Detection of Risky Esophageal Varices by Two-Dimensional Ultrasound: When to Perform Endoscopy

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Abstract: *Objective:* Esophageal varices are a consequence of portal hypertension in cirrhotic patients. Current guidelines recommend that all cirrhotic patients undergo screening endoscopy at diagnosis to identify patients with varices at high risk of bleeding who will benefit from primary prophylaxis. This practice increases costs, involves a degree of invasiveness and discomfort and places a heavy burden on endoscopy units. Several studies have evaluated possible noninvasive predictors of esophageal varices, but most of these studies remain controversial. *Methods:* The intra-abdominal portion of the esophagus in 673 patients who presented with liver cirrhosis and portal hypertension was examined using standard 2-dimensional (2D) ultrasound. A direct relationship between the degree of varices observed on upper endoscopy and the intra-abdominal esophageal wall thickness was detected using 2D ultrasound. *Results:* The mean thicknesses of the esophageal wall were 3.7 ± 0.5 mm (mean ± standard deviation) in normal individuals, 7.3 ± 3.3 mm in those with esophageal varices and 8.65 ± 1.98 mm in those with risky esophageal varices. The overall accuracy of 2D ultrasound was 95%. *Conclusions:* The intra-abdominal esophagus should be observed during abdominal ultrasound examination in patients with liver cirrhosis. Two-dimensional ultrasound can play an important role in screening for esophageal varices.

Key Indexing Terms: Esophageal varices; Two-dimensional ultrasound. **[Am J Med Sci 2014;347(1):28–33.]**

The most serious complication in patients with liver cirrhosis is active hematemesis, especially in undiagnosed individuals. Although the rate of mortality from bleeding episodes has decreased with improved endoscopic and radiologic techniques together with new pharmacologic therapies, the 20% to 30% mortality rate means that bleeding from esophageal varices remains clinically important.[1] The *de novo* formation of varices occurs at a rate of 5% per year, with a higher incidence in patients continuing to consume alcohol or with worsening liver function.[2] Esophageal varices develop in the 3 esophageal venous systems: the intrinsic, associated and extrinsic veins. The intrinsic veins include the subepithelial plexus in the lamina propria, the submucous plexus on the outer aspect of the muscularis mucosa and the perforating veins that pierce the esophageal muscle layer. The associated veins are longitudinal veins located in the adventitia. The extrinsic veins are formed by the union of groups of perforating veins and connect with the left gastric vein inferiorly and with the azygous vein superiorly. The perforating veins connect the intrinsic with the extrinsic veins at multiple levels over the entire length of the esophagus. Upper endoscopy demonstrates only the intrinsic venous system when dilated, whereas endoscopic ultrasonography (US) demonstrates all venous plexuses.[3]

The American Association for the Study of Liver Disease and the Baveno IV consensus conference on portal hypertension recommended that all cirrhotic patients be screened for the presence of esophageal varices when liver cirrhosis is diagnosed. This approach places a heavy burden on endoscopy units, and the repeated testing over time may have a detrimental effect on patient compliance.[4] The noninvasive identification of patients at the highest risk for esophageal varices would reduce the need for upper endoscopy. Noninvasive techniques include upper gastrointestinal radiography, the portal-phase superior mesenteric artery portogram, multidetector computed tomography (CT), magnetic resonance imaging (MRI), transient elastography and laboratory predictors such as the platelet count and spleen-diameter ratio. Most of these investigations have limited specificity and entail major concerns about the risk of cumulative radiation exposure in ongoing screening programs.[5–19]

Two-dimensional (2D) US uses no ionizing radiation to create the image and is associated with no side effects or complications. The use of this method is easy and inexpensive. Although some studies reported that gastroesophageal varices appear as tortuous anechoic structures around the gastroesophageal junction on abdominal US, these veins do not represent the varices within the esophageal wall that cause bleeding.[20]

We prospectively examined the lower esophagi of patients with chronic liver disease using 2D US. We sought to specify the imaging characteristics of the intra-abdominal esophagus caused by the existence of varices to evaluate the clinical usefulness of 2D US in the detection of the degree of esophageal varices according to esophageal wall thickness.

PATIENTS AND METHODS

Abdominal US was performed as a routine standard investigation for all patients presenting with chronic liver disease in our outpatient clinic or hospitalized patients scheduled for upper endoscopy due to evident portal hypertension demonstrated by 2D US at the Al Hussein University Hospital, Cairo, Egypt; Sayed Galal University Hospital, Cairo, Egypt; Al Azhar University Hospital, Asuit, Egypt; Amer Liver Centre, Cairo, Egypt and Kobe General Hospital, Kobe, Japan.

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Between January 2004 and May 2012, 1076 patients presented with chronic liver disease and portal hypertension, classified as parenchymatous liver disease with various degrees of chronic hepatitis to advanced cirrhotic liver, and mild splenomegaly to a huge spleen with marked portal hypertension. Among them, 673 patients (414 men, 259 women) aged 18 to 58 years presented with chronic liver disease and esophageal varices detected using both 2D US and upper endoscopy.

