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SURGICAL SCIENCES / CERRAHİ TIP BİLİMLERİ

Conversion to Hip Arthroplasty After Cut-out Complication of Proximal Femoral Nailing (PFN) in Pertrochanteric Fractures

Pertrokanterik Kırıklarda Proksimal Femoral Çivilemede (PFÇ) "Cut-out" Komplikasyonu Sonrası Kalça Artroplastisine Geçiş

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Abstract

Objectives: A failed intertrochanteric fixation often leads to functional disability and pain. The most commonly observed complication is "cut-out", which frequently requires hip arthroplasty in the subsequent period. In this study, we aimed to compare the results of total hip arthroplasty (THA) and hemiarthroplasty (HA) after cut-out complication of proximal femoral nailing (PFN).

Materials and Methods: Forty patients who were treated with THA (20 patients) and HA (20 patients) due to cut-out complication following PFN were included in our retrospective study. Age, gender, classification of the pertrochanteric fracture (AO/OTA classification), time to arthroplasty surgery, operative time, total blood loss, and complications were reviewed. The clinical results were evaluated by the ambulatory status, Harris hip score (HHS) and visual analog scale (VAS) score at the second year follow-up.

Results: The amount of blood loss and the operative time were significantly higher in the THA group (p=0.001). Post-operative second year VAS score and HHS were similar in both groups (p=0.989 and p=0.820, respectively). There was no significant difference between the two groups in terms of complications rate (p=0.294).

Conclusion: Converting to hip arthroplasty is a successful choice in the treatment of cut-out complications following PFN. Both THA and HA groups had similar clinical results, with the HA group being more advantageous regarding cost, operative time, amount of blood loss, and rate of infection. However, the only valid option for those with acetabular defects during cut-out is THA.

Key Words: Cut-out, Pertrochanteric Fracture, Intertrochanteric Fracture, Proximal Femoral Nailing, Intramedullary Nailing, Hip Arthroplasty

Öz

Amaç: İntertrokanterik fiksasyon cerrahisinin başarısız sonuçlanması sıklıkla ağrı ve fonksiyon kaybına yol açmaktadır. En sık görülen komplikasyon "cut-out" olup, sıklıkla artroplasti ile tedavi edilir. Bu çalışmada, proksimal femur çivileme (PFÇ) cerrahisi sonrası "cut-out" komplikasyonu gelişen olgularda uygulanmış olan total kalça artroplastisi (TKA) ve parsiyel kalça artroplastisi (PKA) sonuçlarını araştırmayı hedefledik.

Gereç ve Yöntem: Bu retrospektif çalışmaya, PFÇ sonrası "cut-out" gelişen 40 hasta (20 hasta-TKA, 20 hasta PKA) dahil edildi. Gruplar yaş, cinsiyet, var olan pertrokanterik kırık tipi (AO/OTA sınıflaması ile), artroplastiye geçiş zamanı, ameliyat süresi, toplam kan kaybı ve komplikasyonlar açısından karşılaştırıldı. Klinik sonuçlar hastaların ikinci yıldaki hareket edebilme kabiliyetleri, Harris kalça skoru (HKS) ve görsel analog ölçeği (VAS) skoru kullanılarak elde edildi.

Bulgular: TKA grubunda ameliyat süresi ve toplam kan kaybı istatiksel olarak anlamlı bir şekilde daha fazlaydı (p=0,001). Grupların ikinci yıldaki HKS ve VAS skorları benzerdi (p=0,989 ve 0,820). Artroplasti sonrası gelişen komplikasyonlar açısından ise istatistiksel olarak anlamlı fark bulunmadı (p=0,294).

Sonuç: PFÇ sonrasında oluşan "cut-out" komplikasyon tedavisinde artroplastiye geçiş başarılı sonuçlar veren bir tedavi seçimidir. Hem TKA hem de PKA grupları benzer klinik sonuçlara sahip olup, PKA maliyeti ameliyat süresi, kan kaybı ve postoperatif enfeksiyon yönünden daha avantajlı görülmektedir. Ancak, asetabulum defekti mevcut olan hastalarda tek geçerli tedavi yöntemi ise TKA'dır.

