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Predictors of length of hospital stay after total hip replacement

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ABSTRACT

Purpose. To identify variables affecting length of hospital stay after total hip replacement (THR) while controlling for potential confounders.
Methods. Records of 199 consecutive elective unilateral THRs were reviewed. Clinical and demographic data including age, gender, body mass index, comorbidities, surgical factors (surgical approach, type of prosthesis, use of cement, operating time), anaesthetic factors (type of anaesthesia, ASA physical status), and length of hospital stay were recorded.
Results. 64% of patients left hospital within 12 days, 28% within 3 weeks, and 8% after 3 weeks. The median length of hospital stay was longer in women than men (11.5 vs. 9 days, $p=0.009$), in patients aged >65 years than those younger (13 vs. 9 days, $p<0.0001$), and in those with American Society of Anesthesiologists (ASA) grades 3 and 4 than grades 1 or 2 (14 vs. 9 days, $p<0.0001$). A greater proportion of women than men (45% vs. 27%, $p=0.007$), patients aged >65 years than those younger (61% vs. 37% or 24%, $p<0.0001$), and those with ASA grades 3 and 4 than grades 1 and 2 (68% vs. 25%, $p<0.0001$) stayed 12 days or longer. In the multiple regression analysis, the predictors for prolonged hospital stay (≥12 days) were patient age >65 years ($p<0.003$), female gender ($p<0.05$), and ASA grades 3 and 4 ($p<0.0001$). Of the 72 patients with prolonged stay, 7% had no, 26% had one, 42% had 2, and 25% had all 3 predictors.
Conclusion. Prolonged hospital stay after THR is largely predetermined by case mix. Our study helps to identify individuals who need longer rehabilitation and more care.

Key words: *arthroplasty, replacement, hip; length of stay*

INTRODUCTION

Total hip replacement (THR) is widely used to improve mobility and relieve pain in ageing adults with osteoarthritis.[1] Decreasing length of hospital stay is an indication of increased cost-effectiveness.[2]

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Outcome variables such as complication rates, length of hospital stay, and resource utilisation affect the quality of medical care. Patient characteristics (age, comorbidities, and American Society of Anesthesiologists [ASA] grade) often co-exist and affect length of hospital stay after THR. Therefore, multiple logistic regression analysis should be used to determine the most important predictors.[3] We aimed to identify variables affecting length of stay after THR while controlling for potential confounders.

MATERIALS AND METHODS

Records of 199 consecutive elective unilateral THR performed between January 2000 and September 2010 were retrospectively reviewed. Patients undergoing revision or bilateral arthroplasties, and those initially treated elsewhere were excluded. Clinical and demographic data including age, gender, body mass index (BMI), comorbidities, surgical factors (surgical approach, type of prosthesis, use of cement, operating time), anaesthetic factors (type of anaesthesia, ASA physical status), and length of hospital stay were recorded.

BMI was classified as normal (18.5–24.9 kg/m^2), overweight (25–29.9 kg/m^2), obese (30–34.9 kg/m^2), and morbidly obese (>35 kg/m^2). ASA physical status was categorised into 4 grades to evaluate surgical morbidity. Length of hospital stay was defined as the number of days from admission to discharge.

The distribution of length of hospital stay was skewed; data were therefore analysed using non-parametric methods. Discrete data (gender, surgical approach, and use of cement) in relation to length of hospital stay were analysed using the Mann-Whitney *U* test. The influence of age, BMI, ASA grade, and operating time on length of hospital stay was analysed using the Kruskal Wallis test. The cut-off of 12 days was based on what seemed a normal distribution of length of hospital stay followed by a long tail of prolonged stay. A univariate analysis of predictors of prolonged hospital stay was performed using the Pearson Chi squared test. Multiple logistic regression analyses were used to identify significant factor influencing prolonged hospital stay while

Table 1
Univariate analysis of variables associated with length of hospital stay

Variable	No. of patients (n=199)	Median (IQR) length of stay (days)	p Value	No. (%) of patients with length of stay ≥12 days (n=72)	p Value
Age (years)			<0.0001*		<0.0001‡
≤45	88	9 (7–12)		21 (24)	
46–65	68	9 (8–14)		25 (37)	
>65	43	13 (10–20)		26 (61)	
Gender			0.009†		0.007‡
Male	97	9 (8–13)		26 (27)	
Female	102	11.5 (8–14)		46 (45)	
Body mass index			0.986*		0.8‡
Normal	93	10 (7–14)		36 (39)	
Overweight	69	9 (8–14)		22 (32)	
Obese	20	10 (8–13)		7 (35)	
Morbidly obese	17	9 (7–17.5)		7 (41)	
American Society of Anesthesiologists grade			<0.0001*		<0.0001‡
1	20	9 (7–12.75)		5 (25)	
2	126	9 (8–12.25)		31 (25)	
3 & 4	53	14 (9–22)		36 (68)	
Surgical approach			0.33†		0.49‡
Posterior	118	9.5 (8–14)		45 (38)	
Lateral	81	9 (7–13)		27 (33)	
Cemented			0.24†		0.128‡
Yes	113	11 (8–14)		46 (41)	
No	86	9 (8–13.25)		26 (30)	
Operating time (minutes)			0.154*		0.44‡
<180	97	9 (8–13)		32 (33)	
180–300	81	10 (8–14)		30 (37)	
>300	21	11 (8.5–22.5)		10 (48)	

