Journal of Orthopaedic Experience & Innovation
Clinical, Economic, and Innovative Orthopaedic Experience

Edwards, Sarah, Heidi A. Israel, Lisa Cannada, and Paul A. Anderson. 2025. "Yes We Can! Reducing the Burden of Proximal Humerus Fractures." *Journal of Orthopaedic Experience & Innovation* 6 (1). https://doi.org/10.60118/001c.129046.

Data Paper

Yes We Can! Reducing the Burden of Proximal Humerus Fractures

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Keywords: osteoporosis, metabolic disease, upper extremity, proximal humerus fracture

https://doi.org/10.60118/001c.129046

Journal of Orthopaedic Experience & Innovation

Vol. 6, Issue 1, 2025

Introduction

The American Orthopaedic Association (AOA) Own The Bone (OTB) registry was utilized to evaluate patients with proximal humerus fractures (PHF) to determine (a) previous fragility fractures, (b) prior treatment for osteoporosis and (c) concurrent fractures to determine risk factors.

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a Sarah Edwards is a medical student at Georgetown University School of Medicine with a background in public health from Baylor University. Her experiences in clinical research, community health, and patient advocacy have shaped her interest in improving healthcare access and outcomes. She has contributed to research on fracture risk factors and presented at a national medical conference. Passionate about interdisciplinary approaches to medicine, she aims to integrate research and patient care to drive meaningful advancements in healthcare.

Conflicts of Interest Statement for Sarah Edwards

b Heidi Israel, PhD, FNP-c, is a faculty at the School of Medicine and focus on research projects of faculty, residents, and medical students. She provides consulting on research design, implementation, and statistical analysis for both basic science and clinical research projects.

Conflicts of Interest Statement for Dr. Heidi Israel

c Dr. Cannada is an Orthopaedic Trauma Surgeon. She is affiliated with Novant health, where she is the Director of Faculty Integration for the UNC School of Medicine Charlotte Campus, Medical Student Clerkship Director and Professor. She completed a 3-year term on the AAOS BOD in 2018 as the first female Chair of the Board of Specialty Societies. She was responsible for developing the current fellowship match process for orthopaedics. She is a member of the Orthopaedic Trauma Association and served on the BOD and received the first OTA DEI and Health Disparities Leadership Award in October 2022. She served as a president of the Ruth Jackson Orthopaedic Society in 2011 and received the inaugural "She for She " Award in 2022. Dr. Cannada has made it her mission to make the path better for those that follow, by her work and leadership roles. In 2021, Drs. Jennifer Weiss, Nancy Yen Shipley and Arianna Gianakos formed "Speak Up Ortho" to pave the way for change in orthopaedic surgery. Her clinical interests and research include both upper and lower extremity fractures and outcomes. She has over 230 publications and 250 presentations at national meetings. She could not do this without the support of her family, her husband Jeff and daughter Annalise and her parents, the late John W. Metcalf MD and her mom, Theresa Metcalf. Her favorite role is "soccer mom", and she looks forward to cheering on her daughter who plays for Lipscomb University in Nashville.

Visit Dr. Lisa Cannada

Conflicts of Interest Statement for Dr. Lisa Cannada

Visit the Open Payments Data Page for Dr. Lisa Cannada

d Dr. Anderson is a board-certified orthopaedic spine surgeon with special interest in spine trauma, tumors, cervical spine, and geriatric spinal diseases and osteoporosis. He is an internationally recognized expert in the field of orthopaedic spinal surgery and currently holds an academic position as Emeritus Professor of Orthopedic at the University of Wisconsin. Currently, he is president of The International Society for Clinical Densitometry. He has served as President of the Cervical Spine Research Society and President of the Lumbar Spine Research Society and has held various positions in a number of spinal and orthopaedic societies. He has served as a member as well as Chairman of the AAOS Biomedical Engineering Committee, Co-Chair of ASTM 04.25, and Clinical Chair of ASTM F04. Most recently, he chaired the "Own the Bone" Steering Committee of the American Orthopaedic Association which aims to educate medical practitioners and patients on the importance of bone health and promote fracture liaison services. In 2022 he received the 3rd Annual Lifetime Achievement Award from the Cervical Spine Research Society. He currently serves as a Reviewer for Osteoporosis International and a member of the Scientific Advisory Council of ISCD as well as President of ISCD. Dr. Anderson earned his undergraduate and Master's degrees from The University of Michigan in Chemical Engineering. He completed medical school and orthopaedic residency at Wayne State University and a clinical spine fellowship with Dr. Henry H. Bohlman (Case Western Reserve University, Cleveland).

