

Decreased Early Complication Rates Associated with Rheumatoid Arthritis Compared to Alternate Indications for Total Elbow Arthroplasty

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ABSTRACT

BACKGROUND: Rheumatoid arthritis is currently seen as the primary surgical indication for total elbow arthroplasty (TEA). Nevertheless, surgical indications continue to expand accounting for greater TEA case volumes. Despite evolving trends, very few data describes complications associated with specific surgical indication of TEA.

METHODS: We analyzed The American College of Surgeons National Surgical Quality Improvement Program (NSQIP) database for individuals that received a TEA from 2006 to 2015. Surgical indications and 30-day postoperative complication data for patients

treated as inpatients at participating hospitals was obtained.

RESULTS: 317 patients were identified for analysis. 22.1% of individuals received TEA for rheumatoid arthritis. 52 total adverse events were reported for all patients undergoing TEA. Rheumatoid arthritis patients experienced significantly lower rates of overall adverse events (8.57% vs 18.62%, $p = 0.045$).

CONCLUSION: Rheumatoid arthritis patients that undergo TEA are significantly less likely to develop a 30 day post-operative complication than patients who receive TEA for other reasons.

Key words: Total elbow arthroplasty; Rheumatoid arthritis; Complications; NSQIP

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INTRODUCTION

Total elbow arthroplasty (TEA) has been shown to be an effective procedure in the management of inflammatory and degenerative arthritis in addition to unreconstructable distal humeral fractures^[1-6]. Although significantly fewer total elbow arthroplasties are performed in comparison to other arthroplasties, the procedure is more commonly associated with complications^[7]. Literature suggests that complication rates associated with TEA range from 14% to as high as 43%^[1,7-16]. Currently, rheumatoid arthritis remains the most common indication for TEA^[17]. The implementation of improved medical management of rheumatoid arthritis however, has led to a reduction in TEA in rheumatoid patients^[18]. Nevertheless, total case volume of TEA has steadily increased^[17]. Recent trends demonstrate increasing use of TEA for traumatic and degenerative indications as cause for increasing case load^[19]. As a result, there is increased importance on characterizing complications associated with indications of TEA other than rheumatoid arthritis. A few small cohort studies have

characterized complications associated with TEA^[17]. However, there are limited large cohort studies that characterizes complications associated with specific indications of TEA. The goal of this study is to provide insight regarding trends of complications associated with rheumatoid arthritis and other indications of TEA.

METHODS

A review of the American College of Surgeons National Surgical Quality Improvement Program (NSQIP) database (2006-2015) was performed to identify patients who underwent total elbow arthroplasty using the *Current Procedural Terminology (CPT)* codes for the procedures. International Classification of Diseases (*ICD*) codes were utilized to identify indication for TEA including degenerative arthritis, rheumatoid arthritis, post-traumatic arthropathy, and acute fracture treatment. All procedures were performed for each year of NSQIP data collection. Patient demographics of age (years) and body mass index (BMI, kg/m²) were treated as continuous variables. Smoking status, diabetes mellitus, history of congestive heart failure, history of chronic obstructive pulmonary disease (COPD), history of myocardial infarction (MI), and American Society of Anesthesiologist (ASA) score (< 3, ≥ 3) were treated as categorical variables. Patient’s hospital length of stay (days) and operative time (minutes) was also extracted from the NSQIP database. 30 day post-operative complications were assessed using variables documented in the NSQIP dataset. Consistent with prior studies^[20-22], major adverse event was defined as death, coma, failure to wean off of a ventilator, unplanned intubation, cerebrovascular accident, pulmonary embolism, cardiac arrest, myocardial infarction, acute renal failure, sepsis, septic shock, or return to the operating room. Minor adverse event was defined as wound disruption, superficial surgical site infection, deep surgical site infection, organ or space surgical site infection, urinary tract infection, pneumonia, transfusion, renal insufficiency, peripheral nerve injury, or deep vein thrombosis. Total adverse events was defined as total number of both major and minor adverse events in the 30-day postoperative follow-up period.

Continuous variables between the groups were compared using an independent sample Student t-test. Categorical variables were analyzed using frequency tables with Fisher’s Exact tests. A *p* value of ≤ 0.05 was interpreted as statistically significant.

