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*Research Article*

# The effect of preexisting radiographic hip osteoarthritis on the functional recovery after surgical treatment of intertrochanteric fractures in elderly patients

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ABSTRACT

***Objective:*** The aim of this study was to evaluate the effect of the grade of preexisting radiographic hip osteoarthritis on the functional outcome of elderly patients with intertrochanteric fractures treated by intramedullary fixation.

***Methods:*** We retrospectively examined the impact of the grade of preexisting osteoarthritis on the functional outcome of 88 patients older than 60 years with intertrochanteric fractures treated by intramedullary fixation. The patients were divided into 2 groups according to the grade of osteoarthritis: group 1, including 52 patients (32 females and 20 males) with Kellgren–Lawrence grades 1 and 2, and group 2, including 36 patients (24 females and 12 males) with Kellgren–Lawrence grades 3 and 4. Functional outcomes were evaluated using the Harris hip score, visual analog scale, EuroQoL general health questionnaire, and the Barthel index.

***Results:*** The mean age was 74.8 ± 5.5 (range = 63-87) years in group 1 and 75.06 ± 5.3 (range = 64-87) years in group 2. At the last follow-up, the mean Harris hip score was significantly higher in group 1 (71.3 ± 4.3) than that of group 2 (69.5 ± 3.5) ($P = .047$). There was no significant difference between the groups in terms of the visual analog scale ($P = .102$), EuroQoL general health questionnaire ($P = .144$), and the Barthel index ($P = .261$) scores. The EuroQoL general health questionnaire and Barthel index scores were worse with increasing age.

***Conclusion:*** As the grade of hip osteoarthritis increases, it may adversely affect the specific hip score, but this parameter alone may not be a poor prognostic factor that affects the quality of life and daily activity level.

***Level of Evidence:*** Level III, Prognostic Study

## Introduction

The treatment of hip fractures aims to restore the previous level of function as quickly as possible while reducing the rate of complications and mortality.[1] Although consensus has been reached for the treatment of femoral neck fractures in the elderly population, it remains controversial whether arthroplasty or fixation should be preferred in treating intertrochanteric fractures.[1,2-5] Osteoarthritis of the hip joint is one of the factors affecting the choice of the implant in the treatment of intertrochanteric fractures.[1,5] Approximately half of the people aged 60 years or older suffer from osteoarthritis.[6,7] However, fractures in osteoarthritic hips are rare, and the treatment of intertrochanteric fractures of the femur with an arthritic hip is challenging for orthopedic surgeons.[1,3,8]

This study aimed to investigate the effect of existing hip osteoarthritis on the postoperative functional outcomes of patients with intertrochanteric fractures.

## Materials and Methods

We performed a retrospective analysis of the data of patients who underwent surgical fixation for intertrochanteric fractures between March 2017 and August 2020. The institutional review board of the ethics committee of our institution approved this retrospective comparative study (2022/75). Informed consent was obtained from all participants.

The inclusion criteria were:

- Patients with intertrochanteric fractures who underwent osteosynthesis with a proximal femoral nail,
- Age above 60 years,
- Presence of coxarthrosis according to Kellgren–Lawrence (KL)[9] grades 1, 2, 3, and 4, and
- Postoperative anatomic or acceptable reduction.

The exclusion criteria were:

- Age under 60 years (24 patients),
- Patients without hip arthrosis (58 patients),
- Patients in whom a sliding screw or plate was used for reduction and internal fixation (21 patients),
- Concomitant fractures (6 patients),
- Immobility before the fracture (7 patients),
- Patients whose postoperative patient-reported outcome measures (PROM) could not be evaluated due to neurologic and impaired mental status (26 patients),

