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Midterm results of total hip replacement in osteonecrosis of the hip joint

Kalça osteonekrozunda total kalça artroplastisinin orta dönem sonuçları

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Amaç: Femur başı osteonekrozunda total kalça artroplastisinin (TKA) orta dönem sonuçları değerlendirildi.

Çalışma planı: Osteonekroz tanısıyla TKA uygulanan 59 hastanın (23 kadın, 36 erkek; ort. yaş 45.6; dağılım 24-66) 72 kalçası incelendi. Osteonekroz 11 kalçada (%15.3) kollum femoriste kırığa bağlı gelişirken, 23 kalçada (%31.9) steroid nedenli idi. Otuz sekiz kalça (%52.8) ise idiyopatik olarak değerlendirildi. Klinik değerlendirmede D'Aubigne-Postel'in ameliyat sonrası fonksiyonel kalça skoru kullanıldı. Radyografik değerlendirmede, kemik-implant ilişkisi femur için Gruen'in yedi bölgesi, asetabulum için Charnley'in üç bölgesi kullanıldı. Ortalama takip süresi 4.1 yıl (dağılım 2-7 yıl) idi.

Sonuçlar : Takip sonunda D'Aubigne-Postel kalça skoru ortalaması 11.8 (dağılım 7-16) bulundu. Tüm kalçalarda klinik sonuç iyi veya mükemmel idi. Çimentosuz ve hibrid sistemler arasında kalça skoru açısından anlamlı fark görülmezken ($p>0.05$), *press-fit* vidalı sistemin ekspansiyon kapa göre daha iyi olduğu görüldü ($p<0.001$). Etyolojinin, kullanılan taşıyıcı yüzeylerin (metal-metal ile metal-polietilen), proksimal femurda *stress shielding* veya femoral stemde varus-valgus açılanması gelişmesinin klinik sonuç üzerine anlamlı etkisi bulunmadı ($p>0.05$). Ancak, ameliyatta veya sonrasında komplikasyon gelişen kalçalarda klinik skor daha düşüktü ($p<0.001$). Ameliyat sırasında beş kalçada fissür, beş kalçada da izole trokanter majör kırığı gelişti ve bunların hepsi çimentosuz sistemlerde görüldü. Altı kalçada heterotopik ossifikasyon gelişti. Sekiz kalçada ortalama 6.5 yıl sonunda hafif polietilen aşınması gözlendi; bunların ikisinde Gruen bölge 1'de fokal osteoliz gelişti.

Çıkarımlar: Gelişen implant teknolojisi ve cerrahi teknikler sayesinde, etyolojiye bakılmaksızın, kalça osteonekrozlarında hem hibrid sistem hem de çimentosuz sistem sonuçları başarılıdır.

Anahtar sözcükler: Artroplasti, replasman, kalça; femur başı nekrozu/cerrahi; kalça eklemi/radyografi; kalça protezi.

Objectives: We evaluated the midterm results of total hip arthroplasty (THA) for femoral neck osteonecrosis.

Methods : The study included 59 patients (23 females, 36 males; mean age 45.6 years; range 24 to 66 years) who underwent THA in 72 hips. Osteonecrosis was secondary to fracture in the femoral neck in 11 hips (15.3%), was associated with steroid use in 23 hips (31.9%), and was idiopathic in 38 hips (52.8%). Functional evaluations were made with the hip scoring system of D'Aubigne and Postel. Bone-implant relations were assessed radiographically using the Gruen's seven zones in the femur and Charnley's three zones in the acetabulum. The mean follow-up was 4.1 years (range 2 to 7 years).

Results: The mean D'Aubigne-Postel hip score was 11.8 (range 7 to 16), with good or excellent results in all hips. While no significant difference was found between cementless and hybrid systems ($p>0.05$), the mean hip score was significantly higher with press-fit acetabular systems compared to expansion cups ($p<0.001$). The effects of the following were found insignificant on the clinical outcome ($p>0.05$): etiology, metal-on-metal or metal-on-polyethylene surfaces, and development of stress shielding in the proximal femur or of varus-valgus angulation in the femoral stem. However, the results were significantly less favorable in cases in which complications arose ($p<0.001$). Intraoperative complications were fissure in five patients and isolated trochanteric fracture in five patients, all of which occurred in cementless THA. Heterotopic ossification was seen in six hips. At the end of 6.5 years, mild polyethylene wear was detected in eight hips, two of which also had focal osteolysis in Gruen zone 1.

