Estimates of Costs of Hospital Stay for Variceal and Nonvariceal Upper Gastrointestinal Bleeding in the United States

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ABSTRACT

Objectives: Variceal (VUGIB) and nonvariceal (NVUGIB) upper gastrointestinal bleeding are prevalent causes of hospitalization. Cost estimates are needed to determine the impact of their contemporary treatments (endoscopic hemostasis and high-dose proton pump inhibition). We determined the costs of upper gastrointestinal bleeding with or without complications (rebleeding).

Methods: Charges and length of stay (LOS) were obtained from the United States Nation-wide Inpatient Sample. We defined NVUGIB using Diagnosis Related Groups, and VUGIB using International Classification of Diseases, Ninth Revision, Clinical Modification codes.

Results: Hospitalization costs with and without complications were $5632 and $3402 for NVUGIB, and $23,207 and $6612 for VUGIB, respectively; similarly, mean LOS were 4.4 and 2.7 days, and 15.2 and 3.8 days.

Conclusion: We present hospitalization costs and LOS for VUGIB and NVUGIB with and without complications. The reliability of our estimates rests with the size and the national representativeness of the databases used, and should prove helpful for cost analyses for UGIB requiring updated national estimates.

Keywords: cost, nonvariceal, peptic ulcer, variceal, upper gastrointestinal bleeding.

Introduction

Upper gastrointestinal bleeding (UGIB), which accounts for approximately 300,000 admissions yearly, for a total expenditure of $2.5 billion annually in the United States [1], has undergone significant evolution in management over the past 10 years [2]. Appropriate and accurate determinations of costs are needed to better assess the cost-effectiveness of new therapeutic modalities such as endoscopic hemostasis and intravenous proton pump inhibition [2]. Existing cost estimates published to date vary widely (from $2,860 [3] to $24,081 [4] for a hospitalization for UGIB, and from $8,832 [5] to $61,522 [6] for variceal ulcer bleeding), because of the use of disparate methodologies and sources of data [7]. We therefore undertook a study to validly determine clinically relevant current hospital stay costs for patients admitted with a diagnosis of UGIB in the United States.

Methods

The charges and length of stay (LOS) per hospitalization were obtained from the Nation-wide Inpatient Sample (NIS2002) database. NIS is sponsored by the Agency for Health Care Policy and Research and contains two databases. The first is a hospital database providing the characteristics of 995 hospitals in 35 states. The second is an inpatient database on 7,853,982 hospitalizations that does not include physician fees. We selected hospitalizations of patients aged 18 years and older who did not die during the hospital stay. We defined nonvariceal UGIB as hospitalizations with a Diagnosis Related Group (DRG) of gastrointestinal hemorrhage with or without complications, and with or without comorbidities (DRG 174 and 175). Cases of variceal UGIB were defined using International Classification of Diseases, Ninth Revision, Clinical Modification (ICD9-CM) codes 456.0 and 456.20. These codes regroup patients with a diagnosis of “esophageal varices with bleeding” and “esophageal varices in diseases classified elsewhere, with bleeding,” respectively. Different methodologies were used to identify patients with rebleeding (as previously defined [8]) according to whether they had experienced an episode of variceal or nonvariceal UGIB. For nonvariceal UGIB, we used the differentiation provided by the DRGs. Because the ICD9-CM codes 456.0 and 456.20 do not distinguish patients with and without rebleeding, we decided to define variceal UGIB with rebleeding according to those patients who have experienced an LOS above an

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10.1111/j.1524-4733.2007.00208.x

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empirically chosen threshold. This threshold was determined by a clinician-expert (AB) after examination of the bimodal distribution of LOS among variceal ulcer patients as it appeared in the NIS database. We established a 9-day threshold, assuming that the second peak of LOS corresponded to a subpopulation of patients with variceal bleeding whose stay was prolonged because of a complication, which often is due to rebleeding [9]. The per-diem charges were computed as the sum of all charges divided by the sum of all LOS. Because the charges do not reflect the actual cost value of the medical resources used for a treatment, we used cost-to-charge ratio, which is a recognized ratio used for converting charges into costs [7]. We used the conversion rates published by Medicare (National Archives and Record Administration) per state, for both urban and rural areas, while merging the hospital and inpatient stay databases to assign the type of hospital (urban or rural) to each hospitalization. We adopted the perspective of a third-party payer (i.e., the charges payer), thus not taking into consideration physician fees. All results were expressed in 2004 $US using the consumer price index for medical care, provided by the Department of Labor.

