Management of acute nonvariceal upper gastrointestinal hemorrhage: Comparison of an American and a Canadian medical centre

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OBJECTIVES: Acute nonvariceal upper gastrointestinal hemorrhage (UGIH) remains a common indication for hospital admission. Differences in the structure, process and outcomes of care in the management of acute nonvariceal UGIH between providers in Canada and the United States have not been previously characterized. The aim of the present study was to compare the structure, process and outcomes of care between a Canadian and an American tertiary care medical centre in the management of acute nonvariceal UGIH.

METHODS: Data were collected from identified cases of acute nonvariceal UGIH at the two medical centres over two years. Process measures analyzed included the level of care (intensive care unit [ICU] monitored bed versus unmonitored bed) and hospital length of stay (HLOS). Outcomes assessed included rebleeding, inhospital mortality and readmission and/or death within 30 days of admission.

RESULTS: One hundred seventy-five and 83 cases of acute nonvariceal UGIH were identified at the American and Canadian centres, respectively. Cases at the American centre had a lower median HLOS, (2.6 versus 3.9 days, P<0.001) but were significantly more likely to be treated in an ICU or monitored setting (67% versus 16%, P<0.001). There were no significant differences in rates of rebleeding or death in hospital or within 30 days of discharge.

CONCLUSIONS: Marked differences exist in the process of care between the Canadian and American medical centres in the management of acute nonvariceal UGIH, despite similar patient severity. Outcomes between the two centres were similar. Minimizing disparity in the process of care of acute UGIH between the two centres may reduce excessive use of resources in the management of acute UGIH without promoting adverse outcomes.

Key Words: *Gastrointestinal hemorrhage; Hospital length of stay; Process of care; Rebleeding*

Traitement des hémorragies digestives hautes, aiguës, non variqueuses : comparaison entre un centre canadien et un centre américain de traitement

OBJECTIF : Les hémorragies digestives hautes (HDH), aiguës, non variqueuses constituent une indication fréquente d'hospitalisation. Les différences de structure, de prestation et de résultats dans le traitement de ce type d'hémorragie entre les fournisseurs de soins au Canada et aux États-Unis n'ont jamais été caractérisées. La présente étude avait pour but de comparer la structure, la prestation et les résultats observés dans un centre canadien et un centre américain de soins tertiaires dans le traitement des HDH aiguës, non variqueuses.

MÉTHODE : Nous avons procédé à la collecte de données provenant de cas avérés d'HDH aiguë, non variqueuse, traités dans les deux centres médicaux, sur deux ans. Les mesures de prestation comprenaient le niveau de soins (soins intensifs, monitorage au chevet ou non) et la durée du séjour à l'hôpital. L'évaluation des résultats comprenait les récidives d'hémorragie, la mortalité intra-hospitalière et les réadmissions ou les décès dans les 30 jours suivant l'hospitalisation.

RÉSULTATS : Cent soixante-quinze et quatre-vingt-trois cas d'HDH aiguë, non variqueuse ont été relevés dans les centres américain et canadien respectivement. La durée médiane du séjour était plus courte dans le centre américain (2,6 contre [c.] 3,9 jours; p<0,001); par contre, le niveau de soins était sensiblement plus élevé (soins intensifs, monitorage au chevet) (67 % c. 16 %; p<0,001). Aucune différence significative n'a été enregistrée quant aux taux de récidive d'hémorragie et de mortalité à l'hôpital ou dans les 30 jours suivant le congé.

CONCLUSION : Des différences marquées ont été relevées dans la prestation de soins entre les centres canadien et américain de traitement des HDH aiguës, non variqueuses, et ce, pour un degré similaire de gravité. Par contre, les résultats, eux, étaient similaires. Le fait de réduire les écarts observés dans la prestation de soins pour ce type d'hémorragie entre les deux centres permettrait peut-être de réduire l'utilisation des ressources, sans pour autant avoir d'incidence sur les résultats.