Conclusion: Thanks to improvements in implant technology and surgical techniques, the results of both cementless and hybrid systems are satisfactory in hip osteonecrosis, regardless of the etiology.

Key words: Arthroplasty, replacement, hip; femur head necrosis/surgery; hip joint/radiography; hip prosthesis.

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Osteonecrosis of the femoral head is also known as avascular or aseptic necrosis. The disease starts with disruption of the blood flow and ends up with a pathology destructing the hip joint. It is generally seen in young patients between second and fourth decades and is seen 4 times more frequently in males. Steroids, excessive alcohol consumption, autoimmune diseases, trauma, pancreatitis, hyperlipidemia, haemoglobinopathies, hypercoagulopathies, and Gaucher's disease are known etiologic factors.[1] Osteonecrosis is idiopathic in 20% of all cases. Both hips may be involved in 30-50% of the cases.[2] The ost frequent complaint is pain and limitation of hip joint movements. Although there are many treatment methods for this problem, none of them eliminates the disease totally giving the patient full relief of symptoms and full return to activities. Total hip arthroplasty is the most efficient method of treatment especially in advanced stage disease when other treatment methods fail.[3] With the advance of implant technology and techniques and elimination of the causes of previous unsatisfactory results, this operation yields excellent results. In this study we aimed to evaluate the midterm results of total hip replacement and the effects of cemented and uncemented stems, bearing surfaces and etiology on implant survival.

Patients and methods

This study was conducted on 59 patients with avascular necrosis who had undergone total hip replacement (72 hips) between January 1997 and January 2004. There were 36 men and 23 women with a mean age of 45.6 (range 24-66). The hips were graded using Ficat grading system.[4] Eight hips were Ficat grade 3, 53 hips grade 4. Eleven hips had post-fracture osteonecrosis.

Direct lateral approach was used in all patients. The etiology was identified according to patient history whenever possible. The hip range of motion was determined by physical examination. The type of prosthesis was determined on preoperative radiographs using templates.

The etiology was idiopathic in 38 (52.8%), steroid use in 23 (31.9%), collum fracture in 11 (15.3%) hips. We used Secure-Fit (Howmedica Osteonics, Mahwah, NJ, USA) prosthesis in 25 (34.7%), Protek-Sulzer (Protek AG, Bern, Sweden) prosthesis in 40 (55.6%) and Zimmer (Zimmer Ltd, Swindon, England) type of prosthesis in 7(9.7%) hips. Cementless stem fixation was used in 44 (61.1%) hips, cemented stem fixation was used in 28 (38.9%) hips. All acetabular cups were cementless. We used pres fit actabular cups with screws in 40 (55.6%) (Howmedıca Osteonıcs, Protek- S u l z e r, Zımmer), and expansion cups in 32 (44.4%) hips (Spotorno CLS, Protek AG, Bern, Üsvıçre). Poliethylene inserts were used in 47 (65.3%) hips and metal inserts were used in 25 (%34.7). All femoral heads had 28mm diameter. The mean operation time was 90 minutes (range 70-110min) and a mean of 3 units of erythrocite suspension was transfused to patients. All drains were removed at 24-48 hours followed by full weightbearing mobilization of the patients using a walker. Antibiotic prophylaxis using first generation cephalosporins was started 30 minutes bofore the operation and was continued till postoperative 3rd day. Antithrombotic prophylaxis was done using low molecular weight heparins till postoperative 3rd week. The stitches were removed at third week and the patients were encouraged to walk without walker at postoperative 4th week.

The mean duration of follow-up was 4.1 years (range 2-7 years).

Clinical evaluation

D'Aubigne-Postel's functional hip score was used for postoperative evaluation.[5] All patients were called to clinical and radiological follow-up at postoperative 3rd, 6th,12th months and yearly thereafter. Hip pain, hip range of motion and differences during walking were recorded both preoperatively and during postoperative follow-up. Points equal to or over 12 were regarded as good development or excellent, points between 7-11 as good, points between 3-7 as moderate and points less than 3 were graded as bad result.

We also tried to determine the role of etiology and the choice of cemented or uncemented systems on peroperative and postoperative complications.

