



## Original research

# Impact of frailty on outcomes in geriatric femoral neck fracture management: An analysis of national surgical quality improvement program dataset



Anand Dayama<sup>a, b, \*</sup>, Odunayo Olorunfemi<sup>a</sup>, Simon Greenbaum<sup>a</sup>, Melvin E. Stone Jr.<sup>a</sup>, John McNelis<sup>a</sup>

<sup>a</sup> Department of Surgery, Jacobi Medical Center, Albert Einstein College of Medicine, Bronx, NY, USA

<sup>b</sup> San Joaquin General Hospital, UC Davis, 500 W Hospital Rd, French Camp, CA 95231, USA

## HIGHLIGHTS

- Patient undergoing hemiarthroplasty are older, are in higher ASA class and more functionally dependent.
- Frailty substantially increases the risk of morbidity, mortality, and FTR in total hip arthroplasty and hemiarthroplasty.
- The Adjusted odds of mortality were 4 times higher in total hip arthroplasty and 2 times in hemiarthroplasty repair patients.

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## ABSTRACT

**Introduction:** Frailty is a clinical state of increased vulnerability resulting from aging-associated decline in physiologic reserve. Hip fractures are serious fall injuries that affect our aging population. We retrospectively sought to study the effect of frailty on postoperative outcomes after Total Hip Arthroplasty (THA) and Hemiarthroplasty (HA) for femoral neck fracture in a national data set.

**Methods:** National Surgical Quality Improvement Project dataset (NSQIP) was queried to identify THA and HA for a primary diagnosis femoral neck fracture using ICD-9 codes. Frailty was assessed using the modified frailty index (mFI) derived from the Canadian Study of Health and Aging. The primary outcome was 30-day mortality and secondary outcomes were 30-day morbidity and failure to rescue (FTR). We used multivariate logistic regression to estimate odds ratio for outcomes while controlling for confounders.

**Results:** Of 3121 patients, mean age of patients was  $77.34 \pm 9.8$  years. The overall 30-day mortality was 6.4% (3.2%-THA and 7.2%-HA). One or more severe complications (Clavien-Dindo class-IV) occurred in 7.1% patients (6.7%-THA vs. 7.2%-HA). Adjusted odds ratios (ORs) for mortality in the group with the higher than median frailty score were 2 (95%CI, 1.4–3.7) after HA and 3.9 (95%CI, 1.3–11.1) after THA. Similarly, in separate multivariate analysis for Clavien-Dindo Class-IV complications and failure to rescue 1.6 times (CI95% 1.15–2.25) and 2.1 times (CI95% 1.12–3.93) higher odds were noted in above median frailty group.

**Conclusions:** mFI is an independent predictor of mortality among patients undergoing HA and THA for femoral neck fracture beyond traditional risk factors such as age, ASA class, and other comorbidities.

**Levels of evidence:** Level II.

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## 1. Introduction

Frailty is defined as a clinical state of increased vulnerability resulting from aging-associated decline in physiologic reserve [1]. With the availability of frailty as an index, perioperative outcomes in the elderly have been predicted for surgical procedures [2,3]. The

\* Corresponding author. San Joaquin General Hospital, UC Davis, 500 W Hospital Rd, French Camp, CA 95231, USA.

E-mail addresses: [dayama.md@gmail.com](mailto:dayama.md@gmail.com), [anand.dayama@nbhn.net](mailto:anand.dayama@nbhn.net) (A. Dayama).

**Table 1**  
The NSQIP modified frailty index.[11]

Variables	CSHA FI	NSQIP mFI
Functional and cognitive impairment	Problems with dressing	Preoperative functional health status—partially or totally dependent
	Problems with bathing	
	Problems with personal grooming	
	Problems with cooking	
	Problems with going out alone	
	Clouding or delirium	
Medical comorbidities	History relevant to cognitive impairment or loss	Impaired sensorium
	Family history relevant to cognitive impairment	
	History of diabetes mellitus	Diabetes mellitus—noninsulin or insulin
	Chronic/acute lung disease	History of severe COPD
		Current pneumonia
	Congestive heart failure	Congestive heart failure $\leq 30$ days before surgery
	Myocardial infarction	History of myocardial infarction $\leq 6$ months before surgery
	Cardiac disease	Previous percutaneous coronary intervention or cardiac surgery
		History of angina $\leq 1$ month before surgery
	Arterial hypertension	Hypertension requiring medication
Cerebrovascular problems	History of transient ischemic attack	
History of stroke	Cerebrovascular accident or stroke with neurologic deficit	
Decreased peripheral pulses	History of revascularization or amputation for peripheral vascular disease	
	Rest pain or gangrene	

