

Original Article

Short versus long intramedullary nails for the treatment of intertrochanteric hip fractures in patients older than 65 years

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Abstract: Objective: The purpose of this study was to compare failure rates between short and long intramedullary nails used for the treatment of intertrochanteric hip fractures in patients over 65 years of age. Methods: A retrospective review of 156 patients aged more than 65 years with femoral intertrochanteric fractures from December 2010 to December 2012 was performed. The patients were allocated to two groups: those treated with long nail (n=59) and short nail (n=97). Relevant patient variables and medical comorbidities were collected. Medical comorbidities were evaluated according to the American Society of Anesthesiologists classification and medical records were also reviewed for age, sex, intraoperative blood loss, operative time, length of stay, time to fracture union, hip pain, Harris Hip Score 1 year postoperatively, and failure rates. The failure rate was defined as periprosthetic fracture or reoperation requiring removal or revision of nail. Variables were statistically compared between the two groups, with statistical significance at $P < 0.05$. Results: Patients treated with long nails and short nails were comparable for all assessed clinical variables ($P > 0.05$). There were no statistically significant differences between these groups in intraoperative blood loss, time to fracture union and Harris Hip Score at 1 year postoperatively ($P > 0.05$). The long nail group had significantly less failure rate (0/59) and hip pain rate (3/59) than those with short nail (3/97 and 13/97, respectively) ($P < 0.05$), but the operative time was significantly longer in the former (60.60 ± 11.43 minutes) than the latter (53.10 ± 8.51 minutes) group ($P < 0.05$). Conclusions: Both the long and short intramedullary nails are the optional internal fixation choices for femoral intertrochanteric fracture in the aged patients older than 65 years. But the long nail could avoid the refracture of femur and reduced postoperative hip pain.

Keywords: Femoral intertrochanteric fracture, intramedullary nail

Introduction

Femoral intertrochanteric fractures account for approximately half the hip fractures in elderly patients. Because of the frequently associated osteoporosis, they are often associated with notable morbidity and mortality [1]. Many studies have reported that intramedullary fixation has advantages over extramedullary fixation for treating intertrochanteric fracture; these include that the former procedure is minimally invasive, takes less operative time and is mechanically superior [2-4]. However, there was no pre-established treatment protocol in choosing long nail or short nail for femoral intertrochanteric fractures, but many surgeons are reluctant to use short nails based on the historic literature showing high fracture rates and believe that long nails will avoid diaphyseal

stress risers and make periprosthetic fracture rates acceptable. And the aim of this study was to evaluate whether the long nail reduce the failure rates or not.

Patients and methods

Approval for this study was obtained from the Institutional Ethics Committee of the Third Hospital of Hebei Medical University and written informed consent was obtained from all patients. Inclusion criteria were as follows: age 65 years or older; had undergone closed reduction and internal fixation with a Synthes proximal femoral nail anti-rotation (PFNA; Synthes GmbH, Oberdorf, Switzerland) of an intertrochanteric hip fracture between December 2010 and December 2012; and a minimum of 1-year follow-up. Patients with subtrochanteric, patho-

Intertrochanteric fracture

Table 1. Relevant patient variables according to group

Groups	Sample size	Age (y)	Gender (M/F)	Location (R/L)	Fracture type (31-A1/A2/A3)	ASA (I/II/III/)
Long nail	59	74.85±8.15	20/39	28/31	17/27/15	29/19/11
Short nail	97	76.81±6.56	46/51	42/45	28/44/25	48/31/18
(P)		0.100	0.116	0.174	0.102	0.210

Table 2. Differences in operation-related variables between two groups

	Long nail	Short nail	P
Blood loss (ml)	77.97±31.88	69.95±21.55	0.063
Operative time (min)	60.61±11.43	53.08±8.51	0.000
Time of fracture union (mon)	10.49±2.02	11.07±2.07	0.087
HHS at 1 year operatively (score)	79.98±8.90	76.16±10.84	0.280
Failure rate (%)	0 (0%)	3 (3.10%)	<0.05
Hip pain (%)	3 (5.1%)	13 (16.5%)	<0.05

logic, open or multiple fractures, walking disability before injury, isolated fractures of the greater or lesser trochanter, and revision hip surgeries were excluded. Patients without at least 1-year follow-up who could not be reached by telephone were considered lost to follow-up and were also excluded.