Anahtar Kelimeler: Cut-out, Pertrokanterik Kırık, İntertrokanterik Kırık, Proksimal Femur Çivileme, İntramedüller Çivileme, Kalça Artroplastisi

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Introduction

With the increasing age of the population, the incidence of proximal femur fractures is also rising. The incidence of proximal femur fractures amounts to 0.11% per year between the age of 65 and 74, whereas, it reaches 1.32% over the age of 85 (1). Closed reduction and internal fixation with proximal femoral nailing (PFN) is the most selected treatment method due to short hospital stays, early mobilization, less blood loss, and infection rate (2). In the literature, the complication rates of PFN are heterogeneous and range between 0.6% and 14.7% (3,4). The most commonly reported complication in internal fixation is "cut-out", defined as "the collapse of the neck-shaft angle into varus, leading to extrusion of the screw from the superior of the femoral head" (5). Several factors such as unstable fracture type (basicervical and complex fractures), non-anatomical reduction, non-optimal lag screw positioning, elderly patients, poor bone quality, implant design, and the choice of caput-collum-diaphysis nail angle have been associated with this complication (6). Converting to hip arthroplasty (total or hemi) is usually preferred after cut-out complications in selected patients with poor bone quality, advanced bone loss, or articular cartilage wear (7).

In this study, our aim was to compare total hip arthroplasty (THA) and hemiarthroplasty (HA) in terms of clinical and radiological outcomes and complications in the treatment of cut-out complication of PFN. To the best of our knowledge, there is no study in the literature that compares the hip arthroplasty types for treatment of cut-out complication of PFN.

Materials and Methods

Approval of the local ethics committee of our institute was obtained for the study. Patients who underwent PFN due to pertrochanteric fracture were screened retrospectively from the hospital database and those who underwent hip arthroplasty as a result of the cut-out complication in PFN during the follow-up period were included in the study. Patients with femoral cut-through complications, who had a follow-up period of less than two years, who underwent re-fracture treatment, and those with a confirmed infection prior to hip arthroplasty were excluded.

The remaining 40 patients who met the inclusion criteria were included in the study and grouped as those who underwent THA (20 patients) or HA (20 patients). Age, gender, type of the pertrochanteric fracture [using the AO/OTA (The AO foundation/Orthopaedic trauma association) classification], time to conversion, operative time, total blood loss, type of the trochanteric union (fibrous or osseous union), and complications (acetabular fracture, dislocation, infection) in each patient were reviewed. In addition, the clinical results were evaluated by the ambulatory status, Harris Hip score (HHS), and visual analog scale (VAS) at the second year follow-up.

Statistical Analysis

IBM SPSS v.20.0 software was used for statistical analyses. Descriptive statistics were expressed as average, standard deviation (±), median, minimum and maximum. Whereas, categorical data were expressed as the number of cases and percentage (%). Student's t-test was used in comparison of the age data in different gender groups. The relationship between the categorical variables were analyzed using Pearson's chi-squared test. Student's t-test was used in the comparison of the continuous data that showed normal distribution, the Mann-Whitney U test in those that did not, and the Kruskal-Wallis test in cases where there were more than two groups. Results with a p-value<0.05 were considered statistically significant.

Results

Mean age was 79.4 years (range: 74 to 85 years) in the THA group and 80.6 years (range: 75 to 88 years) in the HA group. Demographic data of the groups, fracture type according to the AO classification, and time to conversion are shown in Table 1. The average time to implant failure was 11.1±2.5 weeks. There was no statistically significant difference between the groups in terms of age, gender, fracture type (AO/OTA classification), and time to conversion.

The average operative time was 121.5 minutes in the THA group and 101 minutes in the HA group, and showed a statistically significantly difference between the groups (p<0.001). The amount of average blood loss during surgery was 1420 cc in the THA group and 835 cc in the HA group, again exhibiting a significant difference (p<0.001).

Table 1: Demographics, fracture type and time to conversion of patients

	Group THA (n=20)	Group HA (n=20)	p-value
Age	79.4±3.45	80.6±3.49	0.282
Gender	6M, 14F	6M, 14F	1.000
AO type	AO 31A1-6 pts AO 31A2-14 pts	AO 31A1-9 pts AO 31A2-11 pts	0.327
Time to conversion (week)	11.85±1.87	10.5±2.94	0.093

THA: Total hip arthroplasty, HA: Hemiarthroplasty, M: Male, F: Female

Prior to salvage hip arthroplasty, all patients had moderate or severe pain in the hip, and were unable to walk or had minimal walking ability. At the second year follow-up, the mean HHS was 74.4 (range: 66 to 94) in the THA group and 73.0 (range: 60 to 86) in the HA group, while the average VAS in the THA and HA groups was same 3.65 (range: 2 to 6) and 3.65 (range: 2 to 5) respectively (p=0.989). The majority of the pain was in the greater trochanter region (Table 2).

