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Proximal Humerus Fractures in the Elderly: Concomitant Fractures and Management

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ABSTRACT

Introduction. The purpose of this study was to identify additional injuries commonly seen with proximal humerus fractures experienced by patients 65 years or older and to evaluate discrepancies in the management of these patients with regard to provider type.

Methods. A retrospective review was conducted of all patients 65 years or older who sustained a proximal humerus fracture. Patient data collected included demographics, injury details, hospital course, and discharge destination.

Results. Patients with a concomitant fracture (45.5%, n = 65) had a slightly higher Injury Severity Score (ISS; 8.3 ± 3.0 vs. 6.4 ± 3.0, p < 0.001) and experienced one additional death than those with an isolated fracture (54.5%, n = 78). Slightly more patients were managed by a trauma provider (51.7%, n = 74) than by a non-trauma provider (48.3%, n = 69). Those managed by a trauma provider sustained the most pelvic fractures (12.2% vs. 2.9%, p = 0.038), were more likely to be injured in a motor vehicle collision (8.1% vs. 0%, p = 0.005), had a higher ISS (8.0 ± 3.3 vs. 6.4 ± 2.8, p = 0.003), and had more imaging performed than those treated by a non-trauma provider. There was, however, no difference in operative rates, concomitant injuries, length of stay, or discharge disposition regarding provider type.

Conclusion. It is important to recognize proximal humerus fractures as a sign of fragility and to optimize hospital management of these patients. ***Kans J Med 2020;13:101-105***

INTRODUCTION

Falls are the leading cause of injury in adults aged 65 or older with an estimated 300,000 fall-related hospitalizations in the United States each year.[1] Among this age group, one out of five falls results in a severe injury, with 94% of fractures being fall-related.[1,2] Proximal humerus fractures are the third most common fracture in this age group, with an annual incidence of 25.3 per 10,000 person-years.[3,4] Leading risk factors for a proximal humerus fracture are bone fragility and risk of falling.[5] With an aging population, proximal humerus fractures will become an even more commonly encountered injury seen in emergency departments and trauma centers.[6]

Elderly patients who experience a proximal humerus fracture often have additional injuries or comorbid conditions, such as diabetes, depression, or dementia.[5] In addition, proximal humerus fractures among the elderly can result in various complications, such as prolonged hospitalization and increased risk of future fractures.[7] Mortality among those 65 years or older who sustain a proximal humerus fracture is 100 per 1,000 person-years.[8]

There has been little research on nonsurgical treatment and concomitant injuries seen in elderly patients who sustain a proximal humerus fracture. Most studies focused on operative management and functional outcomes.[9-15] However, studies that mention associated injuries and diagnostic imaging usually concentrated on the affected shoulder girdle and did not extend beyond the scope of the injured area.[9-15] For instance, one particular study found that 11.9% of elderly patients with a proximal humerus fracture also had a concomitant fracture, but the type or location of the additional fracture was not expounded.[8]

The purpose of this study was to identify additional injuries commonly seen with proximal humerus fractures experienced by patients 65 years or older and to evaluate discrepancies in the management of these patients with regard to provider type. Specifically of interest were differences seen between providers based on initial imaging studies performed, operative rates, length of hospital stay, and where patients were discharged.

METHODS

A retrospective chart review was conducted of all patients 65 years or older who sustained a proximal humerus fracture and were admitted to an American College of Surgeons-verified level-1 trauma center between January 1, 2001 and December 31, 2015. Proximal humerus fractures included a diagnostic ICD9 code of 812.0 - 812.09 or 812.1 - 812.19. The 2018 Compendium also was later referenced regarding what constitutes a proximal humerus fracture.[16] To evaluate patients with only minor injuries, those with a Injury Severity Score (ISS) greater than 15 were excluded. Data collection included demographics (age, gender, and race), mechanism of injury, ISS, injury details (ipsilateral and concomitant fractures), need for surgery, initial imaging details, hospital length of stay (HLOS), disposition, and mortality.