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Acute nonvariceal upper gastrointestinal hemorrhage (UGIH) is a common and clinically significant cause of hospitalization in North America – accounting for approximately 150 hospital admissions per 100,000 persons in the general population, significant morbidity and a case-fatality rate of 5% to 10% (1-3). Some elements of the structure of the health care systems that provide care to patients with acute UGIH in the United States and in Canada are similar, especially in the area of physician training and physician to patient ratios (4,5). There are also many areas where important distinctions exist, most notably in the area of health care financing (4,5). Variations in the technical and interpersonal aspects that govern interactions between individual patients and their healthcare providers, otherwise known as the process of care, may exist for UGIH patients in the United States and Canada. However, there has been no previous attempt to either describe variations in the process of care for patients with acute UGIH between these nations, or to describe potential differences in the subsequent outcomes of care for patients with acute nonvariceal UGIH. Comparisons of the process and outcomes of care delivered to these patients in distinct healthcare settings may provide opportunities for improving the quality of care delivered to patients in both countries.

The aim of the present study was to describe and compare elements of the structure, process and outcomes of care for patients with acute, nonvariceal UGIH between a university-affiliated tertiary care centre in Canada and one in the United States, respectively. It was hypothesized that outcomes would likely be similar between the two centres despite potential variations in the process of care.

MATERIALS AND METHODS

Structure of care

Study centres: The two sites participating in the present study were the Health Sciences Centre, University of Manitoba, Winnipeg, Canada (UM-HSC), and the Center for the Health Sciences, University of California, Los Angeles, USA (UCLA-CHS). UM-HSC is a tertiary care hospital affiliated with the University of Manitoba. It serves as the primary referral center for Winnipeg and the entire province of Manitoba, as well as parts of Saskatchewan and Northwestern Ontario. UM-HSC serves a largely indigent population due to its location in an economically disadvantaged area and is also the primary referral centre for over 40 rural First Nations reserves, the majority of whom do not have a full-time onsite physician. UM-HSC has 617 adult beds, of which 28 (5%) are intensive care or monitored beds. The remaining beds are in nonmonitored areas on general medicine and surgery wards. There is an acute gastrointestinal (GI) bleeding team composed of eight gastroenterologists and GI surgeons who are available 24 h a day for the evaluation and treatment of GI emergencies. In usual practice at UM-HSC, patients presenting with signs and symptoms of acute UGIH are initially evaluated by the emergency medicine department. Decisions on the need for hospital admission and the level of care required are made jointly by the emergency medicine physician and the admitting internal medicine team. There is no dedicated inpatient gastroenterology service. Patients admitted with acute UGIH are followed and, if indicated, receive endoscopy by the inpatient gastroenterology consult team.

UCLA-CHS is a tertiary care hospital that serves as one of the primary referral centres for tertiary care in Los Angeles County and southern California. Of the 482 adult inpatient beds at UCLA-CHS, 164 (34%) are intensive care or monitored beds. The remaining two-thirds (318) of beds are nonmonitored. Attending gastroenterologists from the CURE Digestive Diseases Research Center hemostasis research group are available 24 h a day at UCLA-CHS for the evaluation and treatment of patients with GI hemorrhage. In usual practice at UCLA-CHS, patients with acute UGIH are admitted to the care of an internal medicine or family medicine primary care team with gastroenterologists serving as consultants. Initial decisions regarding patient need for admission, level of care at admission and medical treatment are made jointly by the emergency medicine department staff and the primary team. There is no dedicated inpatient gastroenterology service at UCLA-CHS. Patients admitted with acute UGIH are followed and receive endoscopy if indicated by the inpatient gastroenterology consultation service.

Patients: Cases were identified via electronic searches of administrative databases containing information on consecutive adult patients (over 18 years of age) admitted to UM-HSC between April 1, 1997, and March 31, 1999, and to UCLA-CHS between January 1, 1997, and December 31, 1998 with a primary discharge diagnosis consistent with acute UGIH. This time period was selected because it followed the publication and dissemination of several papers demonstrating the safety of early discharge for low-risk UGIH patients (6-11). Preselected International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes were used to identify potential subjects; these codes accurately identify patients with UGIH (12) and have also been previously used to compare the processes and outcomes of care between medical centres (13). The ICD-9 codes used are displayed in Table 1.

