# STUDY OF FEMUR UNSTABLE PERITROCHANTERIC FRACTURES TREATED WITH BLOCKED CEPHALODIAPHYSEAL NAIL: A MINIMALLY INVASIVE TECHNIQUE

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## SUMMARY

Sixty five patients with unstable peritrochanteric fractures were surgically treated with blocked intramedullary cephalodiaphyseal fixation (minimally invasive system). Closed reduction in traction table was performed with radioscopy. Assisted partial load was encouraged after the second postoperative day. In all examined patients, healing was achieved within 12 to 18 weeks (average 14.5 weeks). Complications were seen in six cases (9.2%) with vicious union, four cases (6.1%) with shortening of the limb (<1cm), three cases (4.6%) with compression screw migration to acetabulum, and one case (1.5%) with intra-operative fracture of the lateral femur cortical. Five patients (7.6%) presented with distal deep venous thrombosis (DVT) with no clinical repercussion. No superficial or deep infection was seen up to the last review. In the three cases of proximal migration of the compression screw, system was removed without intercurrences. We concluded that the methodology employed here is efficient, safe, with low morbidity potential. It is a fast technique, presenting little complications, promoting an early rehabilitation for the patient.

**Keywords:** Femur; Fracture fixation system; Peritrochanteric fractures; Surgery; Adult; Elderly.

## INTRODUCTION

Fractures involving the peritrochanteric region occur, in a certain frequency, in the elderly, and their treatment constitutes a challenge for the orthopaedic doctor(1). In elderly patients (above the seventh decade), fractures are more frequently generated by low energy of trauma (osteoporosis component) and, in younger individuals, by high energy of trauma(1,2). Resulting from these factors, the early mobilization becomes essential and, to be achieved, a stable fixation is required(2,3). A multicentric study recently conducted in Finland has demonstrated that, regardless of fracture fixation, mortality rates are three times higher in those individuals when compared to the normal population in the same age group(3).

During the past 50 years, many fixation systems and means have been described and used with satisfactory results(1).

From 1980's and 1990's on, some intramedullary fixation systems by closed focus, aided by radioscopy, have been used and successfully described in national and worldwide literature (2,4).

In this study, we present the technique and results of a minimally invasive fixation system (blocked cephalodiaphyseal nail) on unstable peritrochanteric fractures.

The objective of our study is to analyze a minimally invasive fixation methodology for unstable peritrochanteric fractures regarding stabilization, early load, functional outcomes, surgical and hospitalization time, and post-operative complications.

## MATERIALS AND METHODS

In our Service, during the period of 1999 to 2002, 65 patients with femoral unstable peritrochanteric fractures were operated and treated with blocked cephalodiaphyseal nails (model: short PF TARGON AESCULAP) (Figure 1).

Fractures were categorized according to TRONZO(5) as types III, IV and V (Table 1) .

There were 13 male patients and 52 female patients (Table 2).

The affected side was the right one in most of the cases (47 patients) (Table 3) and ages ranged from 42 to 87 years old (average: 64 years old).

All patients were operated by the same medical team and with the same surgical technique. In all cases a bloodless reduction of fracture was performed on traction table with the aid of radioscopy (traction associated to inward rotation of the distal component of fracture).

### Fixation system

A titanium intramedullary nail associated to two points of proximal fixation and two points of distal fixation was used. Nails presented a 10-degree medial angle, with initial proximal diameter of 14 mm. Following holes for proximal fixation, the nail presents a diameter of 12 or 10 mm, non-cannulated and a single length of 220 mm (Figure 1).

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Proximal fixation consists on a sliding pin associated to a "support sheath" fixed on the nail, with variable sizes, and of a screw for rotational blockage. Distal blockage is formed by two fixing screws, with the most distal being dynamic. The nail makes angle with the sliding pin at 125º, 130º and 135º of the femoral diaphysis (physiological cervicodiaphyseal angle). A cap screw may be used on the proximal region of the nail in order to prevent bone formation, which would make its removal difficult.

**Surgical technique**

Patients were positioned in horizontal dorsal decubitus on the traction table (Figure 2). The reduction maneuver consists on traction associated to inward rotation of the distal fragment with radioscopic control.