Union in the trochanteric region was evaluated as osseous and fibrous. Osseous union was observed in 25 patients and fibrous union in 15. There was no statistically significant difference between the groups regarding trochanteric union type (p=0.327).

In terms of complications, intraoperative acetabulum fractures were observed in three patients and postoperative infection in four in the THA group, while early dislocation was detected in four patients in the HA group. Again, no statistically significant difference was found between the groups with regard to complication rate (p=0.294).

No patient was limited to bed or chair. Thirty patients were able to walk outdoors with one-arm support and ten were able to walk indoors only with the use of a walker or a cane. Radiological evaluation showed no loosening or heterotropic ossification. The surgical approach (posterolateral) and the femoral stem used (fully porous-coated femoral stem) were the same in all patients.

Discussion

Failed intertrochanteric fixation often leads to functional disability and pain. In young adults, refixation with implant exchange may be possible because of better bone quality and general medical condition (8). However in elderly patients, preexisting osteoporosis and screw holes may make implant fixation impossible.

Several studies have shown that the prevalence of cut-out with the use of different compression hip screws and intramedullary nails ranges from 0 to 16.5% (9,10). In our department, the prevalence of cut-out complication was reported as 3.5% (40 cases in 1,142 patients).

There are many treatment options such as blade exchange, cement augmentation with blade exchange or hip arthroplasty used in the management of treatment after cut-out complication (11). In elderly patients, early ambulation and self-care ability should be the most important goal in the treatment plan because of high comorbidities (Figure 1).

Hip arthroplasty can provide postoperative immediate weight-bearing, early rehabilitation, functionally recovery, better life quality, and better self-care ability (11). There are mainly two treatment options in failed intertrochanteric fracture fixations via arthroplasty; total or hemi-arthroplasty. Hip arthroplasty can be performed with cement or cementless. The use of a cemented prosthesis provides immediate weight-bearing, however, this technique has important disadvantages such as cement leakage and embolization (12). When a cementless prosthesis is used, the preexisting screw holes may create a stress-raising effect, and the loss of metaphyseal bone stock and abductor mechanism, medialization of the femoral shaft, and osteoporosis may render the use of primary metaphyseal locking prosthesis impossible (13). In our cases, fully porous-coated cementless femoral stems, at least with a length of two times of the distance of the diameter of the femoral shaft from the distal locking screw, were used. We believe that is the reason why we did not encounter any subsidence, loosening, or periprosthetic fracture on the femoral side.

The greater trochanter is either not solidly healed or can be fragmented again during hip arthroplasty, thus affecting the abduction function, which in turn leads to an increased dislocation rate and can adversely affect the ambulatory function after hip arthroplasty (14). In 25 cases, we used a cable

Table 2: Comparison of results between groups

	Group THA (n=20)	Group HA (n=20)	p-value
Surgical time (min)	121.5±15.9	101±15.8	<0.001
Total blood loss (cc)	1420±221.4	835±120.4	<0.001
VAS (2nd year follow-up)	3.65±1.1	3.65±0.8	0.989
HHS (2nd year follow-up)	74.4±6.8	73±7.9	0.820
Trocanteric union (n) Osseous union Fibrous union	 11 9	 14 6	 0.327
Complications Acetabular fracture Dislocation Infection	 3 0 4	 0 4 0	0.294 0.231 0.106 0.106

THA: Total hip arthroplasty, HA: Hemiarthroplasty, Min: Minimum

with the trochanteric plate and achieved osseous union of the greater trochanter. In other cases, only non-absorbable sutures were used, and although osseous union was not obtained at the second year follow-up, fibrous union without proximal migration of the greater trochanter was achieved.

