

High independence level in functional activities reduces hospital stay after total hip arthroplasty regardless of pain intensity

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ABSTRACT

Objective: The purpose of this study is to investigate the relationship between independence level in functional activities and pain, and length of hospital stay in the early postoperative period in patients with total hip arthroplasty (THA).

Methods: The study was performed over 26 end stage hip arthritis patients who were hospitalized in the Department of Orthopedics and Traumatology, Hacettepe University Hospital, Ankara, Turkey, between January 2000 and July 2003 for THA and operated with the same surgical technique by the same surgeon. All patients were mobilized in the first postoperative day and a standard rehabilitation protocol was applied to all patients. The independence level in functional activities of the cases was assessed with Iowa Level of Assistance Scale (ILAS). Iowa Ambulation Speed Scale (IASS) was used to evaluate the speed of ambulation in the early postoperative period. Pain was assessed with visual analogue scale (VAS).

Results: There was no statistically significant relation between pain intensity and independence level in functional activities on the second and sixth postoperative days ($p>0,05$), but independence level scores in functional activities on the second and sixth days were correlated with hospital stay length ($p<0.05$).

Conclusion: The results of this study indicate that in patients with THA, pain does not affect the independence level in functional activities in the early postoperative period. In the same period as the independence level improves, the hospital stay length decreases. This is an important factor that may reduce both the hospital costs and the possible complications due to prolonged hospital stay.

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Total hip arthroplasty (THA) is a very successful operation to relieve pain and reduce disability in patients with end stage arthritis of the hip.¹ Physical therapy is one of the most important components of the acute care of patients after THA and patients with THA represent a large percentage of patients treated in an acute care setting by physiotherapists.^{2,3} The goal of any rehabilitation program applied by physiotherapists following THA

is not only to maximize the patients' functional status with respect to mobility and activities of daily living (ADL) but also to minimize postoperative complications.⁴ Because of financial reasons, decreasing the hospital stay length becomes one of the rehabilitation goals in patients with THA.⁵ Improving the functional outcomes of patients after THA, the use of physical therapy may decrease the total cost of care for the acute care phase for these

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patients by accelerating the time to discharge.^{3,6,7} Early mobilization is the gold standard for achieving functional mobility. Even elderly patients with co-morbid conditions can tolerate early intensive rehabilitation with faster attainment of short term functional milestones (namely standing from bed, walking and stair climbing activities) and fewer days in hospital and lower costs as a result of this approach.⁸ Physical therapy intervention during the immediate postoperative period after THA directly relates to a less than expected total costs of care and to an increased probability of earlier discharge to home.³ Discharge to home depends primarily on restoring sufficient functional mobility.⁹ Adler et al¹⁰ reported that independent ambulation with the least restrictive assistive device, independence in transfers and activities of daily living are discharge criteria's after THA. Nineteen expert centers specialized in treating patients with total joint replacements (TJR), accept the functional criteria including getting out of bed, standing up from the bed, ambulating 15 ft (4.57 m), and climbing up and down 3 steps as discharge criteria for patients with THA.² The importance of independency level in these functional activities at discharge is reported in different studies.^{2,11,12} Patients with THA generally need maximal help during walking training with walker or crutches during the transfer activities, in the early postoperative period. These patients' self-care and functional activities are managed with the help of one or more trained personnel or spouses or relatives of the patients. For this reason the improvement of functional level in THA patients as early as possible is important, not only for enabling early discharge from hospital but also for them to live independently after discharge. Pain is one of the factors affecting independence in transfer activities. Patients undergoing TJR may experience severe postoperative pain and inadequate control of postoperative pain has been associated with poor functional recovery.¹³⁻¹⁵ Several investigators have looked at the question of whether improved analgesia in the immediate postoperative period can facilitate early rehabilitation and improved functional recovery.^{1,16} Mahoney et al⁶ demonstrated that patients, who received epidural analgesia, had improved pain control and joint movement during the first 72 hours postoperatively. Although there are several studies investigating the effects of pain on the rehabilitation outcomes in the early period,^{1,13-16} we could not find any study investigating the relationship between pain and independency level in transfer activities in the early postoperative period particularly in patients with THA. For this reason, in this study we have investigated the relationship between independence level in functional activities, pain and length of hospital stay in the early postoperative period in patients with THA.

