

# Long-Term Outcomes and Complications of Periprosthetic Fractures of The Proximal Femur: Retrospective Review of 48 Patients

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## ABSTRACT

**Objectives:** Periprosthetic fractures, especially periprosthetic proximal femur fractures, are an increasingly important orthopaedic problem. The aim of this study is to evaluate long-term results, mortality and complications of periprosthetic fractures.

**Methods:** Patients who had proximal femur periprosthetic fractures were evaluated retrospectively. Patients with Vancouver type B1 and C were treated with plate-screw osteosynthesis and patients with Vancouver type B2 were operated on using revision femoral systems. Follow-up was evaluated by clinical and radiographic, and functional results were assessed by Gos scoring.

**Results:** Totally 48 patients were evaluated retrospectively. 16 patients (33.3%) were type B1, 18 patients (37.5%) were type B2 and 14 patients (29.2%) were type C. 30 patients (62.5%) with type B1 and C were treated with plate screw osteosynthesis and 18 patients (37.5%) with type B2 treated with revision femoral systems. There was a significant correlation between the surgical method applied and both mortality and preop/postop GOS scoring systems ( $p < 0.05$ ). Complications and/or the need for intensive care were seen in 28 patients (58.3%) only 1 (2.1%) of these was due to iatrogenic. In total, 20 patients (41.7%) from 48 patients could complete the procedure without any problems.

**Conclusion:** As a result of our study, 58% of patients with periprosthetic femur fractures had complications and need intensive care during the treatment process. Periprosthetic proximal femur fractures, which are generally seen in the elderly population, are injuries with very high complication, mortality and morbidity rates. Therefore, it is recommended that surgeons pay maximum attention during the treatment process.

**Level of evidence:** Level IV

**Keywords:** Periprosthetic Femur Fracture; Long-term Results; Glasgow Outcome Scale (GOS); Mortality; Complications

## Proksimal Femur Periprostetik Kırıklarının Uzun Dönem Sonuçları ve Komplikasyonları: 48 Hastanın Retrospektif İncelemesi

### ÖZET

**Amaç:** Periprostetik kırıklar, özellikle periprostetik proksimal femur kırıkları, önemli giderek artan ortopedik bir problemdir. Bu çalışmanın amacı, periprostetik femur kırıklarının uzun dönem sonuçlarını, mortalitesini ve komplikasyonlarını değerlendirmektir.

**Yöntemler:** Proksimal femur periprostetik kırığı olan hastalar retrospektif olarak değerlendirildi. Vancouver tip B1 ve C olan hastalar plak vida osteosentezi ile ameliyat edildi. Vancouver tip B2 olan hastalar ise revizyon femoral sistemler kullanılarak ameliyat edildi. Klinik izlem fizik muayene ve radyografik olarak değerlendirilirken, fonksiyonel sonuçlar Gos skorlaması ile değerlendirildi.

**Bulgular:** Toplam 48 hasta retrospektif olarak değerlendirildi. 16 hasta (%33,3) tip B1, 18 hasta (%37,5) tip B2 ve 14 hasta (%29,2) tip C idi. Tip B1 ve tip C olan 30 hasta (%62,5) plak vida osteosentezi ile, tip B2 olan 18 hasta (%37,5) ise revizyon femoral sistemler ile tedavi edildi. Uygulanan cerrahi yöntem ile hem mortalite hem de preop/postop GOS skorlama sistemleri arasında anlamlı korelasyon vardı ( $p < 0.05$ ). 28 hastada (%58,3) komplikasyon ve/veya yoğun bakım ihtiyacı görüldü, bunlardan sadece 1 (%2,1) hasta iyatrojenik kaynaklıydı. Toplamda 48 hastadan 20 hasta (%41,7) süreci sorunsuz tamamlayabildi.

**Sonuç:** Çalışmamız sonucunda periprostetik femur kırığı nedeniyle tedavi edilen hastaların %58'inde komplikasyon görülmüş ve/veya tedavi sürecinde yoğun bakıma ihtiyaç duyulmuştur. Genellikle yaşlı popülasyonda görülen periprostetik femur proksimal kırıkları komplikasyon, mortalite ve morbidite oranı çok yüksek yaralanmalardır. Bu nedenle cerrahların tedavi sürecinde azami dikkat göstermeleri önerilir.