Adult patients (over 18 years of age) admitted to UM-HSC or UCLA-CHS with a primary ICD-9-CM discharge code suggesting UGIH, who underwent diagnostic upper endoscopy while in hospital were included in the study. Patients were excluded if they developed bleeding while already in hospital, were transferred to UM-HSC or UCLA-CHS from another acute healthcare facility, were found to have bleeding from a presumed variceal source or were found to have a lower GI source for blood loss.

A single investigator at UM-HSC and two investigators at UCLA-CHS abstracted medical record data for potential cases. Data were collected from three time periods associated with the bleeding episode: the periadmission period (time from presentation to the emergency room until admission to hospital), the hospital course and the 30-day period immediately following hospital discharge.

Process and outcome variables evaluated

Data collected from the periadmission period included demographic information, time and site of initial evaluation for UGIH, clinical presentation, initial vital signs, level of consciousness, character of nasogastric tube lavage, use of selected medications on admission, initial laboratory test results and level of care at admission (intensive care unit bed, monitored bed or nonmonitored bed).

Data collected from the hospital course included: use of intravenous histamine-type 2 receptor antagonists (H2RA), time from presentation until endoscopy, place of endoscopy, endoscopic diagnosis, endoscopic stigmata of recent hemorrhage, repeat endoscopy before hospital discharge for the evaluation of bleeding, units of packed red blood cells transfused before and after initial endoscopy, surgery performed for bleeding, death, time of discharge and disposition at discharge (home, skilled nursing facility,

other hospital). Data collected for the 30-day period after hospital discharge included readmission to the hospital or death (for any reason, or specifically due to recurrent GI bleeding) as recorded in the medical record.

The severity of each patient's presentation was assessed using the Rockall risk score (14-17), which is a validated predictive index that may serve as a useful tool for effectively stratifying hospitalized inpatients with acute UGIH according to their risk of subsequent adverse clinical outcomes; specifically, rebleeding and death (14). The Rockall score was initially developed to adjust mortality data for disease severity when comparing the quality of care provided to patients with UGIH among hospitals in the United Kingdom (15-17), and is detailed in Table 2. During the study period, neither facility nor its providers systematically used the Rockall risk score, any other standardized scoring system or any clinical decision tool, either to stratify individual patient risk for adverse clinical outcomes or to determine the need for inpatient versus outpatient management of acute UGIH.

The main outcomes we assessed in this study were rebleeding and death. A patient was considered to have developed rebleeding if one of the following events occurred: repeat endoscopy before hospital discharge before surgery for control of UGIH, or readmission to the hospital within 30 days of discharge due to UGIH. Death was attributable to UGIH if a patient died within 30 days of admission for UGIH. The measures of the process of care assessed were the level of care at admission, the use of intravenous histamine-type 2 receptor antagonists (H2RAs) and the hospital length of stay.

Statistics

SAS (SAS Institute, USA) software for data management and analysis was used. Data which were missing or inconsistent were addressed with a series of checks and corrections. First, the investigators (LT, IG, GD) performed manual checks of the completed data abstraction forms. Second, the data manager performed manual checks during data entry. Third, an automated check was performed after data entry had been completed for each subject file. Missing or inconsistent data were brought to the attention of the investigators and resolved by joint review of the medical record. Two-tailed Student's *t*-tests, χ^2 tests, and Fisher's exact test were used to compare means and proportions of appropriate data from the two sites. Non-normally distributed data were analyzed with the Wilcoxon rank-sum test. A two-sided $P<0.05$ was considered statistically significant.