The underlying diseases were liver cirrhosis due to hepatitis C virus (HCV) or hepatitis B virus (HBV) or a mixed chronic HCV and HBV infection (534 patients), combined hepatic fibrosis and cirrhosis following bilharzia and viral infection (101 patients), hepatic fibrosis due to bilharzia infestation only (32 patients), portal hypertension due to biliary atresia following the Kasai operation (3 patients), Caroli's syndrome type 2 (2 patients) and idiopathic portal hypertension (1 patient).

The thicknesses of the anterior and posterior walls of the intra-abdominal esophagus were measured, and irregularities of the inner surface were assessed. All the patients underwent diagnostic upper endoscopy to estimate the corresponding degree of varices.

Sonography

We advised the patients to fast at least 6 to 8 hours before sonographic examination. Charcoal (280 mg) when administered 8 hours before the procedure might be beneficial in obese patients and in those with colonic gaseous distension. We applied a convex 2D US probe to the midline (epigastric region). By using the left lobe of the liver as an acoustic window, one can observe the lower esophagus (intra-abdominal portion, 3.2–4.2 mm) to appear clearly as separate anterior and posterior walls between the left lobe and the aorta; the anterior and posterior walls are hypoechoic, whereas the lumen is hyperechoic (Figures 1 and 2).

If the esophagus was collapsed, we asked the patient to drink a cup of water. The passage of water separates the 2 identified collapsed walls, and it appears as a hyperechoic flash due to the presence of intraluminal air. Just after the passage of water, the separation of the 2 esophageal walls is obvious. We asked some obese patients to lie in the left lateral position and placed the probe in the same midline position.

The technique is simple, portable, quick and easy to learn.

Consent was obtained from all the subjects.

An Important Question

If esophageal varices are affected by respiration, will this cause collapse or congestion of the varices?

Answer: To determine the accurate diameter of any abdominal vessel during routine US, we made the measurement during shallow respiration because deep inspiration and expiration will markedly affect the diameter. The anterior and posterior walls should be measured accurately because varices can be present in 1 to 4 columns.

We used 2D US without Doppler. Doppler might be a complementary feature, because it is the only means of detecting fundal varices. Fundal varices should be accompanied by esophageal varices, except in splenic vein thrombosis and in other vascular abnormalities, which could be demonstrated with US. Accordingly, we suspect isolated fundal varices in vascular thrombosis detected by US. Rupture or bleeding of fundal varices is rare without esophageal variceal bleeding.

Statistical Analysis

Statistical analysis was used to determine the association between the esophageal wall thickness and degree of esophageal varices detected by upper endoscopy. Categorical data were compared using the χ^2 test, whereas continuous variables were compared using Student's t test.

A descriptive model was generated using a decision tree algorithm (using the Rapid Miner, version 4.6, Berlin, Germany). The Decision tree decides the most significant independent variable in each stage of predicting dependent variables.

RESULTS

In patients presenting with chronic liver disease, the incidence of esophageal varices was 62.5%, and that of risky esophageal varices was 35.5%. The mean thicknesses of the esophageal wall were 3.7 ± 0.5 mm (mean ± standard deviation) in normal individuals, 7.3 ± 3.3 mm in those with esophageal varices, 8.65 ± 1.98 mm in those with risky esophageal varices, 7.05 ± 0.45 in those with esophageal varices grade 3, and 9.1 ± 1.5 in those with esophageal varices grade 4 ($P < 0.0001$, Table 1).

All varices resulted in an irregular inner surface. For the detection of all lower esophageal abnormalities, 2D US had a sensitivity of 97%, specificity of 93% and overall accuracy of 95%.

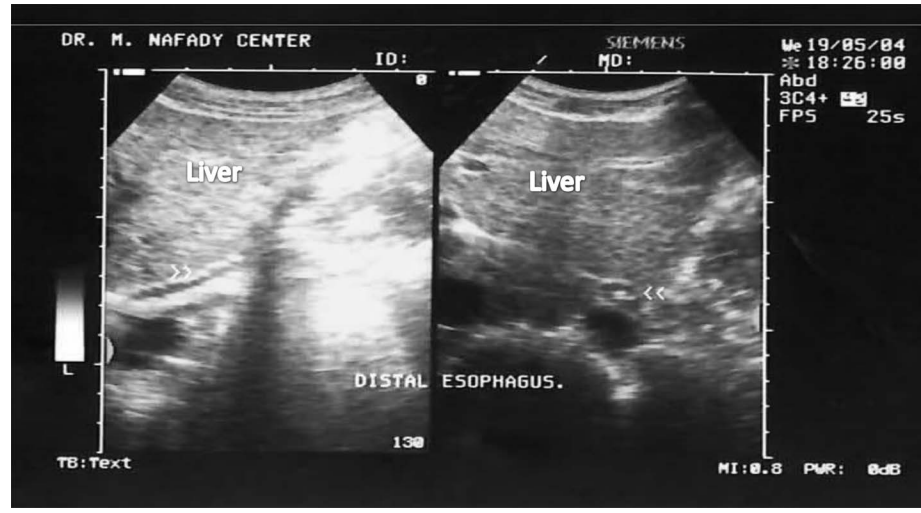

FIGURE 1. Intra-abdominal portion of the esophagus in longitudinal and transverse sections.