

Review of Complications in a Series of Patients With Known Gastro-Esophageal Varices Undergoing Transesophageal Echocardiography

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Background: The presence of gastroesophageal varices is considered a relative contraindication to performing transesophageal echocardiography (TEE), but this is based on expert opinion, and there is limited data to support this recommendation. The aim of this study was to review the complications and benefit of performing TEE in patients with known gastroesophageal varices.

Methods: Fourteen patients with known esophageal varices who underwent TEE from 1997 to 2007 were identified. Patients' charts were reviewed for procedure-related complications as well as benefit in performing TEE.

Results: The 14 patients had an average age of 50.4 years. Six patients had grade 2 esophageal varices at the time of TEE. The most common etiology of portal hypertension was alcoholic liver disease (11 of 14), and the most common indication for TEE was to rule out endocarditis (11 of 14). There were no major bleeding or other complications noted. All 14 procedures were able to provide the clinical information requested.

Conclusion: Although the presence of known esophageal varices was previously thought to be a contraindication to performing TEE, the results of this study show that TEE without transgastric views can be performed without serious complications in patients with grade 1 or 2 esophageal varices who have not experienced recent variceal hemorrhages. Additionally, there is a definite benefit, as all of the clinical questions were successfully answered. (*J Am Soc Echocardiogr* 2009;22:396-400.)

Keywords: TEE, Gastroesophageal varices, Complications

Transesophageal echocardiography (TEE) performed by experienced operators under proper conditions has a high safety profile with few complications.¹⁻⁴ In a large multicenter study, Daniel et al² reported only 18 significant complications (cardiac, pulmonary, and bleeding) among a total of 10,218 procedures (0.18%), of which all but 1 spontaneously resolved after removal of the probe. Similarly, Kallmeyer et al³ reported a low TEE-associated morbidity of 0.2% without TEE-associated mortality in 7,200 patients undergoing intraoperative TEE. Neither group of investigators commented on the safety or benefit of performing TEE in patients with gastroesophageal varices.

The presence of gastroesophageal varices, or esophageal pathology, has been considered a relative contraindication to TEE because

of the blind instrumentation that occurs within the esophagus and the perceived risk for bleeding.¹⁻⁴ As a result, ultrasonographers who perform TEE may request that upper endoscopy be performed on patients at risk for gastroesophageal varices prior to TEE. However, there is limited data available pertaining to the safety and benefit of performing TEE in patients with known gastroesophageal varices. Thus, the aim of this study was to evaluate for serious complications and the benefit of TEE in patients with known gastroesophageal varices.

METHODS

Patients

This retrospective analysis was performed at a tertiary care urban referral medical center, the University of Wisconsin Hospital and Clinics, from January 1997 to December 2007. Subjects were identified by list comparison of patients undergoing TEE and patients having diagnoses of esophageal varices made by endoscopy. The presence of gastric varices was noted but was not an inclusion criterion for the study. Fourteen patients with known gastroesophageal varices undergoing TEE were identified and their charts evaluated for the primary outcome of determining the safety and benefit of TEE. The University of Wisconsin Institutional Review Board approved the study protocol.

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Table 1 Patient characteristics prior to undergoing TEE and indications for and findings of TEE in patients with known gastroesophageal varices

