



## Management of proximal femoral fractures using the Ilizarov principles

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**External fixation can be an exceptional relief solution in the treatment of proximal femoral fractures. We would like to share our experience using external fixation techniques with either the Ilizarov frame or Hofmann system in 23 patients with complicated fractures.**

**Keywords :** external fixation ; proximal femoral fracture ; Ilizarov.

### INTRODUCTION

The primary aim of surgical treatment in proximal femoral fractures is to obtain good fracture reduction and to maintain the reduction until sufficient stability is provided by the fracture-bridging callus. If stable fixation is achieved, rehabilitation can be instituted early and functional recovery may attain near prefracture levels (2). Over the years, several surgical fixation techniques have been proposed. The most widely used implants are the sliding hip screw and the intramedullary hip screw (7,15).

During the 1950s, external fixation was used to treat intertrochanteric fractures, but a high prevalence of postoperative complications such as pin loosening, infection and mechanical failure of the fixator caused surgeons to discontinue its use.

Newly developed external fixators and the introduction of hydroxyapatite coated external fixation pins increased the drive to reconsider external fixation as a suitable treatment option for proximal

femoral fractures (10). Contemporary studies on newer fixator have also shown that the external fixation can provide results similar to or even better than those obtained with conventional internal fixator techniques (10,11,16).

### PATIENTS AND METHODS

Twenty three patients (12 male and 11 female, mean age 75 years, range 10 to 85) with proximal femoral fractures were managed with external fixation between 2000 and 2009. Reduction and fixation were performed under general, epidural or spinal anaesthesia. All patients received a first generation cephalosporin intravenously 30 min before surgery. Antibiotics were continued for 5 days postoperatively in open fractures. The follow-up was 24 months minimum. The Ilizarov external fixator was used in 13 patients, the Hoffman external fixator in the remaining 10 patients. Indications were : open fractures, highly comminuted fractures (Fig. 1a,b), fractures associated with pelvic ring fracture, fractures in poliomyelitis patients with a narrow intramedullary canal (Fig. 2a,b), cases of intraoperative failure of internal fixation, fractures occurring during lengthening or

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**Fig. 1.** — **a.** Comminuted proximal femur fracture (before fixation); **b.** Comminuted proximal femur fracture (during fixation).



**Fig. 2.** — **a.** Proximal femur fracture in a polio patient (before fixation); **b.** Proximal femur fracture in a polio patient (during fixation).



**Fig. 3.** — External fixation upon patient request (due to religious reasons).

when the patient refused internal fixation or the associated blood transfusion (Fig. 3).

### Surgical technique

With the patient on a fracture table and under fluoroscopy control in two planes, two or three Schanz screws 5 or 6 mm in diameter were inserted into the proximal femoral fragment in different directions (when in the head, to a depth of 1 cm below the articular surface

of the femoral head). Both cortices of the femoral diaphysis were drilled with a low-speed burr, and two or three Schanz screws 5 or 6 mm in diameter were inserted manually using a T-handle to a depth of two screw threads beyond the opposite bone cortex. The number and size of the half-pins was based on bone diameter, patient's size, bone quality, and comminution at the fracture site. As a general rule the size of the half-pin should not exceed one-third of the underlying bone diameter. Once the half-pins were in place, they were secured to one proximal arch and one distal arch. When reduction was satisfactory the pin holders were tightened and the fixator mounted. When a Hoffman external fixator was used, the pins were connected by clamps, and then by rods, according to the technical guidelines for Hoffmann® II External Fixation System. No blood transfusion was necessary in any of the cases.

Antithrombotic prophylaxis consisted of low-molecular-weight heparin. Postoperative radiographs were obtained on the first postoperative day. Partial weight bearing with a walker was encouraged in compliant patients. After discharge, follow-up visits were scheduled at monthly intervals for six months. Partial weight bearing was gradually followed by full weight bearing and fixators were removed when complete bone healing was observed. Radiographic union was defined by the presence of trabeculae bridging the fracture site or obvious periosteal callus across the fracture line. During hospitalization the patients were trained on how to clean twice a week the pin entry sites with alcoholic solution.

