Are the Demographic Characteristics of Patients with Primary Hip Osteoarthritis Effective on Functional Improvements After Total Hip Replacement?

Primer Kalça Osteoartritli Hastaların Demografik Özellikleri: Total Kalça Replasmanı Sonrasında Fonksiyonel İyileşme Üzerinde Etkili midir?

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ABSTRACT Objective: The aim of this study was to investigate the influence of demographic features such as age, gender, body mass index (BMI), educational and employment status, place of residence and comorbidities of patients with primary hip osteoarthritis and radiographic severity on the functional improvements of the patients after total hip arthroplasty. **Material and Methods:** Fifty patients (41 females/9 males) with primary hip osteoarthritis were included. The radiographs were graded according to Kellgren-Lawrence system (KL). The operations were performed by the same orthopedist with the same surgical technique. Functional level was determined with hip disability and Osteoarthritis Outcome Score-Physical function Short-form (HOOS-PS) before and six months after the operation. **Results:** The functional levels of all the patients improved at the sixth month. Age, BMI, presence of a comorbidity, working in a job or not, place of residence (rural or city) and obesity did not influence the functional improvement rates. The males, the patients with KL grade 4 osteoarthritis and the primary school graduates showed significantly much more improvements. **Conclusion:** The clinical relevance of this study is that age, gender, BMI, co-morbidities, education degree, place of residence and being an employee or not does not need to be considered by physicians when recommending total hip replacement surgery after failure of conservative treatment in patients with primary hip osteoarthritis. Male patients, patients with radiographically end stage osteoarthritis and educated patients may improve much more in comparison with their counterparts.

Keywords: Arthroplasty, replacement, hip; osteoarthritis, hip; demography; rehabilitation

ÖZET Amaç: Primer koksartroz tanısı ile total kalça artroplastisi geçiren hastalarda; yaş, cinsiyet, beden kitle indeksi (BKİ), eğitim ve çalışma durumu, yerleşim alanı, komorbid hastalıklar ve osteoartritin radyografik düzeyinin fonksiyonel düzelme üzerindeki etkisini araştırmaktır. **Gereç ve Yöntemler:** Primer kalça osteoartriti tanısı olan 50 hasta (41 kadın/9 erkek) dahil edildi. Radyografiler Kellgren-Lawrence (KL) sınıflaması ile değerlendirildi. Operasyonlar aynı ortopedist tarafından aynı cerrahi teknik ile gerçekleştirildi. Fonksiyonel seviye Kalça Dizabilite ve Osteoartrit Sonuç Skoru-Fiziksel Fonksiyon Kısa formu (HOOS-PS) ile operasyon öncesi ve 6 ay sonrasında değerlendirilmiştir. **Bulgular:** Operasyon sonrası 6. ayda tüm hastalarda fonksiyonel olarak iyileşme kaydedilmiştir. İncelenen faktörlerden yaş, BKİ, çalışma durumu ve yerleşim bölgesinin (kırsal-kentsel) fonksiyonel iyileşme ile ilşkisi olmadığı görülmüştür. Bunu yanında erkek hastalarda, KL'ye göre Evre 4 osteoartriti olanlarda ve ilkokul mezunlarında fonksiyonel iyileşme oranının daha yüksek olduğu saptandı. **Sonuç:** Bu çalışmanın klinik önemi, konservatif tedavilerden fayda görmeyen kalça osteoartriti olan hastalara total kalça replasmanı önerilir iken; yaş, BKİ, çalışma durumu ve yerleşim bölgesinin cerrahi sonrasında fonksiyonel iyileşmeyi etkilemeceği; ancak erkek hastaların, radyolojik olarak son evre osteoartrit olan hastaların ve ilkokul mezunlarının daha fazla fonksiyonel düzelme göstereceğinin farkında olmaktır.

