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Emergency general surgery transfers in the United States: a 10-year analysis



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ABSTRACT

Background: Emergency general surgery (EGS) admissions account for more than three million hospitalizations in the US annually; and interhospital transfers (IHTs) are costly. We aimed to better understand the population of transferred EGS patients and their subsequent care in a nationally representative sample.

Methods: Using the 2002–2011 Nationwide Inpatient Sample, we identified patients aged ≥ 18 years with an EGS noncardiovascular principal diagnosis who were transferred from another hospital with urgent or emergent admission status. Patient demographics, hospitalization characteristics, rates of operation, and mortality were identified. Procedure codes were classified into surgery and procedures based on the HCUP Surgery Flag.

Results: We identified an estimated 525,913 EGS admissions transferred from another acute care hospital. The mean age was 60 years, 51% were female, and $>50\%$ were Medicare patients. The rate of EGS IHTs increased while mortality decreased. Surgery was required for only 33% of transferred patients. The most common surgeries were laparoscopic cholecystectomy, lysis of adhesions, and wound debridement. The median length of stay was 4.4 days, 92% of patients were cared for in urban hospitals, and $>50\%$ in teaching hospitals. **Conclusions:** The percent of patients with an EGS diagnosis requiring IHT is increasing, which may reflect a trend toward regionalization of EGS. Transfers require significant resources and may delay care. More than half of the EGS patients did not require surgical intervention. Future studies to identify populations who benefit from IHT and ideal timing of transfer can establish opportunities for optimizing resource utilization and patient outcomes.

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Introduction

Emergency general surgery (EGS) admissions account for more than three million hospitalizations in the US annually and have continued to increase over time.¹ In 2010, the

incidence of hospitalization for an EGS diagnosis was estimated to be 1290 per 100,000 people, substantially higher than the incidence of other public health concerns such as new diagnoses of diabetes, coronary heart disease admissions, new diagnoses of cancer, and heart failure admissions.¹ These

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findings demonstrate the public health burden of EGS disease and the need to better understand the management of the EGS patient. Although there is an ongoing debate regarding the benefits of regionalization of EGS, little is known about the current state of interhospital transfers (IHTs) for patients with EGS diagnoses.

IHT of patients is perceived to be a common occurrence in the current health care system, although the incidence of this has not been well quantified in the United States. Outcomes and resource utilization for IHT are best understood for trauma patients and myocardial infarction.²⁻⁵ In both populations, patients have benefited from clearly defined triage pathways and transfer protocols.^{3,6}

It has previously been demonstrated that patients who undergo surgery after IHT use additional resources at the receiving hospital and have higher acuity and worse outcomes.^{7,8} The transfer of EGS patients has additional costs, including delay in care, duplication of care, and the cost of transportation between facilities, all of which have been poorly characterized. A description of the entire population of EGS transfers in the United States, including those that do not require surgery, has not been previously published. In addition, the trends in transfer and outcomes in the United States have not been characterized. We aimed to better understand the population of transferred EGS patients, both those that undergo surgery at the receiving hospital and those that do not, and their subsequent care in a nationally representative sample.

Methods

The 2002-2011 Nationwide Inpatient Sample (NIS) was used to identify patients for this study. The NIS is a nationally representative sample of all hospitalizations in the United States each year and contains data from approximately eight million hospital stays from a stratified sample of community hospitals.⁹ This study was exempt from institutional review board approval because NIS is publicly available and does not contain any personal identifying information. Patients were included if they met the following inclusion criteria: age ≥ 18 years, had an EGS noncardiovascular principal diagnosis, were transferred from another hospital, and had an urgent or emergent admission status. The American Association for the Surgery of Trauma (AAST) created a list of DRG International Classification of Diseases-ninth revision—Clinical Modification (ICD-9-CM) codes that represented EGS diseases.¹⁰ Vascular and cardiovascular EGS diagnoses (as classified by Gale *et al.*, [Appendix](#))¹ were not included as they were felt to have been outside the domain of a general surgeon. The remaining codes were used to identify patients based on their principle diagnosis code. Prior to 2007, IHT patients were identified by the variable “Admission source” as defined by the NIS indicating that they came from another acute care hospital. In October 2007, the variable admission source was transitioned to “Point of origin for admission or visit.” Because this transition happened gradually in some hospitals, patients discharged in 2007 were identified as having undergone IHT if their admission source was another acute care hospital or if their point of origin indicated transfer from another

hospital.¹¹ Beginning in 2008, a new variable “Indicator of a transfer into the hospital” was created which similarly defined transfer from a different acute care hospital based on admission source or point of origin, and this variable was used to define a transfer from 2008-2011. Admission status in the NIS database was defined by “Admission type” indicating an emergent or urgent admission.

Patient demographics identified included age, sex, race, primary expected payer, and comorbidities. Patients were classified as underinsured if their primary payer was Medicaid or self-pay, and as insured if their primary payer was Medicare or private insurance. Comorbidities were defined in the NIS database using Agency for Healthcare Research and Quality comorbidity software. Patients were grouped into EGS categories based on the AAST DRG ICD-9-CM classifications. Outcomes studied included mortality, length of stay, and whether patients underwent a surgical intervention. Surgical intervention was defined using the Healthcare Cost and Utilization Project (HCUP) Surgery Flag definition.¹² This software applies the “narrow” flag to invasive surgical procedures while the “broad” flag includes procedures, both therapeutic and diagnostic, that do not fit a strict definition of surgery but are often performed in surgical settings. All procedure code fields were queried and divided into three groups based on the HCUP Surgery Flag coding: (1) surgery (narrow flag); (2) procedures (broad flag); or (3) None (neither broad or narrow flag applied). We further labeled patients who underwent surgery only, procedure only, or surgery and a procedure as those who underwent an “intervention” for additional clarity. Patients with a length of stay ≤ 2 days who did not undergo a surgery or procedure as defined by the HCUP Surgery Flag were identified as a potential patient population in which IHT may not have been necessary. Hospitals were identified as urban or rural and teaching or nonteaching as defined in the NIS database.

Total charges are a discrete variable available within the NIS for each hospital discharge and reflect the amount the hospital billed for services. Total charges can be affected by payer mix, local competition, and price strategy and do not reflect how much the services cost or how much the hospital received in payment.^{13,14} The all-payer inpatient cost to charge (APICC) ratio and group average all-payer inpatient cost to charge (GAPICC) ratio are provided by HCUP and allow total charges to be converted into cost estimates. The APICC is calculated from hospital-specific accounting reports. For hospitals that do not have usable reports, the ratio is imputed from a weighted average for a peer group within the state (GAPICC). For this study, the total cost of inpatient care for each patient was estimated by multiplying the total charge by the GAPICC ratio otherwise.¹⁵ We adjusted the estimated cost for inflation using the price indexes for the Gross Domestic Product from the US Department of Commerce Bureau of Economic Analysis using 2010 as the index base. Annual values for the price index starting in 2001 were obtained on February 6, 2015.

To better understand the types of hospitals that were referring patients to other acute care hospitals, we identified all discharges within our data set in which patients had an EGS principle diagnosis, were ≥ 18 years of age, and the discharge destination was designated as a short-term hospital. It is important to note that this subset of patients

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