The Value of U/S to Determine Priority for Upper Gastrointestinal Endoscopy in Emergency Room

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Abstract: In countries endemic for liver and GIT diseases, frequent emergency department (ED) patients contribute to a disproportionate number of visits consuming substantial amount of medical resources.

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One of the most frequent ED visits is patients who present with hypovolemic shock, abdominal pain, or confusion with or without signs of upper gastrointestinal bleeding (UGIB). The use of conventional two-dimensional ultrasound (2D-U/S) may provide immediate and useful information on the presence of esophageal varices, gastrointestinal tumors, and other GIT abnormalities.

The current study investigated the feasibility of using (2D-U/S) to predict the source of UGIB in ED and to determine patients’ priority for UGE.

Between February 2003 and March 2013, we retrospectively reviewed the profiles of 38,551 Egyptian patients, aged 2 to 75 years old, who presented with a history of GI/liver diseases and no alcohol consumption. We assessed the value of 2D-U/S technology in predicting the source of UGIB.

Of 38,551 patients presenting to ED, 900 patients (2.3%), 534 male (59.3%) and 366 female (40.7%) developed UGIB. Analyzing results obtained from U/S examinations by data mining for emergent UGE were patients with liver cirrhosis (LC), splenomegaly, and ascites (42.6% incidence of UGIB), followed by LC and splenomegaly (14.6%), LC only (9.4%), and was only 0.5% who had no morbidity finding by 2D-U/S. Ultrasonographic instrumented increases the feasibility of predictive emergency medicine. The area has recently not only gained a fresh impulse, but also a new set of complex problems that needs to be addressed in the emergency medicine setting according to each priority.

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Abbreviations: 2D-U/S = two-dimensional ultrasonography, EVs = esophageal varices, GERD = gastroesophageal reflux disease, GI = gastrointestinal, HFL = hepatic focal lesion, LC = liver cirrhosis, PHCG = portal hypertensive congestive gastropathy, PHT = portal hypertension, UGE = upper gastrointestinal endoscopy, UGIB = upper gastrointestinal bleeding.

INTRODUCTION

Upper gastrointestinal bleeding (UGIB) is a common medical condition, with high patient morbidity and medical care costs that usually presents as hematemesis and/or melena.1-5 Two-dimensional ultrasonography (2D-U/S) is a simple, portable, and rapid technique that can play an important role in screening for gastrointestinal (GI) and hepatobiliary diseases that cause different forms of UGIB.6 Additionally U/S has recently been used to assess the degree of esophageal varices (EVs) in cirrhotic patients by 2D-U/S.7,8 Data mining programs have identified factors significantly associated with patient mortality.9,10 Therefore, predictive data mining is becoming an instrumental tool in identifying higher risk patients. This study used both data mining and 2D-U/S to
predict UGIB in nonalcoholic patients. We observed that predictors of UGIB were liver cirrhosis (LC) – associated portal hypertension (PHT) – induced splenomegaly and ascites using data-mining analysis.

PATIENTS AND METHODS
Al Azhar School of Medicine, Asuit Branch, Al Azhar University, Egypt, ethics committee specifically has approved this study.

Participants provided their written informed consent to participate in this study. The participant consented form was recorded and kept with study documents. The ethics committee approved the consent procedure.

Of the 38,551 patients evaluated in the emergency room, outpatient clinic and specialized centers, or admitted to the hospital with manifestations of GI/liver disorders between February 2003 and March 2013, 900 (2.3%) nonalcoholic patients had developed UGIB (hematemesis and/or melena). Of those 900 patients, 534 (59.3%) were males and 366 (40.7%) were females, ranging in age from 2 to 75 years. All had been treated for UGIB, including hematemesis and/or melena, at the GI Centers of Al Azhar University Hospitals in Egypt. Patients were diagnosed with UGIB by upper gastrointestinal endoscopy (UGE) from February 2003 until March 2013. The demographic and clinical characteristics of these patients were analyzed to detect factors predictive of UGIB.