**Anahtar Kelimeler:** Periprostetik Femur Kırıkları; Uzun Dönem Sonuçlar; Glasgow Sonuç Skorlaması (GOS); Mortalite; Komplikasyonlar

**T**oday, the incidence of periprosthetic femur fractures is increasing steadily. The major factor in this is the increase in both the elderly patient population and the increased number of patients undergoing arthroplasty. (1) Especially, periprosthetic hip fractures are a serious complication. It is stated that the reoperation rate is about 9.5% due to periprosthetic fracture after Total Hip Arthroplasty (THA) and 11% of the 1-year mortality rate after surgically treated periprosthetic hip fracture (2, 3)

Different treatment modalities have been tried in the surgical treatment of periprosthetic fractures after THA. These are locked plate, cerclage cables, bone morphogenetic protein (BMP) together with allograft and revision femoral systems. (4-6) Plate screw osteosynthesis among these treatment methods can be seen as advantageous because it protects the bone tissue. However, revision femoral systems should also be used in case of indication. (7-9). There are not enough studies in the orthopedic literature to evaluate long-term outcomes and non-fracture complications in periprosthetic hip fractures.

The aim of this study is to evaluate patients treated with locking plate and revision femoral systems for periprosthetic fracture in terms of long-term outcomes, mortality, morbidity and complications. In this way, it is aimed to determine the problems that can be seen during the treatment of these fractures and to guide the surgeons.

## PATIENTS and METHODS

Forty-eight patients with periprosthetic proximal femur fractures who had at least two years of clinical and radiological follow-up and applied to our clinic between 2012 and 2018 were evaluated retrospectively. Patients with pathological fractures and treated conservatively were excluded from the study. Clinical data of the patients were obtained from the hospital information recording system and radiology images were obtained from clinical radiography and the hospital radiology archive system.

Demographic information of the patients, accompanying injuries, time until surgery and hospital stay were recorded. Comorbid diseases of the patients (Hypertension, Diabetes Mellitus, Heart Failure, Chronic Renal Failure, Alzheimer etc.) were questioned and how many comorbid diseases of each patient were recorded. Perioperative and postoperative complications of the patients (vascular injury, cerebrovascular accident, infection, decubitus wound, etc.) were recorded. All patients were operated on by the same team in the same hospital. The graphs at the

time of arrival of the patients were classified according to the Vancouver classification by evaluating the preoperative history and the status of the femoral stem during the operation. Polyax locking plate system was used for Vancouver type B1 and type C and used revision femoral systems for Vancouver type B2. All patients with locked plates were treated with the Polyax Locked Plating System (Biomet, Warsaw, IN, USA). The Arcos Modular Revision Hip System (Biomet, Inc., Warsaw, Indiana, USA) and the Helios Modular Revision Hip System (Biomet Merck Co., Germany) were used as a revision system. The femoral lateral minimally invasive approach was used as a surgical method for Types B1 and C, and anterolateral approach was applied to the hip for Type B2 fractures. Following removal of the femoral stem, if a cemented stem was present, the cement was cleaned after the femoral extended trochanteric osteotomy and a revision femoral stem was placed. In the uncemented stems, revision stem was inserted without osteotomy following removal of the stem. Postoperative thromboprophylaxis was performed using low molecular weight heparin and/or 300 mg acetylsalicylic acid for 6-8 weeks. All patients were mobilized on the first postoperative day by removing their drains. Quadriceps exercises were initiated. Patients were not given full weight for up to 8 weeks.

The patients were called for control once a year after the 3rd week, 6th week, 3rd month, 6th month, 1st year, 2nd year and after discharge. Patients who underwent plate screw osteosynthesis were evaluated as a union if they did not have weight-bearing pain and three cortex calluses were seen radiologically. If any of the plans had a 10-degree angle on radiographic evaluation, it was considered a malunion. Clinical evaluation was assessed using the Glasgow Outcome Scale (GOS). 1- normal daily activities 2- unassisted moderate activities 3- needing help for daily activities 4- not being able to do daily activities (16-18)

Analysis of the data was done using the IBM SPSS 23.0 statistical package program. Pearson Chi-Square and Fisher's Chi-Square tests were used to comparing qualitative data as well as descriptive statistical methods (frequency, percentage, mean, standard deviation, median, min-max). The normal distribution of the data was evaluated by Kolmogorov-Smirnow and Shapiro-Wilk tests. Independent Samples t-test (t-test in independent groups) and One-Way ANOVA test were used to evaluate quantitative data with normal distribution. Relations between variables were evaluated by the Pearson correlation test. Likelihood (P) Values smaller than  $\alpha=0,05$  are significant and there is a difference between groups, with

large values being insignificant and no difference between groups.

