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SHORT REPORT

The relation of body mass index, demographic and health-related variables to length of stay for patients at an acute rehabilitation hospital after total hip arthroplasty

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Karin Greenberg[1]
Thilo Kroll[2]

[1]Medical Rehabilitation, Inc, Pittsburgh, PA, USA; [2]National Rehabilitation Hospital (NRH), Washington DC, WA, USA

Abstract: Obesity is a growing public health concern world-wide. At the same time, knee and hip replacements are becoming an increasingly regular treatment for osteoarthritis. There are conflicting reports in the literature as to what extent body mass affects the length of stay (LOS) of patients undergoing total hip replacements. This chart review aims at examining the relationship between body mass index (BMI), demographic and health-related variables, and LOS. The retrospective chart review of one acute inpatient rehabilitation facility involved n = 119 patients. There was no significant association between LOS and body mass index (BMI), confirming earlier results. Insurance payer type (Medicare vs private) was statistically significant related to LOS. Moreover, there was a trend for the potential influence of race/ethnic patient background on LOS with Caucasians having shorter hospital stays.

Keywords: total hip arthroplasty, obesity, rehabilitation, length of stay, body mass index

Introduction

Obesity is a public health crisis both in the United States,[1,2] Europe,[3] and increasingly in the developing world.[4] The cost of obesity management in the United States alone amounts to approximately $100 billion annually, of which approximately $52 billion are from the direct costs of health care. Approximately, 127 million adults in the United States are overweight (64.5%), 60 million obese, and 9 million severely obese.[2] In 2004, 234,000 total hip replacements or arthroplasties (THAs) and 478,000 total knee arthroplasties (TKAs) were performed in the United States.[5] A significant association of LOS and body mass was found in a Swedish study that examined various lifestyle factors in their contribution to systemic complications and resultant increases in LOS after total hip replacement.[6] Other recent studies concluded that functional gains in inpatient rehabilitation after THA may not be affected by body mass, but confirmed increased excess costs related to obese patients.[7,8] This audit examines whether patients who are overweight or obese have longer LOS in acute inpatient rehabilitation after THA compared to patients with normal or low weight, and what additional clinical or demographic variables may predict LOS.

Aim

The aim of the chart review was to determine the relationship between LOS and body mass, health-related variables, and demographic variables for individuals hospitalized in an acute rehabilitation hospital after THA.

Correspondence: Thilo Kroll
School of Nursing and Midwifery, University of Dundee, 11 Airlie Place, Dundee DD1 4HJ, Scotland, UK
Tel +44 (0) 1382 388 655
Fax
Email t.kroll@dundee.ac.uk

Method

Design

A retrospective chart review of acute inpatient rehabilitation data was carried out by the lead author of this article, who is a rehabilitation medicine specialist in orthopedics.

Sampling

Charts were reviewed for 244 adults, aged 18 and above, who were consecutively admitted and treated at a major rehabilitation hospital on the United States East Coast with a diagnosis of THA due to fractures, arthritis, or tumors between September 1, 2002 and February 28, 2004. This start date was chosen because that was when the Registered Dietitians at the hospital began recording BMI for all inpatients. We excluded individuals from the review when they met one of the following exclusion criteria:

- If primary diagnosis was not THA
- Individuals younger than 18 years
- Individuals with an emergent discharge
- Individuals discharged without a treatment plan (administrative discharge; discharge to another hospital).

Data collection and procedure

All data were extracted using a standardized data extraction form and subsequently entered into spreadsheets. The review tool has been used in the hospital on other occasions, but has so far not been validated. The charts were then reviewed and information was collected regarding age, gender, race/ethnicity, weight, height, diagnosis, co-morbidities, LOS, source of payment, and discharge disposition. Personal identifiers were removed. BMI was calculated using the equation BMI = weight [kg]/height [m^2] based on discharge assessments. The BMI is arguably the most clinically practical measure of obesity.[9] Patients were classified according to the criteria the World Health Organization[10] had endorsed for adults. A BMI between 18.5–24.9 kg/m^2 is considered normal. A BMI below 18.5 kg/m^2 is considered underweight, a BMI between 25.0–29.9 kg/m^2 is considered overweight, and a BMI above 30.0 kg/m^2 is considered obese. Severe, morbid, or extreme obesity is $\geq$40 kg/m^2.