Three small incisions were performed (Figures 3 and 4). The first, with about 7cm, has as initial point 3 cm proximal to the apex of the major trochanter. Fascia opening and the careful divulsion of abductor muscles were performed, finding the insertion point (major trochanter apex, about 2 cm laterally to piriform fossa), using a tap instrument followed by milling (mill with similar design and diameter as the implant). Most of the cases, due to the osteoporosis component of the fracture, milling was not conducted, but the direct insertion of the nail. The diameter and angle were directly measured by simple radiographic images, after reduction and its view on radioscopy. The second incision, of about 4cm, was used to proximal fixation with sliding pin and anti-rotation screw, after guiding thread was placed and radioscopic control was performed. The sliding screw was placed at about 1 cm distal from femoral joint region. The anti-rotation pin was preferably located at the upper third of femoral cervix, approximately 3-4cm proximal to the fracture core. The third incision was performed for distal blockage with a bicortical screw at the dynamic hole. This screw was only used in those patients whose fractures were categorized as TRONZO's III and IV (Table 1). On TRONZO V fractures (reverse trao), we made a distal fixation at the static hole. Mean surgical time was 34 minutes, ranging from 23 to 48 minutes.

*Figure 1 – Fixation system with proximal and distal screws*

| KIND | AF | RF % |
|---|---|---|
| III | 48 | 73.84 |
| IV | 13 | 20.00 |
| V | 4 | 6.16 |
| Total | 65 | 100.00 |

AF- absolute frequency; RF- relative frequency

*Table 1 – Distribution of fractures according to Tronzo classification*

| GENDER | AF | RF % |
|---|---|---|
| M | 13 | 20.00 |
| F | 52 | 80.00 |
| Total | 65 | 100.00 |

AF- absolute frequency; RF - relative frequency; M - male; F – female

*Table 2 – Distribution of fractures according to gender*

Suction drain was not used. Anti-thrombosis drug prophylaxis was employed in all cases. All patients were recommended to seat in the first day post-operatively and encouraged to place a partial load, as allowed by algesic status. No blood transfusion was performed, both during surgical procedure and post-operatively.

All patients were clinically and radiographically followed-up for at least 12 months, ranging from 12 to 34 months. We considered as united and well-resolved those cases where "bone callus" was evidenced by simple radiography in anteroposterior plane and in a profile plane of the affected hip, and when patients didn't report pain or greater functional limitation of the range of motion than the pre-existent one, particularly in elderly patients.

## RESULTS

Patients were allowed to leave hospital by the fourth day post-operatively in average (ranging from the 1st to the 11th day). Union was achieved within 12 to 18 weeks (average: 14.5 weeks). Six patients died during follow-up (more than 12 months after surgery), and thus they were not excluded from the study.

Four (6.1%) patients presented limb shortening (< 1cm) and six (9.2 %), presented vicious union within cervicodiaphyseal angle of 125º - 135º, not considered as complications or bad outcomes. No superficial or deep infection was seen up to the last evaluation date. Five patients (7.6%) presented distal deep venous thrombosis (DVT) with no clinical reflex, diagnosed by Ultrasound+Doppler, not requiring treatment. In three cases (4.6%) there was a compression screw migration to the acetabulum; in one case (1.5%), an intra-operative fracture of the lateral cortical of the femur occurred, and, in another case (1.5%), a femoral diaphyseal fracture happened, distal to the nail, totaling 15.2% of complications. In the three cases of proximal migration of the compression screw, after clinical and

radiographic union, the system was removed without intercurrences.

DISCUSSION

Minimally invasive techniques are based on principles of biologic osteosynthesis, developed for causing less injuries to soft tissues and for preventing fracture core to be opened[1]. Those techniques, when applied on femoral proximal region, reduce infection and re-fracture rates, and the need of using a bone graft[1,2]. Recent studies, in which a technology similar to ours was used, good outcomes are shown in the union period, alignment and operated limb function[2,4].

Traditionally, a successful treatment of those fractures depends, specially, on its stability[2]. Current biomechanical studies show fixation resistance and stability with the various models of blocked cephalodiaphyseal intramedullary nails[6].

The use of a titanium metallic alloy nail, with anatomical design, and the possibility of maintaining the cervicodiaphyseal angle prevent the occurrence of great deviations of the load axis and femoral direction.

The vast majority of patients were females (80%), in the seventh decade of live (64.5 years old), with right side being mostly affected. Those data are directly related to recent literature[1,2,4,7,8], demonstrating the association with advanced age, low energy of trauma and osteoporosis component.

Early gait showed the regression of post-operative edema, in general, during the hospitalization time (four days in average), reducing associated morbidity and avoiding a long-lasting stay in bed, thus allowing an early rehabilitation with exercises for gaining range of motion on the first day post-operatively, thus evidencing that the association of anti-thrombosis prevention maintained the levels of circulatory complications as reported in recent publications[3,9]. Despite the diagnosis of DVT in five patients, none required clinical treatment.