Radiographical evaluation

Anteroposterior and lateral X-rays belonging to the preoperative and postoperative perids were used for radiographical evaluation. The femoral side was evaluated according to the classification of Gruen et

al,[6] and the acetabular side was evaluated according to DeLee and Charnley's classification[7].. The femoral side was evaluated regarding varus- valgus angulation, subsidence, bone resorbtion, radiolucent lines, stress shielding, polyethylene wear. Acetabular components were evaluated regarding the inclination angle and bone cyst formation under the component. Heterotopic bone formations were also recorded.

Statistical analysis

The analyses were done using SPSS statistical software. Student's T-test, Mann-Whitney U-test, Kruskal-Wallis test and Chi-square tests were used. P<0.05 was accepted as significant.

Results

Clinical findings

Bony fissufre developed in proximal femora of 5 patients during insertion of uncemented stems. These were fixed using cable and cerclage systems and none caused a problem regarding implant fixation. Five patients (4 cementless, one cemented) had a non displaced fracture of trochanter major. Only one was fixed the others were conservatively treated. These did not affect implant stability. No patients had an implant dislocation or wound infection in both early and late follow-up. Early and late postoperative complications are listed in Table 1.

The mean postoperative D'Aubıgne-Postel scores were 11.8 (range 7-16). The mean score was 12.3 (8-16) in cementless systems (44) and 11.2 (7-16) in hybrid systems (28). There was no significant difference regarding these scores (p>0.05). When the relationship between acetabular cup and the hip scores were investigated, the pressfit cups with screws (40) yielded a mean score of 12.8 (8-46) and the expansion cups (32) yielded a mean score of 10.7 (7-16). The difference was significant (p<0.001).

The relationship between etiology and the hip scores were also investigated. The mean scores for post fracture, idiopathic and post steroid use hip replacements were 12.1 (10-16), 12.1 (8-16), 11.4 (7-16) respectively. There was no influence of etiology on hip scores (p>0.05). We also found out that the previous fracture fixatiion did not have a negative effect on stem fixation and the clinical result.

No significant differences were found regarding the hip scores in patients with poliethylene on metal (45) and metal on metal (25) bearing surfaces (p>0.05). The mean scores in patients with complication (femoral fissure, trochanteris fracture, heterotopic ossification, polyethylene wear) and without complication were 10.7 (7-16) and 12.7 (9-16) respectively. The difference was significant. (p<0.001).

There was again no difference between the hip scores of the patients with (66) or without (6) stress shielding in the proximal femur. (p>0.05). Varus or valgus angulation of the stem did not affect the results. (p>0.05).

Radiographical findings

Proximal femoral fissures and fractures of the trochanters all developed during cementless femoral stem insertion. (Figure1). All fissures were fixed with cerclage wires and cables. Trochanteric fracture was fixed in only one case as it was unstable. The other 4 were stable and thus, were conservatively treated. The proximal femoral fractures did not affect implant stability.

There was polyethylene wear in 8 hips at a mean of 6.5 years (range 5-7 years) (Figure 2). There was a focal osteolysis in Gruen Zone 1 in 2 of these hips.

There was heterotopic ossification in 6 hips (5 Brooker type1, 1 Brooker Type 2).

We had used cemetless femoral stems with proximal porous coating in all cases with stress shielding. In 4 of the cups with excessive inclination we had used an expansion cup. In 2 we had used pres-fit cups with screws. Nine of the stem alignment problems were in cementless and 3 were in cemented stems. Acetabular cup migration was was seen in only one case with an expansion cup. (Figure 3) . None of the stems showed any subsidence. There

Table 1. Peroperative and postoperative complications.

Complication	Number of Hips
Proximal femoral fissure	5
Trochanteric fracture	5
Polyethylene wear	8
Heterotopic ossification	6
Stress shielding	6
Focal osteolysis	2
Excessive inclination of the acetabular component	6
Varus-valgus angulation of the femoral stem	12
Migration of the acetabular cup	1

Figure 1. A case of bilateral osteonecrosis. Bilateral pres fit acetabular cups were used with cementless stems. A proximal femoral fissure was fixed with cerclage wires Figure legend.

