

ORIGINAL ARTICLE

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Is the proximal femoral nail a favourable option for trochanteric femur fractures in osteopenic elderly patients?

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Abstract

Primary aim of this study to evaluate the functional results and complications of the patients aged 70 and over whom are treated with proximal femoral nail (PFN) because of hip fracture. 128 patients out of 223 patients were included in the study, who were aged 70 and over, to whom treated with proximal femoral nail because of hip fracture in our clinic between 2006 and 2014. Since 26 of these 128 patients who were included in this study passed away before the follow up period of 1 year, they were excluded from the study. Fractures were evaluated by AO/OTA classification. Their Singh index and morphological cortical indexes were calculated from the pre-surgery radiographies. The functional situations of the patients were evaluated by Harris hip score. Average age of the evaluated 102 patients was 81.13 (70-98), 44 of them were male, 58 of them were female. According to AO/OTA fracture classification 48 of them were 31-A1, 25 of them were 31-A2, 29 of them were 31-A3. 54 fractures were on the left hip, 48 fractures were on the right hip. Average Singh index was 2.72 (1-5), average morphological cortical index was 2.94 (2.1-3.7), average Harris hip score was 74.3 (49-88). 4 patients have had complications after surgery and revised with other treatment modalities. Since the functional results are on a satisfactory level, in our opinion as well, proximal femoral nail should be considered among the surgical treatments in the elderly patients with hip fracture.

Keywords: Hip fractures, osteopenia, intramedullary nailing, elderly, osteosynthesis

Introduction

The incidence of hip fractures has been increasing in elderly patients because of osteoporosis. Hip fracture mortality is high in this age group because of additional diseases [1]. In treatment, generally endoprosthesis and DHS (dynamic hip screws) are preferred for early mobilization, but there is a recent increase in the indications of proximal femoral nail preference for intertrochanteric hip fractures because of the decreased surgical time and being less invasive. Many patients with hip fractures are unable to regain their functional level before the hip fracture. Cooper reported that 40% of patients were still unable to walk

independently a year after hip fracture. Among 60% of the patients had difficulty doing at least one essential daily activity, and 80% reported being highly restricted in other activities such as driving or shopping [2]. Recent studies declare that implant selection plays a major role in its impact on quality of life. As a bone-sparing surgery, PFN is advantageous in providing early mobilization, therefore; rapid rehabilitation and early return to daily activities are provided [3,4]. In this study, we analyzed the functional results of the elderly patients with hip fractures treated by proximal femoral nails. We advocate bone-sparing surgery in intertrochanteric fractures and think that its mortality is lower than hemiarthroplasty. We argue that proximal femoral

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nailing can be preferred in the first place among the available alternatives.

Material and Methods

This retrospective study was approved by the institutional ethics committee (decision no: 178) on 25/05/2022. 128 patients out of 223 patients were included in the study, who were aged 70 and over, to whom proximal femoral nail was applied because of hip fracture in our clinic between 2006 and 2014. Since 26 of these 128 patients who were included in this study passed away, they were excluded from the study (Figure 1).

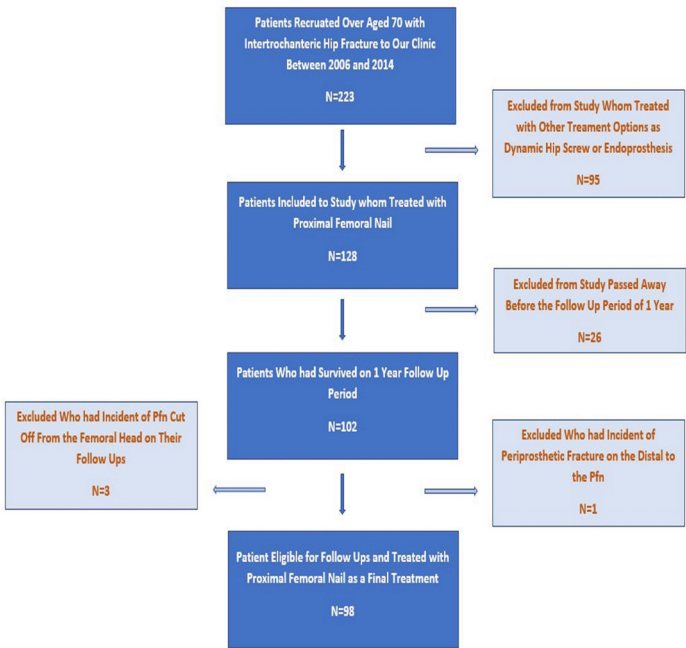


Figure 1. Survey flow. STROBE

Pre-surgery radiographies of the patients, who were included in the study, were used and their fractures were evaluated by AO/OTA classification (Figure 2).



Figure 2. Preoperative intertrochanteric fracture radiography

Their Singh indexes and morphological cortical indexes were also calculated from the same radiographies. Morphological cortical index of femur was obtained in anteroposterior radiography at medial calcar level after the distance between medial and lateral cortexes was divided by medullary canal length which was 7 cm distal from this level (Figure 3).