Conflicts of Interest Statement for Dr. Paul Anderson

Visit the Open Payments Data Page for Dr. Paul Anderson

Methods

Between 2009-2023, data was entered in a HIPAA-compliant registry. Inclusion criteria were age 50 and older and a low-energy fracture. Demographic data was extracted. The data set was filtered for humeral fractures and associations run with history of fractures, medications, gender, BMI, postmenopausal status, and Dexa scores using chi-square statistic, t-tests, and ANOVA.

Results

There were 76,890 patients; 1388 had a primary PHF. 76% (835) were postmenopausal women. BMI data was evenly distributed. 303 (22%) patients experienced a concurrent fracture. Prior fractures occurred in 298 patients (21%). 384 (35%) had a history of Vitamin D deficiency. 40% were on calcium supplements, and 47% were taking Vitamin D at the time of fracture or in the past. 19% of PHF patients completed BMD testing. 83 (6%) of PHF patients consumed 3+ drinks daily ($p < 0.001$), and 118 (9%) were smokers ($p = 0.002$). 305 (22%) of PHF patients had been on PPIs, and 167 (12%) had been on SSRIs. 275 (20%) patients had 2 or more falls in the preceding year.

Discussion

The majority of PHF occurred in postmenopausal females, and 21% had prior fractures. Some patients were supplemented with Vitamin D and calcium, and only 19% had BMD testing indicating areas of improvement. The history of prior falls was 20%, and this should be recognized as a risk factor. The association between patients taking PPIs and SSRIs cannot be overlooked. This study identified premorbid factors that are associated with a PHF and can serve as a form of prevention for subsequent fragility fractures.

INTRODUCTION

Proximal humerus fractures are the third most common osteoporotic fracture, following the distal radius and vertebral compression fractures (Schumaier and Grawe 2018). These fractures increase in incidence after the age of 50 and are known to be associated with low bone mineral density (BMD) (Taskesen et al. 2020). Proximal humerus fractures (PHF) are more commonly observed in older women following low-energy trauma and often manifest with metaphyseal comminution and tuberosity fragments and inferior subluxation of the humeral head (Taskesen et al. 2020). With the aging population, the incidence of osteoporotic proximal humerus fractures is expected to triple over the next three decades (Howard et al. 2018). Examining the impact and contributing factors to proximal humerus fractures is crucial, as the management of these fractures in the setting of elderly, low-energy falls is contributing to the global impact of direct and indirect costs of osteoporosis and fragility fractures (Pencle and Varacallo 2023).

The existence of previous fragility fractures and low bone mineral density are risk factors of proximal humerus factors and can aid in diagnosing osteoporosis in elderly populations effectively. However, the majority of these high-risk patients who have had fractures are not diagnosed and do not receive effective, FDA-approved therapies (LeBoff et al. 2022). Clinton et al (Clinton et al. 2009). concluded that a proximal humerus fracture independently increased the risk of a subsequent hip fracture more than five times in the first year after the humeral fracture.

The American Orthopaedic Association's (AOA's) Own the Bone (OTB) registry is a web-based registry of deidentified patient history and fracture data designed to encourage orthopaedic surgeons to include bone health education and treatment as a distinct part of comprehensive fracture care (Carlson et al. 2018). Any patient ⩾50 years of age with a low-energy (fragility) mechanism fracture was eligible, with over 158 centers providing patient data to the registry for analysis (Carlson et al. 2018). Data from the OTB registry can be utilized to improve identification, diagnosis, and treatment for patients with osteoporosis (Åkesson et al. 2022). The AOA OTB national quality improvement project began gathering prospective data in 2009 on patients presenting with a low-energy fracture in adulthood (>50 years old).

There is limited data comparing the prevalence and characteristics of proximal humerus fractures to other major osteoporotic fractures. In our study, the AOA OTB registry was utilized to evaluate the following research questions: of all participants with PHF, how many had (a) previous fragility fractures, (b) prior treatment for osteoporosis, (c) or concurrent fractures, and (d) what is the prevalence of behavioral and clinical risk factors among participants with PHF?

