



## External fixation of intertrochanteric fractures in elderly high-risk patients

Kostas KAZAKOS, Dimitrios N. LYRAS, Dionysios VERETTAS, Vasilios GALANIS, Ioannis PSILLAKIS, Kostas XARCHAS

*From the Orthopaedic Clinic, Democritus University of Thrace, Greece*

This study concerns 56 elderly high-risk patients with an intertrochanteric fracture of the femur, who were treated with the Citieffe/Ch-N external fixator between November 2002 and February 2004. A short intraoperative time (37 minutes), no need for peroperative blood transfusion, fast mobilisation and a short hospitalisation (average 6 days, thus reducing the total cost) were noted. Union was obtained in all patients after 6 months. There was no significant difference between the functional status before the injury and at follow-up after 12 months ( $p > 0.05$ ). No deep pin track or wound infections occurred, but a superficial skin reaction was seen in 39.3%. The mortality rate was 16.1% at 6 months, and 20.4% at 12 months, which contrasts favourably with other types of treatment. External fixation with this device can be used successfully for the treatment of elderly high-risk patients with intertrochanteric fractures.

**Keywords :** intertrochanteric fractures ; elderly ; external fixation.

The most widely used implants are the sliding hip screw and the intramedullary hip screw, but both techniques are associated with high rates of implant failure (range : 5 to 20%) (22, 25).

The technique of closed reduction and external fixation offers an alternative. However, it was initially abandoned because of the high rate of postoperative complications (1, 6-9, 16, 17, 20, 21, 23, 24). Improved materials and techniques should minimise these postoperative complications (7, 20, 21, 23, 24).

Intertrochanteric fractures occur mostly in elderly people with a poor health status and a high operative and anaesthetic risk. Closed reduction and external fixation should offer the advantages of minimal blood loss, reduction in operative time, and shorter anaesthesia. The aim of this study was to assess the postoperative complications and the

### INTRODUCTION

Union in a good position, low mortality, minimal discomfort for the patient, and minimal cost are essential in the surgical treatment of intertrochanteric fractures (15). Open reduction and internal fixation is the standard treatment. Over the last 40 years new materials, devices and techniques were developed in order to achieve rigid fixation and early weight-bearing (2, 3, 5, 10-13, 15, 18, 19).

- Kostas Kazakos, MD, PhD, Assistant Professor.
- Dimitrios N. Lyras, DVM, MD, Registrar.
- Dionysios Verettas, MD, PhD, Associate Professor.
- Vasilios Galanis, MD, Orthopaedic Surgeon.
- Ioannis Psillakis, MD, Senior House Officer.
- Kostas Xarchas, MD, PhD, Assistant Professor.

*Orthopaedic Clinic, Democritus University of Thrace, Greece.*

Correspondence : Dimitrios N. Lyras, MD, Argyrokastrou 31B, Vrilissia, Athens, BO : 15235, Greece.

E-mail : dimitrislyras@yahoo.gr

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**Fig. 1.** — Fixation of an intertrochanteric fracture in a 92-year-old woman.

clinical results after a follow-up of 12 months, using a modern type of external fixator.

### MATERIALS AND METHODS

Fifty-six high-risk patients with an intertrochanteric fracture of the femur were treated with the Citieffe/Ch-N external fixator between November 2002 and February 2004 (figs 1, 2). The average age at operation was  $82 \pm 7$  years, and the female/male ratio was 39/17.

The inclusion criteria were: more than one comorbidity (diabetes mellitus, neurological disease, heart failure, coronary disease, respiratory disease or anaemia with haemoglobin less than 11 g/L), age above 75 years and a body weight less than 80 kg. Patients with a rare blood group were also treated with external fixation.

Exclusion criteria were: a previous hip fracture, a fracture secondary to a malignant tumour, multiple fractures, chemotherapy and a body weight above 80 kg.



**Fig. 2.** — Sitting in a chair is possible with the Citieffe/Ch-N

The injuries were classified as low, medium or high energy. Low energy trauma meant a fall from the patient's height, from a chair, or from bed. Medium energy trauma meant a fall from a higher level, while high energy trauma meant a road traffic accident. The fractures were classified according to the AO classification system using antero-posterior and lateral radiographs.

The patients were given prophylactic antibiotics (Zinacef), low-molecular heparin (Clexane), and analgesics. They were classified according to the American Society of Anaesthesiologists (ASA) scale. Spinal anaesthesia was routine, but in 3 patients, classified as "very high anaesthetic risk", the fixator was applied under local anaesthesia. The Citieffe/Ch-N external fixator was applied as recommended by the manufacturer (Citieffe, Bologna, Italy). It consists of a dynamic hip screw, which stabilises the fracture, and two or three self-tapping Schanz screws, which are inserted into the middle of the femoral shaft. The device offers the possibility of compression, sliding, diaphyseal distraction, and placement of an anti-rotation pin.

On the second postoperative day, the patients were mobilised, and partial weight-bearing with a walker was encouraged. Screw and pin sites were cleaned twice a week with an antiseptic solution. After discharge from the hospital, follow-up visits were scheduled at 15 days for removal of the sutures, and subsequently at 1.5, 3, 6, 12 and 24 months for clinical and radiological evaluation.

