Higher hospital volume is associated with lower mortality in acute nonvariceal upper-GI hemorrhage

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Background: Acute nonvariceal upper-GI hemorrhage (NVUGIH) is associated with significant morbidity and mortality.

Objective: To examine the relationship between hospital volume and outcomes of NVUGIH.

Design: A cross-sectional study.

Setting: Participating hospitals from the Nationwide Inpatient Sample 2004.

Patients: All discharged patients with a primary discharge diagnosis of NVUGIH based on the International Classification of Diseases, Clinical Modification, ninth edition codes.

Interventions: Patients were divided into 3 groups based on discharge from hospitals with annual discharge volumes of 1 to 125 (low), 126 to 250 (medium), and >250 (high).

Main Outcome Measurements: In-hospital mortality, length of stay, and hospitalization charges.

Results: The study included a total of 135,366, 132,746, and 123,007 discharges with NVUGIH occurred from low-volume, medium-volume, and high-volume hospitals, respectively. On multivariate analysis, when adjusting for age, comorbidity, and the presence of complications, patients at high-volume hospitals had significantly lower in-hospital mortality (odds ratio [OR] 0.85 [95% CI, 0.74–0.98]) than patients at low-volume hospitals. Patients at high-volume hospitals were also more likely to undergo upper-GI endoscopy (OR 1.52 [95% CI, 1.36–1.69]) or early endoscopy within 1 day of hospitalization compared with low-volume hospitals (60.5% vs 53.8%, adjusted OR 1.28 [95% CI, 1.02–1.61]). Undergoing endoscopy within day 1 was associated with shorter hospital stays (–1.08 days [95% CI, –1.24 to –0.92 days]) and lower hospitalization charges (–$1958 [95% CI, –$3227 to –$688]).

Limitations: The study was based on an administrative data set.

Conclusions: Higher hospital volume is associated with lower mortality and with higher rates of endoscopy and endoscopic intervention in patients with NVUGIH. (Gastrointest Endosc 2009;70:422-32.)

Acute nonvariceal upper-GI hemorrhage (NVUGIH) is a common medical emergency associated with significant morbidity, mortality, and health care costs.[1-3] Previous studies showed an incidence between 50 to 150 per 100,000 population,[1,4-6] with a high mortality among hospitalized patients.[1,6] There are several important steps in the management of patients with NVUGIH. These factors can be broadly divided into patient, systems, and provider-related factors. Early fluid resuscitation and stabilization is essential in the management of these patients.[1,5,7] Triage to the appropriate level of care ensures efficient utilization of health care resources. Upper-GI endoscopic examination (EGD) is important to identify the source of hemorrhage and for therapeutic intervention, depending on the culprit lesion.[1,5] Early endoscopy can also help with the triage of patients who have low-risk lesions to a lower level of care, thus leading to lower costs.[1,5] However, similar to the outcomes for complex surgical procedures, the effectiveness of urgent endoscopy in controlling hemorrhage may be dependent on the endoscopist's experience[8] and hence related to the overall volume of NVUGIH hospitalizations at the center. Conceptually,

Abbreviations: ARF, acute renal failure; ICD-9-CM, International Classification of Diseases, Clinical Modification, ninth edition; ICU, intensive care unit; NIS, Nationwide Inpatient Sample; NVUGIH, nonvariceal upper-GI hemorrhage; OR, odds ratio; UGIH, upper-GI hemorrhage.

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there may be differences in one or several of these factors between hospitals that have a high volume of patients with NVUGIH compared with those hospitals that infrequently see these patients.

Results of studies demonstrated a direct relationship between higher hospital volume or surgical experience and superior outcomes.[9-30] Similar results were also seen with intensive care unit (ICU) admissions.[21,25,27] However, there are limited data that examined whether volume-outcome relationships or hospital characteristics are important in the outcomes of GI hemorrhage. Previous studies were limited to specific regions or states[31-33] or failed to differentiate between variceal and nonvariceal hemorrhage,[33] 2 heterogeneous conditions with different etiologies and outcomes.