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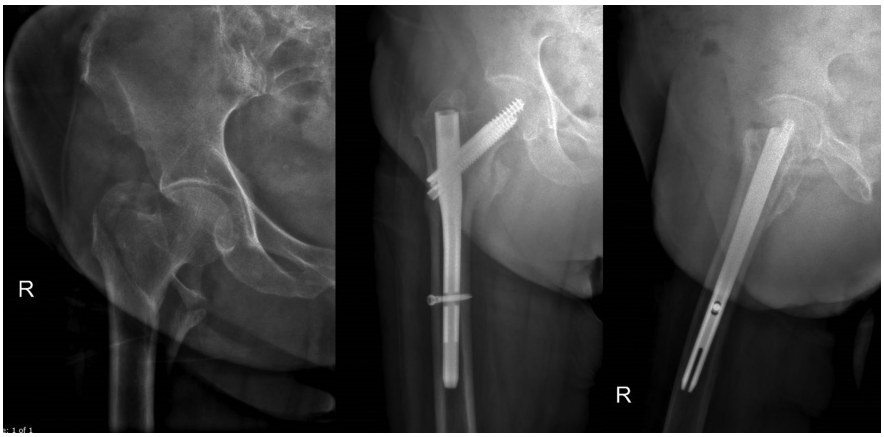


**Figure 1.** Preoperative and postoperative radiological images of a 72-year-old patient in group 1.

- Poor reduction quality and patients who underwent revision surgery due to loss of reduction or material failure during follow-up (10 patients),
- Patients with pathological fractures (4 patients), and
- Less than 6 months of follow-up due to death and various reasons (33 patients).

The patients were divided into 2 groups according to the stage of KL. Group 1 consisted of patients with early-stage osteoarthritis (KL grades 1 and 2), and group 2 consisted of those with severe osteoarthritis (KL grades 3 and 4).

The patient's medical records and digital radiographs were individually reviewed (Figures 1 and 2). The demographic (age and sex) and medical (operative time and American Society of Anesthesiologists score) data were collected from the medical records. The preoperative anterior and posterior radiographs of the pelvis were evaluated according to the KL grading scale as follows: grade 1, doubtful narrowing of joint space and possible osteophytic lipping; grade 2, definite osteophytes and possible narrowing of joint space; grade 3, moderate multiple osteophytes, definite narrowing of joints space, some sclerosis, and possible deformity of bone contour; and grade 4, large osteophytes, marked narrowing of joint space, severe sclerosis, and definite deformity of bone contour.[9] The reduction quality was classified according to varus–valgus and anteversion–retroversion on the postoperative anteroposterior and lateral radiographs compared to the healthy hip. Up to 5° was classified as anatomic, 5°-10° as acceptable, and over 10° as poor reduction.[10] Radiological evaluations were undertaken by an independent radiologist.

The function and satisfaction of the patients were estimated based on the following parameters at final control: the Harris hip score (HHS),[11,12] visual analog scale (VAS) (0: no pain, 10: worst possible pain ever experienced), EuroQoL (EQ) general health questionnaire (EQ-5D-3L),[13] and the Barthel index.[8,14] The HHS is a joint-specific clinical assessment that contains 8 items representing pain, walking function, activities of daily living (ADL), and range of motion of the hip joint.[11] The EQ-5D-3L descriptive system measures the dimensions of mobility, self-care, usual activities, pain/discomfort, and anxiety/depression, each at 3 levels: no problems, some problems, and extreme problems. The upper value of EQ-5D-3L is 1, corresponding to total health, while 0 represents a health state equivalent to death, and a negative index value indicates a state worse than death.[12] The Barthel index is used to check patients' independence regarding their mobility in ADL.[14] Ten variables describing ADL and mobility are scored, with a higher number reflecting a greater ability to function independently.

**Statistical analysis**

The statistical analyses of the data were performed in the computer environment using Statistical Package for Social Sciences v. 18.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were presented as minimum–maximum and mean ± SD values. In the comparison of the groups, Student's *t*-test was conducted. A *P*-value of <.05 was considered significant. In addition, age and outcome scores were compared with the Pearson's correlation test.