Any injury-related imaging obtained within 24 hours of the patient's arrival or any prior imaging from a transferring hospital was considered as initial imaging. Fractures defined as concomitant excluded the shoulder girdle. Providers were defined as either trauma or non-trauma providers. Trauma providers included fellowship trained trauma surgeons and rotating trauma residents that respond to any trauma activations and trauma consults. A non-trauma provider included patients managed by orthopedic surgeons, family physicians, emergency physicians, or internal medicine physicians. Descriptive analyses were presented as frequencies with percentages for categorical variables and means with standard deviations for continuous variables. Independent sample t-tests were used to explore mean differences between continuous variables where Chi-square tests were used to assess the distributions of categorical variables. Prior to performing comparative analysis, patients were grouped by fracture type (concomitant vs. isolated) and by provider (non-trauma vs. trauma).

All statistical tests were two-sided and analyses were considered significant when the resultant p value was ≤ 0.05. All analyses, except where noted, were conducted using SPSS release 23.0 (IBM Corp., Armonk, New York). The study was approved by the Institutional Review Board of Via Christi Hospitals Wichita, Inc. and the Human Subjects Committee at the University of Kansas School of Medicine-Wichita.

RESULTS

A total of 177 patients were identified from the trauma registry. However, 34 patients were excluded since they had an ISS greater than 15. Of the remaining 143 patients, most were female (77.6%, n = 111) and Caucasian (95.1%, n = 136), with an average age of 80 ± 8.2 years and ISS of 7.3 ± 3.1. Most fractures were fall-related (93.0%, n = 133), and none of the patients sustained a spleen, liver, kidney, pancreas, or hollow viscus injury.

Forty-five percent (n = 65) of patients sustained a concomitant fracture and 54.5% (n = 78) experienced an isolated fracture (Table 1). Patients with a concomitant fracture had a slightly higher ISS (8.3 ± 3.0 vs. 6.4 ± 3.0, p < 0.001) and were more likely to be discharged to a rehabilitation center (21.5% vs. 7.7%, p = 0.014) than those with an isolated proximal humerus fracture. There were no differences between fracture type regarding age, gender, mechanism of injury, operative rates, or hospital length of stay.

Slightly more patients were managed by a trauma provider (51.7%, n = 74) than by a non-trauma provider (48.3%, n = 69; Table 2). No difference was noted regarding the frequency of concomitant fractures between the different treatment groups. However, those managed by a non-trauma provider experienced more frequent ipsilateral hip fractures (20.3% vs. 5.4%, p = 0.007) and those managed by a trauma provider experienced more frequent pelvic fractures (12.2% vs. 2.9%, p = 0.038).

Patients managed by a trauma provider had a higher average ISS (8.0 ± 3.3) than those managed by a non-trauma provider (6.4 ± 2.8, p = 0.003; Table 3). In addition, all patients in a motor vehicle collision (MVC) were managed by a trauma provider (8.1% vs. 0%, p = 0.005), whereas patients injured in a fall were more likely to be managed by a non-trauma provider (98.6% vs. 85.1%, p = 0.002). There was no difference between the provider groups regarding average age, the frequency of concomitant fractures, operative management, hospital length of stay, or discharge disposition.

Among all patients, computed tomography (CT) was most likely performed of the cervical spine (46.2%, n = 66) or the head (43.4%, n = 62; Table 4). Most axial X-rays were to the chest (68.5%, n = 98) and most non-axial X-rays were to the shoulder of injury site (96.5%, n = 138; Tables 5 and 6). Patients managed by a trauma provider were more likely to receive additional imaging, particularly CT imaging of the head, spine, chest, abdomen, and the affected upper extremity (Table 4). Trauma providers also performed more axial X-rays of the chest, pelvis, and the cervical spine than those managed by a non-trauma provider (Table 5). Nonaxial X-ray imaging was similar between provider types except for the ipsilateral hip and ankle (Table 6).

Table 1. Comparison of demographics and injury severity of patients with proximal humerus fractures based on fracture.