Methods. Twenty-six hip arthritis patients who were hospitalized for THA were enrolled in the study. This study was carried out at the Department of Orthopedics and Traumatology, Hacettepe University Hospital, Ankara, Turkey, between January 2000 and July 2003. All subjects had a diagnosis of hip osteoarthritis and had unilateral chronic hip pain and disability unresponsive to conservative treatment.

Subjects were excluded if there was a history of hip infection, significant neuromuscular disease, malignancy, previous hip surgery, bilateral hip disease, mental impairment, and poor general health status. Cementless THA was performed to all patients under general anesthesia by posterolateral approach. During the first 3 days postoperatively, all patients took patient controlled analgesia (PCA) for pain control.

Patients were informed on the surgical procedure and postoperative rehabilitation program prior to the operation. A rehabilitation program consisting of breathing exercises, range of motion (ROM) exercises to the non-operated extremity, ankle pump exercises, isometric exercises for hip abductor, gluteal and quadriceps femoris muscles, and passive, active-assistive or active ROM exercises to the operated extremity was applied from the first postoperative day, until discharge. In the first postoperative day, patients were allowed to sit, stand up, and ambulate with partial or full weight bearing. Walker or crutches was used during the ambulation. Patients climbed stairs on the sixth postoperative day. On the postoperative first day, patients were instructed on safe ways of performing daily living activities, self aid materials, and dislocation positions of the prosthesis. Also, an illustrated patient guide including exercises for THA was given to all patients.

On the postoperative second and sixth days the following evaluations were used:

Functional tests. a) Functional level test - the independence level during the 4 functionally related activities-transfer from supine to sitting, transfer from sitting to standing, ambulate 15 ft (4.57 m), and climb up and down 3 steps, which are the indicatives of functional capacity of patients with THA in the early period were assessed with Iowa University Level of Assistance Scale (ILAS).¹² The Iowa scale is a 7 point ordinal scale which ranges from "independent" at the upper end of the scale down through "supervision", "minimal assistance", "moderate assistance", "maximal assistance", failed with maximal assistance", and "not tested" at the lower end. Each activity is graded on an ordinal scale from 0-6 for the level of assistance required. "Independence" indicates that the therapist could leave the room and the patient could safely perform the activity being assessed. "Supervision" indicates that the therapist would not feel comfortable leaving

the patient alone during activity; the therapist however, provides no physical assistance. "Minimal assistance" indicates that the therapist provides one point of contact with the patient, "moderate assistance" indicates that the therapist applies 2 point of contact and "maximal assistance" indicates that the therapist or therapists are applying a total of 3 or more points of contact. An activity that is attempted but is not completed with maximal assistance indicates that the patient has "failed with maximal assistance". A patient who is not tested for reasons of safety by the therapist's judgment is graded as "not tested".^{2,12}

The first 3 activities were assessed in the postoperative days 2 and 6 and climbing up and down 3 steps was assessed on the postoperative day 6. These functional activities are the most common discharge criteria's that are accepted by 19 leading centers which specialize in the treatment of patients with THA.²

b) Ambulation speed test - patients were asked to ambulate 13.4 m (44 ft) as quick as possible in the postoperative day 6. The result of the test was assessed by Iowa Ambulation Speed Scale (IASS)² (Table 1). Approximately 13.4 m (44 ft) was selected for this test because of the extrinsic oxygen (O₂) uptake data with established metabolic equivalent levels available for ambulating this distance.¹⁷ In addition, a close association has been found between speed and functional abilities.¹⁸