## Results

A total of 277 patients were evaluated retrospectively, and 88 patients meeting the study criteria were included in the sample. There were 52 patients (59.1%) with KL grades 1 and 2 (group 1) and 34 (40.9%) with KL grades 3 and 4 (group 2). The average age of this series of patients was 74.9 ± 5.4 (range, 63-87) years. In our cohort, 56 patients (63.6%) were female, and 32 (36.4%) were male. The mean duration of surgery was 63.8 ± 10.1 minutes. The mean follow-up duration was 14.2 ± 6.9 months (Table 1). The age and gender distribution of the 2 groups was similar (age and gender: $P=.834$ and $P=.628$, respectively)

Our cohort's mean HHS was 70.6 ± 4.1 (range, 60-82). The mean HHS of group 1 was higher than that of group 2. We found a statistically significant difference between the 2 groups concerning the specific hip function and grade of osteoarthritis ($P=.047$). The mean VAS score was 3.4 ± 0.9 (range 1-6) in the whole sample, 3.3 ± 0.8 in group 1, and 3.6 ± 0.9 in group 2. There was no significant difference in the VAS score between the 2 groups ($P=.102$). The mean follow-up EQ-5D-3L score was 0.574 ± 0.12 (range, 0.181-0.755) for

**HIGHLIGHTS**

- Osteoarthritis of the hip joint is one of the factors affecting the choice of the implant in the treatment of intertrochanteric fractures. This study aimed to evaluate the effect of the grade of preexisting hip osteoarthritis on the functional outcome of elderly patients with intertrochanteric fractures treated with intramedullary fixation.
- The results showed that the patients with Kellgren-Lawrence grade 1 and 2 hip osteoarthritis compared grade 3 and 4, had significantly higher Harris Hip Scores however, the differences were not significant for the pain scores, EuroQoL general health questionnaire and the Barthel Index.
- The results from this study indicate that the degree of hip osteoarthritis is associated with worse Harris Hip Scores, however this parameter alone may not be a poor prognostic factor that affects the quality of life and daily activity level.

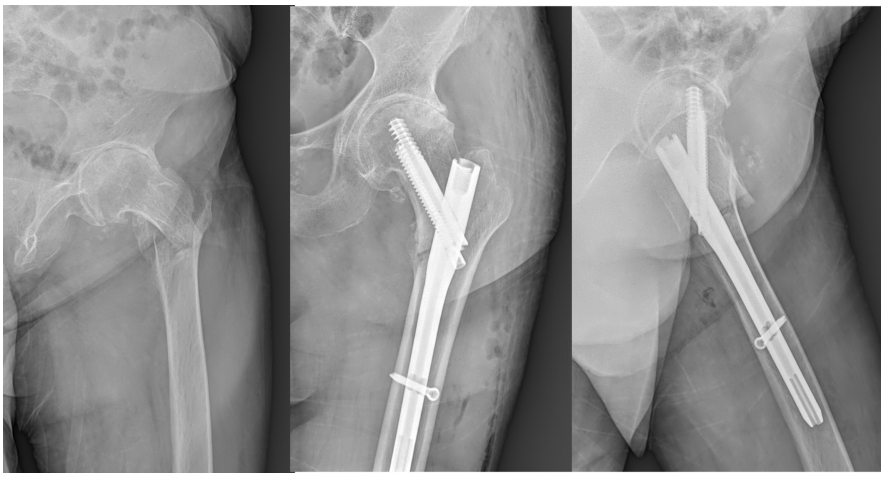

**Figure 2.** Preoperative and postoperative radiological images of a 77-year-old patient in group 2.

the whole sample, 0.522 ± 0.130 for group 1, and 0.483 ± 0.112 for group 2. The EQ-5D-3L score did not significantly differ between the groups ($P$=.144). The mean Barthel index score was 71.84 ± 7.42 and 70.19 ± 5.53 in groups 1 and 2. There was no statistically significant difference between the groups concerning the Barthel index score ($P$=.261) (Table 2).