One hundred and fifty-six of 186 patients were eligible for this study, the left 30 patients were lost to follow-up at 1-year postoperatively. The patients were allocated to two groups: those treated with long nail (n=59) and short nail (n=97). Patient medical records, operative reports, and digital radiographs were individually reviewed. The following clinical variables were collected for each subject: age, sex, Orthopedic Trauma Association (OTA) classification of fractures, American Society of Anesthesiologists (ASA) score [5], blood loss, operative time, length of stay, time to fracture union, Harris Hip Score (HHS) 1 year postoperatively, hip pain and failure rates. The failure rate was defined as periprosthetic fracture or reoperation requiring removal or revision of nail.

All procedures had been performed by two senior orthopedic trauma surgeons with the patient in the supine position on a fracture table with fluoroscopic-guided imaging. After the patient had been anesthetized, closed reduction to a near anatomical position was performed before making an incision. Femurs were reamed by hand and guide wires used in

all procedures. Distal interlocking screws were placed through the nail guide for all nails. There were no intraoperative complications. Postoperatively, patients were allowed to bear weight as tolerated.

All data for the two groups were statistically analyzed for normality by the Shapiro-Wilk

test and by Mann-Whitney rank sum test or χ^2 test. For all tests, statistical significance was set at $P < 0.05$. Statistical analyses were performed by graduate-trained research engineers with the aid of SPSS 19.0 for Windows (SPSS, Chicago, IL, USA).

Results

One hundred and fifty-six of 186 patients were eligible for this study. Their average age was 75.61 years (range, 65-91 years) and they comprised 66 men and 90 women. There were 70 right femoral intertrochanteric fractures and 86 left fractures. All fractures were caused by low-energy injuries. There were no statistically significant differences in age, sex, fracture location, fracture type and ASA score between the two groups ($P > 0.05$) (Table 1).

There were no statistically significant differences between these groups in intraoperative blood loss, time to fracture union and Harris Hip Score at 1 year postoperatively ($P > 0.05$). The long nail group had significantly less failure rate (0/59) and hip pain rate (3/59) than those with short nail (3/97 and 13/97 respectively) ($P < 0.05$), but the operative time was significantly longer in the former (60.60±11.43 minutes) than the latter (53.10±8.51 minutes) group ($P < 0.05$) (Table 2).

Discussion

This retrospective series demonstrates there is clinically significant differences in failure rate

Intertrochanteric fracture

and hip pain rate when treated with pertrochanteric hip fractures by long nails and short nails. The long nail group had significantly less failure rate and hip pain rate than those with short nails. To the best of our knowledge, this is the first study who found the above difference after newer generation cephalomedullary nails (both short and long) were developed. Several recently studies have found no differences using long or short intramedullary for femoral intertrochanter fractures in the elderly [6-8]. They attributes such no difference to the advanced changes in biomaterials, including more flexible titanium implants and adjusting the radius of curvature to give a more anatomic fit for the geriatric femur in long nails. Similarly, short nails were modified in length, and incorporated a tapered end and smaller locking screws. All the above changes could achieve the goal of decreasing the incidence of fractures in the diaphyseal region. So it could explain the reason of no differences between long nail and short nail for pertrochanteric hip fractures.