Results

Twenty percent (1,570,796 records) of the complete NIS database was used for the cost estimates of nonvariceal UGIB. Because the number of hospitalizations recorded as variceal UGIB was much less, all valid cases of variceal UGIB were extracted from the complete database (7,853,982 hospitalizations). As a result, we selected 19,077 admissions (3,131 with rebleeding) for nonvariceal UGIB, and 840 (67 with rebleeding) for variceal UGIB. Estimations of charges, LOS, and costs are presented in Table 1. Because the first days of a hospitalization typically require more medical resources, the per-diem can be lower for patients with longer stays as is the case for complicated versus uncomplicated variceal UGIB. Except for rebleeding among patients with variceal UGIB, all other UGIB hospitalizations presented an LOS between 2 and 5 days, costing $3000 to $7000. The hospitalizations of patients with complicated variceal UGIB lasted much longer (more than 2 weeks on average) and were associated with a greater mean cost (more than $23,000) (Table 1). The cost and LOS attributable to rebleeding were approximately fourfold higher for variceal UGIB when compared with nonvariceal UGIB.

Discussion

Cost and LOS estimates for nonvariceal and variceal UGIB vary widely in the literature, yet more precise estimates are required because new treatments have prompted the publication of many recent cost-effectiveness analyses [2,8]. Unfortunately, the determination of actual inpatient costs is difficult, and all estimates are in fact approximations [7]. In the United States, costs vary substantially, even within the same city [7]. The different possible approaches in treating UGIB, the rapid evolution of technologies, differences among hospitals, and patient characteristics are all determinants of costs and LOS. Additionally, adopted costing methods are not uniform. Some publications have used large databases [3,4,8,10], which could be representative of a national average, while others base their calculations only on patient cohorts from single centers or small groups of local institutions [6,9], which may not be as generalizable. Some articles refer to means [3,4,6,8–10], others to median costs [10], and yet others to both [11]. Because the costs attributable to the management of UGIB are not normally distributed (a few hospitalizations utilize a very large quantity of medical resources), a choice has to be made

<table>
<thead>
<tr>
<th>Table 1 Cost and charge estimates for UGIB</th>
<th>NVUGIB</th>
<th>VUGIB</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Without CC</td>
<td>With CC</td>
</tr>
<tr>
<td></td>
<td>DRG 175</td>
<td>DRG 174</td>
</tr>
<tr>
<td>N</td>
<td>3,131</td>
<td>15,946</td>
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<tr>
<td>Female %</td>
<td>49</td>
<td>52</td>
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<tr>
<td>Mean age</td>
<td>65</td>
<td>71</td>
</tr>
<tr>
<td>Mean LOS</td>
<td>2.7 (1.9)</td>
<td>4.4 (3.6)</td>
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<tr>
<td>Per-diem charges</td>
<td>3,647 (3.276)</td>
<td>3,656 (3.814)</td>
</tr>
<tr>
<td>Per-diem cost</td>
<td>1,255 (968)</td>
<td>1,287 (1,176)</td>
</tr>
<tr>
<td>Per stay charges</td>
<td>9,883 (8,877)</td>
<td>16,006 (16,695)</td>
</tr>
<tr>
<td>Per stay costs</td>
<td>3,402 (2,622)</td>
<td>5,632 (5,149)</td>
</tr>
</tbody>
</table>

Values in parentheses are standard deviations.
The dead are excluded.
The rebleeding categories are defined by the CC (CC = complications/comorbidity).
All costs are expressed in 2004 $US.

DRG, Diagnosis Related Group; ICD9, International Classification of Diseases, Ninth Revision; LOS, length of stay; NVUGIB, nonvariceal upper gastrointestinal bleeding; UGIB, upper gastrointestinal bleeding; VUGIB, variceal upper gastrointestinal bleeding.
as to which summary measure of central trend is used. The mean appears to be more appropriate, as the median ignores the 50% most expensive hospitalizations, which are not uncommon when considering the prevalence of rebleeding, a clinically important entity. Indeed, for UGIB, admissions with complications are an inherent component of the disease and affect a significant proportion of patients with the condition [9], with a resultant significant cost impact. We thus chose to consider the mean in order not to underestimate costs. A more important source of heterogeneity arises from the disparate use of either charges [6,8] or costs [4,10]. We presented estimates of both charges and costs, using cost-to-charge ratios, as previously carried out [7]. Costs and LOS associated with rebleeding or complications are difficult to identify, and thus rarely cited [6,8]. We used diagnostic codes wherever possible; where this information was not available, we adopted an arbitrary and pragmatic definition based on the assumption that, among patients with variceal bleeding, a second frequency peak of longer LOS is largely determined by a significant proportion of patients with rebleeding [9]. Although refinement of this working definition should ideally be sought, the validity of our cost estimations should also be noted in the size of the source of data and its national representativeness, because NIS is indeed the largest all-payer inpatient care database publicly available in the United States. Moreover, our estimates of costs and LOS for a UGIB hospitalization are within the broad range of US estimates published in the last 10 years [3–6].

Conclusion

We have determined valid, broadly representative costs attributable to hospitalizations for variceal and nonvariceal UGIB, including those with and without rebleeding. These conclusions may serve as a common standard that may populate in a more meaningful and standardized fashion the assumptions used in future cost-effectiveness analyses assessing the management of patients with UGIB.

Source of financial support: Dr. Alan Barkun is a research scholar funded by the Fonds de la Recherche en Santé du Québec.

References