All patients with UGIB were evaluated by UGE and 2D-U/S. Patients were categorized by age into those <20, 21 to 30, 31 to 40, 41 to 50, 51 to 60, and >60 years.

Statistical Analyses
All statistical analyses were performed using SPSS version 18 software for Microsoft Windows (Statistical Package for the Social Sciences; SPSS Inc., Chicago, IL).

Data-Mining Analysis
Data-mining analysis is a process by which a computer examines large amounts of data to create an algorithm. Both naïve Bayes (10-fold cross-validation) and a decision-tree model were used. The descriptive Rapid I models of Rapid miner Program (Germany) were initially generated to determine the most significant independent variable in each stage of predicting dependent variables using the computational analysis instead of mathematical analysis.

RESULTS
Of 38,551 patients aged 2 to 75 years (mean age 43.5 ± 1.2 years) and presenting with GI/liver diseases, only 900 (2.3%) had UGIB. These 900 patients included 534 males (59.3%) and 366 females (40.7%); of these, 78.1% and 87%, respectively, presented with hematemesis and/or melena, respectively, presented with melena. The most frequent predisposing factors for UGIB included peptic ulcer, gastroesophageal reflux disease (GERD), gastritis, and duodenitis (65.8%), with PHT-associated lesions, EVs, gastric varices, portal hypertensive congestive gastropathy (PHCG), and duodenopathy accounting for 30.1% (Table 1). The frequencies of most UGIB diseases were similar in males and females, but EVs were more common in males (28.4% vs 18.3%) and GERD (19.6% vs 14.2%) and gastritis (20% vs 12.7%) were more common in females (Figure 1).

Clinical presentation of patients with UGIB may help in predicting diagnosis. For example, abdominal pain, heartburn, and vomiting commonly occurring in first 3 decades-related bleeding diseases. Additionally, sonographic images will help in such demonstration prediction in various age-groups, LC, diffuse hepatic pathology, splenomegaly, hepatic focal lesion, and ascites commonly occurring in 4th and 5th decades-related bleeding morbidities (Table 2).

Common but not serious causes of UGIB included peptic ulcer (both gastric and duodenal), gastritis, and lower end esophagitis, which occurred more frequently during the 2nd and 3rd than during other decades of life (Figure 2). Serious UGIB, with higher morbidity and mortality rates, included EVs, gastric varices, esophageal cancer, gastric cancer, PHCG, and

TABLE 1. UGE Finding in Both Male and Female Groups

| UGE Finding          | Male       | Female      |
|----------------------|------------|-------------|
|                      | 534; (59.3%) | 366; (40.7%) |
| Hematemesis; Melena; |            |             |
| 417; (78.1%)         | 318; (86.9%) |
| 117 (21.9%)          | 48; (13.1%) |
| 1-Esophageal Varices | 152; (28.4%) | 67; (18.3%) |
| 2-Peptic Ulcer       | 111; (20.7%) | 65; (17.7%) |
| 3-GERD               | 76; (14.2%)  | 72; (19.6%)  |
| 4-Gastritis          | 68; (12.7%)  | 74; (20.2%)  |
| 5-Duodenitis         | 69; (12.9%)  | 58; (15.8%)  |
| 6-Gastric Varices    | 21; (3.9%)   | 10; (2.7%)   |
| 7-PHCG               | 11; (2.05%)  | 6; (1.6%)    |
| 8-Cancer Esophagus   | 6; (1.1%)    | 1; (0.2%)    |
| 9-Cancer Stomach     | 5; (0.9%)    | 1; (0.2%)    |
| 10-GI Polyp          | 6; (1.1%)    | 6; (1.6%)    |
| 11-Blood Disease     | 2; (0.37%)   | 2; (0.5%)    |
| 12-Mallory Weiss     | 1; (0.18%)   | 1; (0.2%)    |
| 13-Duodenopathy/     | 4; (0.74%)   | 1; (0.2%)    |
| Duod Varices         |             |             |
| 14-Dieulafoy’s Lesion| 2; (0.37%)   | 0; (0%)      |
| 15-No Aberrant Lesion| 0; (0%)     | 2; (0.5%)    |
| Total; No%           | 534; (100%)  | 366; (100%)  |