Shortening, malunion in external rotation or varus angulation, pain at the hip and knee, range of movement

of the hip and knee, evidence of union and infection were recorded. During final follow-up at 24 months function of the hip was assessed using the Harris hip score (6) and the Parker-Palmer mortality score (14). Parker-Palmer mortality score evaluates the patients on the basis of their ability to walk within their place of residence, their ability to walk outside, and their ability to go shopping. Each activity was assigned a score on the basis of its level of difficulty : 3 points indicated that the patient had no difficulty ; 2 points indicated that the patient needed a cane or other aid ; 1 point indicated that the patient needed help from another person, and 0 points indicated that the activity was impossible for the patient to perform.

## RESULTS

All fractures united clinically and radiologically at an average of 12 weeks (range : 10-14 weeks). There were no cases of pin loosening, breakage or penetration into the hip joint. The fixator did not interfere with sitting or lying. The average operating time was 20 min (range : 15-25 minutes). Familiarity with the technique played a significant role in reducing operative time. No intraoperative complications occurred and there was no need for intraoperative blood transfusion as the blood loss was negligible. Average duration of hospital stay after the operation was 3 days (range : 2-4 days). At the final evaluation, the mean range of motion of the hip was 95° flexion (range : 90°-100°), 30° abduction (range : 25°-35°) and 40° external rotation during flexion of the hip (range : 35°-45°). The mean Harris hip score (6) for all patients at six months was over 80 i.e. good ; at 24 months it was over 90 i.e. excellent. All patients had limited knee flexion in the postoperative period ; however, improvement was seen during the follow-up. At the final evaluation, the mean range of motion of the knee was 120° (range : 90° to 140°).

Using the criteria of Rockwood and Green (3) superficial pin tract infection was observed around 10 pins (15%). This usually involved the proximal pins. Infections were successfully treated with oral antibiotics and daily cleansing with antiseptic solutions. There were no deep infections and in no case did the pins have to be removed before completion of treatment.

## DISCUSSION

Open proximal femoral fractures, highly comminuted fractures associated with pelvic ring fracture or fractures in a poliomyelitis patient with a narrow intramedullary canal are hard to be internally fixed. Also, intraoperative failure of internal fixation of a proximal femoral fracture, fracture of proximal femur during lengthening or simply a fracture in a patient who refuses internal fixation or blood transfusion are a challenge. In all these circumstances external fixation can be considered.

As compared with internal fixation, external fixation is less traumatic ; it is a cost effective surgical option which provides short operative and hospitalization time, negligible additional blood loss and minimal surgical stress for the patient (5,12). External fixators give the surgeon a wide range of freedom to implant the Schanz screws in different angles and numbers depending on the surgeon's preference and the width of the femoral neck. External fixation has a significantly lower incidence of mechanical complications. The element of elasticity encourages rapid formation of abundant callus without disturbing the fracture haematoma (1).

Despite these evident advantages, the external fixator has failed to become popular because of the significant complications reported in previous studies, with infection being the most common. Cases of deep infection that required pin removal or repositioning have been reported (5). Vossinakis and Badras (17) reported that pin track infection developed in 15 of their 50 patients (30%). In a similar study, 18 out of 41 patients (45%) treated in our unit had pin track complications. Decrease in the severity and rate of pin track infection was attributed to meticulous surgical technique during Schanz screw insertion and good patient education about pin care (4,13).

The presence of osteolysis around the pins without infection has been reported (8). This has been attributed to incorrect surgical technique : it may have been the result of thermal necrosis following high speed drilling. We did not observe any signs of osteolysis and we attribute this to our non-traumatic technique.

Table I. — Patients included in the study, according to the indication

Indication	Number of cases
Open proximal femur fracture	4
Highly comminuted fracture	4
Associated pelvic ring fracture	2
Fracture in poliomyelitis patient with a narrow intramedullary canal	1
Intraoperative failure of internal fixation	1
Fracture of proximal femur during femoral lengthening	10
Patient refused internal fixation or the associated blood transfusion process	1
Total	23

In conclusion, external fixation is a minimally invasive technique with minimal additional blood loss, which allows early mobilization. It can be exceptionally recommended for the fixation of proximal femoral fractures. Indications include open proximal femoral fractures, highly comminuted fractures, proximal femoral fractures associated with pelvic ring fracture, fractures in a poliomyelitis patient with a narrow intramedullary canal, intraoperative failure of internal fixation of a proximal femoral fracture, fracture of proximal femur during lengthening or simply if the patient refused internal fixation or the associated blood transfusion process.