TABLE 1
Identifying International Classification of Diseases, Ninth Revision codes for acute nonvariceal upper gastrointestinal hemorrhage

530.7	Gastroesophageal laceration-hemorrhage syndrome
530.82	Esophageal hemorrhage
In examples below: x = 0 without obstruction, 1 with obstruction	
531.0x	Acute gastric ulcer with hemorrhage with/without obstruction
531.2x	Acute gastric ulcer with hemorrhage & perforation with/without obstruction
531.4x	Chronic gastric ulcer with hemorrhage with/without obstruction
531.6x	Chronic gastric ulcer with hemorrhage & perforation with/without obstruction
532.0x	Acute duodenal ulcer with hemorrhage with/without obstruction
532.2x	Acute duodenal ulcer with hemorrhage & perforation with/without obstruction
532.4x	Chronic duodenal ulcer with hemorrhage with/without obstruction
532.6x	Chronic duodenal ulcer with hemorrhage & perforation with/without obstruction
533.0x	Acute peptic ulcer with hemorrhage with/without obstruction
533.2x	Acute peptic ulcer with hemorrhage & perforation with/without obstruction
533.4x	Chronic peptic ulcer with hemorrhage with/without obstruction
533.6x	Chronic peptic ulcer with hemorrhage & perforation with/without obstruction
534.0x	Acute gastrojejunal ulcer with hemorrhage with/without obstruction
534.2x	Acute gastrojejunal ulcer with hemorrhage & perforation with/without obstruction
534.4x	Chronic gastrojejunal ulcer with hemorrhage with/without obstruction
534.6x	Chronic gastrojejunal ulcer with hemorrhage & perforation with/without obstruction
535.01	Acute gastritis with hemorrhage
535.11	Atrophic gastritis with hemorrhage
535.21	Gastric mucosal hypertrophy with hemorrhage
535.31	Alcohol gastritis with hemorrhage
535.41	Other specified gastritis with hemorrhage
535.51	Unspecified gastritis and gastroduodenitis with hemorrhage
535.61	Duodenitis with hemorrhage
537.83	Angiodysplasia of stomach & duodenum with hemorrhage
569.85	Angiodysplasia of intestine with hemorrhage
578.0	Hematemesis
578.1	Blood in stool, melena
578.9	Hemorrhage of gastrointestinal tract, unspecified

Data from reference 12

RESULTS

Two hundred fifty-eight potential cases at UM-HSC and 293 potential cases at UCLA-CHS were indentified (Table 3). Of these, 83 cases at UM-HSC and 175 at UCLA-CHS were included for further analysis. Reasons for exclusion included: patient medical records not retrievable, no endoscopy performed, variceal upper GI bleeding, lower GI bleeding, no acute GI bleeding episode confirmed, patient transferred from outside facility, in hospital bleed or patient admitted to hospital outside predefined study period.

The demographic characteristics of included cases were similar across centres (Table 4). Moreover, the distribution of endoscopic diagnoses was similar to what has been reported in other series of acute, nonvariceal UGIH, with peptic ulcer disease being the most common diagnosis at both facilities (1-3,8-13,17) (Table 5). Furthermore, both the average Rockall scores and the distribution of patients within Rockall risk strata were similar between the two centres.

Table 6 displays a comparison of process measures between the two centres. Patients admitted to UCLA-CHS with acute UGIH were significantly more likely to be admitted to an ICU or monitored bed (67% versus 16%, $P<0.001$), but were also more likely to be discharged sooner than patients with similar Rockall risk scores admitted to UM-HSC (2.6 days versus 3.9 days, $P<0.001$). The majority of cases in both centres underwent endoscopy within 24 h of admission, although this was significantly more likely to have occurred at UM-HSC. The mean time from initial presentation until endoscopy was significantly shorter at UM-HSC, both overall (0.5 days versus 0.8 days, $P<0.001$) and in each risk stratum. Both centres per-

TABLE 2
Rockall risk score

	Score			
	0	1	2	3
Age	< 60 years	60-79 years	≥80 years	
Shock	HR<100, SBP>100	HR>100, SBP>100	SBP<100	
Comorbidity	None		IHD, CHF, any major comorbidity*	Renal failure, liver failure metastatic malignancy
Diagnosis	Mallory-Weiss tear	All other diagnoses	Malignancy of UGI tract	
Stigmata of recent hemorrhage	Clean base ulcer, flat spot		Blood in UGI tract, clot, visible vessel, bleeding	