Assessment of pain. The pain was assessed with a standard 100 mm visual analogue scale (VAS). Patients were asked to mark the intensity of their pain on the 100 mm scale (0 mm: no pain, 100 mm: worst imaginable pain) during the activity. Although pain intensity was assessed everyday, only second and sixth day scores were used for the statistical analyses. Since it was previously reported that, the total functional score represented by the sum of Iowa Level of Assistance Scale (ILAS)

scores for 5 functionally related activities, appears to be responsive to changes in patients' functional status between 2 and 6 days postoperatively, during the acute phase of rehabilitation following total hip and knee replacements,² we made the functional assessments in these days.

Statistical analyses. The relation between parametric variables was analyzed using Pearson correlation analyses.¹⁹ Statistical Package for Social Sciences 10 for Windows statistical packet program was used for the statistical analyses. Level of significance was set at $p < 0.05$.

Results. Twenty-six THA patients (23 female, 3 male) were assessed in the study. The mean age was 52.46 ± 13.31 years (range 22-70 years). The average body mass index (BMI) was 26.70 ± 4.16 (range 19.44 - 33.98). Average length of hospital stay was 8.80 ± 1.98 days (range 6-13 days). The mean ILAS scores were 2.93 ± 1.04 on postoperative second day and 1.59 ± 0.95 on sixth day. Despite PCA, the mean VAS score for pain was 47.11 ± 26.63 mm (range: 0-84 mm) on the second postoperative day and it decreased to 21.73 ± 26.15 mm (range: 0-83 mm) on the sixth day (Table 2). There were no statistically significant relation between pain and any of functional scores on the second day ($p > 0.05$), but transfer from supine

Table 1 - Iowa Ambulation Speed Scale (IASS) with associated ordinal values.

Score	Distance	Ordinal values
0	Ambulates 13.4 m (44 ft)	≤20 seconds
1	Ambulates 13.4 m (44 ft)	21 - 30 seconds
2	Ambulates 13.4 m (44 ft)	31 - 40 seconds
3	Ambulates 13.4 m (44 ft)	41 - 50 seconds
4	Ambulates 13.4 m (44 ft)	51 - 60 seconds
5	Ambulates 13.4 m (44 ft)	61 - 70 seconds
6	Ambulates 13.4 m (44 ft)	> 70 seconds

Table 2 - Pain and functional activity scores.

Activity scores	Mean ± SD
VAS score (second day)	47.11 ± 26.63
Supine to sit (second day)	3.19 ± 0.93
Sit to stand (second day)	3.07 ± 1.16
Ambulate 15 ft (second day)	2.53 ± 1.63
ILAS second day	2.93 ± 1.04
VAS score (sixth day)	21.73 ± 26.15
Supine to sit (sixth day)	1.96 ± 1.07
Sit to stand (sixth day)	1.65 ± 1.12
Ambulate 15 ft (sixth day)	0.84 ± 0.83
Climb up and down 3 steps	1.92 ± 1.46
ILAS sixth day	1.59 ± 0.95
IASS	4.38 ± 1.52

VAS - visual analogue scale score,
ILAS - Iowa Level of Assistance Scale score,
IASS - Iowa Ambulation Speed Scale score

Table 3 - Relationship between hospital stay length, visual analogue scale (VAS) scores and Iowa Level of Assistance Scale subscores on the second day.

Parameters	Supine to sit*	Sit to stand*	Ambulate 15 ft*
Hospital stay length			
r	0.472	0.354	0.479
p value	0.015	0.076	0.013
Second day VAS score			
r	0.412	0.007	0.204
p value	0.037	0.971	0.318
r - pearson correlation coefficient, *Iowa Level of Assistance Scale subscore on the second day			

Table 4 - Relationship between hospital stay length, visual analogue scale (VAS) scores and Iowa Level of Assistance Scale subscores on the sixth day.