Parameter*	Concomitant Fracture	Isolated Fracture	p value
Number of patients	65 (45.5%)	78 (54.5%)	
Age (years)	78 ± 8.5	80 ± 8.0	0.225
Female sex	49 (75.4%)	62 (79. 5%)	0.558
Injury Severity Score (ISS)	8.3 ± 3.0	6.4 ± 3.0	< 0.001
Mechanism of injury			
Fall	58 (89.2%)	75 (96.2%)	0.106
Motor vehicle collision	5 (7.7%)	3 (3.8%)	0.319
Surgery (proximal humerus)	15 (23.1%)	24 (30.8%)	0.304
Hospital length of stay, days	5.6 ± 4.0	4.5 ± 2.8	0.073
Disposition			0.014
Home, home with health care	16 (24.6%)	37 (47.4%)	
Rehabilitation	14 (21.5%)	6 (7.7%)	
Nursing home, skilled nursing	32 (49.2%)	32 (42.3%)	
Hospice, death	3 (4.6%)	2 (2.6%)	

*Values presented as number (%) or mean ± standard deviation.

Table 2. Concomitant fractures among patients with proximal humerus fractures based on provider.

Parameter*†	Total	Trauma	Non-Trauma	p value
Number of patients	143 (100%)	74 (51.7%)	69 (48.3%)	
Concomitant fractures	65 (45.5%)	38 (51.4%)	27 (39.1%)	0.142
Ipsilateral upper extremity	19 (13.3%)	10 (13.5%)	9 (13.0%)	0.934
Ipsilateral hip	18 (12.6%)	4 (5.4%)	14 (20.3%)	0.007
Pelvis	11 (7.7%)	9 (12.2%)	2 (2.9%)	0.038
Ipsilateral femur	8 (5.6%)	6 (8.1%)	2 (2.9%)	0.277
Lower extremities (excluding ipsilateral hip/ femur)	7 (4.9%)	4 (5.4%)	3 (4.3%)	1.000
Spine	6 (4.2%)	5 (6.8%)	1 (1.4%)	0.211
Facial bones	5 (3.5%)	3 (4.1%)	2 (2.9%)	1.000
Ribs	4 (2.8%)	4 (5.4%)	0 (0.0%)	0.121
Contralateral upper extremity	3 (2.1%)	1 (1.4%)	2 (2.9%)	0.609

*Values presented as number (%).
†More than one patient could have more than one fracture.

Table 3. Comparison of demographics and injury severity of patients with proximal humerus fractures based on provider.

Parameter*	Trauma	Non-Trauma	p value
Number of patients	74 (51.7%)	69 (48.3%)	
Age (years)	79 ± 8.4	80 ± 8.0	0.346
Female	53 (71.6%)	58 (84.1%)	0.056
Injury Severity Score (ISS)	8.0 ± 3.3	6.4 ± 2.8	0.003
Concomitant fracture	38 (51.4%)	27 (39.1%)	0.142
Mechanism of injury			
Fall	64 (85.1%)	69 (98.6%)	0.002
Motor vehicle collision	8 (8.1%)	0 (0.0%)	0.005
Surgery (proximal humerus)	17 (23.0%)	22 (31.9%)	0.232
Hospital length of stay, days	5.2 ± 3.9	4.8 ± 2.8	0.940
Disposition			0.870
Home, home with health care	29 (39.2%)	24 (34.8%)	
Rehabilitation	9 (12.2%)	11 (15.9%)	
Nursing home, skilled nursing	33 (44.6%)	32 (46.4%)	
Hospice, death	3 (4.1%)	2 (2.9%)	

*Values presented as number (%) or mean ± standard deviation.

Table 4. Comparison of CT imaging frequency of patients with proximal humerus fractures based on provider.