No statistically significant relationship was detected between the EQ-5D-3L score and the osteoarthritis grade. However, there was a negative correlation between age and the EQ-5D-3L score (Pearson's correlation coefficient $r$=−0.576). The EQ-5D-3L score decreased with increasing age. No statistical difference was found when the patients were compared according to the Barthel index ($P$=.261) (Table 2). A negative correlation was observed between the age of the patients and the Barthel index (Pearson's correlation coefficient $r$=−0.543). This score was worse with advancing age.

## Discussion

In this study, we compared the outcome of intertrochanteric fractures according to the grade of preexisting hip arthrosis. We found that the degree of osteoarthritis of the hip joint did not affect the functional recovery and quality of life of anatomically reduced intertrochanteric fractures despite resulting in worse specific hip function.

Intertrochanteric femur fractures have become a significant public health problem.[1] The aim of treatment for patients with intertrochanteric hip fractures includes early and safe surgical stabilization to enable rapid mobilization and reduce morbidity and mortality.[1,3] It is widely accepted that internal fixation is the gold standard for these fractures.[15-17] Proximal femoral nails, widely used in the internal fixation of intertrochanteric fractures, have come to the fore with their advantages, such as the minimally invasive technique, the short surgical time, and the achievement of early mobilization.[1,15-18] Although successful clinical results are obtained with proximal nails, some authors recommend primary arthroplasty surgery for intertrochanteric fractures, especially in elderly and osteoporotic patients.[19,20] Many studies in the literature compare these 2 surgical methods.[5,15-20] Unlike femoral neck fractures, arthroplasty also has technical difficulties in intertrochanteric fractures. In addition to arthroplasty, additional fixation of major or minor trochanter fragments is required in most intertrochanteric fractures. This procedure is a factor that increases the postoperative complication rate and morbidity by increasing surgical time and blood loss.[18,20] It has been shown in a recent meta-analysis that osteosynthesis had a significantly shorter operation time compared with arthroplasty, In addition, blood loss and blood transfusion rate was also lower in the fixation group. For clinical outcome, the HHS of osteosynthesis was significantly higher than the arthroplasty, and the mortality rate was lower within 1 year.[20] The patient group we discussed had not applied for coxarthrosis before, and their first application was after fracture. Therefore, we prefer fixation as the first choice in such fractures.

The literature suggests that treating intertrochanteric hip fractures with arthroplasty is generally based on the patient's advanced age and osteoporotic bone.[18-20] The intertrochanteric fractures of the femur complicated by the osteoarthritis of the ipsilateral hip are uncommon and only found in a few reports.[8,21,22] Boese et al[8] found a statistically significant correlation between the grade of the radiographic osteoarthritis of the affected hip and functional outcome at 6 and 12 months postoperatively. In contrast, Biyani et al[22] reported that a fracture had the same effect as an osteotomy on osteoarthritis and reduced pain in painful hips. In the current study, although the HHS was lower in the group with more osteoarthritis, we found that

**Table 1.** General demographic and clinical characteristics of the patients

| | Group 1 (KL grades 1 and 2) (n=52) | Group 2 (KL grades 3 and 4) (n=36) | *P* |
|---|---|---|---|
| Age, years [mean ± SD (range)] | 74.8 ± 5.5 (63-87) | 75.06 ± 5.3 (64-87) | .834 |
| Gender | | | |
| Female, n (%) | 32 (61.5) | 24 (66.7) | .628 |
| Male, n (%) | 20 (38.5) | 12 (33.3) | |
| ASA, n (%) | | | |
| 1 | 2 (3.8) | 1 (2.7) | .379 |
| 2 | 14 (26.9) | 11 (30.5) | |
| 3 | 27 (51.9) | 20 (55.5) | |
| 4 | 9 (17.3) | 4 (11.1) | |
| Duration of surgery, minutes | 64.7 ± 9.5 | 62.9 ± 10.6 | .238 |
| Follow-up duration, months | 13.7 ± 6.4 | 14.6 ± 7.4 | .321 |