Age (y)/gender	Etiology of liver disease	MELD score	INR	Platelet count ($\times 10^3/\mu\text{l}$)*	Varices	Prior variceal hemorrhage	Prior treatment for varices	Indication for TEE	Findings on TEE
41/F	ALD, HCV	15	1.7	273	E, grade 1	No	None	Evaluate for MV thrombus (IE)	Negative for MV thrombus; AV shunt discovered, implicating HPS
62/F	ALD	21	1.8	83	E, grade 1; G, small	No	Banding	Evaluate for IE	Negative for IE
54/M	ALD, A1AT	11	1.3	58	E, grade 2; G, small	No	None	Evaluate for IE	Negative for IE
38/F	ALD, HCV	24	1.8	35	E, grade 2	Yes	Banding	Evaluate for IE	Negative for IE
51/M	ALD, A1AT	30	1.5	139	E, grade 1	Yes	Sclerotherapy	Evaluate for IE	Negative for IE
49/F	CRYP	21	2.1	49	E, grade 1	No	None	Evaluate for RLS	Negative for intrapulmonary shunt
66/M	CRYP	14	1.2	41	E, grade 2	No	None	Evaluate for IE	Negative for IE
37/M	ALD	12	1.3	165	E, grade 2	No	None	Evaluate for IE	Negative for IE
43/M	ALD	14	1.3	67	E, grade 1	No	Banding	Evaluate for PFO with ASA	Confirmed
48/M	ALD	20	2.2	137	E, grade 1	No	None	Evaluate for IE	Negative for endocarditis; interatrial septal aneurysm, RLS (intracardiac vs intrapulmonary) diagnosed
69/F	ALD	30	1.6	97	E, grade 2	Yes	Banding	Evaluate for IE	Negative for IE
43/F	ALD	11	1.2	372	E, grade 2; G, large	Yes	None	Evaluate for IE	Negative for IE
54/M		10	1.4	226	E, grade 1	No	None	Evaluate for MV disorder	MR, rheumatic heart disease diagnosis made
51/M	ALD, HCV	23	1.5	174	E, grade 1	No	None	Evaluate for MV thrombus (IE)	Negative for IE; AV shunt discovered, implicating HPS

ALD, Alcoholic liver disease; A1AT, α -1 antitrypsin deficiency; ASA, atrial septal abnormality; AV, arteriovenous; CRYP, cryptogenic cirrhosis; E, esophageal; G, gastric; HCV, hepatitis C virus; HPS, hepatopulmonary syndrome; INR, international normalized ratio; MV, mitral valve; PFO, patent foramen ovale; RLS, right-to-left shunt.

*Reference range: $160 \times 10^3/\mu\text{l}$ to $370 \times 10^3/\mu\text{l}$.

TEE

After providing written informed consent and undergoing a minimum of 6 hours of fasting, patients were transported to the echocardiography lab, or they remained in their intermediate or intensive care wards, where appropriate procedural and postprocedural monitoring could occur. Topical oropharyngeal anesthetic (topical benzocaine) and intravenous glycopyrrolate were used at the discretion of the performing physician. Sedation was performed in all patients with intravenous midazolam and fentanyl. Adult multiplane transesophageal probes were inserted blindly, and probe position was confirmed via probe depth and 2-dimensional imaging. Standard views were obtained by rotating the transducer array from 0° to 135° , by clockwise and counterclockwise rotation of probe shaft, and with flexion-extension of the probe. In those patients who had transgastric views, the probe was advanced into the stomach no greater than 50 cm as measured from the incisors, and standard views were obtained by ante-flexion, axial rotation of the ultrasound probe, and rotation of the transducer array.

Definition and Evaluation of Complications

Procedure-related complications were defined as those related to moderate sedation (requiring the administration of reversal agents or an advanced airway), aspiration (defined clinically or via chest x-ray), injury to the esophagus or gastric mucosa (confirmed via upper endoscopy or chest x-ray), bleeding (a drop in hemoglobin >2 g/dL or a need for blood-product transfusion within 48 hours of TEE), clinical worsening of hepatic encephalopathy within 48 hours of TEE, or clinical and radiographic evidence of perforation.