Parameters	Supine to sit*	Sit to stand*	Ambulate 15 ft*	Climb up and down 3 steps*
Hospital stay length				
r	0.390	0.416	0.296	0.463
p value	0.049	0.034	0.142	0.017
Second day VAS score				
r	0.305	0.045	0.286	0.197
p value	0.130	0.825	0.157	0.334
r - pearson correlation coefficient, *Iowa Level of Assistance Scale subscore on the sixth day				

Table 5 - Relationship between hospital stay length, visual analogue scale (VAS) scores, body mass index (BMI) and Iowa Level of Assistance Scale (ILAS) scores on the second and sixth days, and Iowa Ambulation Speed Scale (IASS) score.

Parameters	ILAS second day	ILAS sixth day	IASS
Hospital stay length			
r	0.520	0.476	0.568
p value	0.007	0.014	0.002
Second day VAS score			
r	0.231	0.165	0.070
p value	0.256	0.420	0.735
Sixth day VAS score			
r	0.338	0.238	0.153
p value	0.092	0.242	0.455
BMI			
r	0.180	0.081	0.046
p value	0.379	0.694	0.825
r - pearson correlation coefficient			

to sitting ($r=0.412, p<0.05$) (Table 3). Pain was also not correlated with any of the functional scores obtained on the sixth day ($p>0.05$) (Table 4). Hospital stay length was significantly correlated both with second and sixth days' overall functional independence scores ($r=0.520, p<0.01$; $r=0.426, p<0.05$) (Table 5). Length of hospital stay was also found to be correlated with Iowa University Ambulation Speed Scale score ($r=0.568, p<0.01$) (Table 5). There were no relation between functional scores and BMI ($p>0.05$) (Table 5).

DISCUSSION. The results of our study indicate that higher independence level in functional activities in the early postoperative period reduces the hospital stay length.

The effect of early rehabilitation on the length of hospital stay has been investigated by several authors. Munin et al⁸ showed that early rehabilitation was associated with a reduction in the mean length of hospital stay from 14 days to 11 days. Shields et al¹² evaluated the functional status during early rehabilitation in patients with total hip or knee arthroplasty with Iowa University Level of Independence Scale in a study aimed to describe the development of functional measures entering database. They have reported that this measure appeared to be valid and responsive for patients with TJR and changes in functional status in these patients occur in the second and sixth postoperative days. They have reported 6.4 ± 1.4 days hospital stay for patients with THA receiving standard physical therapy.¹² Duke and Keating¹¹ have assessed the level of independence in functional activities with Iowa Level of Independence Scale and reported that measurements of mobility on day 2 post-surgery are significant and reliable predictors of independence in transfers and ambulation within 2 weeks postsurgical in patients with hip fracture. Forrest et al²⁰ accepted activities such as sitting from supine position, standing from sitting, walking a short distance in the home with crutches or walker, and independence in daily living activities as discharge criteria in patients with TJR. They reported the average hospital stay length was reduced from 6.4 days in 1995 to 5.1 days in 1997 in accordance with this criteria. Ganz et al²¹ evaluated the day of discharge and its relation to the milestones of rehabilitation after THA from the hospital records between years 1990 to 2000. In 1990, patients stayed on average of 9.7 days after surgery and by 2000, patients stayed only 5.3 days. Wang et al⁶ reported that the length of hospital stay varied from 5-39 days in patients with THA. They have evaluated the recovery of function after THA with modified barthel index (MBI). Modified barthel index scores increased rapidly between days 3 and 5 and began to plateau from day 8, and

suggested that a clinical pathway with functional milestones laid out over 8 days would be appropriate criterion for the discharge of the majority of patients with THA. Munin et al²² found that the majority of total joint arthroplasty patients achieve functional independence and can be discharged to home within 8.2 days. The average day of discharge has a tendency to decrease in the last decade. Many factors such as new technologies in surgery and anesthesia and innovative rehabilitation approaches may have contributed this decrease. New technologies in surgery and rehabilitation approaches have resulted in earlier achievement of many functional activities.²¹ In our study, the average hospital stay length was 8.80 ± 1.98 days, and this finding is parallel with the literature. Hospital stay length was correlated with both second and sixth day functional independence scores in our study. Hospital stay length decreased as the functional scores increased. This is important in both reducing costs and the complications due to prolonged hospitalization as shown in previous studies.^{5,8,20}