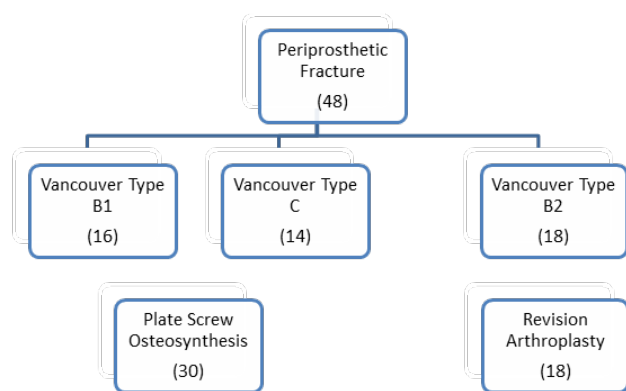
## RESULTS

### Patient Demographics

A total of 48 patients were included in the study. 26 of the patients were female (54.2%), 22 were male (45.8%) and the mean age of the patients was  $70.9 \pm 15.4$  (range, 43-92). The mean age of patients who underwent plate-screw osteosynthesis was 71.8 (range, 66-92) and the mean age of patients with revision system was 69.4 (range 43-81). The mean follow-up time was 26.1 months (range 0-96 months). There was no statistically significant difference between the groups in terms of age, gender and follow-up time ( $p > 0.05$ )

### Fracture Classification

16 patients (33.3%) were classified as Vancouver type B1, 9 patients (37.5%) were Vancouver type B2, and 14 patients (29.2%) were Vancouver type C when patients were classified according to Vancouver classification. 30 patients (62.5%) with type B1 and C fractures were operated on with plate screw osteosynthesis, and 18 patients (37.5%) with type B2 fractures were operated on using revision femoral systems. (Graphic 1) (Fig. 1-4)



**Graphic 1:** Patients Characteristics

### Complications

12 patients (25%) underwent pressure ulcers on hip and heel, despite routine postoperative rehabilitation and mobilization during the hospitalization period. These patients were planned to be followed up by plastic surgery. Superficial infection developed in six patients (12.5%) and the infections resolved with short-term antibiotic treatment. Postoperative embolism developed in the hospital

in 3 patients (6.3%) and the final results were CVS. Two patients had hemiparesis on the operated side and 1 patient had hemiplegia on the non-operated side. Muscle strength was evaluated as 3/5 in two patients and 0/5 in one patient. The treatments of the patients were rearranged by the neurology department. During the operation, femoral artery injury occurred in one patient. The vascular repair was performed by the cardiovascular surgeon in the same session, and the patient's fracture healed completely in the 5th month. (Graphic 2)

### Mortality and Scoring

When classified according to GOS, during the preoperative period, GOS 1 in 24 patients (50%), GOS 1 in 10 patients (20.8%), GOS 2 in 14 patients (29.2%), while GOS 1 in 14 patients (29.2%), 14 patients (%) 29.2) GOS 2, 8 patients (16.7%) had GOS 3, 12 patients (25%) had GOS 4. There was a significant correlation between the survival of the patients and the preoperative GOS grading system ( $p < 0.05$ ). All patients with preoperative GOS 3 died within the first 3 years (mean 8 months, range 0-32). 12 of 14 patients with a preoperative GOS value of 3 had a GOS of 4 in the postoperative period, and all these patients died on a mean postoperative 5th month (0-8 months). The mean age of 14 patients was 81.3 (range, 77-92). This rate was higher than the average age of all patients. Of the 14 patients, 3 (6.3%) were treated with the femoral revision system, and 11 (22.9%) were treated with plate-screw osteosynthesis. There was a significant relationship between mortality and surgical method. ( $p < 0.05$ ) (Table 1)



**Figure 1:** 74 years old female Vancouver Type B2 preoperative graphy



**Figure 2:** 74 years old female Vancouver Type B2 postoperative 1-year graphy



**Figure 4:** 81 years old female Vancouver Type B1 postoperative 1-year graphy

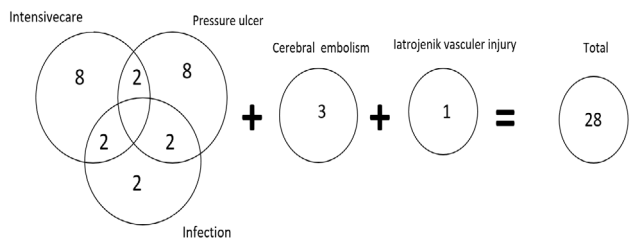


**Figure 3:** 81 years old female Vancouver Type B1 preoperative graphy

**Table 1:** Comparison of the operation method and the other parameters

	Plate-screw osteosynthesis (n=30)	Revision systems (n=18)	P value
Mean age	71.8 (66-92)	69.4 (43-81)	0,131 <sup>a</sup>
Mean preop Gos	1.80	1.78	0,140 <sup>b</sup>
Mortality (n)	11	3	<b>0,024<sup>a</sup></b>
Mean postop Gos in patients who died	3.82	4.00	<b>0,364<sup>b</sup></b>

