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Precise placement of lag screws in operative treatment of trochanteric femoral fractures with a new guide system

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ABSTRACT

Purpose: We assessed the accuracy of a new guide system that we developed to place lag screws in the proper position with the minimum number of attempts for operative treatment of trochanteric femoral fractures.

Methods: A total of 55 consecutive trochanteric femoral fractures were treated with a cephalomedullary nail. The first 27 consecutive patients were treated with the standard operation (group A), while the new guide system was used in the last 28 consecutive patients (group B). The numbers of attempts to place K wires and the duration of surgery were noted. Accuracy of lag screw placement was evaluated by measuring the angle of deviation from the central axis of the femoral head.

Results: Deviation values ranged from −11? to +15? for the 27 cases in group A, with a median absolute deviation of 8? ± 6?. That in the 28 cases after the introduction of the new guide system (group B) ranged from −5? to +6?, with a median absolute deviation of 0.5? ± 3? ($P < 0.001$). The total numbers of attempts to place lag screws and mean operation time decreased significantly after introduction of the new guide system ($P < 0.001$).

Conclusions: With this new guide system, we are able to insert lag screws successfully in the optimal position even in most unstable fractures. The present study indicated that this new guide system and nail facilitate accurate placement of lag screws in the appropriate position with the minimum number of attempts.

PRECISE PLACEMENT OF LAG SCREWS IN AN OPERATIVE TREATMENT OF TROCHANTERIC FEMORAL FRACTURES WITH A NEW GUIDE SYSTEM AND TROCHANTERIC NAIL.

Introduction

The most common cause of failure after operative treatment of intertrochanteric fracture is "cutout" of the lag screw within the femoral head. The bone density of the femoral head, the type of fracture, and the accuracy of reduction are considered to contribute to such lag screw cutout. Patients with unstable trochanteric hip fractures and osteoporotic bone are in the highest risk group for cutout, regardless of the device used [1]. In addition to the bone density of the femoral head and type of fracture, the position of the lag screw within the femoral head is an important factor in the success or failure of the implant. Based on theoretical and experimental considerations, the most appropriate lag screw location is inferior in the frontal plane and central in the sagittal plane [2,3]. However, accurate positioning is achieved in less than 50% of cases [4,5].

To reduce the incidence of cutout, it is essential to pay particular attention to placement of the lag screw in the femoral head. We developed a new improved guide system to insert lag screws with the minimum number of attempts into the optimal position—exactly central on the lateral view—and to prevent any additional damage to the osteoporotic lateral cortex, which may result from several K wire insertion attempts. This study was performed to determine the accuracy of our new guide system.

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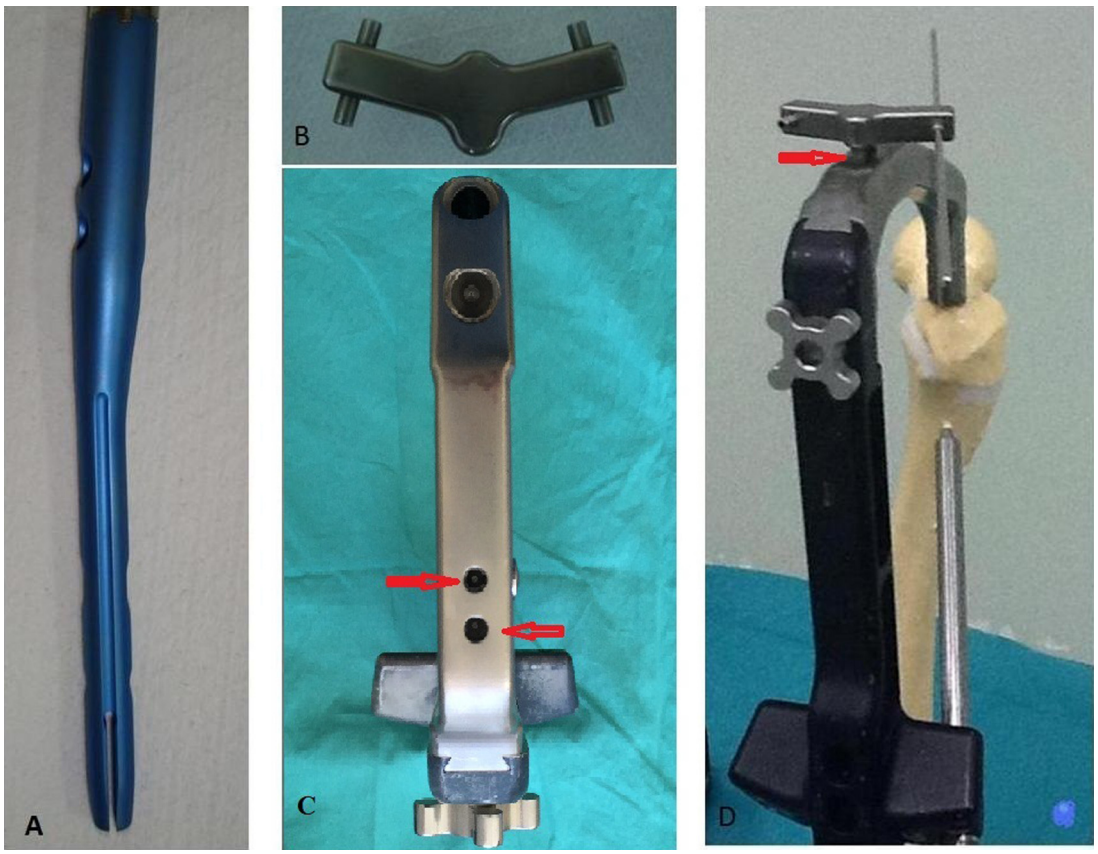