*Patients are assigned point values for each of five clinical (age, shock, comorbidity) and endoscopic (diagnosis, stigmata of recent hemorrhage) variables. The Rockall score is equal to the sum of the points assigned. Scores can range from 0-11 points. Patients with Rockall scores of ≤2 are at low risk for developing rebleeding or death. CHF Congestive heart failure; HR Heart rate; IHD Ischemic heart disease; SBP Systolic blood pressure; UGI Upper gastrointestinal. *Comorbid disease was determined using definitions from the Charlson index of comorbid disease (30). Comorbid diseases resulting in a 2 point score include angina, coronary artery disease, history of myocardial infarction, congestive heart failure, valvular heart disease, chronic arrhythmia, peripheral vascular disease, cerebrovascular disease, moderate to severe pulmonary disease, diabetes with end-stage complications, lymphoma, leukemia, AIDS, inflammatory bowel disease, and rheumatic disease. Data from reference 16*

TABLE 3
Case identification

	UCLA-CHS	UM-HSC
Total cases identified	293	258
Charts not found	0	24
Total cases available for review	293	234
No endoscopy performed	90	7
Lower gastrointestinal bleeding only	6	46
No acute bleeding episode	0	8
Transfer from other facility	22	72
Variceal upper gastrointestinal bleeding	0	7
Inhospital bleed	0	8
Admitted outside study period	0	3
Total cases excluded	118	151
Total cases included for analysis	175	83

UCLA-CHS Center for the Health Sciences, University of California, Los Angeles, USA; UM-HSC Health Sciences Centre, University of Manitoba, Winnipeg

TABLE 4
Demographic data of upper gastrointestinal hemorrhage cohorts by centre

	UCLA-CHS	UM-HSC	P
Total patients (n)	175	83	
Male, %	54 (47–62)	71 (60–81)	0.014
Mean age, years (range)	61.5 (26–94)	59.4 (22–90)	> 0.2
NSAID/ASA use, %	46 (38–53)	39 (28–50)	> 0.2
Diagnosis of PUD, %	36 (29–44)	49 (38–61)	0.040
Stigmata of recent hemorrhage, %	33 (13–25)	22 (13–32)	> 0.2
Rockall Score (mean ± SD)	3.7±2.1	4.0±2.0	> 0.2
Rockall Score 0-2, %	30 (23–38)	22 (18–32)	0.148
Rockall Score 3-5, %	50 (43–58)	58 (46–69)	> 0.2
Rockall Score 6-11, %	19 (14–26)	20 (12–31)	> 0.2

95% confidence intervals in parenthesis unless otherwise indicated. ASA Acetylsalicylic acid; NSAID Nonsteroidal anti-inflamatory drug; PUD Peptic ulcer disease (ie, gastric or duodenal ulcer); UCLA-CHS Center for the Health Sciences, University of California, Los Angeles, USA; UM-HSC Health Sciences Centre, University of Manitoba, Winnipeg

formed endoscopy in a dedicated endoscopy unit, as opposed to at the bedside or in the emergency room. Regardless of risk strata, most cases received intravenous H2RAs while in hospital, although use was significantly greater at UM-HSC (81% versus 60%, P<0.001).

There were no significant intercenter differences in the measured outcomes of care; specifically, in the rates of total adverse events, blood transfusion after initial endoscopy, surgery and death (Table 7).

DISCUSSION

The present study reveals a significant variation in the process of care for patients with acute, nonvariceal UGIH of similar severity without a corresponding variation in outcomes. The use of ICU and monitored beds was greater in the American centre, whereas the length of stay was longer in the Canadian center. Although our study lacked sufficient power to draw definitive conclusions, these findings reveal possible inefficiencies in the management of acute nonvariceal UGIH that may be amenable to improvements in the process of care.