## REFERENCES

- Badrans L, Skretas E, Vayanos ED.** [Treatment of trochanteric fractures by external fixator.] (in French). *Rev Chir Orthop Reparatrice Appar Mot* 1997 ; 84 : 461-465.
- Baumgaertner MR.** The pertrochanteric external fixator reduced pain, hospital stay and mechanical complications in comparison with the sliding hip screw. *J Bone Joint Surg.* 2002 ; 84-A : 1488.
- Blair B, Koval KJ, Kummer F, Zuckerman JD.** Basicervical fractures of the proximal femur. A bio-mechanical study of 3 internal fixation techniques. *Clin Orthop Relat Res* 1994 ; 306 : 256-263.
- Catagni MA, Ottaviani G, Combi A, Elhence A.** External circular fixation : A comparison of infection rates between wires and conical half-pins with threads outside or inside the skin. *J Trauma.* 2006 ; 61 : 1186-1191.
- Christodoulou NA, Sdrenias CV.** External fixation of select intertrochanteric fractures with single hip screw. *Clin Orthop Relat Res* 2000 ; 381 : 204-211.
- Harris WH.** Traumatic arthritis of the hip after dislocation and acetabular fractures : treatment by mold arthroplasty. An end-result study using a new method of result evaluation. *J Bone Joint Surg.* 1969 ; 51-A : 737-755.
- Kakkar R, Kumar S, Singh AK.** Cephalomedullary nailing for proximal femoral fractures. *Int Orthop* 2005 ; 29 : 21-24.
- Karn NK, Singh GK, Kumar P et al.** Management of trochanteric fractures of the femur with external fixation in high-risk patients. *Int Orthop* 2009 ; 33 : 785-788.
- Kourtzis N, Pafilas D, Kasimatis G.** Management of pertrochanteric fractures in the elderly patients with an external fixator. *Injury* 2001 ; 32 : 115-128.
- Moroni A, Faldini C, Pegreff F et al.** Dynamic hip screw compared with external fixation for treatment of osteoporotic pertrochanteric fractures : A prospective, randomized study. *J Bone Joint Surg* 2005 ; 87- A : 753-759.
- Moroni A, Faldini C, Pegreff F, Hoang-Kim A, Giannini S.** Osteoporotic pertrochanteric fractures can be successfully treated with external fixation. *J. Bone Joint Surg* 2005 ; 87-A : 42-51.
- Ozdemir H, Dabak TK, Urgüden M, Gür S.** A different treatment modality for trochanteric fractures of the femur in surgical high-risk patients : a clinical study of 44 patients with 21- month follow-up. *Arch Orthop Trauma Surg* 2003 ; 123 : 538-543.
- Ozkaya U, Parmaksizoglu AS, Gul M.** Management of osteoporotic pertrochanteric fractures with external fixation in elderly patients. *Acta Orthop Traumatol Turc* 2008 ; 42 : 246-251.
- Parker MJ, Palmer CR.** A new mobility score for predicting mortality after hip fracture. *J Bone Joint Surg* 1993 ; 75-B : 797-798.
- Pervez H, Parker MJ, Vowler S.** Prediction of fixation failure after sliding hip screw fixation. *Injury* 2004 ; 35 : 994-998.
- Shalaby M, Boghdady GW.** Safety and reliability of external fixation for basicervical and intertrochanteric fractures in high-risk elderly patients. *Strat Traum Limb Recon* 2007 ; 2 : 83-89.
- Vossinakis IC, Badras LS.** The external fixator compared with the sliding hip screw for pertrochanteric fractures of the femur. *J Bone Joint Surg* 2002 ; 84-B : 23-29.