METHODS

SUBJECTS

The AOA OTB registry was utilized for this study. Between 2009 and February 2023, de-identified data was collected on over 76,000 patients and organized in a HIPAA-compliant registry. Inclusion criteria for patient registration were age 50 years or older and a low-energy fracture. Exclusion criteria was pathologic fracture due to primary or metastatic tumor, patients with end stage renal disease, severe dementia or on-going palliative care. Demographic data was extracted including age, gender, race and Body Mass Index

(BMI). We also extracted information on medical comorbidities, social history information on smoking and drinking.

FRACTURE HISTORY

The primary criteria was a Proximal Humerus Fracture. The history of a previous fracture to the hip, spine, pelvis, upper extremity, or lower extremity was recorded. The mechanism of injury was collected along with whether or not there was a history of falls.

DEXA T-SCORE-BASED BONE STATUS CLASSIFICATION AND PHARMACOLOGIC INTERVENTIONS

We extracted data from the registry on these patients to include whether or not they had previous bone mineral density (BMD) testing. Pharmacologic data evaluated included the use of Vitamin D and calcium supplementation and the use of anabolic or antiresorptive treatments.

STATISTICAL ANALYSIS

Data was analyzed from a larger database that contained 1388 humerus shaft fractures. Descriptives were run on patient data. Comorbidities, age, medications, falls, additional injuries, and prior injuries were analyzed using Chi-square statistics, t-tests or Mann-Whitney tests for comparison of 2 groups on categorical or continuous level data, and cut scores on Dexa values to compare fracture occurrences. Data was analyzed using SPSS 29.0 (IBM, New York.)

SOURCE OF FUNDING

There was no funding received for this research.

RESULTS

DEMOGRAPHIC DATA

In the dataset of 76,890 patients provided by Own the Bone, the primary admitted fracture for 1388 patients was a proximal humerus fracture. Seventy-six percent (835) of PHF patients were postmenopausal women. Five and a half percent (83) of PHF patients consumed 3+ drinks daily ($p < 0.001$, Table 1) There were 10.7% (118) of patients with PHF who were smokers ($p = 0.002$). Eighty-three of the smokers (70.3%) were women.

RISK ASSOCIATED MEDICATIONS

Twenty-one and six tenths percent (305) of PHF patients had been on proton pump inhibitors (PPIs) at the time of fracture or in the past (OR = 1.046, CI [0.920, 1.91]), and 12.4% (167) of PHF patients had been on selective serotonin reuptake inhibitors (SSRIs) at the time of fracture or in the past (OR = 0.900, CI [0.766, 1.057]). However, only 5.7% (79) of PHF patients had been on oral glucocorticoids at the time of fracture or in the past. Ten and six tenths percent (147) of PHF patients had been taking bisphosphonates at the time of fracture or in the past.

CONCURRENT AND PREVIOUS FRACTURES

Of the patients with proximal humerus fractures, 22% (303) of patients experienced a concurrent fracture (Table 2). Concurrent fracture types included 154 hip, 22 radius/ulna, 37 wrist, 34 spine, 27 pelvic ring, and 29 femur fractures. A hip fracture was the most prevalent concurrent fracture, presenting in 11.1% (154) of patients.

Forty percent (556) had previous fractures reported in the registry (OR = 1.061, CI [0.950, 1.183]). The most common primary site for a prior fracture among PHF patients was at the wrist. While 7.3% (101) of patients had a prior wrist fracture, 6.3% (88) had a prior hip fracture, 5.6% (78) had a prior spine fracture, and 2.2% (31) had a prior pelvic ring fracture.

NUTRITIONAL SUPPLEMENTATION

Data on Vitamin D deficiency was available for 1099 patients, and 34.9% (384) of patients had a history of Vitamin D deficiency or Vitamin D deficiency confirmed by lab work. Thirty-seven and eight tenths percent (525) of PHF patients had been taking calcium supplements at the time of fracture or in the past, and 47% (652) of PHF patients had been taking Vitamin D at the time of fracture or in the past.