Despite similarities in the structure of care between these medical centres, there are notable differences that may account for the observed variation in the process of care measures. For example, inpatient health care at UM-HSC is financed solely by the Manitoba Department of Health, a branch of the provincial government, whereas most of the patient care financing at UCLA-CHS is provided by private insurers. Private for-profit payers could potentially encourage earlier hospital discharge, decreasing the high costs associated with an inpatient hospital stay. Furthermore, UCLA-CHS receives a fixed payment for any Medicare beneficiary admitted, regardless of the length of stay or the level of resource utilization. Therefore, it may be in the financial interest of American medical centres like UCLA-CHS to encourage the early discharge of Medicare patients. Conversely, medical centres and healthcare providers in Canada are less likely to face financial incentives to expedite hospital discharge.

Despite the fact that many patients with acute UGIH are managed in the ICU (18), recent data indicate that most patients may be safely managed in step-down units or unmonitored medical floors (19,20). We discovered a wide variation in the process of care provided to patients with acute UGIH of similar severity, as determined by the Rockall risk score. We found that patients at UCLA-CHS were more likely to be admitted to ICU and monitored beds, whereas patients of similar severity at UM-HSC were more likely to be admitted to

TABLE 5
Endoscopic diagnoses of UCLA-CHS and UM-HSC patients

	UCLA-CHS	UM-HSC*
Total patients (n)	175	83
Endoscopic diagnosis (n [%])		
Gastric ulcer	40 (23)	20 (24)
Duodenal ulcer	23 (13)	21 (25)
Gastroduodenopathy	14 (8)	12 (14)
None	23 (13)	8 (10)
Mallory-Weiss tear	15 (9)	6 (7)
Esophagitis	23 (13)	6 (7)
Other	3 (2)	2 (2)
Gastroduodenal erosions	23 (13)	11 (13)
Angiomata	11 (6)	2 (2)

**Five subjects at Health Sciences Centre, University of Manitoba, Winnipeg (UM-HSC) had more than one endoscopic diagnosis. UCLA-CHS Center for the Health Sciences, University of California, Los Angeles, USA*

TABLE 6
Measures of process of care by centre

	UCLA-CHS	UM-HSC	P
Total patients (n)	175	83	
Admitted to intensive care unit or monitored bed (%)			
All patients	67 (59–74)	16 (9–25)	<0.001
Low risk	49 (36–63)	17 (4–41)	<0.001
Medium risk	72 (60–80)	13 (5–25)	<0.001
High risk	82 (70–95)	24 (7–50)	<0.001
Endoscopy within 24 h of admission (%)			
All patients	56 (47–64)*	80 (69–88)	<0.001
Low risk	61 (45–76)	72 (47–90)	> 0.2
Medium risk	46 (35–58)	83 (70–93)	<0.001
High risk	77 (56–91)	76 (50–93)	> 0.2
Median time to endoscopy (days) (IQR)			
All patients	0.8 (0.6–1.4)*	0.5 (0.2–0.9)	<0.001
Low risk	0.8 (0.6–1.4)	0.5 (0.2–1.1)	<0.001
Medium risk	0.9 (0.6–1.4)	0.5 (0.2–0.9)	<0.001
High risk	0.7 (0.4–1.1)	0.9 (0.2–1.0)	<0.001
Intravenous histamine-type 2 receptor antagonists utilization (%)			
All patients	60 (52–67)	81 (71–89)	<.001
Low risk	57 (43–70)	89 (65–99)	0.013
Medium risk	56 (45–66)	71 (56–83)	> 0.2
High risk	26 (59–90)	100 (81–100)	0.029
Median length of stay (days) (IQR)			
All patients	2.6 (1.8–4.1)	3.9 (2.7–6.1)	<0.001
Low risk	1.9 (1.3–3.6)	3.6 (2.7–5.1)	0.002
Medium risk	2.8 (1.8–4.3)	3.7 (2.4–5.1)	0.060
High risk	2.9 (1.9–5.7)	6.0 (4.0–10.7)	0.006