Anahtar Kelimeler: Artroplasti, replasman, kalça; osteoartrit, kalça; demografi; rehabilitasyon

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Total hip replacement (THR) is a treatment choice when conservative treatments have failed to control pain and/or if there are serious functional limitations that affect the daily living activities of the patient. However, there are not accurate rules for the timing of this operation. Some patients have stated greater dissatisfaction with their postoperative status. Therefore patient selection for surgery is important.[1]

A lower level of postoperative functional gain has been reported in the elderly.[1-3] There are conflicting results on the effect of gender and body mass index (BMI) on postoperative functions and pain in literature.[2-4] In a recently published review it was concluded that selection of appropriate candidates for total joint replacement is critical but there were no clearly defined criteria and current literature cannot be employed to refine patient selection.[5] Therefore, aim of this study is to investigate the association between postoperative functional status and clinical and sociodemographic characteristics (age, gender, body mass index, radiographic severity, educational status, comorbidities, working status and place of residence) of patients with hip osteoarthritis.

MATERIALS AND METHODS

This prospective study was carried out by the Orthopedics and Physical Medicine and Rehabilitation departments of a central tertiary hospital between January and October 2014. The patients were chosen among the ones that were decided on to undergo total hip replacement surgery. Fifty patients with unilateral THR based on primary hip osteoarthritis included in the study. Patients operated on for reasons other than primary hip osteoarthritis (e.g. patients with developmental hip dysplasia or inflammatory rheumatological diseases), those who had previously undergone lower limb surgery or revision surgery, patients with any malignancy and patients with symptomatic hip osteoarthritis on the contralateral side were not included in the study. The study was approved by the Local Scientific Research Ethics Committee. Informed consent forms were obtained from all the patients.

All patients were questioned in respect of age, gender, weight and height, working status, educational status, place of residence (rural area or city center) and co-morbidities and responses were recorded. Body mass index was calculated for each patient and the preoperative radiographs of the study participants were evaluated by the same physician. The weight-bearing anteroposterior pelvis radiographs of the patients were graded according to the Kellgren-Lawrence system.[6] In this system the radiographs are graded as follows: Grade 0: no radiographic features of osteoarthritis are present. Grade 1: suspected joint space narrowing and possible osteophytic lipping. Grade 2: definite osteophytes and possible joint space narrowing. Grade 3: multiple osteophytes, definite joint space narrowing, sclerosis, possible bony deformity. Grade 4: large osteophytes, marked joint space narrowing, severe sclerosis and definitely bony deformity. The functional status of the patients was evaluated pre-operatively and at the postoperative 6th month by the same physician. Functional status was determined with the Hip disability and Osteoarthritis Outcome Score-Physical function Short-form (HOOS-PS). HOOS-PS was derived from the Hip disability and Osteoarthritis Outcome Score (HOOS) by shortening it. HOOS-PS assesses the degree of difficulty that the patient experiences when descending stairs, getting in and out of the bath tub, sitting, running and twisting/pivoting on the loaded leg. HOOS-PS has been shown to be a valid and reliable scale for measuring functional loss in patients with a hip disability.[7,8] The total score ranges from 0 to 100 with a lower score indicating less functional difficulty. The reliability and validity of the Turkish HOOS-PS has been proven.[9]

All the operations were performed by the same senior surgeon with the same surgical technique via anterolateral (Modified Watson Jones) approach. The Exceed ABT Acetabular system and optimal proximal press-fit (PPF) (Biomet Inc., Warsaw, IN, USA) was implanted without cementation in all patients. Pre and postoperative radiographs of patients with grade 3 and grade 4 hip osteoarthritis are shown in Figures 1 and 2.

FIGURE 1: (a) Anteroposterior preoperative radiograph of the 62 years-old female patient with Kellgren-Lawrence grading scale type 3 hip osteoarthritis and **(b)** postoperative anteroposterior radiograph after total hip arthroplasty.

FIGURE 2: (a) Anteroposterior preoperative radiograph of the 68 years-old female patient with Kellgren-Lawrence grading scale type 4 hip osteoarthritis and **(b)** postoperative anteroposterior radiograph after total hip arthroplasty.

Functional scores before and 6 months after surgery were compared. The relationship between demographic and clinical and functional recovery were examined.

STATISTICAL ANALYSIS

Statistical analyses were made with SPSS 18.0 (Statistical Package for Social Sciences for Windows) softare. The Shapiro-Wilk test was used to test normality. General descriptive statistics were expressed as median (minimum- maximum) and mean ± standard deviation. The Wilcoxon test was used to analyze the changes in HOOS-PS scores. The difference between subgroups of improvement in HOOS-PS was studied with analysis of variance in repeated measuresrepeated measures. More than 2 subgroups Post hoc tests were used. Pearson analysis was used to evaluate the correlation between the variables. A value of $p<0.05$ was considered statistically significant.