All data were then reviewed and the accuracy of data entry was checked by comparing all case data records with the spreadsheets before final data analysis. Independent variables included age, gender, race, health insurance type, number of co-morbid conditions, number of days between THA surgery and discharge from rehabilitation, discharge to home/other, and BMI. The dependent variable was LOS.

Due to small numbers in the various categories of the variables 'body weight' (eg, underweight, normal range, marginally overweight, overweight, very overweight), race/ethnicity (eg, Caucasian, African American, Asian American, Hispanic American, Other) and discharge disposition (eg, home, nursing facility, subacute facility, acute care hospital) categories were merged prior to cross-tabulation analyses to obtain meaningful analysis units. The recoded variables consisted of the categories underweight/normal, overweight, and obesity for 'weight,' Caucasian vs non-Caucasian for 'race/ethnicity,' and home vs other for 'discharge disposition'. For continuous variables, the median-split method was used to produce dichotomous categories.

Statistical analysis

Statistical analyses were performed using the statistical software package SPSS 12.0 (SPSS Inc, Chicago, IL). Frequencies were computed for study variables. Continuous variables were dichotomized and converted into categorical variables using the median split. Further, bivariate analyses were conducted to determine the association among BMI, demographic variables, and LOS. In these analyses, Phi (2×2 tables) and Cramer's V (tables larger than 2×2) were calculated. The significance of differences between the two groups for LOS was determined with the Phi/Cramer's V test. The significance level alpha was set at $P < 0.05$ (two-sided). Logistic regression analysis using the enter method was computed for LOS as the dependent variable. This means that all significant independent variables based on the bivariate analysis were entered in the equation at once.

Results

Sample characteristics

The final sample size consisted of n = 119 individuals with a primary diagnosis of THA. In total, 125 individuals were excluded from the analysis. There were 83 (69.7%) women and 36 (30.3%) men. The median age was 68 years (min 22; max 90 years). The median length of stay was 10 days (min 2; max 25). The median split for LOS was used to divide individuals who stayed 0–9 and those who stayed 10 or more days in inpatient rehabilitation (Table 1).

Relationship between LOS and BMI

The bivariate cross-tabulation analysis shows that there was no significant association between length of stay and BMI after THA (Table 1). Interestingly, the proportion of patients in the obesity category and those with normal weight, including being underweight with a LOS of 10 days, was larger than those found for patients who were categorized as being overweight.

Table 1 Bivariate relationship between LOS and demographic and clinical correlates

	0–9 days (n = 48)	≥10days (n = 71)	Phi/Cramer's V	*P*
Age			0.171	0.062
18–68	30 (62.5%)	32 (45.1%)		
69–99	18 (37.5%)	39 (54.9%)		
Gender			–0.018	0.846
Female	33 (68.8%)	50 (70.4%)		
Male	15 (31.2%)	21 (29.6%)		
Race/ethnicity			0.197	0.032*
Caucasian	22 (45.8%)	19 (26.8%)		
Non-Caucasian	26 (54.2%)	52 (73.2%)		
Health insurance			0.336	0.001**
Medicare	24 (50.0%)	52 (73.2%)		
Medicaid	7 (14.6%)	13 (18.3%)		
Private	17 (35.4%)	6 (8.5%)		
BMI			0.073	0.725
Underweight/normal	15 (31.3%)	24 (33.8%)		
Overweight	12 (25.0%)	21 (29.6%)		
Obese	21 (43.8%)	26 (36.6%)		
Number of comorbid conditions			0.027	0.769
0–5	27 (56.3%)	38 (53.5%)		
6≤	21 (43.8%)	33 (46.5%)		
Number of days between surgery date and discharge from rehab			0.079	0.402
0–4	36 (78.3%)	47 (71.2%)		
5≤	10 (21.7%)	19 (28.8%)		
Discharge disposition			0.003	0.977
Home	42 (87.5%)	62 (87.3%)		
Other	6 (12.5%)	9 (12.7%)		

Notes: *$P < 0.05$, **$P < 0.01$.