*95% confidence intervals in parenthesis unless otherwise indicated. Low Risk: Rockall Score 0-2; Medium Risk: Rockall Score 3-5; High Risk: Rockall Score 6-11. *Data on time of endoscopy missing or incomplete on 33 subjects. IQR Interquartile range; UCLA-CHS Center for the Health Sciences, University of California, Los Angeles, USA; UM-HSC Health Sciences Centre, University of Manitoba, Winnipeg*

TABLE 7
Measures of outcomes of care by centre

	UCLA-CHS	UM-HSC	P
Rebleeding (%)			
All patients	13 (4–12)	14 (8–24)	0.078
Low risk	4 (0–9)	11 (1–35)	> 0.2
Medium risk	8 (3–16)	13 (5–25)	0.127
High risk	12 (1–23)	24 (7–50)	> 0.2
Transfusion after initial endoscopy (%)	17 (11–22)	22 (13–32)	> 0.2
Surgery for rebleeding (%)	1 (0–3)	1 (0–7)	> 0.2
Readmission (%)			
All cause	13 (9–19)	11 (5–20)	> 0.2
Gastrointestinal bleeding	5 (2–10)	10 (4–18)	0.11
Death within 30 days (%)	2 (0–4)*	0 (0–4)	> 0.2

*95% confidence intervals in parenthesis unless otherwise indicated. *Both deaths in patients from medium risk group. Low Risk: Rockall Score 0-2; Medium Risk: Rockall Score 3-5; High Risk: Rockall Score 6-11. UCLA-CHS Center for the Health Sciences, University of California, Los Angeles, USA; UM-HSC Health Sciences Centre, University of Manitoba, Winnipeg*

unmonitored settings. There are several possible explanations for this disparity. In particular, whereas 30% of the adult hospital beds at UCLA-CHS are ICU or monitored, only 5% of the beds at UM-HSC are ICU or monitored. This mismatch in the availability of monitored beds may lead to a disparity in their use, even when cardiovascular monitoring or intensive care is not otherwise required. Therefore, the unique structure of each centre may influence the process of care delivered to patients within each centre.

Utilization of higher levels of care at UCLA-CHS may also result from a greater fear of malpractice litigation. Health care providers in the United States may deliver a greater intensity of care than is necessary in an effort to decrease liability in the event of a poor medical outcome. While patients and their families are entitled to seek financial restitution in Canada in the event of a perceived adverse outcome, the likelihood of a medical malpractice suit being initiated may be much lower in Canada than in the United States (21). Furthermore, the settlements awarded when physicians and hospitals are found to be at fault are generally lower in Canada than in the United States. Therefore, an American provider may be more likely than their Canadian counterpart to have a patient admitted to a setting with a higher intensity of care to decrease the risk of costly litigation in the event of an adverse outcome.

Upper GI endoscopy is the procedure of choice for patients with evidence of acute UGIH. Patients with acute UGIH received endoscopy on average 14 h sooner at UM-HSC than at UCLA-CHS. Earlier endoscopy may have led to less frequent use of ICU or monitored beds, as endoscopy allows for complete risk stratification and allows clinicians to feel more comfortable in assigning a patient with acute UGIH to a non-monitored bed. Conversely, endoscopists at UCLA-CHS may have been more comfortable in delaying endoscopy because of the higher rate of ICU and monitored bed use. Differences in time to endoscopy between the two centres may also be indicative of small area variations in process of care, as has been described in the management of other medical conditions (22,23).

The time from presentation to endoscopy may be an important determinant of the total length of hospital stay (24). However, mean hospital length of stay was longer at UM-HSC, despite the mean time from presentation to endoscopy being shorter than that observed at UCLA-CHS. Clearly, there are other factors, aside from time from presentation to endoscopy, that may be important determinants of length of stay in this patient cohort. These observed differences in the length of stay may also be explained by differences in the populations served at each hospital. UM-HSC serves a

high proportion of socioeconomically disadvantaged persons, whereas UCLA-CHS primarily serves individuals of higher socioeconomic standing who are also more likely to be covered by some type of health insurance. Moreover, although data on alcohol use and home living conditions were not collected in this present study, it is likely that patients at UM-HSC may have an increased prevalence of social conditions such as homelessness and alcoholism. Due to these underlying social concerns, these patients may have stayed in hospital beyond the time required to treat the initial presenting illness, which in turn prolonged the average length of hospital stay.

