

# Treatment of Peritrochanteric Fractures by the Use of Gamma Nail

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## ABSTRACT

*The Gamma nail was designed to treat unstable intertrochanteric and subtrochanteric fractures. In this study we analysed a total of 60 patients (44 men and 16 women), who were surgically treated for the peritrochanteric fracture in period 2006–2007 at the University Hospital Mostar. After the surgical treatment good bone healing was achieved in 50 patients (83.3%). A total of five patients had delayed healing or protrusion of the cervical screw, and in two patients nails were not appropriately distally locked. During the follow-up period a total of 7 patients died. The average operation time was 40 minutes, and the average blood loss was 400 mL, which is a comparable result with the previously published studies. In conclusion, although most of the peritrochanteric fractures treated at the University Hospital Mostar were fixated by gamma nail, the final decision regarding the operational technique should be left to surgeon's judgment, since the efficacy of the treatment plan is highly dependent on experience of the operational team and surgeon's operational technique.*

**Key words:** gamma nail, trochanteric fracture, distal locking, protrusion of the cervical screw

## Introduction

The hip fracture represents one of the most common problems encountered by orthopedic surgeons around the world<sup>1–6</sup>. As the proportion of elderly people and average life expectancy increase, orthopedic surgeons will need to focus more on treating hip fractures, because the incidence of such fractures was described to double at each decade beyond the age of 50 years<sup>2,7</sup>. The hip fractures are directly related to general morbidity and mortality, and 15–20% of the surgically treated patients die within the first year. It is estimated that the lifetime risk for hip fracture in industrialized countries is at present 6% for men and 18% for women<sup>8</sup>.

Peritrochanteric fractures can be classified by several possible approaches, based on the anatomic observations, and/or biomechanics values known to be important in prognostic validity<sup>9</sup>. The early operative treatment of the peritrochanteric fractures is widely accepted practice and different sliding nail-plate systems, including Gamma Nails (GN) are used in the treatment. The GN was de-

signed to treat unstable trochanteric fractures. It transmits the weight closer to the calcar than the dynamic hip screw does and it has greater mechanical strength. In most cases, a semi-closed operative technique is used, with an average duration of operation of 35 minutes and little blood loss. Distal locking screws can be used to maintain rotational stability, and can be inserted without the use of an image intensifier. Results of the previous studies showed satisfactory fracture union with minimal loss of position, even in comminuted fractures<sup>10,11</sup>. Operative complications were few, but included fractures of the base of the greater trochanter. The most important post-operative complication were fractures of the shaft of the femur at the distal end of the nail, but this healed well after re-nailing<sup>10</sup>.

In this paper we have analyzed data of the peritrochanteric operations performed using the GN at the University Hospital Mostar, Bosnia and Herzegovina.

## Materials and Methods

The study was based on a total of 60 patients (44 males and 16 females; mean age 59, range 47–71 years) surgically treated for the peritrochanteric fracture in the period 2006–2007. All patients underwent GN osteosynthesis. Patients with multiple traumas and other evident co-morbidity that could influence the results were excluded from the study.

Data were collected on the basis of regular postoperative check-ups, performed at two, four and six months following the surgery. Following variables were included in the study: efficacy of the reposition; GN positioning; intraoperative complications; type of peritrochanteric fracture according to the AO (Muller) classification, duration of the hospitalization, blood loss, life quality, and mobility – weight bearing (documented on the 2-, 4- and 6-month postoperative examinations): possibility of sitting, possibility of walking with walker, possibility of walking with two crutches, possibility of walking with a cane.

In few cases, the follow-up data was obtained by phone. Postoperative RTG was used to analyze the positioning of the bone fragments, the positioning of the osteosynthetic material and signs of bone healing.

### Operational procedure

After preoperative assessment, all patients were placed on the traction table and general anesthesia was applied. After the longitudinal traction, the hip was positioned in the adduction and inner rotation. Reposition was checked by C-Arm in two positions. The trunk was tilted to the unaffected side to allow access to the trochanteric area. The opposite limb was kept in flexion and abduction so as to position C-Arm. After the tip of the

greater trochanter was identified by palpation, a 5-cm incision extended proximally from it. Care was taken not to extend the incision too proximally as this would damage the inferior gluteal nerve. Incision was deepened through fascia lata, splitting the abductor muscle for approximately 3 cm immediately above the tip of the greater trochanter, thus exposing its tip.

The entry site was opened up with a cannulated curved awl and a guide wire passed into the medulla simultaneously achieving reduction at fracture site. An anteverision guide wire was placed to judge the plane of femoral neck anteversion. Reaming was done in 0.5 mm increments up to 10–12 mm with the help of flexible reamers. In order to accommodate the proximal end of the nail, the trochanteric region was reamed up to 17 mm, irrespective of distal diameter chosen. All nails were 11 mm in diameter and positioned in 130 degrees, and the RTG screening was used to determine the depth of the nail positioning (Figure 1 and 2). Next, Kirchner wire was placed in the middle of the neck and femur head and the cervical screw was positioned and locked. Distally one or two screws were locked to achieve rotational stability.

The results were analyzed by  $\chi^2$  statistics.

## Results

Out of the total of 60 patients that were included in the present study, bone healing after one year of follow-up was achieved in 50 patients (83.3%), while in five patients delayed healing was recorded. The most frequent postoperative complication as suggested by postoperative RTG control was protrusion of the cervical screw (Figure 3), which was recorded in five patients. In two patients nails were not appropriately distally locked.



Fig. 1. Well positioned bone parts and osteosynthetic material.



Fig. 2. Well positioned bone parts and osteosynthetic material.



