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Original Article

# Hip Arthroplasty for Fracture vs Elective Care One Bundle Does Not Fit All

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ABSTRACT

*Background:* To quantify how baseline differences in patients undergoing hip arthroplasty for fracture vs elective care potentially lead to significant differences in immediate health care outcomes and whether these differences affect feasibility of current bundled payment models.
*Methods:* New York Statewide Planning and Research Cooperative System database for the years 2000-2014.
*Results:* A total of 76,654 patients underwent total hip arthroplasty or hemiarthroplasty between 2010 and 2014; 82.8% of the sample was for elective care and 17.2% for fracture-related etiology. Fracture patients were significantly older, more likely to be female, Caucasian, reimbursed by Medicare, and receive general anesthesia. Comorbidity burden and postoperative complications were significantly higher in the fracture group, and hospital charges were significantly greater for fracture patients as compared with those of the elective cohort.
*Conclusion:* Patients undergoing hip arthroplasty for fracture care are significantly older and have more medical comorbidities than patients treated on an elective basis, leading to more in-hospital complications, greater length of stay, increased hospital costs, and significantly more hospital readmissions. The present bundled payment system, even with the recent modification, still unfairly penalizes hospitals that manage fracture patients and has the potential to incentivize hospitals to defer providing definitive surgical management for these patients. Future amendments to the bundled payment system should consider further separating hip arthroplasty patients based on etiology and comorbidities, allowing for a more accurate reflection of these distinct patient groups.



In April 2016, the Centers for Medicare and Medicaid Services (CMS) launched the nationwide Bundled Payment for Care Improvement (BPCI) program in an effort to encourage maximizing quality and value of health care in the United States [1,2]. Hip arthroplasty, which includes both total hip arthroplasty (THA) and hemiarthroplasty (HA), is a major component of the bundled care initiative [1,3–5]. Some hospital and health care systems have been involved in the bundled care initiative, before the nationwide rollout, primarily in the elective arena [3,6,7]. With the ability to modify risk factors before elective THA and total knee arthroplasty, participants have shown a successful implementation and application of the bundled care initiative [6].

However, early government pundits of the BPCI failed to account for hip fracture patients who require hip arthroplasty, but presenting in an urgent clinical setting, risk factors cannot be modified, increasing risk of complications [8,9]. Furthermore, these patients are sicker at baseline, increasing the risk of inpatient complications, longer length of stay (LOS), increased admissions to the intensive care unit, and readmission on discharge [10]. Although some studies have outlined the inherent medical differences in fracture and elective patients, very few have outlined the comparative outcomes, complications, and cost between the cohorts [11,12]. Here, in this study, we compare the 2 cohorts of patients and outline why the BPCI may be applicable for the

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Ethical review board: institutional review board approval was deemed exempt for this study.

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elective patients but may need further modifications for fracture patients.

## Materials and Methods

The New York Statewide Planning and Research Cooperative System (SPARCS) database was queried to identify patients ≥18 years who underwent inpatient THA or HA between 2010 and 2014. Numerous peer-reviewed publications have used SPARCS for epidemiologic studies in orthopedics [13–19].

The *International Classification of Diseases, Ninth Revision,* codes 81.51 and 81.52 were used to identify patients undergoing unilateral THA and HA, respectively. Demographic information regarding patient age, gender, race, and insurance was collected. Concomitant medical comorbidities were identified using the Elixhauser comorbidity criteria, which has been previously validated in orthopedic database studies [20]. Overall comorbidity burden was also stratified into 4 groups: 0, 1, 2, and ≥3 comorbidities.

After initial identification of THA and HA, patients were stratified into either "elective" or "fracture" cohorts based on the primary diagnosis at the time of initial arthroplasty. Our elective cohort consisted of patients with a primary diagnosis for hip osteoarthritis. Similar to previous methodology, we excluded patients from our elective cohort with malignancy, pathologic fractures, or evidence that the procedure was a revision or due to prior surgical complications [21,22]. Our fracture cohort consisted only of those patients with a primary diagnosis of femoral neck or intertrochanteric hip fractures [23].

Hospitals were stratified based on teaching status, urban or rural location, and bedsize, small (<200 beds), medium (200-400 beds), and large (>400 beds), whereas anesthesia was grouped as either general or regional.

In-hospital postoperative complications were identified using previously documented *International Classification of Diseases, Ninth Revision,* codes [5,23,24]. As the SPARCS database provides an encrypted unique patient identifier [25], all patients were longitudinally followed within the database for all unplanned readmissions within 90 days of index procedure. Patients were censored after their first hospital readmission to avoid skewing of readmission data [26].