RESULTS

A total of 321 patients who received a primary total elbow arthroplasty from 2006 to 2015 were identified from the NSQIP database. Four patients were excluded due to incomplete data entry leaving 317 patients available for analysis. Indications for the 317 TEA’s performed were as follows: 70 for rheumatoid arthritis and 247 for all other surgical indications (109 for degenerative arthritis, 29 for post-traumatic arthropathy, and 109 for acute fracture). From a demographics perspective, patients of both groups were similar in age. Rheumatoid arthritis patients were less likely to be male (18.6% vs 23.9%, *p* = 0.0351). In addition, rheumatoid arthritis patients had significantly lower BMI’s and were less likely to have diabetes when compared to all other TEA patients (26.2 vs 29.3, *p* < 0.001 and 5.70% vs 18.2%, *p* = 0.011 respectively). No other difference were appreciated in regards to comorbidities and ASA scores between the two groups (Table 1). In regards to peri-operative variables, no difference was appreciated in operative time and length of hospital stay between the two groups (159.9 vs 151.9 minutes, *p* = 0.346 and 2.81 vs 2.98 days *p* = 0.691 respectively) (Table 2).

In regards to post-operative complications, rheumatoid arthritis

Table 1 Patient demographics of rheumatoid arthritis patients and all other surgical indication patients undergoing total elbow arthroplasty.

	Rheumatoid Arthritis (n = 70)	All other surgical indications (n = 247)	<i>p</i>
Age, mean (sd)	62 (11.8)	65 (14.0)	0.103
Gender, %			
Male	18.6	23.9	0.351
Female	81.4	76.1	
BMI, kg/m ² (sd)	26.2 (5.6)	29.3 (6.8)	<0.001
Diabetes, %	5.7	18.2	0.011
Smoke, %	8.57	14.2	0.217
COPD Hx, %	1.43	4.86	0.203
CHF Hx, %	0	2.42	N/A
MI Hx, %	0	0.4	N/A
ASA Score, mean	2.67	2.6	
ASA Score, %			
< 3	32.9	42.9	0.134
≥ 3	67.1	57.1	

Table 2 Peri-operative variables of rheumatoid arthritis patients and all other surgical indication patients undergoing total elbow arthroplasty.

	Rheumatoid arthritis (n = 70)	All other surgical indications (n = 247)	<i>p</i>
Mean operative time, min (sd)	159.9 (58.1)	151.9 (63.8)	0.346
Length of hospital stay, days (sd)	2.81 (4.24)	2.98 (2.77)	0.691

Appendix A Frequency of specific adverse events within 30 days of total elbow arthroplasty for rheumatoid and other patients.

	Rheumatoid Arthritis		All other surgical indications		<i>p</i>
	N	%	N	%	
Serious adverse events					
Death	0	0	1	0.4	N/A
Failure to wean off ventilator	0	0	0	0	N/A
Unplanned intubation	1	1.4	1	0.4	0.348
Cerebrovascular accident	0	0	2	0.8	N/A
Pulmonary embolism	0	0	3	1.2	N/A
Cardiac arrest	0	0	0	0	N/A
Myocardial infarction	0	0	0	0	N/A
Acute renal failure	0	0	0	0	N/A
Sepsis	1	1.4	3	1.2	0.894
Septic shock	1	1.4	0	0	N/A
Return to the operating room	2	2.8	10	4	0.641
Minor adverse events					
Wound disruption	0	0	3	1.2	N/A
Superficial surgical site infection	1	1.4	3	1.2	0.894
Deep surgical site infection	0	0	3	1.2	N/A
Organ/space surgical site infection	0	0	3	1.2	N/A
Urinary tract infection	0	0	1	0.4	N/A
Transfusion	0	0	12	4.8	N/A
Renal insufficiency	0	0	0	0	N/A
Peripheral nerve injury	0	0	1	0.4	N/A
Deep vein thrombosis	0	0	0	0	N/A
Total adverse events	6	8.57	46	18.6	0.046
Total adverse event for data set	52	16.4			

patients experienced significantly lower rates of minor adverse events than other TEA surgical indication patients (1.43% vs 10.5%, *p* = 0.0169). However, no significant difference was appreciated

when comparing major adverse events (7.14% vs 8.10%, $p = 0.793$). Nevertheless, when comparing total adverse events, rheumatoid arthritis patients experienced significantly lower rates than other TEA patients (8.57% vs 18.6%, $p = 0.0462$) (Figure 1). A total of 52 adverse events were reported for all individuals that received a TEA with overall adverse event rate of 16.4%. A full listing of the frequency of specific adverse events for both rheumatoid arthritis patients and reference control patients within 30 days of surgery can be found in appendix A.

