Survivorship of Early vs. Late Total Shoulder Arthroplasty After Proximal Humerus Fractures

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INTRODUCTION:
Proximal humerus fractures are one of the most common fractures amongst the elderly. Some patients may elect to attempt non-operative management in an effort to avoid surgery. However, trials of non-operative management may fail due to pain or unsatisfactory function. The impact of delaying surgical treatment with total shoulder arthroplasty is unclear. The purpose of this study is to assess the effect of timing on the complication rate and revision-free survivorship after total shoulder arthroplasty for proximal humerus fractures.
METHODS: The New York Statewide Planning and Research Cooperative System (SPARCS) database was queried from 2010 to 2020 for patients who presented with proximal humerus fractures and subsequently underwent total shoulder arthroplasty using ICD and CPT codes. Patients were categorized into early or late TSA depending on the length of time between initial injury presentation and procedure. Patients who underwent TSA within 30 days were considered as the "early" group. Patients who underwent TSA after 6 months were considered the "late" group. Demographic variables, overall rate of revision and complications at 3 and 12 months were collected and compared. A Cox proportional hazards model controlling for age, gender, race, insurance and Elixhauser comorbidity index was performed. A cumulative hazard plot and a log-rank test were performed. Statistical significance was set at $p < 0.05$.
RESULTS:
A total of 4,143 patients were included (n = 3,335 early, n = 808 late). Patients in the late group were younger, more likely to be male, more likely to be white, more likely to have private insurance, and more likely to be a smoker. (Table 1) At 3 months from surgery, the late group had a lower rate of dislocations ($p = 0.007$) but more revisions ($p = 0.043$). (Table 2) At 12 months, the late group had lower rates of dislocation ($p = 0.002$) but greater a rate of revisions ($p = 0.003$) and readmissions ($p = 0.001$). Overall, the late group had a significantly increased rate of revision at 3.0% vs. the early group at 1.0% ($p < 0.001$). When controlling for age, gender, race, insurance and Elixhauser score, the late group had an increased hazard ratio of 2.10 (95% CI: 1.22-3.59; $p = 0.007$). (Table 3) The log-rank test and the cumulative hazard plot demonstrate that the late group has a significantly greater cumulative hazard rate ($p < 0.001$). (Figure 1)
DISCUSSION AND CONCLUSION: Our study indicates that late reverse total shoulder arthroplasty after a proximal humeral fracture is associated with increased revision rates and lower revision-free survivorship. Patients should be counseled that delaying rTSA after a proximal humerus fracture may result in an increased risk for needing additional surgery.

Figure 1. Cumulative Hazard Plot for Revision

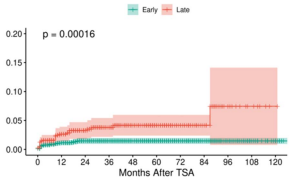

Table 1. Demographics

	Early	Late	p-value
n	3,335	808	
Age (mean (SD))	73.01 (10.11)	67.43 (10.62)	<0.001
Age Groups (%)			<0.001
0-50	80 (2.4)	37 (4.6)	
50-65	644 (19.3)	298 (36.9)	
65-80	1811 (54.3)	383 (47.4)	
80+	800 (24.0)	90 (11.1)	
Male Gender (%)	706 (21.2)	195 (24.1)	0.074
Elixhauser Score (mean (SD))	2.54 (5.75)	2.28 (5.83)	0.257
Race (%)			<0.001
White	2784 (83.5)	515 (85.0)	
Black	98 (2.9)	22 (3.6)	
Hispanic	160 (4.8)	26 (4.3)	
Other or Unknown	293 (8.8)	43 (7.1)	
Insurance (%)			<0.001
Private	823 (24.7)	247 (30.6)	
Medicare	2299 (68.9)	460 (56.9)	
Medicaid	100 (3.0)	44 (5.4)	
Worker's Compensation	76 (2.3)	49 (6.1)	
Other	37 (1.1)	8 (1.0)	
Diabetes (%)	851 (25.5)	209 (25.9)	0.874
Smoking (%)	271 (8.1)	99 (12.3)	<0.001
Obesity (%)	619 (18.6)	171 (21.2)	0.101

Table 2. Complications

	Early	Late	p-value
n	3,335	808	
3 Months:			
Wound / Cellulitis (%)	50 (1.5)	16 (2.0)	0.410
Dislocation (%)	106 (3.2)	11 (1.4)	0.007
Fracture (%)	34 (1.0)	10 (1.2)	0.725
Infection (%)	3 (0.1)	0 (0.0)	0.901
Revision (%)	20 (0.6)	11 (1.4)	0.043
Readmission (%)	408 (12.2)	90 (11.1)	0.424
12 Months:			
Wound / Cellulitis (%)	88 (2.6)	24 (3.0)	0.689
Dislocation (%)	118 (3.5)	11 (1.4)	0.002
Fracture (%)	49 (1.5)	16 (2.0)	0.373
Infection (%)	4 (0.1)	0 (0.0)	0.724
Revision (%)	28 (0.8)	17 (2.1)	0.003
Readmission (%)	641 (19.2)	199 (24.6)	0.001
Any Revision (%)	33 (1.0)	24 (3.0)	<0.001

Table 3. Cox Proportional Hazards Regression Model

	HR	95% CI	p-value
Timing			
Early	1.00	—	
Late	2.10	1.22, 3.59	0.007
Age[†]	0.78	0.60, 1.01	0.060
Gender			
Female	1.00	—	
Male (relative to female)	2.90	1.67, 5.01	<0.001
Race			
White	1.00	—	
Black	0.62	0.15, 2.66	0.5
Hispanic	0.65	0.16, 2.69	0.6
Other or Unknown	1.09	0.43, 2.81	0.9
Insurance			
Private	1.00	—	
Medicare	0.45	0.24, 0.85	0.013
Medicaid	1.02	0.37, 2.76	>0.9
Worker's Compensation	0.48	0.11, 2.00	0.3
Other	0.70	0.09, 5.31	0.7
Elixhauser Score	0.95	0.90, 1.01	0.077

[†] *scaled by 10; HR = Hazard Ratio, CI = Confidence Interval*