Table I. — Pre-injury health status of the patients

Comorbidity	Number of patients
Heart failure	27
Coronary disease	31
Respiratory disease	14
Diabetes mellitus	19
Neurological disease	16
Anaemia	19
Total	126

The data recorded for all patients included intraoperative time, duration of hospitalisation, need for blood transfusion, nonunion, superficial and deep wound or pin track infection. The Lower Extremity Measure (14), modified by Boretto *et al* (4), was used to evaluate the pre-injury and the postoperative functional status at 12 months. It is based on daily activities, walking capacity, and pain. A score of 100 means an excellent function, a score of 85-99 a very good function, a score of 55-84 a good function, a score of 26-54 a fair and a score of 25 points a poor function.

The Mann-Whitney U test, a non-parametric test, was used for statistical analysis of the difference between the pre-injury and the final functional status.

## RESULTS

Twenty-seven patients suffered from heart failure, 31 from coronary disease, 14 from respiratory disease, 19 from diabetes mellitus, 16 from neurological disease and 19 from anaemia (table I). Thirty-eight patients were classified as ASA III, and 18 as ASA IV.

The average operative time was  $37 \pm 8$  minutes. Eight patients needed a blood transfusion preoperatively because of pre-existing anaemia, but no perioperative blood transfusions were necessary. An anti-rotational external fixation pin was used in 9 cases. The average duration of hospitalisation was 6 days (range : 3 to 8). The mortality rate was 16.1% after 6 months and 21.4% after 12 months. Three patients died during hospitalisation and 9 patients died after discharge from hospital. Fifty-three (94.6%) fractures were classified as low-energy trauma, and 3 fractures (5.4%) as medium-energy trauma.

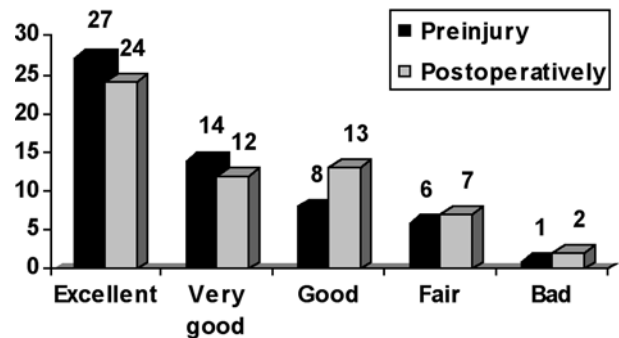


Fig. 3. — Functional score of the patients, pre-injury (black) and at 12 months postoperatively (grey): No significant difference.

All patients were mobilised on the first day after surgery. Sitting in a chair was possible with the Citieffe/Ch-N fixator and no cases with permanent knee stiffness were recorded (fig 2). Three cases of varus deformity and 2 cases of intra-articular migration were seen, but all were corrected by manipulation of the fixator. There were no deep wound or pin track infections, but 22 patients (39.3%) developed superficial skin reactions around the screw and the pins. Cultures were negative in all cases. The treatment of choice was cleaning and dressing with chlorhexidine, without administration of antibiotics. Union was obtained in all patients after 6 months.

As to the pre-injury functional status of the patients, 27 of them had an excellent score (100), 14 scored 85-99 (very good), 8 scored 55-84 (good), 6 had a fair score (26-54) and 1 scored 25 (poor). After 12 months 24 patients scored 100 (excellent), 12 scored 85-89 (very good), 13 had a good score (55-84), 7 scored 26-54 (fair) and 2 patients had a score of 25 (poor) (fig 3). There was no significant difference between the pre-injury and the final functional score ( $p > 0.05$ ).

## DISCUSSION

All patients were elderly individuals in poor health, according to the ASA scoring system. The associated diseases and the anaemia or the rarity of the blood group were the main indications for the

application of the external fixation device. The short intraoperative time, the short hospitalisation and the absence of need for peroperative blood transfusion were in accordance with previous studies (1, 6-9, 16, 17, 20, 21, 23, 24). The authors believe that these advantages are very important for this vulnerable patient population.

The mortality rate was 16.1% at 6 months and 21.4% at 12 months. Christodoulou and Sdrenias (7), using a comparable external fixator, reported a mortality rate of 17.1% at 6 months. Authors using other types of external fixators mostly noted higher mortality rates, from 14 to 27%, at 6 months (1, 17, 23, 24). Even higher mortality rates were reported after open reduction and internal fixation (12, 18, 19), although these series were not limited to high-risk patients. Union was always present after 6 months, which is in accordance with other studies (7-9, 16, 20, 21, 24). No permanent knee stiffness was reported, which is in agreement with recent studies concerning modern external fixation devices (7, 24). In contrast, initial knee stiffness was recorded in the majority of patients treated with older fixator types (8, 9, 16).

The main problem in external fixation is pin track infection: 39.3% of the patients developed superficial skin reactions, which necessitated the help of relatives or nurses. No deep wound or pin track infections occurred, although previous studies showed a high incidence of deep pin track infection (6, 7, 23). Moroni *et al* (20) used hydroxyapatite-coated pins and saw no infection at all.

As to the functional status of the patients, no significant difference was seen between the pre-injury and final scores ( $p > 0.05$ ).

In case of secondary varus deformity, the Citieffe/ChN-fixator allows easy correction, without need for an open surgical intervention. In addition, it offers a dynamic hip screw which mimics the one classically used for internal osteosynthesis; this considerable advantage differentiates the Citieffe/ChN-fixator from other external fixation devices.

The authors strongly believe that the use of this external fixator for intertrochanteric fractures in elderly high-risk patients offers a low-risk operation with minimal blood loss, fast mobilisation, few

postoperative complications, low incidence of mortality and reduced cost because of the short hospitalisation. Its disadvantages are the high cost of the device and the need for prolonged care by relatives or nurses.

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