DISCUSSION

Although total elbow arthroplasties are associated with good clinical outcomes^[6], the procedure has been found to have high complication rates. Gschwend *et al.* reported an overall complication rate of 43% in 1996 while Voloshin *et al.* reported a complication rate of 24.3% in 2011. Our data demonstrated an overall complication rate of 16.4%. Although the methodology of these studies cannot be directly compared, our reported data is consistent with trends of decreasing complication rates^[17]. Literature suggest that improving surgical technique and prosthetic design may be contributing factors however, it is difficult to quantify^[5,17,23]. Although our data demonstrates a large decrease in overall complication rate, the reported rate still remains significantly higher than complication rates for other joint arthroplasties^[7,24,25].

This investigation revealed that rheumatoid arthritis patients have significantly lower adverse event rates than other surgical indications of TEA. This is consistent with previous reported data of increased survivorship and decreased complications in rheumatoid patients^[17,26,27]. Zhang *et al.* corroborate this idea and even state that the ideal candidate for TEA is a patient with end-stage rheumatoid arthritis^[27]. Although rheumatoid arthritis is currently the most common indication for TEA, data suggest that this trend is changing^[17,28]. These trends seem consistent with our dataset where only 22% of total elbow arthroplasties were conducted for rheumatoid arthritis patients. Authors suggest improving medical management of rheumatoid arthritis has led to a decrease in the number of symptomatic patients.⁵ This decrease is consistent with data that characterizes an up to 132% increase in number of total elbow arthroplasties for trauma and acute fracture^[29]. However, we were unable to directly comment in regards to yearly operative trends due to variations in NSQIP case reporting. Nevertheless, the trends of increasing TEAs for all surgical indications is likely secondary to increased provider confidence. Recent literature characterizing improved implant design^[30,31] and relative good functional outcomes⁶ has likely increased TEA use and popularity. As a result, it is important to characterize and understand complications associated with alternative surgical indications for TEA. This evolution in trends may in fact lead to increased complication rates in the coming years as shrinking percentage of rheumatoid arthritis patients receive TEA. In regards to our data, a fewer percentage of rheumatoid arthritis patients had diabetes and had significantly lower BMIs when compared to patients with other surgical indications for TEA. Previous literature has characterized increased complication rates with both of these risk factors in regards to TEA^[4,32,33]. Although our patient cohort possesses potential confounding variables, our goal of this manuscript is not to determine causation but rather characterize trends in patients and complications that occur with total elbow arthroplasties.

This study has several limitations. First, we were limited to variables reliably documented in the NSQIP database. This dataset only contains postoperative complications up to 30 days post-op. In

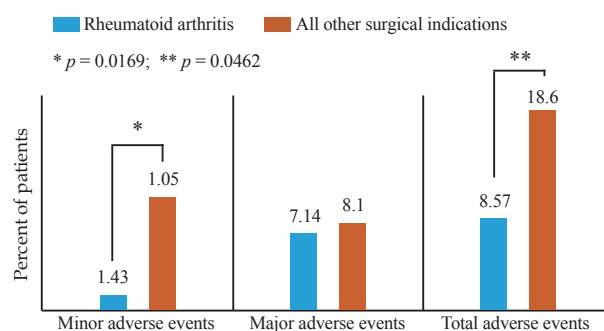


Figure 1 Adverse event rate of patients who receive total elbow arthroplasty.

addition, the dataset lacked complications specifically pertaining to TEA such as prosthesis loosening, revision surgery, joint dislocation, and periprosthetic fracture. However, this manuscript presents one of the largest and most recent patient cohorts in regards to complications with total elbow arthroplasty.

In conclusion, complication rates of total elbow arthroplasty have remained high. Using a large nationwide database, we were able to characterize demographics and 30-day complication rates of a relatively large cohort of individuals that underwent a total elbow arthroplasty. We found that patients who receive TEA for rheumatoid arthritis have fewer complications than other surgical indications. As trends continue to evolve, surgeons and patients alike should be aware of complication rate associated with TEA.

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