



Proximal humerus fragility fractures: recent trends in nonoperative and operative treatment in the Medicare population



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Background: With an aging population, fragility fractures including injuries to the proximal humerus continue to rise in the United States. The purpose of this study was to investigate recent trends in the incidence and treatment of proximal humerus fractures (PHFs) in a cross-sectional elderly population.

Methods: Medicare data from 2005 to 2012 were queried to identify patients treated for PHF. Associated patient demographics, hospitalization data, treatment, and revision status were obtained. Statistical analyses were performed to identify significant trends in treatment.

Results: There were 259,506 PHFs recorded, with 79% occurring in female patients. In all age groups, nonoperative treatment of PHF was the most common method (67%). Within the surgical group, open reduction with internal fixation was most frequently used, and total shoulder arthroplasty (TSA) or reverse total shoulder arthroplasty (RTSA) was the least common (11%). However, although the overall rate of surgical intervention remained constant, there was a significant increase in treatment with TSA from 3% in 2005 to 17% in 2012. In particular, RTSA represented 89% of all TSAs for PHF in 2011. All surgical treatment options demonstrated high 2-year survival rates without revision surgery (97%).

Conclusion: Recent trends show that in the elderly population, nonoperative management remains the most common treatment for PHFs. Within the surgically treated cohort, there has been an increase in treatment with arthroplasty including RTSA, with a low rate of early revisions. There are excellent survival rates in all surgically treated PHFs, but long-term data will be required to fully evaluate the viability of these surgical options.

Level of evidence: Level IV, Epidemiology Study, Large Database Analysis.

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Keywords: Proximal humerus fracture; fragility fracture; shoulder arthroplasty; internal fixation; hemiarthroplasty; Medicare database

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It is estimated that there are 2 million fractures related to osteoporosis in the United States annually.⁵ In patients older than 65 years, proximal humerus fractures (PHFs) account for 10% of all fractures and are the third most common fracture in the elderly behind hip and distal radius fractures.^{1,16,17,21} A study of the Finnish population by

Kannus et al found an increasing age-specific incidence of osteoporotic PHFs from 1970 to 1993 as well as an increase in the average age of the at-risk population. They predicted an exponential increase in the incidence by 2020 to 2030.¹⁴ Although much attention has been paid to hip and spine fractures associated with osteoporosis in this aging population,^{2,8,18,25} it is clear that PHFs are also a group that must be investigated.

Various methods of treatment exist for PHFs; 50% to 80% of PHFs are nondisplaced or minimally displaced and are stable enough to be treated nonoperatively.¹⁰ However, displaced and unstable fractures can be treated with open reduction and internal fixation (ORIF), hemiarthroplasty, total shoulder arthroplasty (TSA), or reverse total shoulder arthroplasty (RTSA).^{13,27} The patient's age and functional activity level and the surgeon's preference, training, and ability to reconstruct the fragments all play a critical role in determining the best primary treatment for patients with this type of injury.^{13,27} A recent Cochrane review of treatments for PHF found that there is insufficient evidence to support the best treatment option,¹¹ and the indications for each continue to evolve. Further, a recent randomized clinical trial showed no difference in outcomes between surgical and nonoperative treatment of displaced surgical neck fractures with 2-year follow-up.²²

In a large, prospective, multicenter study, Südkamp et al demonstrated that ORIF with locking proximal humerus plate resulted in significant improvement in range of motion and Constant scores that were similar to the contralateral side. However, there was a 34% complication rate, with screw perforation being the most common.²⁷ Avascular necrosis (AVN) is also a concern in these patients treated with ORIF. The rate of AVN has been reported from 34% in 3- and 4-part fractures up to 75% in 4-part fractures treated with ORIF.^{19,20,26} These elderly patients for whom ORIF fails may then require a revision to TSA or RTSA. In recent years, these options have found more widespread use with expanding indications.^{13,15,23} Although there are multiple methods for treatment of PHF, there is a lack of analyses investigating recent trends in treatment in a large cross-sectional population.

With a growing population of patients at risk for fragility fractures,^{14,16} it is important to recognize current practice patterns and changes that may be occurring in the management of these fractures. The purpose of this study was to analyze the utilization of nonoperative and operative treatment of PHF and the associated complications. We hypothesize that as the aging population continues to grow and fragility fracture rates increase, the associated incidence of PHFs treated surgically in the United States will also increase.

Materials and methods

The Medicare Standard Analytic Files, containing 100% of Medicare inpatient and outpatient facility data, were

reviewed using the PearlDiver Technologies Database (PearlDiver Technologies, Fort Wayne, IN, USA). PearlDiver is a Health Insurance Portability and Accountability Act-compliant national insurance database, currently containing Medicare data for years 2005 through 2012. Inclusion criteria were based on *International Classification of Diseases, Ninth Revision* (ICD-9) coding, identifying patients who underwent ORIF of the proximal humerus (ICD-9 procedure code: 79.31), hemiarthroplasty (ICD-9 procedure code: 81.81), or TSA (ICD-9 procedure code: 81.80) with concurrent diagnoses of PHF (ICD-9 diagnosis codes: 812.00-812.03, 812.09-812.13, and 812.19). Coding for RTSA became available in the year 2011 (ICD-9 procedure code: 81.88), which allowed subanalysis in 2011-2012 data. Search results yield number of patients with the coding parameters queried, 5-year age groups, year of service, gender, and region of the United States. All patients with at least 24 months of follow-up were tracked for subsequent procedural coding indicating revision or conversion. Patients dying or lost to follow-up were counted as revision free, and therefore the conversion rates presented should be viewed as a minimum value.

A χ^2 analysis was performed to determine statistical significance of procedure type with regard to gender. The Cochrane-Armitage trend test was used to evaluate age groups and temporal trends. The level of significance was defined to be $P < .05$.

Results

Results by year

From 2005 to 2012, 259,506 PHFs occurred in this population. Nonoperative treatment was the most common treatment method as 174,252 patients (67%) were managed without surgery. The overall frequency of nonoperative treatment was consistent during the study period, ranging from 65% to 69% (Fig. 1). Operative treatment was used in almost 33% of the population, with 19.3% treated by ORIF, 11.2% by hemiarthroplasty, and 2.4% by TSA. Surgical treatment with ORIF remained stable throughout the study period, from 55% of surgical cases in 2005 to 60% in 2012. There was a decreasing trend in treatment with hemiarthroplasty during this period from 42% of all surgical cases in 2005 to 24% in 2012 ($P = .015$). Conversely, there was an increase in the rate of TSA, which included RTSA, from 3% of surgical cases in 2005 to 17% of cases in 2012 ($P = .013$).

As a subanalysis of this increasing trend in use of TSA in 2011-2012, we were able to extract data for the utilization of RTSA within this population for analysis. ORIF was the most commonly performed surgical intervention across all age groups (60.5%), followed by hemiarthroplasty (24.9%), RTSA (13%), and TSA (1.6%). For PHFs treated

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