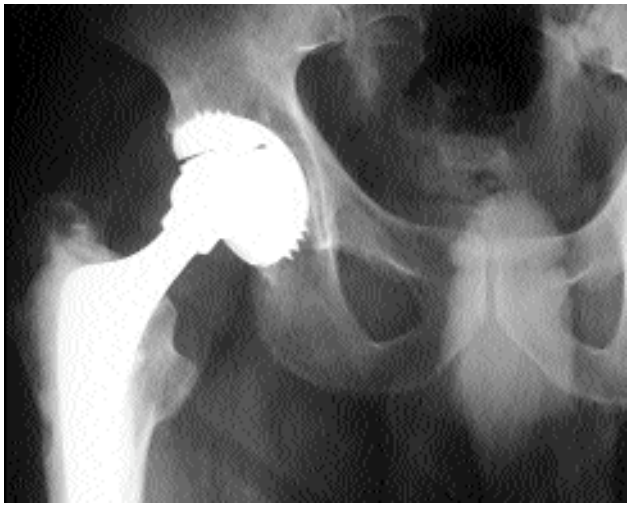

Figure 2. Polyethylene wear in an expansion cup.

was no cortical erosion or cystic lesion in any of the hips.

Discussion

Although there are various surgical treatment alternatives regarding femoral head osteonecrosis, THA is the optimal method of threatment regarding pain relief and functional outcome in advanced stage disease. There are studies advicating that total hip arthroplasty yields beter results than hemiarthroplasty or resurfacing arthroplasty in terms of pain relief.[8-10] We did not perform hemiarthroplasty or resurfacing to any one of the patients. . In 8 patients with cementless stems there was groin pain. Four of them had an iatrogenic fissure in the proximal femur. And the other four had proximal stres shielding. Groin pain possibly originated from too tight insertion of the stem or the surgical technique.

Both cemented and uncemented THA's yielded unsatisfactory early results in osteonecrotic hips in the past. Implant geommetry, cementnig techniques, periprostetic osteolysis, polyethylene wear, bad quality of osteonecrotic bone were all accused factors.[6,9,11 - 13] Our results in both cemented and uncemented hips were satisfactory. At a mean of 4.1 years, the mean D'Aubıgne-Postel hip scores were 11.8 (range 7-16) and there were no differences between cemented and uncemented systems. ($p>0.05$).

We think that the improved cementing techniques and the improved implant designs positively affected our results.

There are authors reporting very good clinical results with the use of expansion cups.[14,15]

We used pres fit cups in 40 and expansion cups in 32 patients. The mean hip score in press fit group

Figure 3. Micromotion and resultant heterotopic ossification around and expansion cup.

was (12.78) excellent but was (10.72) good in expansion cup group. The difference was statistically significant. ($p<0.001$). We think that the cause of this was the micromotion of these cups. Chiu et al.[16] compared the outcomes of THR's done for osteonecrosis and osteoarthritis and reported that the implant survival was less in the osteonecrotic group especially in cases secondary to alcohol or steroid use. The idiopathic cases or the cases secondary to trauma did not yield iinferior results to the cases with osteoarthritis. In our study the hip scores of the patients with post fracture, idiopathic and post steroid use osteonecrosis were 12.1, 12.1 and 11.4 respectively and the etiology did not influence the scores. ($p>0.05$). Prior fracture fixation also did not adversely influence the stem fixation and the clinical result. In previous studies, the short survival in post steroid use osteonecrosis was attributed to tendency to infection and low bone quality but we did not find any influence of the etiology of osteonecroosis on clinical outcome at a mean of 4.1 years follow-up.

One of the biggest problems following THR is bearing surface osteolysis. Metal on polyethylene and metal on metal surfaces are the most frequently used combinations. Although there are many reasons for osteolysis the most important causative factor is the debris material originating from the polyethylene insert.[17, 18] We have been using the UHMWPE (ultra hıgh molecular weıght polyethylene) to decrease polyethylene wear. Jessen et al applied metal on metal bearing surfaces to 100 consecutive patients and did not find any evidence of loosening ofter 10 years follow-up.[19] In our study, of 47 hips with poliethylene on metal articulation, 32 had UHMWPE inserts. We used metal on metal articulation in 25 hips. We did not find any clinical difference between these two bearing surfaces but found signs of poliethylene wear in 8 patienyts with classical metal on poliethylene articulation at 5-7 years follow-up. Two of these had focal osteolysis in Gruen zone 1. The mean scores in patients with complication (femoral fissure, trochanteris fracture , heterotopic ossification, polyethylene wear) and without complication were 10.7 (7-16) and 12.7 (9-16) respectively. The difference was significant. ($p<0.001$).

Although there are studies showing that proximal femoral stres shielding decreases bone stock in the long term and adversely affects the clinical outcome,[20] we did not find any effect of proximal stres shielding or varus valgus malalignment on clinical outcome.