BONE MINERAL DENSITY TESTING

Nineteen and one tenth percent (265) of PHF patients had completed BMD testing. Data on the lumbar spine t-score was available for 310 patients, and the t-scores of 61 of these patients were considered as osteoporotic.

DISCUSSION

Osteoporosis is considered the most prevalent bone disorder in the world and is an initially subclinical condition. However, a decrease in bone mineral density, indicative of osteoporosis, increases the risk of fractures in vertebral bodies, distal radius, proximal femur, and proximal humerus, especially in the elderly population (Taskesen et al. 2020). More specifically, estimates indicate that 50% of women and 20% of men aged over 50 years will experience an osteoporosis-related fracture (Coughlan and Dockery 2014).

In addition to bone mineral density, patients who have had a single fragility fracture are at significantly increased risk of having a second fracture in the future (Clinton et al. 2009). A prospective cohort study of older Caucasian women was established to test the hypothesis that a proximal humeral fracture is an independent risk factor for a subsequent hip fracture and that the risk of the subsequent hip fracture is highest within the first five years after the humeral fracture (Clinton et al. 2009). Researchers found that the risk of a subsequent hip fracture after a proximal humeral fracture was highest within one year after the proximal humeral fracture with a hazard ratio of 5.68[6].

Table 1. Demographic Data

Demographic Factor	Gender			
	Male (N = 211)	Female (N = 888)	Total (N = 1,099)	P Value
Race				
Caucasian	176 (83.4%)	799 (90.0%)	975 (88.7%)	
African American	17 (8.1%)	23 (2.6%)	40 (3.6%)	
Asian	2 (0.9%)	13 (1.5%)	15 (1.4%)	
American Indian/Alaska Native	2 (0.9%)	3 (0.3%)	5 (0.5%)	
Hispanic	9 (4.3%)	44 (5.0%)	53 (4.8%)	
Indian Subcontinent	3 (1.4%)	1 (0.1%)	4 (0.4%)	
Other (mixed race)	2 (0.9%)	5 (0.6%)	7 (0.6%)	
Fracture risk factors				
Vitamin D deficiency	90 (42.7%)	294 (33.1%)	384 (34.9%)	0.009
Alcohol, ≥3 drinks per day	27 (12.8%)	33 (3.7%)	60 (5.5%)	< 0.001
Current Smoker	35 (16.6%)	83 (9.3%)	118 (10.7%)	0.002
History of ≥2 falls	49 (23.2%)	226 (25.5%)	275 (25.0%)	0.502

Table 2. Fracture Data

Fracture Site	Frequency
Concurrent Fracture	
Forearm (radius/ulna shaft)	22 (1.6%)
Wrist	37 (2.7%)
Spine	34 (2.4%)
Pelvic ring	27 (1.9%)
Hip	154 (11.1%)
Thigh (femoral shaft)	29 (2.1%)
Total (N = 1388)	303 (21.8%)
Previous Fracture	
Wrist	101 (7.3%)
Spine	78 (5.6%)
Pelvic ring	31 (2.2%)
Hip	88 (6.3%)
Thigh (femoral shaft)	21 (1.5%)
Shoulder	58 (4.2%)
Arm (humeral shaft)	152 (11.0%)
Elbow	27 (1.9)
Total (N = 1388)	556 (40.0%)

While proximal humerus fractures can serve as precursors for future fragility fractures, there is limited literature surrounding previous fragility fractures being related to future proximal humerus fractures, which was an interest in our study. Our results found that 40% (556) of PHF patients sustained previous fragility fractures. Robinson et al (Robinson, Carlson, Poppendeck, et al. 2020)., a study also utilizing the OTB database, found that 52% of patients with low-energy clinical vertebral fractures reported a prior fracture after the age of 50, which supports our findings that previous fractures serve as a risk factor for subsequent fragility fractures.

