

Patients Transferred for Upper Extremity Amputation: Participation of Regional Trauma Centers

Shantum Misra, BA,* Suzanne C. Wilkens, MD,† Neal C. Chen, MD,† Kyle R. Eberlin, MD‡

Purpose Level-I trauma centers are required to provide hand and microsurgery capability at all times. We examined transfers to our center to better understand distant patient referrals and, indirectly, study referrals in our region.

Methods Records were reviewed from 2010 to 2015 to evaluate patients transferred to our level-I institution for upper extremity amputation. Patients were referred from 6 states to our institution over this period. We measured the straight-line distance from each patient's transferring facility to our facility and compared this distance with the straight-line distances from the zip code of the transferring facility to the zip code of each level-I trauma center.

Results We had data for 250 transferred patients (91% male, 9% female). For 110 patients (44%), our hospital was the nearest level-I trauma center; however, for the remaining 140 patients (56%), other level-I trauma facilities were located closer to the referring hospital. Among these 140 patients, the mean distance of the referring facility to the nearest level-I trauma center (30 miles; SD, 27) was significantly different from the mean distance of the referring facility to our facility (71 miles; SD, 60). A median of 4 (range, 1–10) level-I trauma centers were bypassed before patients arrived at our center. Medicaid and “self-pay” patients were more likely to be transferred to our facility.

Conclusions Fifty-six percent of patients transferred to our hospital for upper extremity amputation had a level-I trauma center closer to their injury. Patients with upper extremity amputation are referred to our regional center despite the proximity of closer level-I trauma centers. This suggests that regional microsurgery expertise does not correlate with level-I trauma designation, and establishment of designated microsurgery centers and formal referral guidelines may be beneficial for management of these difficult injuries.

Clinical relevance We believe that this study further supports the need for formal designation of regional centers of expertise for microsurgical hand trauma. (*J Hand Surg Am.* 2017; ■ (■):1.e1-e9. Copyright © 2017 by the American Society for Surgery of the Hand. All rights reserved.)

Key words Amputation, patient transfer, trauma center, upper extremity.



From the *George Washington University School of Medicine and Health Sciences, Washington, DC; the †Department of Orthopedic Surgery, Hand and Upper Extremity Service; and the ‡Division of Plastic Surgery, Massachusetts General Hospital, Harvard Medical School, Boston, MA.

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Corresponding author: Kyle R. Eberlin, MD, Massachusetts General Hospital, Harvard Medical School, Associate Director MGH Hand Surgery Fellowship, Division of Plastic and Reconstructive Surgery, Wang Ambulatory Care Center 435, 55 Fruit St., Boston, MA 02114; e-mail: keberlin@mgh.harvard.edu.

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THE LIMITED SUPPLY OF ON-CALL specialists in emergency departments (EDs) has been a continued challenge for many health care facilities.^{1,2} In 1986, Congress passed the Emergency Medical Treatment and Active Labor Act (EMTALA) to provide regulations for the appropriateness of transferring patients who were medically unstable.^{3,4} However, in 2003, the Centers for Medicare and Medicaid Services revised these regulations under the “Final Rule,” stating that hospital EDs are not required to have specialist coverage at all times, but must have procedures in place in case a specialist or on-call physician is not available.⁵ As such, a decrease in the presence of subspecialty physicians to primarily evaluate and treat these injuries has led to an increase in interhospital transfers.^{6,7} Several factors play a role in the decision to transfer, including available hospital resources such as operating rooms and personnel; however, regardless of the reason, medical facilities without adequate specialist coverage—and thus an inability to treat certain patients who present for emergency care—are obligated to transfer these patients to an alternate facility where appropriate specialty care is available.⁸

The upper extremity is the most common anatomical site of injury presenting to the ED.⁹ For certain injuries, urgent intervention is required to optimize patient outcomes, and patients with upper extremity amputations are often transferred to other facilities for evaluation and management.¹⁰ The American College of Surgeons (ACS) designates trauma centers based partly on the resources and expertise of the medical facility into levels I, II, and III. According to the ACS,¹¹ all designated level-I trauma centers are required to provide specialized services, including hand surgery and microsurgical capability, 24 hours a day. Despite this requirement, ACS guidelines do not explicitly state that hand surgeons at level-I centers must provide replantation services. Within our region, there are 33 designated adult trauma centers, 13 of which have level-I designation. It is our experience that some patients travel extensive distances to reach our center, perhaps suggesting unofficial recognition of specialized, regional centers to treat microsurgical hand trauma. Although previous studies have investigated patients transferred between facilities to receive specialized care, to our knowledge, no study has specifically evaluated distances travelled for patients transferred with upper extremity amputations.

The objective of this study was to evaluate patients presenting to our level-I trauma center with upper extremity amputations, measure the distances travelled

by patients transferred from other facilities, and study factors that may have affected such transfers. We hypothesized that patients are transferred to our academic, tertiary-care center despite the availability of closer, ACS level-I trauma facilities.

MATERIALS AND METHODS

A retrospective review of patients transferred to our facility for upper extremity amputations was conducted from October 2010 to June 2015. The ninth revision of the *International Statistical Classification of Diseases and Related Health Problems* (ICD-9) was used to identify codes specific for any amputation of the upper extremity. Any patient with 1 or more of the following ICD-9 codes was screened for eligibility in the study: traumatic thumb amputation (885.0); traumatic thumb amputation, complete (885.1); traumatic finger amputation (886.0); traumatic finger amputation, complete (886.1); amputation below elbow, unilateral, complete (887.1); amputation below elbow, unilateral (887.0); amputation above elbow, unilateral (887.2); amputation of arm, bilateral (887.6); amputation above elbow, unilateral, complete (887.3); amputation of arm, bilateral, complete (887.3); and amputation of arm, bilateral, complete (887.7). Patients were excluded from the study if they expired prior to discharge from the ED or if they presented directly to our ED (ie, they were not transferred from another facility).

After reviewing individual charts in detail, 261 patients presented to our ED with an upper extremity amputation, of which 250 (96%) had available data. The referring facility for each eligible patient was identified using medical records and each facility's trauma certification was determined using the ACS Web site (<https://www.facs.org/search/trauma-centers>). The referring hospitals were categorized as not having a trauma designation or as a level-I, -II, or -III trauma center. Patients from 6 surrounding states were transferred to our facility: Massachusetts (n = 168), Maine (n = 22), Vermont (n = 10), New Hampshire (n = 48), New York (n = 1), and Connecticut (n = 1).

The distances between our facility and the referring facilities were determined using U.S. Postal Service zip codes. Point-to-point straight-line distances were calculated by measuring values (in miles) from the center of the transferring facility zip code to our facility. In addition, straight-line distances from the transferring facility to all other level-I trauma centers within these 6 states were calculated to determine whether there was a closer level-I trauma

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