Why we get different conclusions? One reason may be a considerable of OTA 31-A3 fractures was included in our study, while it was not in Hou Z [6] and Boone C's [7] study. It should be noted that the short intramedullary nail is not suitable for 31-A3 fracture because its distal nail is too short to provide effective stabilization. In contrast, the long nail is suitable for almost all types of intertrochanteric fractures. The long Gamma nail has a lengthened arm, so as to increase its stability which has advantages especially in elderly intertrochanteric fracture with severe osteoporosis or severe comminuted fracture. In Clinical practice, both a long and short nail could be chosen for less osteoporosis OTA 31-A1 and 31-A2 fractures, while long nail fixation will be used for more severe osteoporosis OTA 31-A1 and 31-A2 fractures or comminuted 31-A3 fractures in order to achieve very satisfactory results. This view is as same as Hou Z [6] and Boone C's [7] study. But Kleweno C did the same study to us, which also included OTA 31-A3 fracture [8]. He found that short and long nails exhibit similar treatment failure rates. The only difference between the two studies was they had a longer follow-up of 30 months, while we have only 12 months' follow-up. So the overall failure rate in our study is relatively lower than their study. But we still can-

not make a conclusion that short nail could play the same role in the treatment for femoral intertrochanter fractures when compared to long nails. Because all the above studies (including our study) were retrospective in nature with its inherent bias. For example, without randomization there could have been a bias of implant selection among the different surgeons. So prospective randomized controlled studies will be helpful to clarify this problem.

As to the reason of thigh pain induced by Gamma nail fixation, it was considered to have relative to the squeeze of nail to femoral cortex or the irritation of iliotibial. In our studies, three cases using long nails can relieve themselves, which did not affect the daily life. There were 13 cases of thigh pain induced by short nails, of which 11 relieved by removal of intramedullary nails and 2 relieved only by medication. Thus the results support the above hypothesis. By the way, the end of a long nail is located in distal femoral with relatively large medullary cavity, thus reduce the pressure on the femoral cortex and reduce the incidence of postoperative pain.

Conclusions

Both the long and short intramedullary nails are the optional internal fixation choices for femoral intertrochanteric fracture in the aged patients older than 65 years. But the long nail could avoid the refracture of femur and reduced postoperative hip pain.

Disclosure of conflict of interest

None.

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References

- [1] Mundi S, Pindiprolu B, Simunovic N, Bhandari M. Similar mortality rates in hip fracture patients over the past 31 years. *Acta Orthop* 2014; 85: 54-59.
- [2] Knobe M, Munker R, Sellei RM, Schmidt-Rohlfing B, Erli HJ, Strobl CS, Niethard FU. Unstable periintertrochanteric femur fractures. Failure rate, lag screw sliding and outcome with extra-

Intertrochanteric fracture

- and intramedullary devices (PCCP, DHS and PFN). *Z Orthop Unfall* 2009; 147: 306-313.
- [3] Wirtz C, Abbassi F, Evangelopoulos DS, Kohl S, Siebenrock KA, Krüger A. High failure rate of intertrochanteric fracture osteosynthesis with proximal femoral locking compression plate. *Injury* 2013; 44: 751-756.
- [4] Shen L, Zhang Y, Shen Y, Cui Z. Antirotation proximal femoral nail versus dynamic hip screw for interintertrochanteric fractures: a meta-analysis of randomized controlled studies. *Orthop Traumatol Surg Res* 2013; 99: 377-383.
- [5] Dripps R. New classification of physical status. *Anesthesiol* 1963; 24: 111.
- [6] Hou Z, Bowen TR, Irgit KS, Matzko ME, Andreychik CM, Horwitz DS, Smith WR. Treatment of pertrochanteric fractures (OTA 31-A1 and A2): long versus short cephalomedullary nailing. *J Orthop Trauma* 2013; 27: 318-24
- [7] Boone C, Carlberg KN, Koueiter DM, Baker KC, Sadowski J, Wiater PJ, Nowinski GP, Grant KD. Short versus long intramedullary nails for treatment of intertrochanteric femur fractures (OTA 31-A1 and A2). *J Orthop Trauma* 2014; 28: e96-e100.
- [8] Kleweno C, Morgan J, Redshaw J, Harris M, Rodriguez E, Zurakowski D, Vrahas M, Appleton P. Short versus long cephalomedullary nails for the treatment of intertrochanteric hip fractures in patients older than 65 years. *J Orthop Trauma* 2014; 28: 391-7.