Existence of previous fragility fractures and low bone mineral density are risk factors of proximal humerus fractures that can serve as means to effectively diagnose osteoporosis in elderly populations. We found that 40% (556) of patients had prior fractures. However, the majority of high-risk women and men who have had fracture(s) are not diagnosed and do not receive effective, FDA-approved therapies (LeBoff et al. 2022). Thirty-seven and eight tenths percent (525) of PHF patients had been taking calcium supplements at the time of fracture or in the past, and 47% (652) of PHF patients had been taking Vitamin D at the time of fracture or in the past. However, only 19% (265) had BMD testing indicating areas of improvement. One method to improve a multidisciplinary approach to patients and their bone health is through hospital enrollment in the OTB initiative. However, if a hospital does not have a multidisciplinary program in place, referral to an endocrinologist and bone health personnel is important to prevent future fractures. The importance of this cannot be overemphasized because improved bone health leads to improved long-term survival. Recognition of potential risk factors for proximal humerus fractures can serve as a form of prevention for subsequent fragility fractures.

Women comprised the majority of PHF patients with a history of smoking in this study, in addition to women being at the greatest risk of PHF (Taskesen et al. 2020). Existing literature points to a higher rate of smoking among women with osteoporosis, with one all-female study finding that subjects with osteoporosis smoked cigarettes more frequently than the control group (Ratajczak et al. 2021). Cigarette smoking has been found to cause women to experience menopause prematurely, with greater bone loss experienced by postmenopausal women who smoke than non-

smokers (Al-Bashaireh et al. 2018). The high percentage of female smokers in our study supports this relationship between smoking and osteoporosis.

Treatment with effective antifracture medication prevents fractures and improves outcomes in osteoporotic patients, seeing as untreated osteoporosis can lead to a vicious cycle of recurrent fracture(s), often resulting in disability and premature death (LeBoff et al. 2022). Additional means of fracture prevention include adequate intake of calcium and vitamin D, avoidance of smoking and excessive alcohol intake, weight-bearing and resistance-training exercise, and fall prevention (LeBoff et al. 2022). The history of prior falls in the preceding year was 20.8% (289), and this should be recognized as a risk factor. When injuries occur and patients sustain a fracture, treatment should include physical therapy and home safety assessments to minimize further falls and fractures.

While the use of steroids has been considered a risk factor for fragility fractures in the past, we found that only 5.6% (79) of PHF patients had been on oral glucocorticoids at the time of fracture or in the past.

Researchers found that BMD and other medical comorbidities were not risk factors for severe PHF, but BMD still serves as means to diagnose osteoporosis in individuals with PHF[13]. The most common primary site for a prior fracture among PHF patients was at the wrist. While 101 patients had a prior wrist fracture, 88 had a prior hip fracture, 78 had a prior spine fracture, and 31 had a prior pelvic ring fracture. The treatment of primary fragility fractures, specifically proximal humerus fractures, can also serve as initiation of effective preventative measures of secondary fragility fractures. Once the index osteoprotic fracture is identified, it is important to determine a plan to prevent future fractures. A critical evaluation of current medications and social habits is warranted. Medications and supplements can be useful, but concentrating on physical strength and proprioception is needed to minimize risk of future falls and subsequent fractures.

WEAKNESSES

This is a database study with inherent limitations. For example, the accuracy of the data is dependent on the individual entering the information. We are limited by the data that is entered into the OTB database, which is not inclusive of all proximal humerus fractures. There are other databases that may have more proximal humerus fracture data, but they do not have the details regarding bone health that OTB does. However, our study is limited in that is does not include information that would help in evaluating how social drivers of health affect health outcomes. Additionally, we only reported and evaluated the occurrence of PHF and not the treatment. The specific fracture treatment is a source of continued evaluation in the orthopaedic literature.

CONCLUSION

The majority of PHF in our study occurred in postmenopausal females, and 40% (556) had prior fractures. Some patients were supplemented with Vitamin D and calcium, and only 19% had BMD testing indicating areas for improvement in this patient population. The history of two or more falls in the preceding year was 20.8% (289), and this should be recognized as a significant risk factor for future fractures. The association between patients taking PPIs and SSRIs cannot be overlooked. Further research is needed in this area to determine the long-term implications of medications on patients' overall bone health. Previously, certain classes of drugs have been thought to be the optimal treatment for osteoporosis, but we found over time that long-term use of certain classes of drugs can lead to pathologic fractures. Because of this, research should be centered on balancing short-term benefits with long-term sequelae. This study identified premorbid factors that are associated with a PHF and can serve as a form of prevention for subsequent fragility fractures. An important area of future research is determining the significance of patient adherence to supplementation recommendations aimed at improving bone health.