Procedure-related complications were evaluated by applying the following approach to each of the 14 patients who met the entry criteria. First, the procedure notes were reviewed to identify immediate postprocedural complications. Second, postprocedural daily progress notes, nursing notes, and hospital discharge summaries were reviewed for evidence of delayed complications, including bleeding, encephalopathy, or infection. Third, electronic record lab data for the day of the procedure and the following 48 hours were reviewed to screen for a total decline in hemoglobin of 2 g/dL. Transfusion

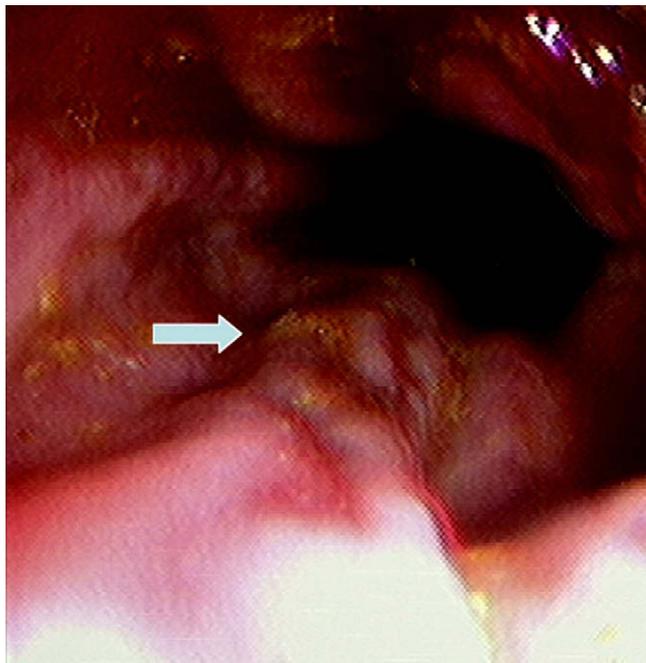


Figure 1 Endoscopic image revealing grade 2 esophageal varices (*white arrow*) requiring band ligation for variceal hemorrhage 13 days prior to TEE. This patient underwent successful TEE without complication.

records were also reviewed to check for blood-product transfusion within 48 hours following TEE. Finally, 30-day follow-up was assessed to evaluate for readmission or delayed complication secondary to TEE.

Supplemental Variables Collected

Other variables collected for this study included age, gender, and etiology of portal hypertension. Data regarding each patient's gastroesophageal varices (most recent size [grade 1, 2, or 3], previous bleeding, and prior treatment) were recorded. The indications for TEE were tracked, as were the outcomes. Laboratory values obtained included platelet count, serial hemoglobin, international normalized ratio, creatinine, and total bilirubin (the latter 3 values were used to calculate each patient's model for end-stage liver disease [MELD] score). The MELD score is a marker of disease severity in patients with advanced liver disease. Originally developed to estimate patients' early mortality after undergoing transjugular intrahepatic portosystemic shunt procedures, this calculated number is currently used as an objective measurement when assigning rank for those on the list for liver transplantation.⁵

RESULTS

Patient Characteristics

We identified 14 patients (8 men, 6 women) who had esophageal varices diagnosed by endoscopy and who subsequently underwent TEE (Table 1). The average age was 50.4 years (range, 37-69 years). The most common etiology inducing portal hypertension and thus leading to the formation of gastroesophageal varices was advanced alcoholic liver disease. The severity of liver disease, as determined by MELD score, averaged 18.3 in our population (range, 10-30). At

the time of TEE, the mean international normalized ratio was 1.6 (range, 1.2-2.2), and the mean platelet count was $137 \times 10^3/\mu\text{L}$ (range, $35 \times 10^3/\mu\text{L}$ to $372 \times 10^3/\mu\text{L}$).

Of the 14 patients, 6 had grade 2 esophageal varices (Figure 1). The remaining 8 patients had grade 1 varices. Upper endoscopy was performed an average of 27 days prior to TEE (range, 0-88 days). Two endoscopies were performed for clearance prior to TEE. In the remaining 12 instances, 3 endoscopies were performed for upper gastrointestinal hemorrhage (1 variceal, 2 peptic ulcer), and 9 were performed per routine screening protocol in patients with cirrhosis.