Parameter*	Total Population	Trauma	Non-Trauma	p value
Number of patients	143 (100%)	74 (51.7%)	69 (48.3%)	
C-spine	66 (46.2%)	50 (67.6%)	16 (23.2%)	<0.001
Head	62 (43.4%)	37 (50.0%)	25 (36.2%)	0.001
Affected upper extremity	24 (16.8%)	21 (28.4%)	3 (4.3%)	<0.001
L-spine	20 (13.9%)	17 (22.9%)	3 (4.3%)	0.001
T-spine	18 (12.6%)	17 (22.9%)	1 (1.4%)	<0.001
Pelvis	18 (12.6%)	12 (16.2%)	6 (8.7%)	0.175
Maxillofacial	7 (4.9%)	5 (6.8%)	2 (2.9%)	0.285
Abdomen	6 (4.2%)	6 (8.1%)	0 (0.0%)	0.016
Chest	6 (4.2%)	6 (8.1%)	0 (0.0%)	0.016
CTA chest	2 (1.4%)	1 (1.4%)	1 (1.4%)	0.960
CTA pelvis	1 (0.7%)	1 (1.4%)	0 (0.0%)	0.333

*Values presented as number (%).

Table 5. Comparison of axial X-ray frequency of patients with proximal humerus fractures based on provider.

Parameter*	Total Population	Trauma	Non-Trauma	p value
Number of patients	143 (100%)	74 (51.7%)	69 (48.3%)	
Chest	98 (68.5%)	64 (86.5%)	34 (49.3%)	<0.001
Pelvis	85 (59.4%)	60 (81.1%)	25 (36.2%)	<0.001
C-spine	8 (5.6%)	7 (9.5%)	1 (1.4%)	0.037
L-spine	5 (3.5%)	3 (4.1%)	2 (2.9%)	0.943
Flexion/ extension	4 (2.8%)	3 (4.1%)	1 (1.4%)	0.345
T-spine	4 (2.8%)	3 (4.1%)	1 (1.4%)	0.345
Lumbosacral	3 (2.1%)	2 (2.7%)	1 (1.4%)	0.593

*Values presented as number (%).

Table 6. Comparison of non-axial X-ray frequency of patients with proximal humerus fractures based on provider.

Parameter*	Total Population	Trauma	Non-Trauma	p value
Number of patients	143 (100%)	74 (51.7%)	69 (48.3%)	
Shoulder of humerus (injury site)	138 (96.5%)	71 (95.9%)	67 (97.1%)	0.707
Upper extremity ipsilateral				
Elbow joint (below injury)	21 (14.7%)	13 (18.3%)	8 (11.6%)	0.313
Wrist	18 (12.6%)	8 (11.3%)	10 (14.5%)	0.507
Forearm	17 (11.9%)	12 (16.9%)	5 (7.2%)	0.98
Hand	9 (6.3%)	6 (8.5%)	3 (4.3%)	0.355
Scapula	2 (1.4%)	1 (1.4%)	1 (1.4%)	0.960
Upper extremity contralateral				
Shoulder	6 (4.2%)	4 (5.4%)	2 (2.9%)	0.455
Wrist	4 (2.8%)	3 (4.1%)	1 (1.4%)	0.345
Hand	2 (1.4%)	1 (1.4%)	1 (1.4%)	0.960
Elbow	1 (0.7%)	1 (1.4%)	0 (0.0%)	0.333
Forearm	1 (0.7%)	1 (1.4%)	0 (0.0%)	0.333
Lower extremity ipsilateral				
Hip	24 (16.8%)	7 (9.5%)	17 (24.6%)	0.015
Knee	16 (11.2%)	10 (13.5%)	6 (8.7%)	0.361
Femur	11 (7.7%)	8 (10.8%)	3 (4.3%)	0.147
Ankle	4 (2.8%)	4 (5.4%)	0 (0.0%)	0.050
Tibia/ fibula	2 (1.4%)	1 (1.4%)	1 (1.4%)	0.960
Foot	1 (0.7%)	0 (0.0%)	1 (1.4%)	0.299
Lower extremity contralateral				
Knee	9 (6.3%)	7 (9.5%)	2 (2.9%)	0.106
Hip	5 (3.5%)	3 (4.1%)	2 (2.9%)	0.707
Femur	4 (2.8%)	3 (4.1%)	1 (1.4%)	0.345
Ankle	2 (1.4%)	2 (2.7%)	0 (0.0%)	0.169
Tibia/ fibula	1 (0.7%)	1 (1.4%)	0 (0.0%)	0.333

*Values presented as number (%).