RESULTS

This study included 50 patients (F: 41, M: 9) with the mean age of 64.7±8. The demographic and clinical characteristics of the study group are presented in Table 1.

Overall, the study group benefitted from the arthroplasty operation. Functionality was significantly improved at the 6th month. Comparison of pre and post-operative HOOS-PS scores and the p value are presented in Table 2. Complications of deep vein thrombosis were seen in one patient and wound site infection in two, all of whom were treated successfully and not removed from the study.

Each of the patient subgroup according to demographic and clnical characteries indicated significantly functional improvement (Table 3). The improvement difference between the subgroups

TABLE 1: Demographic and clinical characteristics of the study group.

Age (mean±SD)	64.7±8
Gender (female/male)	41/9
Body mass index (mean±SD)	27.6±3.4
Radiologic score (grade3/grade4)	32/18 (64%/36%)
Living place (rural area/urban) (n,%)	33/17 (66%/34%)
Working status (yes/no) (n,%)	11/39 (22%/78%)
Co morbidities (n,%)	
None	7 (14%)
Cardiovascular diseases	21 (42%)
Diabetes mellitus	15 (30%)
Other	7 (14%)
Educational status	
Illiterate	12 (24%)
Primary school	27 (54%)
Collage	8 (16%)
University	3 (6%)

SD: Standard deviation.

TABLE 2: Functional status changes at the 6th month of the total hip replacement operations.

	Pre-operative	Post-operative	p
HOOS-PS (mean, SD)	46.4±10.7	21.9±7.1	<0.0001

HOOS-PS: Hip disability and Osteoarthritis Outcome Score-Physical function Short-form; SD: Standard Deviation.

was assessed in Table 4. There was no correlation between HOOS-PS changes and patient age or BMI (p= 0.724 for age and 0.247 for BMI). The presence of a comorbidity, being an employee or not, place of residence (rural or city) and obesity also had no effect on the functional status changes (p>0.05, Table 4). Gender was determined to affect functional improvement with a greater decrease in the HOOS-PS scores of males. In other words, the functional improvement of males was statistically significantly greater than that of females (Figure 3). All the patients had a radiographic score of grade 3 or 4 preoperatively. The group with a radiographic score of grade 4 had greater functional gains compared to the patients with grade 3 radiographic osteoarthritis. In addition, educational status was found to be an influential factor. The functional status of primary school graduates improved statistically significantly more than that of patients who were illiterate (Table 4).

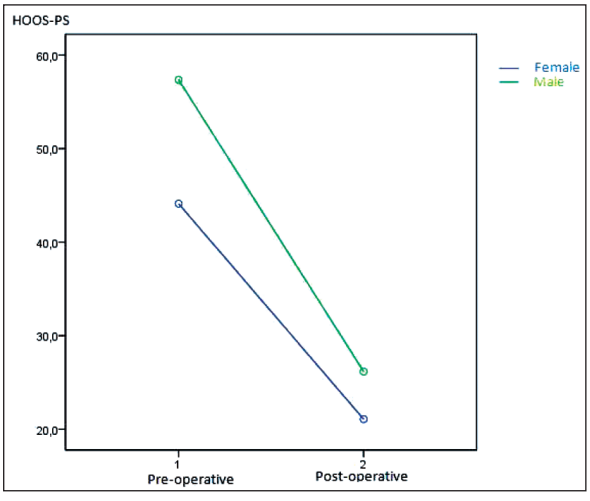

FIGURE 3: Pre and post-operative HOOS-PC changes in female and male patients.

TABLE 3: Functional improvements in patient groups according to demographic data.