Four patients had histories of variceal hemorrhages an average of 365 days (range, 13-1,027) prior to TEE. Five patients had undergone prior endoscopic therapy for esophageal varices (4 with band ligation, 1 with sclerotherapy).

Procedure-Related Data

The majority (11 of 14) of procedures were performed in the midesophagus, but transgastric imaging was deemed necessary in 3 patients to obtain the needed information (Table 1). Of those who underwent transgastric TEE, the patients did not have gastric varices. The most common indication for TEE was to evaluate for infective endocarditis (IE; 11 of 14 cases). One study was performed to further characterize a known valvular abnormality (mitral). The final 2 studies were performed to characterize the interatrial septum (Video 1, [View video clip online](#)). IE was ruled out in all 11 patients.

Complications

There were no major bleeding complications following TEE in any of the 14 patients, even those higher risk patients with histories of prior variceal hemorrhages or those with prior endoscopic therapy (sclerotherapy or band ligation). No patient had a decline in hemoglobin of >2 g/dL in the 48 hours after the procedure. There were also no packed red blood cell transfusions during that same time period. Hepatic encephalopathy was not exacerbated after the procedure in any patient. In addition, there were no cardiopulmonary complications during or immediately after these procedures. No perforations occurred. There were no 30 day readmissions secondary to TEE or other delayed complications.

DISCUSSION

On review of the literature, there is limited data addressing the safety of TEE in patients with known esophageal varices. A single study primarily evaluating the usefulness of TEE at the time of liver transplantation included 21 patients with known esophageal varices.⁶ There was a single complication of upper gastrointestinal hemorrhage that could not be definitively diagnosed as variceal in nature. Because of the overall lack of literature in this area, we performed a retrospective analysis to further elucidate the ability to perform TEE in these higher risk patients. Our results show that among 14 patients reviewed, there were no TEE-associated complications, either immediate or delayed.

The presence of esophageal varices is traditionally considered a relative contraindication to performing TEE. For example, in a review by Daniel et al,² gastroesophageal varices were considered an absolute contraindication to TEE at 10 of the 15 centers included in the study. In addition, other large, retrospective studies evaluating the safety of TEE have not reported complications while performing the procedure on patients with known gastroesophageal varices.^{1,3,4} The

concern, and the cause for exclusion in some instances, is the perceived risk for traumatic injury leading to catastrophic variceal hemorrhage. However, the most likely cause of variceal hemorrhage is not a function of external trauma to the varix but due to increased variceal wall tension. Variceal wall tension is determined by the vessel diameter⁷ and the pressure within the varix, which is directly related to the hepatic venous portal gradient. By decreasing the hepatic venous portal gradient to <12 mm Hg, investigators have shown significant reductions in variceal hemorrhage.^{8,9} Such reductions are typically obtained with the use of nonselective β -blockade or transjugular intrahepatic portosystemic shunt procedures.

A similar question of safety has been raised with respect to placing nasogastric tubes and esophageal stethoscopes in patients with known esophageal varices undergoing liver transplantation.¹⁰ Ritter et al¹⁰ reported on 75 patients and stated that despite documented esophageal varices, significant coagulopathies, and a high incidence of previous upper gastrointestinal bleeding, no patient in their series developed gastrointestinal hemorrhage as a result of blind esophageal instrumentation. Although the placement of nasogastric tubes and esophageal stethoscopes is not the same as performing TEE, there is some evidence that blind esophageal instrumentation in the setting of known esophageal varices may be safe. Our study corroborates these findings by Ritter et al in patients undergoing TEE.