Fig. 3. Protrusion of the cervical screw.

During the follow-up period 7 patients died. The average operation time was 40 minutes, ranging from 32 to 55 minutes. The average blood loss was 400 mL (220–800 mL). Treated patients were included in the rehabilitation program first day after operation including the transposition in the sitting and vertical position with no support. Total support on the operated extremity (weight-bearing) was introduced at the end of the first postoperative week for A1 and A2 fracture, and at the end of the second week for the A3 fracture, with no significant differences in the final income ( $\chi^2$ ;  $p > 0.05$ ).

## Discussion

Unstable peri- and subtrochanteric fractures of the proximal femur are complicated by the massive tension moments laterally and compressive forces created medially by the weight of the body, hip flexors and external rotators and by the abductor musculature, resulting often in fracture displacement, loss of fixation and implant failure<sup>12,13</sup>. The GN proved to be an adequate implant to stabilize stable and unstable peri- and subtrochanteric fractures. However, GN is a temporary implant with limited life expectancy under continuous dynamic stress loads. In cases of delayed healing as well as nonunion, a metal fatigue due to dynamic stress is to be expected sooner or later. The same as in the recent study of Sharma et al.<sup>14</sup> our results showed no signs of manufactory weakness suggested by Zafiroopoulos et al.<sup>15</sup> but typical fatigue fractures of the broken implants. Clinical reports in the literature describe only fatigue fractures at the aperture of the lag screw. However, biomechanical examinations<sup>16,17</sup> showed that the major axial component of

the total load is transmitted distally to the locking screws so that fractures at the location of the distal locking apertures are to be expected under continuous dynamic stress loads.

As stated in the introduction, peritrochanteric fractures are one of the most commonly suffered fractures. The available published literature on this subject has shown that these fractures may be treated by a variety of devices, including Nail Plate devices, Dynamic hip screw (DHS) and Medullary devices, e.g. Ender's Nail, Zickel nail, GN devices. Arnout et al.<sup>18</sup> presented 76 cases of trochanteric fractures treated by GN and found it to be better than contemporary devices like Ender's nails. They found it to be especially useful in subtrochanteric fractures. Calvert<sup>19</sup> in his study found that GN was better for the management of complex peritrochanteric fractures with subtrochanteric extension. Various other studies<sup>20–22,12</sup> found favorable results with GN in managing a greater variety of hip fractures with a less invasive technique and with better results. In the available literature the mean age for these fractures was 80 years<sup>23</sup>, and our data (mean age 72 years) do not differ substantially from those previously reported.

The operating time in our study ranged from 32 to 55 minutes and this was almost identical to operation time for fractures treated by GN by Leung et al.<sup>23</sup> and Sharma et al.<sup>14</sup> The blood loss in our patients (400 mL in average) was also comparable to other reports<sup>22,23</sup>. The results regarding postoperative weight-bearing were also comparable to other studies<sup>23,24</sup>. As in previous studies<sup>23</sup> we have found significant mortality, but probably due to the fact that practically all patients were older than 50 years of age. Other studies have reported favorable results with GN in terms of shorter operation time, less blood loss, shorter hospital stay, decreased wound infection and reduced complication rate<sup>25–27</sup>. Also, it has been observed that the rate of complications associated with GN decreases appreciably with increase in learning curve of the operating surgeons<sup>28</sup>.

## Conclusion

Osteosynthesis with GN is operational procedure with extraordinary results in operations of the peritrochanteric fractures. The main advantage of this procedure includes lesser tissue damage and better operation outcomes. GNs are theoretically more load-sharing with the medial cortex of the femoral neck than are lateral cortical constructs. Because of more medial placement of the intramedullary nail compared to the side plate of the compression hip screw, the bending moment at the nail-screw junction is lower than that at the plate-screw junction. Other potential advantages of intramedullary fixation include smaller operative exposure and possibly shorter operative time. All suggested advantages are clearly shown in this study, too. However, we are of the opinion that the most important factor in performing adequate GN operational procedure has to be found in (1) the experience of the operational team and (2) superior

operational technique. Finally, it is our belief that the final decision of the operational technique should be left to

individual estimation of the main surgeon and his/her team.

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## LIJEČENJE PERITROHANTERIČKIH PRIJELOMA KORIŠTENJEM GAMA ČAVLA

### SAŽETAK

Gama čavao je osmišljen za liječenje nestabilnih intertrohanteričkih i subtrohanteričkih prijeloma. U ovom istraživanju analizirali smo ukupno 60 pacijenata (44 muškaraca i 16 žena), koji su bili liječeni kirurškim metodama zbog peritrohanteričkih prijeloma u razdoblju 2006–2007. godine u Kliničkoj bolnici u Mostaru. Nakon operacije, cijeljenje kosti zabilježeno je kod 50 bolesnika (83,3%). Ukupno pet pacijenata imalo je odgođeno zacjeljivanje ili protruziju cervikalnog vijka, a u dva bolesnika su čavli bili pomaknuti. Tijekom istraživanog razdoblja zabilježeno je 7 smrtnih ishoda. Prosječno trajanje operacije iznosilo je 40 minuta, a prosječan gubitak krvi bio je 400 mL, što je rezultat usporediv s prethodno objavljenim istraživanjima. U zaključku, iako je većina peritrohanteričkih prijeloma liječenih u Kliničkoj bolnici Mostar liječena korištenjem gama čavla, konačna odluka o operativnoj tehnici bi se trebala ostaviti kirurgu, jer je efikasnost plana liječenja ovisna o iskustvu operativnog tima i operativnoj tehnici kirurga.