	Pre-operative HOOS-PS (mean, SD)	Post-operative HOOS-PS (mean, SD)	Mean difference	95%CI		p
Gender						
Males	57.3±10.1	26.2±5.4	-31.1±2.1	-35.8	-26.5	<0.001
Females	44.1±1.5	21.1±1.1	-23.1±1.1	-25.4	-20.6	<0.001
Body weight						
BMI <30	46.3±10.6	22.1±6.3	-24.2±1.2	-26.8	-21.7	<0.001
BMI ≥30	47.2±12.1	21.6±6.1	-25.5±2.5	-31.5	-19.5	<0.001
Radiologic score						
Grade 3	42.9±9.9	21.4±7.9	-21.4±1.2	-23.95	-19.02	<0.001
Grade 4	52.9±9.1	23±5.2	-29.8±1.6	-33.32	-26.42	<0.001
Living place						
Rural	47.6±9.1	23.4±8.8	-24.5±1.4	-27.44	-21.67	<0.001
Urban	44.3±13.3	19.2±5.6	-24.5±1.8	-28,4	-20,6	<0.001
Working status						
Working	51.8±8.3	25.7±4.9	-26.9±2.6	-32.8	-21.1	<0.001
Non-working	44.9±10.9	21±7.3	-23.7±1.2	-26.2	-21.3	<0.001
Education Illiterate(1)	39.2±11.2	20.7±10.4	-18.4±1.8	-22.5	-14.3	<0.001
Primary school (2)	49.4±9.4	21.6±4.9	-27.8±1.4	-30.7	-24.9	<0.001
Collage (3)	45.3±11.1	22.5±6.7	-22.8±2.8	-29.6	-16,1	<0.001
University (4)	52.6±5.6	29.3±8.1	-23.3±1.3	-29.2	-17.4	0.003
Co-morbidities None (1)	47.2±8.1	27.9±4.8	-19.3±1.9	-23.9	-14.6	<0.001
Cardiovascular disease (2)	47.7±12.2	20.6±7.1	-27.1±1.8	-31.1	-23.2	<0.001
Diabetes mellitus (3)	45.5±10.8	20.2±7.2	-25.2±1.8	-29.2	-21.3	<0.001
Other (4)	44.3±9.6	24±6.5	-20.3±2.7	-26.3	-13.7	<0.001

HOOS-PS: Hip disability and Osteoarthritis Outcome Score-Physical function Short-form; BMI: body mass index; SD: Standard Deviation.

TABLE 4: Effect of the patients' clinical characteristics on the functional improvements.

	Pre –post operative HOOS-PC Mean difference±SD	p
Gender		
Males	-31.18±2,01	
Females	-23.04±1.18	0.002
Body weight		
BMI <30	-24.2±1.2	
BMI ≥30	-25.5±2.5	0.952
Radiologic score		
Grade 3	-21.4±1.2	
Grade 4	-29.8±1.6	0,014
Living place		
Rural	-24.5±1.4	
Urban	-24.5±1.8	0.126
Working status		
Working	-26.9±2.6	
Non-working	-23.7±1.2	0.441
Education		0.004
Illiterate(1)	-18.4±1.8	
Primary school(2)	-27.8±1.4	
Collage(3)	-22.8±2.8	
University(4)	-23.3±1.3	
Co-morbidities		0.056**
None (1)	-19.3±1.9	
Cardiovascular disease (2)	-27.1±1.8	
Diabetes mellitus (3)	-25.2±1.8	
Other (4)	-20.3±2.7	

HOOS-PS: Hip disability and Osteoarthritis Outcome Score-Physical function Short-form; BMI: body mass index, SD: Standard Deviation

*p value between Illiterate and primary scholl group is 0.03, p value between other sub-groups are >0.05. Post-hoc test Bonferoni was used.

** no difference was found between co-morbidity subgroups.

DISCUSSION

The results of this study indicated that the post-arthroplasty functional improvements of patients with primary hip osteoarthritis were not affected by age, BMI, place of residence or being a worker or not. However, male patients showed a much greater improvement than females and patients with a preoperative radiological score of grade 4 also improved more than patients with a radiological grade 3 score. In addition, the functional progress of patients with primary school level of education was better than that of those who were illiterate. All the patients in this study group benefit from the arthroplasty operation and were in a better situation functionally in the post-operative 6th month.