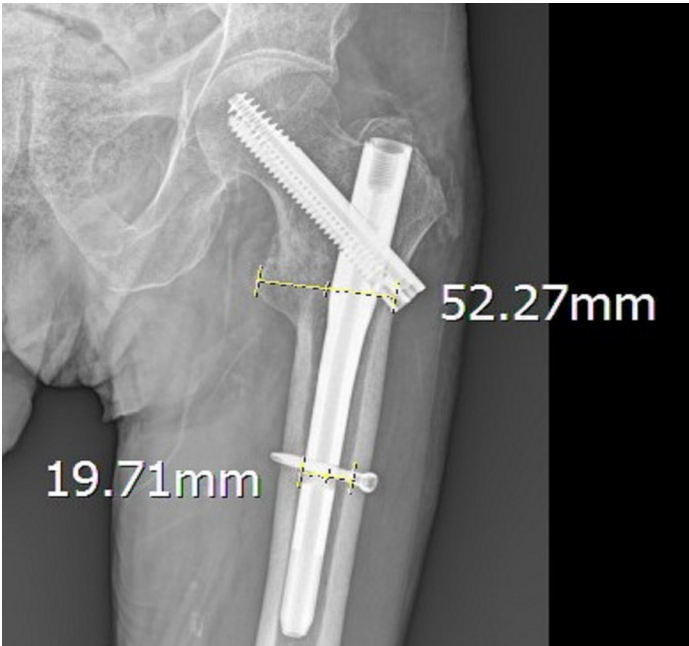


Figure 3. Morphological cortical index measurements on AP radiography of Hip

Functional situations of the patients were evaluated by Harris Hip score. Through this scoring system, the average functional scores of the patients were evaluated for pain, function, deformity, and joint range of motion (Figure 4,5).



Figure 4. Postoperative 8th month AP radiography

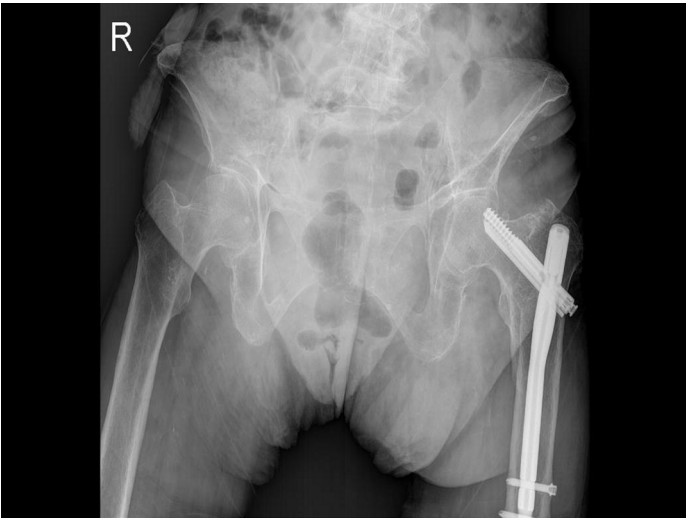


Figure 5. Postoperative 7th year AP radiography

IBM SPSS V22 (Statistical Package for the Social Sciences 2019) was used for statistical analysis. In addition to descriptive statistical methods (Mean, Standard Deviation, Median, Frequency, Ratio) in the analysis of statistical data, Student's t-Test was used to compare normally distributed quantitative data between the two groups. The Kruskal-Wallis test was used in the comparison of the parameters that did not show the normal distribution in groups with three or more values. Mann-Whitney U test was used in the evaluation of the two groups that did not show the normal distribution or the group that caused a difference between the three or more groups. Spearman's correlation analysis was used to evaluate the relationships between parameters. Significance was evaluated as $p<0.01$ and $p<0.05$. Complications such as cut-off, periprosthetic fracture and infection after surgery were evaluated.

Results

The average age of 102 patients included in the study was 81.13 (70-98), 44 of them (%43.1) were male, 58 of them (%56.8) were female. When classified according to age; there were 11 patients aged 90 and over, 17 patients aged between 85-89, 31 patients aged between 80-84, 21 patients aged between 75-79 and 22 patients aged between 70-74. 54 fractures (%52.9) were on the left hip, 48 fractures (%47) were on the right hip (Table 1).

Table 1. Demographics of the patients

Age	Male	Female	Total
70-74	11	11	22
75-79	13	8	21
80-84	12	19	31
85-89	6	11	17
>90	2	9	11
Total	44	58	102

According to AO/OTA fracture classification, 48 of them (%47) were 31-A1, 25 of them (%24.5) were 31-A2, 29 of them (%28.4) were 31-A3. Patients are divided into subgroups according to their age. Preoperatively morphologic hip index was evaluated and there was no significant difference between groups and with average data in the literature. Sigh Index was evaluated between groups and no significant difference was found. The functional outcomes were evaluated by the Harris Hip Score. Accordingly, a significant difference was found in favor of the younger group (Table 2).