Femoral head osteonecrosis is a disease that destructs the entire hip joint. This typically is the disease of the young people. The higher activity level of these individuals exclude the THR as a treatment alternative in early stage osteonectrosis. With the advent of new technology, THR is the best treatment alternative in advanced stage osteonecrosis especially when other treatment methods fail. Today, this operation can be performed on young and active patients just as in older osteoarthritic patients. The insertion of cementless stems require a high level of attention with a meticulous technique. Unnecessary pushing movements should be prevented. Although the etiology does not have any influence on implant survival, we advocate the use of pres-fit acetabular cups with screws. As there are no significant differences between the bearing surfaces, the choice of the bearing surface should better be the decision of the surgeon.

References

1. Chang CC, Greenspan A, Gershwin ME. Osteonecrosis: current perspectives on pathogenesis and treatment. Semin Arthritis Rheum 1993;23:47-69.
2. Dinulescu I. Aseptic necrosis of femoral head and its treatment. In: Casteleyn PP, Duparc J, editors. EFORT. European Instructional Course Lectures. Vol. 2, London: British Editorial Society of Bone and Joint Surgery; 1995. p. 9-18.
3. Babis GC, Soucacos PN. Effectiveness of total hip arthroplasty in the management of hip osteonecrosis. Orthop Clin North Am 2004;35:359-64.
4. Ficat RP. Idiopathic bone necrosis of the femoral head. Early diagnosis and treatment. J Bone Joint Surg [Br] 1985;67:3-9.
5. Shetty AA, Slack R, Tindall A, James KD, Rand C. Results of a hydroxyapatite-coated (Furlong) total hip replacement: a 13- to 15-year follow-up. J Bone Joint Surg [Br] 2005; 87:1050-4.
6. Gruen TA, McNeice GM, Amstutz HC. "Modes of failure" of cemented stem-type femoral components: a radiographic analysis of loosening. Clin Orthop Relat Res 1979;(141):17-27.
7. DeLee JG, Charnley J. Radiological demarcation of cemented sockets in total hip replacement. Clin Orthop Relat Res 1976;(121):20-32.
8. Ito H, Matsuno T, Kaneda K. Bipolar hemiarthroplasty for osteonecrosis of the femoral head. A 7- to 18-year follow-up. Clin Orthop Relat Res 2000;(374):201-11.
9. Cabanela ME. Bipolar versus total hip arthroplasty for avascular necrosis of the femoral head. A comparison. Clin Orthop Relat Res 1990;(261):59-62.
10. Steinberg ME, Corces A, Fallon M. Acetabular involvement in osteonecrosis of the femoral head. J Bone Joint Surg [Am] 1999;81:60-5.

11. Cornell CN, Salvati EA, Pellicci PM. Long-term follow-up of total hip replacement in patients with osteonecrosis. Orthop Clin North Am 1985;16:757-69.
12. Kim YH, Oh JH, Oh SH. Cementless total hip arthroplasty in patients with osteonecrosis of the femoral head. Clin Orthop Relat Res 1995;(320):73-84.
13. Salvati EA, Cornell CN. Long-term follow-up of total hip replacement in patients with avascular necrosis. Instr Course Lect 1988;37:67-73.
14. Modrego FJ, Molina J. Self-expanding cup CLS. 10 years results. Rev Fac Cien Med Univ Nac Cordoba 2004;61:7-12. [Abstract]
15. Cech O, Dzupa V, Svatos F. The uncemented cup of the CLS Spotorno joint endoprosthesis - 5 years' results. Acta Chir Orthop Traumatol Cech 2001;68:10-7. [Abstract]
16. Chiu KH, Shen WY, Ko CK, Chan KM. Osteonecrosis of the femoral head treated with cementless total hip arthroplasty. A comparison with other diagnoses. J Arthroplasty 1997; 12:683-8.
17. Charnley J, Halley DK. Rate of wear in total hip replacement. Clin Orthop Relat Res 1975;(112):170-9.
18. Griffith MJ, Seidenstein MK, Williams D, Charnley J. Socket wear in Charnley low friction arthroplasty of the hip. Clin Orthop Relat Res 1978;(137):37-47.
19. Jessen N, Nickel A, Schikora K, Buttner-Janz K. Metal/metal - a new (old) hip bearing system in clinical evaluation. Prospective 7-year follow-up study. Orthopade 2004;33:594-602. [Abstract]
20. Roberts J, Meek RM, Roberts P, Grigoris P. Metal-on-metal hip resurfacing. Scott Med J 2005;50:10-2.