Difference between groups regarding hospital LOS, discharge disposition (homebound or nonhomebound), postoperative complications, in-hospital mortality, and 30-day and 1-year mortality rates was determined. In addition, readmission rates at 30 and 90 days along with primary diagnosis for hospital readmission were compared between elective and fracture cohorts.

Similar to prior studies, hospital LOS and total charges were analyzed as both continuous and binary variables, defined as hospital LOS and total charges in the 75th percentile [27]. To account for inflation, all charges were normalized to the year 2014.

Student *t* tests were used for continuous variables, and the chi-square analysis for categorical variables. To account for potential confounding, multivariate logistic regression was performed, and odds ratios (ORs) within a 95% confidence interval are provided. SAS 9.3 (Cary, NC) was used for all data collection and statistical analyses, with *P* values <.05 considered statistically significant. Institutional review board approval was not required as human subjects were not involved.

## Results

Between 2010 and 2014, a total of 76,654 patients met our inclusion criteria and underwent THA or HA. The majority of our sample (82.8%; 64,317 of 76,654) consisted of patients undergoing elective hip arthroplasty, whereas 17.2% (13,337 of 76,654) underwent arthroplasty for fracture-related etiology. The fracture cohort consisted of 85.5% (11,403 of 13,337) HA and 14.5% THA (1934 of 13,337). Of the fractures, 95.5% (12,689 of 13,337) were for femoral neck fractures, and the remaining 4.1% (648 of 13,337) were for intertrochanteric hip fractures (Table 1).

**Table 1**
Demographics and Univariate Comparison.

| Total (n = 77,760) | Elective THA (n = 64,317) | Fracture Arthroplasty (n = 13,337) | *P* Value |
|---|---|---|---|
| Femoral neck, n (%) | n/a | 12,689 (95.5) | n/a |
| Hemiarthroplasty, n (%) | n/a | 11,441 (85.5) | n/a |
| Age, mean (SD), y | 65.0 (11.3) | 81.1 (10.2) | <.001 |
| Female, % | 55.8 | 70.6 | <.001 |
| Comorbidities (≥3), % | 13.8 | 44.6 | <.001 |
| Charges, mean (SD), USD | 46,432 (22,954) | 54,075 (44,351) | <.001 |
| LOS, mean (SD), d | 3.3 (1.7) | 7.3 (5.7) | <.001 |
| Discharge disposition, % | | | <.001 |
| Home | 58.1 | 8.8 | |
| In-hospital mortality, n | 35 | 339 | <.001 |
| 30-d readmission rate, % | 3.7 | 16.4 | <.001 |

LOS, length of stay; n/a, not applicable; SD, standard deviation; THA, total hip arthroplasty; USD, US dollars.

### *Baseline Demographics*

Baseline differences between cohorts can be found in Table 1. Patients undergoing elective THA were significantly younger than those for fracture-related care (65.0 ± 11.3 vs 81.1 ± 10.20 years; $P < .001$). Females consisted of a significantly greater proportion of arthroplasty for hip fracture than males (70.5% vs 29.5%; $P < .001$). Minor differences were noted regarding race, as Caucasians comprised a greater proportion of fracture cases (89.9% vs 84.8%; $P < .001$), whereas blacks consisted of more elective procedures (6.0% vs 3.7%; $P < .001$). Fracture cases were significantly more likely to be reimbursed by Medicare as compared with all other forms of insurance (87.9%; $P < .001$). Differences between hospital teaching status were noted, as elective procedures were performed primarily at teaching hospitals as compared with that of fracture cases (79.5% vs 68.2%; $P < .001$). In addition, elective hip arthroplasty was almost exclusively performed at urban centers as compared with fracture cases (93.3% vs 89.0%; $P < .001$). Fracture cases occurred more often at large hospitals than elective THA (20.2% vs 12.8%; $P < .001$). Although elective procedures were divided relatively equally between general and regional anesthesia (45.4% vs 54.6%), fracture cases were performed significantly more often in the setting of general anesthesia (76.6% vs 23.4%; $P < .001$).

Concomitant medical comorbidities differed significantly between cohorts (Figs. 1 and 2), with the majority of comorbidities being significantly more prevalent in the fracture group. Exceptions to this included the following: peptic ulcer disease and human immunodeficiency virus–acquired immune deficiency syndrome were not significantly different between cohorts, and obstructive sleep apnea and obesity were the only comorbidities more prevalent in the elective arthroplasty group. Figure 3 depicts the significantly greater overall comorbidity burden observed in the fracture group as compared with elective THA.

### *In-Hospital Outcomes*

Patients undergoing arthroplasty had a mean hospital LOS that was greater than twice that of the elective cohort (7.3 ± 5.7 vs 3.3 ± 1.7 days; $P < .001$). Mean hospital charges were also greater