There was no dehiscence of sutures

| Side | AF | RF % |
|---|---|---|
| R | 47 | 72.30 |
| L | 18 | 27.70 |
| Total | 65 | 100.00 |

R - right; L – left; AF - absolute frequency; RF – relative frequency

*Table 3 – Distribution of patients according to affected side*

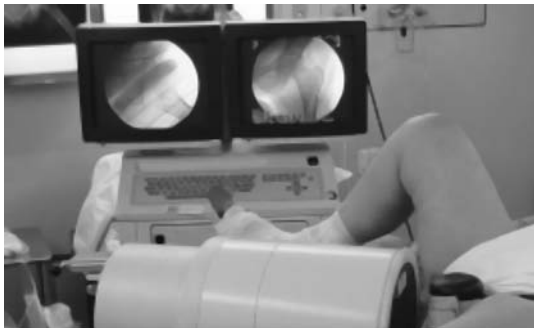

*Figure 2 – Patient positioning on traction table*

*Figure 3 – Proximal incision with nail introduction*

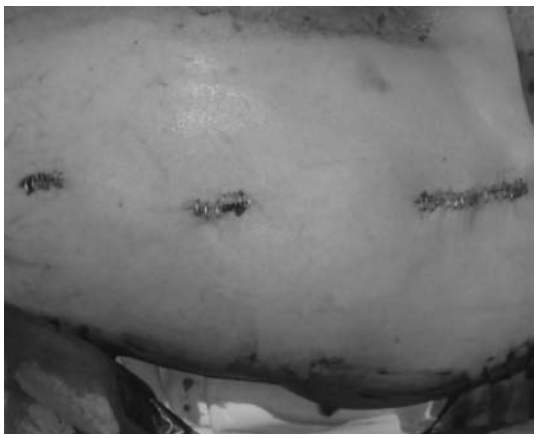

*Figure 4 – Detail of the three closed incisions*

(three small incisions, the largest with about 7 cm), corroborating, thus, the decision of not to use suction drain.

All fractures required reduction on traction table, proving instability, but they didn't present significant residual angle deformities (varus or valgus angle above five degrees from the average - 125-135 degrees). Alignment and fragments medial contact, after closed reduction were adopted by us as a parameter for good position.

The use of double proximal fixation did not allow proximal fragment rotation, and the dynamic distal fixation, except for Tronzo V cases, allowed an early load, probably, being responsible for the absence of pseudoarthrosis or union delays. In cases of fractures categorized as Tronzo V, we chose the static distal fixation because of the association of the great instability and the possibility of fracture deviation[4].

No blood transfusion was required, both during surgery and at the post-operative period. This fact confirms the low level of morbidity of the surgical procedure. A shorter surgical time associated to the minimally invasive technique has also contributed to the low rates of post-operative complications (DVT within global standards)[1,2], for a minimal hemorrhage during surgical procedure, as well as for a short hospitalization time.

Regarding peritrochanteric fractures treatment with external fixation devices, it was shown that the stability associated to a short surgical time has produced a reduction of mortality rates at the immediate post-operative period and in the short-term, resulting from a shorter hospitalization time and from an early mobilization[9]. We consider these factors as indispensable for patients' evolution and prognosis.

The average union period of 14.5 weeks was compatible with current literature[2,6], and the partial load with crutches or "walkers", which was encouraged from the second post-operative day on, seemed to be essential.

The cases where sliding screw migration and vicious union occurred were the first ones of this series, which were

probably associated to mistakes in planning, technique and learning curve[2].

Regarding to the two associated fractures, they had different causes: one during the surgical procedure (lateral cortical) was related to an error of the technique of nail introduction port. The other was a femoral diaphyseal fracture distal to the nail, approximately 20 months after the first one. It was treated by removing the first nail and placing another retrograde nail with blockage, presenting union in five months. Load transfer to distal regions from the core was experimentally and clinically reported, maybe because of the stiffness of the operated segment[8,9]. More recent studies advocate the initial use of long nails (340, 380mm), which would prevent load transfer and potential distal fractures[6,7].

We think that, for further studies, it would be interesting to compare the rates of distal fractures with long and short systems, so that this question could be definitely answered.

*Figure 5 - Tronzo III Fracture – Male patient, with three years of post-operative follow-up – nail with 130º, 10mm – cervicodiaphyseal angle maintained and fixation system*

We believe that, in elderly individuals with osteoporosis component, the medullar channel milling is not required, but the enlargement of the initial port. Our first choice was the 10mm nail and, in the majority of studied patients, the 130-degree nail was used (physiological angle). The preference for dynamic distal fixation, except for those three cases that were already mentioned above, was due to the fact that we achieved stability with reduction and proximal fixation, allowing initial dynamization (Figure 5).

## CONCLUSION

*We concluded that this is an efficient, safe, low-morbidity method, which provides for an early rehabilitation of patients, with a low complication rate. The blocked cephalodiaphyseal nail produced the benefits of the closed technique on hip fractures, offering resistance, allowing early load and a good stabilization, even in the most unstable fractures.*

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