role of frailty in surgery is emerging and becoming increasingly important [4]. The incidence of frailty is estimated to be about 10% in those above 65 years while it is up to 50% in patients older than 85 years [5]. It is estimated that the elderly (above 65 years old) will constitute about 15–18% of the U.S population by 2020 [6]. With this change in demography, comes increased incidence of elderly falls causing hip fractures. In 2010, there were 258,000 hospital admissions for hip fractures among people aged 65 and older [7]. The 1-year mortality rates for hip fractures are reported to be about 14–36% [8]. Generally, the choice of procedure to repair hip fracture has mostly been influenced by factors such as individual factors, fracture location and the degree of displacement of the fracture [8]. Based on the finding that age by itself is not sufficient to predict surgical outcomes in total or hemiarthroplasty, we sought to describe the impact of frailty on mortality and morbidities following hip arthroplasty for femoral neck fractures. We studied the effect of frailty on postoperative outcomes after total hip arthroplasty as compared with hemiarthroplasty for femoral neck fracture in a national data set. We hypothesize that adding frailty to other factors will help clinicians to better evaluate and select patients for either of the two procedures.

## 2. Methods

### 2.1. Data source

The American College Surgeons-NSQIP is a risk-adjusted data collection mechanism that collects and analyzes clinical outcomes data for surgery excluding poly-trauma. Participating hospitals use their collected data to develop quality initiatives that improve surgical care and to identify elements in provided healthcare that can be improved when compared with other institutions. The ACS-NSQIP collects data on a variety of clinical variables, including preoperative risk factors, intraoperative variables and 30-day postoperative mortality and morbidity outcomes for patients undergoing major surgical procedures in both the inpatient and outpatient setting. A site's surgical clinical nurse reviewer captures outcomes data using a variety of methods including medical chart abstraction.

### 2.2. Data selection

Using the ACS-NSQIP database from 2005 to 2010, we identified patients undergoing total hip arthroplasty (THA) and hemiarthroplasty (HA) using the American Medical Association's Current Procedural Terminology (CPT, Chicago, IL) code that describes THA and HA. We then cross-referenced these CPT codes with the *International Classification of Diseases, Ninth Revision, Clinical Modification* diagnosis code listed for each patient to assure the procedure was performed in a setting of femoral neck fracture.

Preoperative data obtained included age, gender, race, history of smoking (within one year of surgery), and alcohol use (more than two drinks a day in the two weeks prior to surgery). Comorbidities included were presence or absence of renal disease (dialysis dependence), coronary artery disease [angina within 30 days of surgery, myocardial infarction (MI) within six months of surgery, prior percutaneous coronary intervention (PCI), and prior cardiac surgery], congestive heart failure (CHF), hypertension, peripheral arterial disease (PAD) requiring previous revascularization/amputation, rest pain in lower extremity, history of chronic obstructive pulmonary disease (COPD), neurologic event or disease [stroke with or without residual deficit, transient ischemic attack (TIA), and hemiplegia], diabetes mellitus, chronic corticosteroid use, weight loss (more than 10% in the 6 months prior to surgery), bleeding disorders, and presence of open wounds. Other factors considered were the American Society of Anesthesiologists' (ASA) class admission status (from home versus facility), preoperative functional status - ability to perform activities of daily living in the 30 days prior to surgery (independent, partially dependent, totally dependent), dyspnea (none, moderate exertion, at rest), prior surgery within 30 days, do not resuscitate (DNR) status prior to operation, disseminated cancer, preoperative sepsis, days from admission to operation, and body mass index (BMI) and preoperative laboratory variables.

### 2.3. NSQIP mFI

Frailty was assessed using the modified frailty index (mFI) derived from the Canadian Study of Health and Aging [9,10] and mapped to the NSQIP data. To quantitatively measure frailty, we used the 11-point NSQIP mFI derived from the CSHA FI and validated in the NSQIP database [11]. Table 1 reports corresponding

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