Although we have shown that TEE in patients with gastroesophageal varices can be performed without complication, we have also demonstrated benefit. Of the 14 procedures, all were complete and satisfactorily answered the questions for which they were performed (Table 1). Eleven patients had IE ruled out, 1 patient underwent further characterization of a known valvular abnormality, and the final 2 patients underwent TEE to discriminate between intracardiac (ie, atrial septal defects) and extracardiac shunt defects. In 2 patients being evaluated for IE, additional information was obtained suggesting a diagnosis of hepatopulmonary syndrome, a further benefit to the procedures. In most instances, midesophageal images were adequate to obtain the clinical information necessary, but transgastric TEE was deemed necessary on 3 occasions and did not result in complications. Other instances that would support transgastric views would include the need for full Doppler interrogation of the aortic valve, adequate visualization of subcordal mitral and tricuspid valve structures, and adequate visualization of the distal segment (ie, beyond the gastroesophageal junction) of the descending aorta, particularly when adequate transthoracic and midesophageal images cannot be obtained.

Additionally, TEE should be considered only when information cannot be adequately obtained from transthoracic echocardiography, particularly with regard to IE. In this study, transthoracic echocardiography could not identify the presence of valvular vegetation, so TEE was performed to enhance the sensitivity for excluding IE. In this patient population with end-stage liver disease (immunocompromised state), the presence or absence of infection must be confidently determined to help guide medical decision making and minimize the associated morbidity and mortality associated with occult infection. However, it is reasonable to start with transthoracic echocardiography, because positive results would potentially negate the need to perform TEE.

Performing upper endoscopy prior to TEE in patients with histories of esophageal varices may not be necessary and would subject patients to an additional procedure that would increase the risks associated with moderate sedation and instrumentation of the upper gastrointestinal tract, as well as patient discontent with additional fasting and additive health care costs. However, screening guidelines for patients with established diagnoses of cirrhosis do suggest endoscopic surveillance for gastroesophageal varices.¹¹ The findings on the index

surveillance endoscopy dictate the frequency of future surveillance. For patients with compensated cirrhosis and no varices, repeat endoscopy in 2 to 3 years is recommended. Patients with grade 1 varices should have repeat endoscopy in 1 to 2 years. In decompensated cirrhosis or varices of grade 2 or 3, repeat endoscopy should occur yearly. As long as these guidelines are followed, we would suggest no further screening prior to TEE, particularly in stable, noncoagulopathic patients. That said, if a patient has never undergone endoscopy, and TEE is indicated, it would be practical to perform preprocedural endoscopy in this situation on a case-by-case basis. In addition, patients with known varices should have platelet counts obtained and appropriate coagulation studies done prior to performing TEE.

This study was limited by the total number of patients reviewed, but this series provides further evidence that the perceived additive risk of performing TEE in patients with gastroesophageal varices may be overstated. Also, although all of the patients had esophageal varices, only 3 patients had gastric varices, and of those, none underwent transgastric TEE. Thus, limited conclusions can be made about performing transgastric TEE in patients with gastric varices.

In conclusion, although the presence of known gastroesophageal varices was previously thought to be a contraindication to performing TEE, our study has suggested that TEE can be performed without additive complication and with probable benefit in the patient population described here. Our case study, coupled with the fact that a procedure-related TEE complication in a patient with varices has never been reported, suggests that TEE can be performed without excessive risk in patients with portal hypertension and known or suspected esophageal varices.

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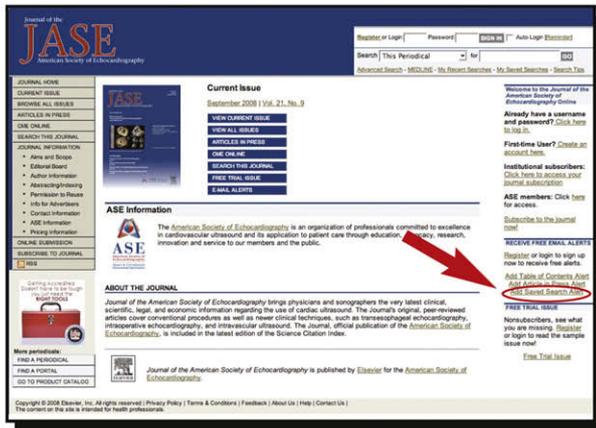
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