This is the first study to compare management of acute UGIH between hospitals in the United States and Canada. Despite similarities in patient case mix, there are significant differences in process measures, including the level of care at admission and the overall length of stay. Interestingly, this variation in the process of care is not associated with any significant differences in patient outcome, clinical outcomes of rebleeding or death. Our findings corroborate with results obtained by previous comparative studies between American and Canadian centres in the management of other acute medical conditions, including myocardial infarction and acute subarachnoid hemorrhage (25-27). These studies also collected data on hospital expenditures and found that the cost per hospital admission was significantly greater in the American centre. Although direct health care costs were not calculated in this study, level of care arguably accounts for the greatest proportion of hospital costs, making it likely that care at the American centre was associated with higher expenditures.

This study has several limitations, largely due to its retrospective design. During the study period, there were not enough cases of UGIH identified at the study centres to attain sufficient power to rule out a type II error. Also, possible reasons for admission other than UGIH were not evaluated systematically and some patients admitted for other indications may have been misclassified as UGIH. However, we selected cases according to ICD-9-CM codes showing nonvariceal UGIH as the primary discharge diagnosis, suggesting that UGIH was the reason for admission in most cases. In addition, incomplete case identification may have occurred due to this use of codes for principal discharge diagnosis only. However, others have validated this method for case identification (12). Furthermore, since only UCLA-CHS and UM-HSC medical record data were available for abstraction, our data on postdischarge outcomes of interest may be incomplete. It is possible that some patients treated for UGIH at one of the study hospitals may have been admitted with recurrent bleeding at a different hospital or may have died outside of the study hospitals. However, there is no a priori reason to believe that most patients discharged from UCLA-CHS or UM-HSC would not return to the same facility for recurrent episodes of UGIH. The rate of rebleeding at each of the study centres is significantly lower than what has been reported in other large series of UGIH (2,14). This may be partly due to our not including certain cohorts of patients with UGIH who are at high risk of rebleeding, particularly previously hospitalized patients (14,28) and persons with UGIH secondary to ruptured varices (29). Furthermore, as rebleeding is difficult to assess retrospectively, we were compelled to use a number of related endpoints as surrogates for recurrent GI bleeding, which may have affected the accuracy of our rebleeding rates. It is possible that a portion of the repeat endoscopic procedures were for an indication other than rebleeding, such as a 'second-look' evaluation of a high risk ulcer. Conversely, some patients may have had clinical evidence of recurrent hemorrhage but did not undergo endoscopy.

This study also has several noteworthy strengths. Our patient populations represent all consecutive adult admissions to two tertiary care university hospitals in the United States and Canada with appropriate principal discharge diagnoses during 1997 to 1999, providing a sample that is relatively large and varied across the spectrum of disease activity. Furthermore, both cohorts were defined in the same standardized manner, helping to ensure the validity of the findings. Finally, multiple measures of healthcare resource utilization and adverse outcome were assessed. The present study thus provides a detailed comparison of the process and outcomes of healthcare services provided to two cohorts of patients with acute, nonvariceal UGIH in distinct practice settings.

Future studies should identify barriers and facilitators to efficient, high-quality health care for patients hospitalized with acute, nonvariceal UGIH from the perspective of key players, including primary care providers, gastroenterologists, emergency medicine physicians, hospital administrators, financiers of health care, nurses and patients. These findings may be applied to guide the development of interventions designed to decrease the unnecessary use of interventions and medications such as intravenous H2RA, the utilization of ICU and monitored beds, and the length of hospital stay. The safety and efficacy of these interventions should then be systematically assessed before their implementation in clinical practice.

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