Relationship between LOS and demographic and health-related variables

Similarly, age, gender, number of co-morbid conditions, number of days between surgery date and discharge from rehabilitation, and discharge disposition (home vs other) were not associated with the LOS. Statistically significant bivariate associations for LOS were found for insurance payer type and race (Table 1). Patients receiving Medicare or Medicaid had significant longer rehabilitation stays than those with private insurance. A significantly larger proportion of patients receiving Medicare had a LOS of 10 days or more compared to Medicaid or privately insured patients. While nearly three-quarters of the non-Caucasian patients had a LOS of 10 days or more, only a quarter of Caucasians stayed for this duration.

Logistic regression analysis showed that the odds of having a stay of 10 days or more in acute inpatient rehabilitation are more than five times of those insured through Medicare compared to those with private health insurance coverage (odds ratio (OR) = 5.854, confidence interval (CI): 2.018–16.982, $P = .001$) and more than three times higher for patients covered by Medicaid compared to private insurance (OR = 3.616, CI: 0.919–14.234, $P = 0.066$). Moreover, the odds of spending more than 10 days for patients who are of Caucasian background are half of those found for patients of non-Caucasian background (OR = 0.451, CI: 0.188–1.092, $P = 0.078$). The only statistically significant regression was found for Medicare vs private coverage.

Conclusion

There was no significant association between LOS and BMI after THA. This confirms earlier findings by Jiganti et al,[11] who also found no significant difference in the LOS between non-obese and obese THA patients. However, in a recent study that involved 15 United States' hospital researchers found that LOS was 0.8–1.3 days longer in the non-obese group compared with other weight groups ($P \leq 0.05$). Hospital expenditures were significantly higher for the severely obese patients in that study.[7] Previously, the same study group found a curvilinear relationship between LOS and BMI and higher total hospital charges for severely obese patients undergoing total hip arthroplasty.[12] The latter finding is, however, drawn

into question by findings that did not suggest an overall higher resource utilization of patients who are obese and who are undergoing elective THA.[13] Our study did not find a relationship between age or gender and LOS, however, functional outcomes may well differ for men and women and different age groups, as a recent study showed.[14] Nor did we identify any significant differences for LOS in terms of number of co-morbid conditions. This finding is inconsistent with what was found in a Canadian study where LOS was clearly associated with age and co-morbid conditions.[15] Others found clear evidence for increased hospital expenditures linked to co-morbid conditions in patients undergoing THA.[16] Insurance type, however, appears to influence the LOS after THA. To date there is little information from other United States' studies comparing Medicare recipients with other insurance types with regard to LOS. A large recent retrospective cohort study could show that Hispanic Americans had significantly longer LOS after THA than Caucasian Americans.[17] In our review, there was a trend towards significance for race/ethnicity as a predictor of LOS.

The audit that was restricted to one clinical site only which presents several study limitations. Findings are not generalizable to other inpatient rehabilitation facilities. The LOS is continuously decreasing. Our study data were extracted during a very specific time only. The sample size is rather small, which did not allow for more sophisticated analysis (ie, comparisons among first time THA patients and revision surgery; different types of insurance plans, ie, fee-for-service vs managed care). Other critical variables, such as dietary habits and exercise behavior, could not be included as this data was not available as part of the hospital records. It is especially crucial to examine how insurance type may affect the rehabilitation opportunities available to individuals and related outcomes. It would be necessary to replicate findings with larger data sets and track changes over time. Larger study samples would allow for more complex statistical analyses and examination of multiple variables at once. These analyses are needed to determine the independent contribution of demographic, health-related, and health service variables to LOS after THA.

Disclosure

The authors report no conflicts of interest in this work.

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