In contrast to these findings, in a study by Dowsey et al. 835 THA patients were evaluated 12 months postoperatively and it was reported that older age, higher BMI and a higher number of co-morbidities were associated with worse function at 12 months.[2] In a study by Kennedy et al. less improvement in function was reported with increasing age.[10] In another study, the age of the patient was reported as an effective factor on the patient's post-operative ambulation ability. Ambulation capacity was evaluated with the 'timed up and go test' in the 3rd week, 4th and 7th months and a cut-off value of age 73 years was determined to affect the ambulation ability.[11] In the current study there was no relationship between age and pre and post-operative HOOS-PS changes. The study group was relatively younger than that of previous studies. As only 3 patients were aged 75 years or older, no comparison could be made of patients younger or older than 75 years.

In a study by Kennedy et al. it was reported that males and females had similar improvement rates after THR.[10] In another study, while older age and higher BMI were associated with function at post operative 12th months, there was no difference by gender.[1] Sucedo et al. were evaluated risk factors for readmission after THA, they indicated that there was no relation between postoperative complaints and gender.[12] However, similar to our results, in a systematic review by Santaguida et al. it was reported that females showed less improvement in function than males.[3] A possible explanation of this finding might be that females have higher expectations than males or another possible explanation may be that self-assessment differs between males and females in different ethnic groups.

In the current study, there was also no linear relationship between BMI and improvements in functional status. When patients with BMI≥30 and BMI<30 were compared in respect of HOOS-PS

changes, there was no difference between the groups. In the 2 previously mentioned studies, the huge difference between sample size and the number of obese patients (835/50 and 371/9, respectively) may explain these different results in addition to the use of different measurement scales. In those studies patients were evaluated with the Harris Hip Score, which is a more comprehensive scale than the HOOS-PS. Pain, limping, walking distance, need for walking aids, ability to don shoes and socks, catch public transport, range of joint motion and joint deformities are assessed in this questionnaire. However, results similar to those of the current study have also been reported in literature. In a study by Judge et al. 282 patients undergoing THR were evaluated after 12 months and there was no difference in response rates between obese and non-obese groups.[13]

Approximately %85 of the current study patients had at least one comorbidity. Cardiovascular diseases and diabetes mellitus were the most frequent. Although the presence of a comorbidity or the type of comorbidity were not associated with the functional recovery level, it has been reported in other studies that patients with fewer comorbidities have shown better functional improvement.[2,14] In the current study, the patients were not grouped according to number of comorbidities, which may have accounted for this different result.

In a study with 2 cohorts from Switzerland and United States, it was argued that Switzerland patients had higher levels of education and lower Western Ontario McMaster Universities (WOMAC) pain and function scores.[15] The current study results have also demonstrated that the educational level of the patients affects the level of benefit gained from the operation. A difference was determined between the illiterate group and those who had attended primary school. Patients who had gone to school gained much more functional improvement compared to those who had never attended school. The number of patients who had attended secondary school, college or university was not sufficient to make any further comparisons. This is a limitation of the study and may explain why the only difference was between illiterate patients and those who had attended school for 5 years.

Living in a rural region or in a city centre had no effect on the degree of functional gain. Only one study could be found in literature that examined rural-urban differences in outcomes following total joint replacement. That study was carried out by Dowsey et al and they also reported no difference between rural and urban patients with regard to postoperative function.[16]

In spite of the fact that clinical and radiologic severity may not be compatible in osteoarthritic patients, in the current study group, the patients with a grade 4 radiographic score had more functional restrictions and their benefit from the operation was greater than that of patients with grade 3 osteoarthtitis (Table 4) . Similar to these results, in a multi-center study from the Netherlands, it was reported that patients with severe radiographic osteoarthritis had a better prognosis for physical function but the groups compared in that study had mild (Grade 0-2 according to Kellgren-Lawrence classification system) or severe (Grade 3,4) hip osteoarthtitis and it was emphasised that taking the preoperative radiological severity into account might help prevent postoperative patient dissatisfaction.[17] There were no patients with grade 0,1 or 2 osteoarthtitis in the current study group. According to our results radiograpically last stage patients may show the best functional improvement.

In conclusion, because the functional levels of all the patients in the current study significantly improved after total hip arthroplasty patients with primary hip osteoarthritis can be recommended for total hip replacement surgery regardless of age, gender, BMI, co-morbidities, educational level, radiologic severity and place of residence when conservative treatments fail. However, a greater level of improvement can be expected from males, patients with radiographically end stage osteoartritis and patients with primary school education compared to females, radiographically moderate-severe osteoartritis and illiterate patients respectively.

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