Fig. 1. (A) Trochanteric nail (TRON). (B) The new guide system has two arms that are anteverted by 15?, with 3.0-mm K wire holes. (C) The holes mounting with the new guide system at the superolateral end of the targeting device (arrows). (D) The targeting device and the new guide system used together. The guide pin, applied to the posterior arm, is in the same line as the drill guide sleeve. (For interpretation of the color information in this figure legend, the reader is referred to the web version of the article.)

Patients and methods

A total of 55 consecutive trochanteric femoral fractures were treated with a cephalomedullary nail (TRON; Tıpsan Medikal, Istanbul, Turkey), by two surgeons randomly, between October 2011 and December 2012 at our hospital regardless of fracture pattern. The first 27 consecutive patients were treated using the standard procedure (Group A), while all lag screws were inserted using the new guide system in the last 28 consecutive patients (Group B).

"TRON" is an anatomical nail, available in lengths of 180, 200, and 220 mm, with a proximal diameter of 16 mm at the trochanteric region, and 10, 11, and 12 mm distally. The neck shaft angle is 125° with 5° mediolateral curvature. At proximal part it has two lag screw holes. To decrease the excessive rigidity of the implant and compressive loads at the tip of the nail, the distal end of the nail is cleaved in four (Fig. 1A). In accordance with the proximal femoral anatomy, lag screws can be placed at 15° anteversion with a targeting device in parallel to the femoral shaft in the frontal plane (Fig. 1D).

The new guide system is composed of two arms anteverted by 15°. Both arms contain holes 3.0 mm in diameter to which K wires are applied (Fig. 1B and D). Two arms aim to be used at both right and left hip fractures. The device is applied to the proximal end of the targeting device (by two columns which sits to the holes on the targeting device) to use the K-wire as a projection for where the lag screw wire will be placed on the lateral view which minimizes the number of K-wire pilot holes drilled into the "at risk" lateral cortex (Fig. 1C and D).

The patients consisted of 33 women and 22 men with a mean age of 80.1 ± 10.3 years. Fracture types according to the AO classification [6] were as follows: A1.1, $n = 4$; A1.2, $n = 9$; A1.3, $n = 5$; A2.1, $n = 6$; A2.2, $n = 14$; A2.3, $n = 12$; A3.2, $n = 1$; and A3.3, $n = 4$. There were 18 fractures of the stable type and 37 fractures of the unstable type in the study population. Type of fractures were statistically similar in each group ($p = 0.456$) (Table 1).

Numbers of attempts to place K wires in an appropriate position and total operation time were noted. To evaluate the accuracy of lag screw placement on lateral radiographs, the deviation angle between the axis of the lag screw and the femoral head was measured on all lateral radiographs obtained immediately postoperatively, as described by Nishiura et al. [7]. Two surgeons measured the deviation angles independently. Measurements were made for the 27 fractures in group A and 28 fractures in group B (Fig. 2).

For statistical analyses, the independent-samples t test and Mann–Whitney U-test were used to compare the independent groups. The partial correlation test was used to examine correlations between parameters.

Table 1
Preoperative patient data.

	Group A no. (%)	Group B no. (%)	Total no.
No. patients	27	28	55
No. hips	27	28	55
Mean age (year)	80.1 ± 10.3	76.7 ± 10.6	83.3 ± 9.1
Gender (M/F)	12/15	10/18	22/33
Fracture patterns			
AO type I	11(40.7%)	7(25%)	18(32.7%)
AO type II	14(51.9%)	18(64.3%)	32(58.2%)
AO type III	2(7.4%)	3(10.7%)	5(9.1%)
Stable (AO type 1)	11(40.7%)	7(25%)	18(32.7%)
Unstable (AO type 2 and 3)	16(59.3%)	21(75%)	37(67.3%)