*a:*Fisher's Chi-Square Test, *b:*Pearson Chi-Square Test



**Graphic 2:** Complications

## DISCUSSION

Studies have estimated that until 2030, total and revision hip arthroplasties will increase by 174% and 137%, respectively (10). Periprosthetic femoral fractures are becoming an increasingly common issue for orthopedic surgeons due to the increase in life expectancy in the community and arthroplasty surgeries. New treatment protocols and long-term results are needed to achieve better results in periprosthetic femoral fractures with increased incidence. The most important finding of our study is that the long-term results of periprosthetic fractures are poor regardless of the operations performed, and the complication and mortality rates are very high.

The mortality rates in the first month after periprosthetic fracture are seen to vary between 0.9% and 16% in the literature (2, 11-14). In a study conducted by Berry et al., 1 of 8 patients (12.5%) who underwent Vancouver type B3 periprosthetic fracture after hip arthroplasty and underwent femoral stem revision died within the first week (13). Parvizi et al. reported that 0.9% of 110 periprosthetic fractures in the study died within the first month. (12) McLaughen et al reported 45 patients with periprosthetic femur fractures and reported that 4 patients (8.9%) died in the first month. In the same study, 9 patients reported that they died within the first 3 months. (11). When the long-term mortality rates are considered, it is said that the mortality risk persists in the first 6 months after the surgery and there is a significant decrease after 6 months. Bhattacharyya and colleagues found a mortality rate of 11% at the end of one year when they were followed up with 106 proximal femur periprosthetic fractures in their study. (3) Springer et al. evaluated 134 patients who had periprosthetic femur fractures. Mortality was developed in 11 (8.2%) patients at the end of 2 years (15) In the studies conducted, it is said that the GOS classification is reliable and useful in evaluating functional results in periprosthetic femur fractures (16-18). In the current study, unlike other studies, the issue we found was the relationship between preoperative and postoperative GOS scores and mortality. Of the 14 patients with a preoperative GOS score of 3, 12 of them had a postoperative GOS score of 4, and all of these patients died within 5 months. According to these results, it can be said that the results are worse in fully or partially immobilized patients.

There are also studies showing that mortality may be affected by the surgical procedure performed. Bhattacharyya et al. 106 followed the femur fracture patient for an average of 2.2 years and found that the mortality rate of the

patients who underwent plate-screw osteosynthesis was 33%, whereas the mortality rate was 12% in the patients who underwent surgery with revision system. (3) In another similar study, Langenhan et al. the periprosthetic proximal femur fracture of the plate-screw osteosynthesis and the revision system compared with patients who made the first 6 months mortality plate 30% to 10% higher in the osteosynthesis group (19). In our study, most of the patients who died were surgically treated with plate-screw osteosynthesis (22.9%). Since fracture healing is expected in patients undergoing plate-screw osteosynthesis, their mobilization is more limited compared to patients who have undergone revision femoral system. Restricted mobilization and the resulting decrease in physical capacity can be considered predisposing factors for mortality.

Periprosthetic fractures have been evaluated in terms of post-treatment union and mortality in studies performed, but post-treatment morbidity and complications were almost never emphasized. Since periprosthetic hip fractures are generally seen in a high population in the age group, morbidity and complication rates are high in treatment regardless of surgery. In terms of morbidity, hemodynamic instability was observed in 12 patients (25%) requiring postoperative intensive care. The patients stayed in the intensive care unit for an average of 2.2 days. (range 1-4 days). Bleeding and reduced tolerance to anaesthesia can be seen as a possible causes of this condition. Another important point is the complications that may occur. Although routine postoperative care protocols were applied in the postoperative period, 12 patients (25%) had pressure ulcers in the heel and hip, and 6 (12.5%) had a superficial infection at the wound site. The postop GOS value of the patients with heel pressure ulcers was 3 and above. The mean age of the patients who developed complications was found to be relatively high (47-76 age range). Since the age group is high, microcirculation disorders and prolonged immobilization can be considered the main reason for this situation.

Our study has some limitations. The first of these is that the study is retrospective, and the number of patients is relatively small, although the results of patients with long-term follow-up are. Another limitation is that most of the patients who died did not complete the 2-year clinical and radiological follow-up.

In conclusion, periprosthetic fractures are an orthopaedic question that we have to deal with not only with the surgery but also complications and high mortality rates and its results were seen in the elderly population. Given that we will face more fractures in the future, we need to be more prepared in this regard and we need more and more prospective studies to be able to cope with their complications.

## Compliance with Ethical Standards

### Conflict of Interest

The authors declare that they have no conflict of interest.

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