GERD = gastroesophageal reflux disease, GI = gastrointestinal, PHCG = portal hypertensive congestive gastropathy, UGE = upper gastrointestinal endoscopy.
GI polyps, these occurred more frequently during the 3rd, 4th, and 5th decades of life than in other decades (Figure 3). Sonographic images frequently supported the diagnoses of serious UGIB (Figure 4). The decision tree algorithm of Rapid I ver. 4.6 Berlin, was able to predict UGIB 42.6% of patients with LC, splenomegaly, and ascites, but in only 14.6% of patients with LC-associated PHT or splenomegaly and in only 9.4% of patients with LC alone. Only 0.5% of patients negative for morbidity by 2D-U/S showed signs of bleeding (Figure 5). However, it was 14.6% in LC-associated PHT splenomegaly and only 9.4% in those presented with only LC. Those without any morbidity finding by 2D-U/S technology showed 0.5% incidence bleeding (Figure 5). A modified algorithm was developed to enable 2D-U/S to predict UGIB in patients presenting with GI and/or hepatic disorders (Figure 6).

DISCUSSIONS
UGIB is a common medical emergency, estimated to affect 150 per 100,000 adults per year and with inpatient mortality rate as high as 10%. The most common causes of UGIB include gastric and/or duodenal ulcers, esophagogastric varices with or without PHCG, gastric antral vascular ectasia (GAVE), esophagitis, erosive gastritis/duodenitis, Mallory–Weiss syndrome, angiodysplasia, mass lesions (polyps/cancers), and Dieulafoy lesion. Less frequent causes of UGIB include hemophilia, hemosuccus pancreatitis, and aortoenteric fistula. Given the high prevalence of viral hepatitis in Egypt, the usual load of emergency rooms and the urgent care that UGIB patients need, therefore, identifying high risk UGIB patients by data mining will save much need time, effort and will ultimately improve the patient care.
FIGURE 3. Incidence of ultrasound-detected gastrointestinal polyps, stomach cancer, esophageal cancer, portal hypertensive gastropathy, gastric varices, and esophageal varices in patients assorted by age groups.

FIGURE 4. Incidence of ultrasound-detected liver cirrhosis, splenomegaly, hepatomegaly, hepatic focal lesion (HFL), and ascites in patients assorted by age groups.
This study used data-mining analysis to retrospectively examine the demographic and clinical characteristics of 900-UGIB patients, thereby enabling factors leading to the development of these conditions and their sequelae to be identified. Preexisting liver disease associated PHT was the most prominent predisposing factor for UGIB, being present in 30.1% of patients. However, peptic ulcer, GERD, gastritis, and duodenitis accounted were observed in 65.8% of patients with UGIB.

The initial evaluation of a patient with a suspected acute UGIB includes brief personal and family history, physical examination, laboratory tests, U/S investigation, and for some patients, nasogastric lavage. This evaluation is performed to assess the severity of the bleeding, identify potential bleeding sources, and determine if any preexisting conditions that may affect subsequent management. UGE remains the gold standard for the diagnosis of esophago-gastroduodenal lesions. In
In this study, the decision-tree algorithm showed a high-incidence association of UGIB with the occurrence of LC, splenomegaly, and ascites, 42.6%. It was 14.6% in LC and splenomegaly (compensated group sonographically), 9.4% in those with LC only. However, only 9.5% of patients developed UGIB if there is a negative sonographic picture-related GI and hepatobiliary systems (Figure 5).

CONCLUSIONS

Ultrasoundography should be a diagnostic urgent investigation in the emergency room and this will increase the ability to predict UGIB in patients with GI and liver diseases with special concern for countries that are endemic with LC-related morbidities.

LIMITATIONS OF THE STUDY

This study was performed in Egypt, which has one of the highest rates of endemic HCV infection worldwide. Thus, results in countries with lower rates of HCV infection may differ markedly. Therefore, our results may require confirmation in other countries and in other diverse ethnic groups.

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