The complication rates of salvage hip arthroplasty due to failed trochanteric and subtrochanteric fracture fixation surgery are higher than primary hip arthroplasty surgery performed to the same fracture types. Bonnevialle et al. (15) recently reported a reoperation rate of 3% in a prospective study of 106 patients followed for at least six months after primary arthroplasty due to trochanteric fracture. However, Enocson et al. (16) reported a reoperation rate of 16% in the treatment of patients with failed internal fixation of trochanteric and subtrochanteric fractures. In their study, reoperations were performed due to a periprosthetic fracture (42%), deep prosthetic infection (35%) and dislocation (23%). In another study conducted on 13 patients who underwent arthroplasty after a failed internal fixation of intertrochanteric fracture, Mehlhoff et al. (17) reported that five patients had good or excellent results, while another five had a dislocation or instability (38%). Brunner et al. (11) stated that THA was the only valid salvage procedure in PFN cut-out complications, although it has a higher complication rate than primary arthroplasty.

In our study, dislocation occurred in four patients in the HA group (20%), while no dislocation was observed in the THA group. However, intraoperative acetabulum fractures in three patients (15%) and postoperative infection in four patients (20%) in the THA group were detected. Infection in these four cases occurred as a growth from the cultures taken during the revision and in the form of a prolonged wound drainage; all treated with IV antibiotics. Patients with acetabular fractures were treated using plate screws and cages. HA patients with dislocations were treated by converting to cage-supported revision THA. Thus, the reoperation rate was 20% in the HA group, whereas no patient in the THA group was reoperated. In our opinion, the reason for the dislocations after HA, which is considered to be more stable, was the posterosuperior wall defect in the acetabulum that occurred during the cut-out complication, and could not be detected preoperatively or intraoperatively. We were able to detect this defect preoperatively in some of our THA cases (Figure 2). Therefore, the authors suggest that a better preoperative evaluation of the acetabulum and intraoperative confirmation of the continuity of the acetabulum are essential in the treatment of cut-out complications.

Converting to hip arthroplasty in PFN cut-out complications seems to be the most valid treatment method. Both THA and HA produce clinically similar results, with HA being more advantageous regarding cost, operative time, amount of blood loss, and rate of infection (Figure 3). However, THA remains the only viable option in cases with preoperative or intraoperative acetabular defects. Besides, when a cut-out complication treatment is performed in such a patient population with advanced osteoporosis, preparations should be carried out with a comprehensive implant set (cage, acetabular plates, and screws).

Figure 1: Eighty-two y F. a) Cut-out complication at postoperative 6th week following PFN procedure. b) Coronal and sagittal image of computed tomography showed the defect created by the blade of nail in the acetabulum superior wall. c) Image after THA convertion. Defect was filled bone graft derived from resiudal femoral head