Submitted: October 13, 2024 EDT. Accepted: January 25, 2025 EDT. Published: April 29, 2025 EDT.

REFERENCES

Åkesson, K. E., K. Ganda, C. Deignan, M. K. Oates, A. Volpert, K. Brooks, D. Lee, D. R. Dirschl, and A. J. Singer. 2022. "Post-Fracture Care Programs for Prevention of Subsequent Fragility Fractures: A Literature Assessment of Current Trends." *Osteoporosis International* 33 (8): 1659–76. https://doi.org/10.1007/s00198-022-06358-2.

Al-Bashaireh, A. M., L. G. Haddad, M. Weaver, X. Chengguo, D. L. Kelly, and S. Yoon. 2018. "The Effect of Tobacco Smoking on Bone Mass: An Overview of Pathophysiologic Mechanisms." *J Osteoporos* 2018:2018. https://doi.org/10.1155/2018/1206235.

Carlson, B. C., W. A. Robinson, N. R. Wanderman, A. N. Nassr, P. M. Huddleston, M. J. Yaszemski, B. L. Currier, et al. 2018. "The American Orthopaedic Association's Own the Bone® Database: A National Quality Improvement Project for the Treatment of Bone Health in Fragility Fracture Patients." *Osteoporosis International* 29 (9): 2101–9. https://doi.org/10.1007/s00198-018-4585-7.

Clinton, J., A. Franta, N. L. Polissar, B. Neradilek, D. Mounce, H. A. Fink, J. T. Schousboe, and F. A. Matsen. 2009. "Proximal Humeral Fracture as a Risk Factor for Subsequent Hip Fractures." *Journal of Bone and Joint Surgery* 91 (3): 503–11. https://doi.org/10.2106/JBJS.G.01529.

Coughlan, T., and F. Dockery. 2014. "Osteoporosis and Fracture Risk in Older People." *CME GERIATRIC MEDICINE* 14. https://doi.org/10.7861/clinmedicine.14-2-187.

Howard, L., R. Berdusco, F. Momoli, J. Pollock, A. Liew, S. Papp, K. Lalonde, W. Gofton, S. Ruggiero, and P. Lapner. 2018. "Open Reduction Internal Fixation vs Non-Operative Management in Proximal Humerus Fractures: A Prospective, Randomized Controlled Trial Protocol." *BMC Musculoskelet Disord* 19 (1). https://doi.org/10.1186/s12891-018-2223-3.

LeBoff, M. S., S. L. Greenspan, K. L. Insogna, E. M. Lewiecki, K. G. Saag, A. J. Singer, and E. S. Siris. 2022. "The Clinician's Guide to Prevention and Treatment of Osteoporosis." *Osteoporosis International* 33 (10): 2049–2102. https://doi.org/10.1007/s00198-021-05900-y.

Pencle, F., and M. Varacallo. 2023. "Proximal Humerus Fracture." In *StatPearls [Internet]*. Treasure Island (FL): StatPearls Publishing. https://www.ncbi.nlm.nih.gov/books/NBK470346/.

Ratajczak, A. E., A. Szymczak-Tomczak, A. M. Rychter, A. Zawada, A. Dobrowolska, and I. Krela-Kaźmierczak. 2021. "Impact of Cigarette Smoking on the Risk of Osteoporosis in Inflammatory Bowel Diseases." *J Clin Med* 10 (7). https://doi.org/10.3390/jcm10071515.

Robinson, W. A., B. C. Carlson, H. Poppendeck, et al. 2020. "Osteoporosis-Related Vertebral Fragility Fractures: A Review and Analysis of the American Orthopaedic Association's Own the Bone Database." *Spine (Phila Pa 1976)* 45 (8): E430–38. https://doi.org/10.1097/BRS.0000000000003324.

Schumaier, A., and B. Grawe. 2018. "Proximal Humerus Fractures: Evaluation and Management in the Elderly Patient." *Geriatr Orthop Surg Rehabil* 9. https://doi.org/10.1177/2151458517750516.

Taskesen, A., A. Göçer, K. Uzel, and Y. U. Yaradılmış. 2020. "Effect of Osteoporosis on Proximal Humerus Fractures." *Geriatr Orthop Surg Rehabil* 11. https://doi.org/10.1177/2151459320985399.