KL, Kellgren-Lawrence; ASA, American Society of Anesthesiologists

**Table 2.** Functional outcomes of the study groups

| | Group 1 (KL grades 1 and 2) (n=52) | Group 2 (KL grades 3 and 4) (n=36) | *P* |
|---|---|---|---|
| Harris hip score | 71.3 ± 4.3 | 69.5 ± 3.5 | .047 |
| VAS | 3.3 ± 0.87 | 3.6 ± 0.99 | .102 |
| EQ-5D-3L | 0.522 ± 0.130 | 0.483 ± 0.112 | .144 |
| Barthel index | 71.84 ± 7.42 | 70.19 ± 5.53 | .261 |

EQ-5D-3L, EuroQoL general health questionnaire; KL, Kellgren–Lawrence; VAS, visual analog scale.

the osteoarthritis of the hip joint did not affect the quality of life in patients who underwent fixation after acceptable anatomic reduction. Thirty-two patients in our series (27.4%) showed signs of severe osteoarthritis (KL grades 3 and 4) on preoperative radiographs, and their quality of life scores were not lower compared to the other groups. Similarly, when we evaluated ADL, it had no correlation with the grade of osteoarthritis.

Although there is a perception that osteoarthritis is an indication of arthroplasty in patients with intertrochanteric fractures, we did not find sufficient evidence for this when we reviewed the literature.[23-27] In a recent systemic review[23] analyzing 81 studies, 28 poor prognostic factors were identified for the outcome of hip fractures, with handgrip strength and frailty being reported as the top 2. Osteoarthritis was shown as a poor prognostic factor in only 1 of the 81 studies.[8] In another recent study,[25] 74 associated factors were identified in 43 studies reporting functional recovery. Most were related to biological and sociodemographic factors or factors inherent to patients' baseline characteristics, including their pre-facture functional capacity. Existing osteoarthritis and osteoarthritis degrees were defined from these factors, but both were specified as impact negative. Most studies that included age as a factor found this parameter to have a significant effect associated with a poor prognosis.[23-27] Similarly, we found that age was a poor prognostic factor affecting the quality of life and ADL after an intertrochanteric fracture.

For patients who have suffered from a hip fracture, there is no consensus on the most appropriate PROMs.[28-29] In a review,[25] the authors reported that 61 instruments were used to measure function in previous articles. Most methods used to evaluate functional outcomes resulted in problems reporting results.[22,23,25] Different problems and cognitive disorders may affect clinical results in this age group. Therefore, it may not be sufficient to evaluate only hip functions.[28,29] In the current study, we evaluated functional outcomes using the EQ-5D-3L and Barthel index scores and HHS. The EQ-5D is a global measure and is thus designed to capture the complex and multifactorial aspects of a patient's health status.[28] The Barthel index can be used to determine a level of functioning and evaluate changes in the inability to perform ADL over time.[30]

This paper has several limitations. First, it carries the burden inherent in the retrospective design. Second, the sample size was small and insufficient, especially that of group 2, representing severe osteoarthritis. Third, since our study was conducted on patients admitted with intertrochanteric fractures, preoperative HHS, EQ-5D-3L, and Barthel index data were absent. Last, our short follow-up period and evaluation independent of fracture type can be considered limitations.

This retrospective study showed that the degree of hip osteoarthritis increased negatively affected the specific hip score. However, this parameter alone may not be a poor prognostic factor that affects the quality of life and ADL. Functional outcomes can be challenging to assess in the older age group due to their comorbid diseases and cognitive variability; therefore, more homogeneous cohort groups should be evaluated in future studies.

**Ethics Committee Approval:** Ethical committee approval was received from the Ethics Committee of İstanbul Gaziosmanpasa Training and Research Hospital (Approval No: 75/2022).

**Informed Consent:** Informed consent was obtained from all participants.

**Author Contributions:** Concept - F.F.; Design - F.F., A.P.; Supervision - F.F., A.P.; Materials - F.F., A.P.; Data Collection and/or Processing - F.F., A.P.; Analysis and/or Interpretation - F.F., A.P.; Literature Review - F.F., A.P.; Writing - F.F., A.P.; Critical Review - F.F., A.P.

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**Declaration of Interests:** The authors have no conflicts of interest to declare.

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