F: Female, PFN: Proximal femoral nailing, THA: Total hip arthroplasty

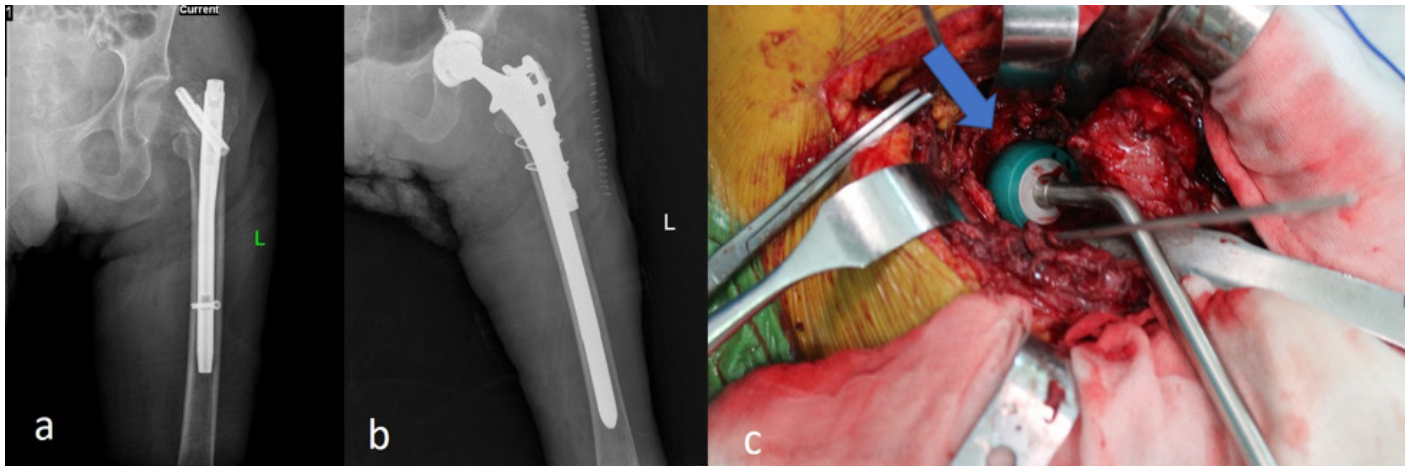

Figure 2: Eighty y F. a) Cut-out complication at postoperatively 5th week following PFN procedure. b) Converting total hip arthroplasty with trochanteric plate and cables. c) Defect in the superior wall of the acetabulum is seen during THA procedure

F: Female, PFN: Proximal femoral nailing, THA: Total hip arthroplasty

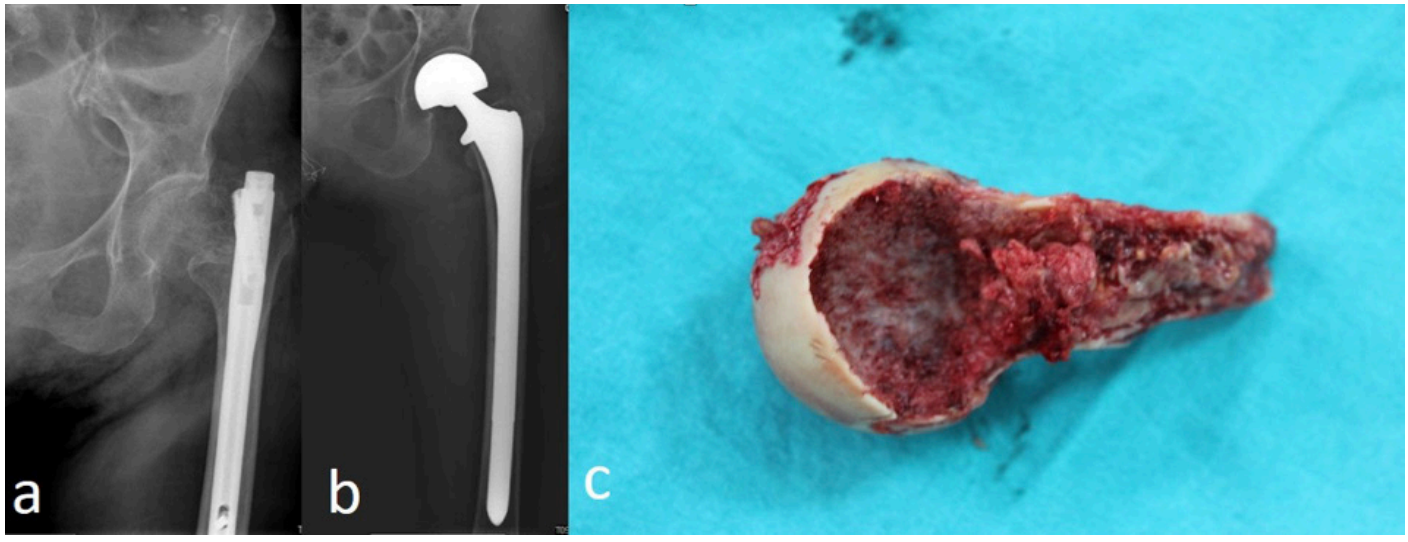

Figure 3: Seventy-eight y F. a) Cut-out complication at postoperative 4th week following PFN procedure. b) Image after HA convertion. c) The image of fragmentation of the femoral head after resection of femoral head

F: Female, PFN: Proximal femoral nailing, THA: Total hip arthroplasty

Conclusion

In the case of treatment of failure of trochanteric fracture with arthroplasty, we strongly advise a careful evaluation of the acetabulum both preoperatively and intraoperatively. In addition, preparations for the surgery should be made considering the possible scenarios of a total hip replacement or an acetabular revision.

Ethics

Ethics Committee Approval: This study was approved by Human Research Ethics Committee of Ankara University (İ9-594-20).

Informed Consent: Retrospective study.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: A.M., K.B., M.K., H.K., Concept: A.M., M.O.K., E.A.O., Design: A.M., M.O.K., E.A.O., Data Collection or Processing: A.M., Analysis or Interpretation: A.M., Literature Search: A.M., Writing: A.M.

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