We performed this study with the following aims: (1) to compare the in-hospital mortality for patients with NVUGIH discharges between high-volume, medium-volume, and low-volume hospitals, (2) to compare the length of stay and total hospitalization charges between high-volume and low-volume hospitals, and (3) to examine the frequency of use of EGD in patients with NVUGIH across the different volume strata.

Capsule Summary

What is already known on this topic

- The effectiveness of urgent endoscopy in controlling acute nonvariceal upper-GI hemorrhage (NVUGIH) may be dependent on experience.

What this study adds to our knowledge

- Patients with NVUGIH treated at high-volume hospitals had significantly lower in-hospital mortality, were more likely to undergo upper-GI endoscopy, and were more likely to receive endoscopy within 1 day of hospitalization, compared with patients at low-volume hospitals.

PATIENTS AND METHODS

Data source

We used data from the Nationwide Inpatient Sample (NIS) for the year 2004,[34] a part of the Healthcare Cost and Utilization Project under the Agency for Healthcare Research and Quality.[35] The NIS is constructed from all discharges in a 20% stratified sample of nonfederal short-term hospitals across 37 participating states. It has been found to correlate well with the National Hospital Discharge Survey and has been used in previous studies of hospital and procedural volume.[9,15-17,28] The NIS 2004 contains data from nearly 1000 hospitals and 8 million discharges. The unit of construct in the NIS is an individual hospital discharge that is coded with 1 primary diagnosis determined to be the principal reason for the hospitalization on discharge. In addition, up to 14 secondary diagnoses and 15 associated procedures are also coded by using the International Classification of Diseases, Clinical Modification, ninth edition (ICD-9-CM) codes.

Study population

The study population for this analysis consisted of all the patients with a primary discharge diagnosis of NVUGIH. This included patients with discharge ICD-9-CM codes for bleeding peptic ulcer, gastritis with hemorrhage, Mallory-Weiss syndrome, Dieulafoy's lesion, angiodysplasia of the stomach or the duodenum, hematemesis, melena, or unspecified GI hemorrhage (Table 1). These codes were previously used and were shown to have a good sensitivity and positive predictive value.[36-40] Patients with coexisting ICD-9-CM codes for variceal hemorrhage were excluded.

Definition of hospital volume

The annual volume of NVUGIH hospitalizations was calculated by summing the number of discharges from each hospital with a primary discharge diagnosis that met the above case definition. The hospitals were then divided into low-volume, medium-volume, and high-volume hospitals if they had 1 to 125, 126 to 250, or more than 250 annual hospitalizations for NVUGIH, respectively. These cutoffs were selected after examining the data based on the a priori decision to divide the hospitals into tertiles of total number of discharges by the national estimate. Hospital bed size was categorized into small, medium, or large. These cutoffs are provided within the NIS and vary depending on the hospital location, teaching status, and region. Hospital location was divided into rural and urban by using the description within the core-based statistical area groups based on the 2000 census data. Teaching hospitals were defined by the presence of an approved residency program, membership to the Council of Teaching Hospitals, or a ratio of full-time equivalent interns and residents to beds of 0.25 or higher (http://www.hcup-us.ahrq.gov/db/nation/nis/DataElements_NIS_2004_Hospital.pdf).

Definition of variables

The NIS routinely collects data on the age, sex, primary insurance source, and race. Information on race was missing in approximately a fifth of the study population and was coded as a separate category within that variable. We adjusted for comorbidity by using the Deyo modification of the Charlson's comorbidity index,[41,42] a validated and widely used measure in analyses of administrative databases that correlates well with predicting mortality. The Charlson's index ranges from 0 to 17, with higher numbers representing a greater comorbidity burden. However, in our study, the ICD-9-CM codes for peptic ulcer disease