 1850 Rigaud treated a fracture of the olecranon using two screws brought together with a string. In 1870 Feraud improved Rigaud's technique by joining the screws with a wooden bar (Quoted from Vidal, 1983).

In 1897, Parkhill designed a bone clamp, consisting of four screws with 2 sets of wing plates attached to these screws (Fig.1c) (Parkhill, 1897). In 1902 Lambotte, used percutanous pins with a rigid external frame on the femur and other long bones (Fig. 1d) (Mears, 1980).

Researches for improvement of external fixators has three aims :-

(1) To attain better tolerance for pins and to increase anchorage.

(2) To improve handiness of the apparatus, to allow correction of displaced long fragments.

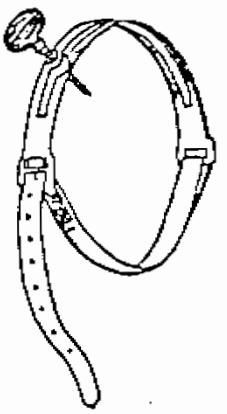

Fig. 1a Malgaigne's Device
(Clin. Orthop. No.180)

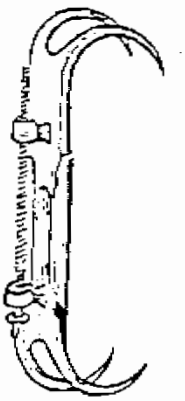

Fig. 1b Malgaigne's Clamp
(Clin. Orthop. No.180)

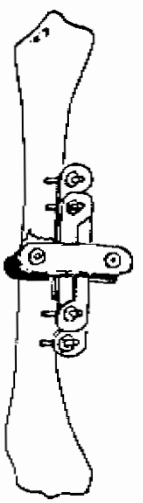

Fig. 1c Parkhill's Bone Clamp
(Clin. Orthop. No.180)

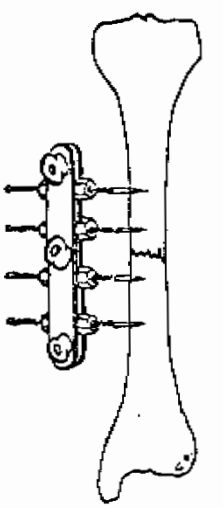

Fig. 1d Lambotte External Fixator
(Clin. Orthop. No.180)

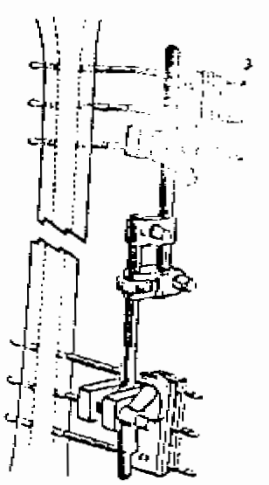

Fig. 1e Hoffman External Fixator
(Clin. Orthop. No.180)

(3) To provide complete stability in all planes as with internal fixation.

Currently the external fixators in use are so numerous that all can not be mentioned. However, it is possible to distinguish six types of frames according to geometric configuration (Fig. 2):-

(1) The Unilateral frame : is the simplest configuration. This category includes the frames devised by Hoffman, Wagner, Denham, Shohayeb and dynamic axial fixator.

(2) The bilateral frame : employs a rigid bar on both sides of the limb connected to full pins that transfix the bone. e.g. Rezaian fixator.

(3) The Quadrilateral frame has four bars, two on each side of the limb connected to pins that transfix the bone. The Vidal - A dray frame is a typical example of this type.

(4) The half circular frame, employs bars that incompletely encricle the limb e.g. Ace-Fisher fixator.

(5) The circular frame employs rounded bars that completely encircle the limb e.g. Ilizarov and Monticelli Spinelli fixators.

(6) The Triangular frame places pins in two planes for increased stability, the ASIF tubular fixator can be used in unilateral, bilateral or triangular configuration.

One of the circular fram that completely encircle the limb is the Ilizarov external fixator was originally developed in Kurgan,