Table 2. Descriptive and inferential statistics

	N	Range	Min.	Max.	Mean	Std. Deviation	p-Value
Age	102	33	65	98	81.13	0.698	
Harris Hip Score	102	39	49	88	74.30	0.707	0.049
Sign Index	102	4	1	5	2.72	0.071	0.612
Morphologic Hip Index	102	1.6	2.1	3.7	2.94	0.0586	0.957

Also in specific age ranges compared with the literature, it was observed that there was no significant difference between patients who underwent endoprosthesis and PFN [5-7]. In the measurements from the pre-surgery radiographies, average singh index was determined as 2.72 (1-5) while average morphological cortical index was determined as 2.94 (2.1-3.7). The mean score was 74.3 (49-88) in the Harris hip scoring performed at the last follow-ups. In one of the patients, two months after the hip surgery femur fracture was observed from the distal of the nail; so the PFN of the patient was extracted and femoral nail was applied. In 3 patients, PFN was cut off from femoral head. Hip partial endoprosthesis was applied to these 3 patients.

Discussion

Osteoporosis is a systemic skeleton disease characterized by the decrease in the mineral density of bones and deterioration in its microarchitecture. The incidence of osteoporosis increases together with the age and causes an increase in the incident of fractures [8]. Fractures which may occur especially in low energy traumas decrease the life standart quality of the patients and sometimes even threaten their lives. The rate of hip fractures relating osteoporosis is 33 % in females while it is 11 % in males [9]. Bone density measurement (BMD) is used in its follow up period and diagnosis. There are various publications on the relationship between BMD measurements and the risk of hip fracture [10]. While especially the risk of intertrochanteric femur fracture is in a strong relationship with BMD measurements, the risk of femoral neck fracture was also detected multifactorial [11]. Since there were no BMD measurements for the patients included in our study group on the date of their hip fractures, Singh indexes and morphological cortical indexes (MCI) were calculated from their pre-surgery radiographies instead. MCI was described by Spotorno et al. [12] for femoral component selection in total hip prothesis; but later on it was realized that it

was also in relationship with morphological changes regarding osteoporosis [13]. Average rates of these two indexes used in order to understand the bone quality were found as 2.72 (1-5) for Singh index and 2.94 (2.1-3.7) for morphological cortical index in our study group. We cannot state that patients in our study groups have osteoporosis or osteopenia with this data. However; we can state that their microarchitectural structures deteriorate in femur proximal and their cortical thickness is decreased [14]. There are a lot of studies in the literature regarding structural changes on the hips because of osteoporosis or osteopenia as well as the risk of hip fracture [15,16].

There are treatment options as endoprosthesis, dynamic hip screws, plate or nails in for elderly patients on hip fracture treatment [17]. However; proximal femoral nails are mostly preferred in subtrochanteric and unstable intertrochanteric fractures [18]. Proximal femoral nails outweigh DHS because of the short surgical time and less blood loss [19]. Kim WY et al. [20] state in their studies that implant deficiency is mostly observed in patients having osteoporotic and unstable fractures to whom DHS is applied because of intertrochanteric fracture. It was also stated in the literature that one of the risk factors of implant deficiency in elderly patients with hip fractures was early loading [21]. Implant deficiency was observed in 3 patients of 102 patients included in the study group. This number is in accordance with the rates in the literature. Our patients were mobilized on the first day after surgery. Full loading was not permitted until bone union is radiologically observed. Implant deficiency is not only related with fracture type and osteoporosis. We think that surgical technique and the experience of the surgeon change the risk rate. Patients included in our case series were operated by surgeons in different experience level from the same clinic. Their only mutual characteristic was that all of the patients were operated in lateral decubitus position without traction table. Turgut A et al specified 3 important criteria to fulfill in this lateral decubitus position in their studies. They are as the following: avoiding from varus reduction, enabling appropriate apex distance and placing the implant into appropriate quadrant within the head. We think that one advantage of lateral decubitus position is that it saves time during surgery if it is necessary to shift to endoprosthesis.

We used Harris hip scoring system for functional evaluation. Our mean score is consistent with the scores in the popular series of PFN and has been evaluated in this scoring system. Although we had an idea on functional situation with the help of this comparison, we could not determine the degree of loss of function in the patients after the treatment because patients had no hip scores before hip fracture. It is also thought that pain and loss of function, which are available in elderly patients because of some reasons prior to the fracture, decrease the scores.

As a conclusion, we think that proximal femoral nail should be primarily preferred in elderly patients having especially intertrochanteric femur fractures.

Limitations

The limitations of the study include the small number of patients and the retrospective nature of the study. Stronger evidence could have been obtained by increasing the number of patients and by planning a multicenter study.

Conflict of interests

The authors declare that there is no conflict of interest in the study.

Financial Disclosure

The authors declare that they have received no financial support for the study.

Ethical approval

This retrospective study was approved by the Institutional Review Board of Prof. Dr. Cemil Tascioglu City Hospital (decision no: 178) on 25/05/2022.

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