



# Traumatic Upper-Extremity Amputations: An Epidemiologic Study using the National Trauma Data Bank

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## INTRODUCTION

Major extremity trauma and amputations have been a recent focus of study given the high prevalence of extremity injuries in recent military conflicts. While many studies in the orthopaedic literature have focused on developing predictors of outcomes following severe lower extremity trauma in order to guide clinical treatment, there is little data examining the epidemiology and outcomes of severe upper extremity trauma. While the vast majority of major amputations are in the lower extremity, upper extremity amputation results in the highest levels of impairment of all extremity war injuries (Ficke and Bosse, 2011). Despite the impact of these amputations, the distributions of various upper extremity amputations and their relative frequency of complications and reoperations have not been described. We used the 2012 National Trauma Data Bank (NTDB) to evaluate these questions.

## METHOD

**Subjects:** 421 subjects who underwent an upper-extremity amputation secondary to trauma were gathered from the NTDB. The NTDB draws from 900 trauma centers from around the U.S. and contains over three million incident trauma cases. **Procedures:** We conducted a secondary data analysis of the 2012 NTDB Research Data Set, using means and frequencies to characterize our patient population and describe the distribution of upper limb amputations. **Data Analysis:** Multivariable regression models were fit in order to identify which variables significantly influence length of hospitalization, rate of reoperation, and adverse surgical complications.

## RESULTS

A total of 421 patients underwent an upper-extremity amputation secondary to a traumatic upper limb injury, representing 0.05% of all NTDB trauma admissions. 80.1% were male and 19.9% were female. 66.8% were White. The 421 patients had 595 amputation-related procedures performed. Table 1 shows the incidence of amputations, re-amputations, and proximal extension procedures at the four most frequent levels. The most frequent diagnostic codes for all upper limb amputations were traumatic amputations of the forearm or hand (6.6%), traumatic amputations of the upper arm (4.8%), and open fractures of the humerus (2.0%). 15.4% of amputees experienced major post-surgical complications. The

most frequent major complications included pneumonia (4.9%), organ/ space surgical site infections (3.1%), and acute kidney injury (2.7%). Table 2 provides the incidence of major complications, average length of hospitalization, and percentage of patients needing assistive care in a specialized nursing or rehabilitation facility following discharge. Predictors of major post-surgical complications included Injury Severity Score (ISS) ( $p < 0.001$ ) and the presence of compartment syndrome ( $p = 0.003$ ). Risk factors for amputation among those with an open forearm fracture included age ( $p = 0.005$ ), location of the fracture (proximal greater than distal) ( $p = 0.002$ ), and presence of

Amputation Level	Frequency (%)	Re-amputations (%)	Proximal Extension (%)
Through Humerus	32.3	29.3	2.0
Through Elbow	7.5	34.3	8.6
Through Forearm	25.4	29.7	7.6
Through Hand	13.3	8.1	4.8
Level	Hospitalization (days)	Complications (%)	Discharge (%)
Through Humerus	18.8	18.4	44.1
Through Elbow	15.6	20.0	40.0
Through Forearm	15.1	13.9	60.2
Through Hand	12.0	10.9	65.5

compartment syndrome ( $p = 0.043$ ).

## DISCUSSION & CONCLUSION

We report a high rate of complications and reoperations among trauma-related upper limb amputees. We identified predictors for post-surgical complications and amputation that have not been described in the literature. Future therapeutic studies should focus on modifiable risk factors for re-amputation and surgical outcomes.

## CLINICAL APPLICATIONS

American Academy of Orthotists & Prosthetists  
**41st Academy Annual Meeting &  
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This work will contribute to the sparse epidemiologic literature on traumatic upper-extremity amputations and provide prognostic information for patients with limb threatening injuries.

## REFERENCES

Ficke and Bosse. J Am Acad Orthop Surg. 19: v-viii, 2011.

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