* Kruskal-Wallis test
† Mann-Whitney *U* test
‡ Chi squared test

Table 2
Logistic regression model for significant variables

Variable	No. (%) of patients with length of hospital stay ≥12 days (n=72)	Odds ratio (95% CI)	p Value
Age 45–65 years	25/68 (37)	2.15 (1–4.6)	0.05
Age >65 years	26/43 (61)	3.78 (1.58–9.04)	0.003
Female gender	46/102 (45)	1.91 (0.98–3.7)	0.05
American Society of Anesthesiologists grades 3 & 4	36/53 (68)	6.22 (2.96–13)	<0.0001

Table 3
Proportion of patients by predictors of length of hospital stay

Predictor	No. (%) of patients with length of stay <12 days (n=127)	No. (%) of patients with length of stay ≥12 days (n=72)
None	33 (26)	5 (7)
Age only	29 (23)	8 (11)
Gender only	26 (21)	3 (4)
American Society of Anesthesiologists (ASA) grade only	5 (4)	8 (11)
Age & gender	22 (17)	20 (28)
Age & ASA grade	4 (3)	5 (7)
Gender & ASA grade	3 (2)	5 (7)
All 3 predictors	5 (4)	18 (25)

controlling for confounders. A p value of <0.05 was considered significant.

RESULTS

The distribution of length of hospital stay was skewed, with a mean of 11.8 (standard deviation, 6; range, 4–45) days and a median of 9 days. 64% of patients left hospital within 12 days, 28% within 3 weeks, and 8% after 3 weeks. The median length of hospital stay was longer in women than men (11.5 vs. 9 days, p=0.009), in patients aged >65 years than those younger (13 vs. 9 days, p<0.0001), and in those with ASA grades 3 and 4 than grades 1 or 2 (14 vs. 9 days, p<0.0001). A greater proportion of women than men (45% vs. 27%, p=0.007), patients aged >65 years than those younger (61% vs. 37% or 24%, p<0.0001), and those with ASA grades 3 and 4 than grades 1 and 2 (68% vs. 25%, p<0.0001) stayed 12 days or longer (Table 1). BMI and surgical factors (operating time, surgical approach, and use of cement) were not associated with the length of hospital stay (Table 1).

In the multiple logistic regression analysis, the predictors for prolonged hospital stay (≥12 days) were patient age >65 years (p<0.003), female gender (p<0.05), and ASA grades 3 and 4 (p<0.0001) [Table 2]. Of the 72 patients with prolonged hospital stay, 7% had no, 26% had one, 42% had 2, and 25% had all 3 predictors (Table 3). Co-existence of old age and female gender was the most significant pair of predictors in patients with prolonged hospital stay. Compared to patients staying <12 days, almost 6 times as many patients staying ≥12 days had all 3 predictors (25% vs. 4%, Table 3).

DISCUSSION

Length of hospital stay is a major determinant in medical costs.[2] Variables associated with prolonged hospital stay include advanced age,[2,4] comorbiditeis[4,5] gender,[2,4] and obesity.[4,6] In a US population cohort, length of hospital stay is associated with BMI, with a J- or U-shaped relationship.[7] Nonetheless, associations with obesity are not always reproduced.[8] Women and patients with higher ASA grades (more co-morbidities) are more likely to stay >12 days.[9] Shorter operating time and non-cemented prosthesis are associated with shorter length of hospital stay.[3] Patients with operating time of >140 minutes have a median length of hospital stay of 10.5 days, which is significantly longer than those with shorter operating time (p=0.001).[3] Cemented femoral components provide immediate postoperative advantages, but opinion over long-term results is divided. Some orthopaedic surgeons use non-cemented prostheses in younger patients (age <65 years) and cemented prosthesis in older and less active patients (with a shorter projected life span); the adjusted means length of stay were 10.1 and 7.9 days (p=0.10), respectively.[10] In our study, operative factors were not associated with the length of stay.

The retrospective nature of our study was one limitation. No attempt was made to adjust baseline patient characteristics, in spite of the fact that comorbidities (including diabetes and cardiac disease) are known to prolong hospital stay.[11] Patients with considerable comorbidities may not have been candidates for THR, thereby introducing a selection bias.

Identification of the variables associated with prolonged length of stay after THR is important before setting up a fast-track surgery unit, especially in the developing countries with limited resources. Our study helps to identify individuals who need longer rehabilitation and more care.

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