DISCUSSION

The current study results indicated that concomitant fractures are common among elderly patients who sustain proximal humerus fractures, with nearly half of all patients sustaining a concomitant fracture. In comparison to previous studies, this incidence was much higher.[17,18] For instance, Clement et al.[17] cited 10% of patients had multiple fractures, and Neuhaus et al.[18] reported 28% of patients had multiple fractures. Additional study results indicated that upper extremity, hip, and pelvic fractures commonly were associated with a proximal humerus fracture. These findings were consistent with an Italian study by Pedrazzoni et al.[19] which also showed that the most

common simultaneous fractures are of the hip, distal radius, pelvis, and ribs.

The percentage of concomitant hip fractures in the current study was higher than had been reported previously.[20-22] Di Monaco et al.[21-22] studied patients with hip fractures and evaluated concomitant fractures; however, concomitant proximal humerus fractures ranged from 1.4% to 2.1%. This discrepancy could be related to other factors, such as the degree of osteoporotic disease at the time of the fracture. Future research could be done to determine the unique characteristics of patients presenting with proximal humerus fractures and how best to manage them.

Studies of simultaneous hip and proximal humerus fractures have reported conflicting data regarding the length of stay.[21-24] However, in the current study, there was no difference in hospital length of stay between patients with concomitant and isolated fractures. In addition, Neuhaus et al.[18] demonstrated that adults with concomitant fractures and a proximal humerus fracture had an increase in adverse events and mortality, and a greater percent were discharged to a facility. In the current study, patients with concomitant fractures were more likely to require rehabilitation than those with isolated fractures.

Previous studies have suggested discrepancies in hospital management techniques among different providers regarding proximal humerus fractures and other types of fractures.[24-26] In the current study, for instance, differences were noted with regard to the number of images obtained by provider type. These differences could be attributed to differences in injury mechanism. For example, all patients injured in an MVC were managed by a trauma provider. This was not surprising considering most MVC patients are transported by ambulance and are more likely to activate a trauma response. Although trauma providers ordered more imaging than non-trauma providers, there was no difference in the frequency of operative treatments between the two groups. Previous studies supported this finding by reporting that CTs do not affect treatment recommendations, specifically regarding operative vs. nonsurgical management.[15,27]

Patients treated at trauma centers typically have higher associated costs and more interventions than those treated at non-trauma centers with similar outcomes.[28] Although we did not evaluate costs in this study, one could surmise that patients managed by a trauma provider accrued higher costs since these patients had more imaging performed than those managed by a non-trauma provider, even though they had similar operative rates and lengths of stay. The additional diagnostic modalities utilized by trauma providers could place a strain on the system and represent aggressive, labor-intensive management strategies that do not necessarily produce different patient outcomes.

There were several limitations of this study, including the weaknesses inherent in a retrospective study design. Additional limitations of this study included a small sample size, including patients from a single level 1 trauma center with few minorities represented, and including only patients with an ISS less than 15, which did not allow direct comparisons to most previous studies. In several cases that were analyzed, the patient was transferred from an outside hospital and had prior imaging at that hospital. Even though the medical provider likely had access to these initial images, these initial images were not available among patient medical records, therefore were not included. This could be a future area of research to compare elderly patients with multiple fractures to those with isolated fractures.

CONCLUSIONS

Concomitant fractures are common in elderly trauma patients who experience a proximal humerus fracture. Patients managed by trauma providers were more likely to be injured in an MVC, have a higher ISS, experience more pelvic fractures, and have more imaging performed than those treated by non-trauma providers. Despite these differences, no differences in the frequency of operative treatments were observed between the different providers. It is important to recognize proximal humerus fractures as a sign of fragility and to optimize hospital management of these patients.

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