There are some reports suggesting that insufficiently controlled pain would result in poor functional recovery in patients with TJR.¹⁵ In a study comparing the effects of patient-controlled analgesia (PCA) and subcutaneous morphine, Keita et al²³ reported that, in patients with THA, both during resting and mobilization, the PCA group obtained lower pain scores.²³ Mahoney et al¹⁶ demonstrated that patients with total knee arthroplasty (TKA) who received epidural analgesia had improved pain control and joint movement during the first 72 hours postoperatively. Wang et al²⁴ reported that in patients with TKA, pain control with single injection femoral nerve block enables earlier ambulation. All these studies emphasize the importance of pain control in the early period in the rehabilitation of patients with TJR. However the relationship between pain and independence level in functional activities in patients with THA in the early postoperative days was not investigated in any of these studies.

In our study, pain intensity on the postoperative days 2 and 6 was not correlated with the independence level in functional activities in the same days. This may also be due to our patient population. In the literature, it is reported that regardless of the joint affected, women had a higher prevalence of arthritis, worse symptoms, and greater disability. It was also reported that woman have greater functional impairment than man before THA or TKA, which may be due to, despite an equal willingness to undergo surgery, women are less likely to have had arthroplasty compared to men.²⁵⁻²⁷ Also, it was found that women had more risk of intensified pain compared with men while they waited for surgery.²⁸ Kennedy et al²⁷ found that

women awaiting THA or TKA had a greater disability in terms of self report and physical performance measures. Katz et al²⁹ showed that women had comparable or greater functional improvement following surgery. Among the 26 patients enrolled in this study, only 3 of them were male. This heterogeneity in the distribution of genders in our study and the subjective nature of pain sensation may be the reasons of our findings. More controlled, prospective studies with wider patient populations are necessary to demonstrate the effect of pain on functional activities in this patient group. Although there was no correlation between total independence score and pain intensity on the second day, pain score was correlated with the ILASS at transfer from supine to sitting position. In patients with THA it is reported that early mobilization is the most important factor for achieving functional mobility.⁹ Our results underlines the importance of pain control in the early postoperative period to prevent complications due to prolonged bed rest and immobilization in THA patients by enabling functional mobility and early mobilization.

The relationship between obesity (measured by BMI) and the TJR has been investigated in several studies.³⁰⁻³⁴ Most of these studies suggest higher BMI is associated with an increased risk of hip replacement and revisions of hip and knee joint replacement surgeries due to osteoarthritis. Sticles et al³⁴ reported that BMI is associated with an increased risk of having difficulty descending or ascending stairs at one year in patients with TJR. We could not find any study investigating the relationship between BMI and independency level in functional activities in the early postoperative period particularly in patients with THA. In our study, average BMI was $26,70 \pm 4,16$ kg/m². This value is in the range of 25-29.9 kg/m² which is accepted as overweight, health risks start at this degree of obesity both for men and women.^{31,35} Body mass index could be a factor also affecting the independence level in patients with THA, but we could not find any correlation between BMI and any of functional independence scores both in the second and sixth days.

The primary purpose of early rehabilitation programs in patients with THA is to maximize the patients' functional status in ambulation and ADL. Increasing the level of independence and decreasing the hospital stay length can be achieved by proper rehabilitation programs. Earlier discharge implies reduced costs and reduced risk of complications associated with hospitalization.

It is concluded that higher independence level in functional activities reduces the length of hospital stay after THA, regardless to pain intensity.

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