Transesophageal Echocardiography in Patients With Esophageal Varices

Kirk T. Spencer, MD, *Chicago, Illinios*

Transesophageal echocardiography (TEE) has proved invaluable in the evaluation of a number of conditions, including stroke, endocarditis, prosthetic valves, and acute aortic syndromes, as well as in the preoperative and perioperative evaluation of valvular heart disease.[1] The value of TEE must of course be balanced against the risk of performing the procedure. The insertion and manipulation of a transesophageal echocardiographic probe may infrequently cause pharyngeal, esophageal, or gastric trauma. Screening for esophageal pathology by history and review of the medical record is an essential component of evaluation before performing TEE. Patients with esophageal stricture, esophageal cancer, esophageal diverticulum, and recent esophageal surgery are generally considered to have near absolute contraindications for TEE. Esophageal varices have been considered an absolute as well as a relative contraindication to TEE, depending on the center and/or operator.

Esophageal varices develop to decompress the hypertensive portal vein circulation that results from obstruction to portal venous outflow; cirrhosis is the most common cause. In prospective studies using fiber optic endoscopy, new varices develop at a rate of 5% in the first year.[2] Twenty-eight percent of patients with cirrhosis have varices at 3 years.[2] It is clear that variceal bleeding carries significant morbidity in patients with cirrhosis. A number of factors have been demonstrated on esophagogastroendoscopy to predict the likelihood of variceal hemorrhage, including the location, size, and appearance of the varices. In addition, several clinical features of individual patients portend a greater variceal bleeding risk. Experienced echocardiography laboratories usually do not consider esophageal varices an absolute contraindication to TEE, but the potential added information should be weighed against the risk for provoking a major upper gastroesophageal bleed. In this issue of the *Journal of American Society of Echocardiography*, Spier et al[3] report a retrospective analysis of the complications of performing TEE in a series of patients with known gastroesophageal varices.

Physicians who perform TEE need to make individualized decisions on the risk/benefit ratio of performing TEE in patients with known or suspected varices. When evaluating the risk, a number of issues should be considered, including the grade of the varices, clinical history of gastroesophageal bleeding, and evidence of coagulopathy (platelet count and international normalized ratio [INR] for prothrombin time). The fact that no reported case of upper variceal bleeding precipitated by TEE can be found in the published literature suggests one of several possibilities: (1) The risk for precipitating gastroesophageal bleeding with TEE is in fact only theoretical. Given the literature demonstrating minor esophageal trauma with TEE and the significant morbidity of variceal bleeding should it occur, it seems prudent to assume that this is a real, not simply a perceived, risk. (2) In general, patients with varices do not undergo TEE. This is not the case at my institution or Spier et al's[3] institution. (3) When experienced echocardiographers assess the safety of performing TEE in patients with known esophageal varices, they do a good job of assessing the risk. This is the most likely explanation, but the complex clinical assessment that this involves has never been formally studied.

Spier et al[3] retrospectively reviewed their TEE database over a 10-year period (1997-2007) and found 14 patients with known esophageal varices. No major bleeds or other complications were noted in these patients during or after TEE. They examined the incidence not only of clinically apparent bleeding but also of occult bleeding, defined by a drop in hemoglobin >2 g/dL or a need for blood-product transfusion within 48 hours of TEE.

Unfortunately, given the retrospective nature of this study, we have no data on how many patients with esophageal varices were refused for TEE during this 10-year period. Were the patients with varices who were referred for TEE but not imaged different in their bleeding risk? Was the decision to perform TEE in patients with varices dependent on the operator or his or her clinical experience? Did the patients undergoing TEE have more urgent clinical indications for TEE? Finally, these data do not address the safety of TEE in patients with end-stage liver disease or cirrhosis with no known histories of varices but without screening endoscopy. Does a risk for provoking bleeding with esophageal instrumentation exist for these patients? Spier et al[3] noted that 11 of the 14 patients with varices underwent endoscopy as part of a screening protocol, but it is unclear how many (if any) patients with end-stage liver disease underwent TEE without screening endoscopy.

To use the data in Spier et al's[3] paper clinically, it is important to characterize completely the patients studied with regard to risk for variceal bleeding. None of these patients had grade 3 varices. At the time of TEE, the mean INR was 1.6 (maximum, 2.2), and the mean platelet count was 137,000 (minimum, 35,000). All patients underwent upper endoscopy within 90 days of TEE; 3 of these studies had been performed for gastrointestinal bleeding. Nine endoscopies were performed for routine screening in patients with cirrhosis, and 2 were performed specifically for the purpose of clearance before TEE. Four of the patients had histories of variceal hemorrhage, and 5 had undergone prior endoscopic therapy for esophageal varices. It is clear that the degree of liver dysfunction is an important predictor of variceal hemorrhage. A common risk-stratifying tool is the Model for End-State Liver Disease (MELD) score, which uses a patient's laboratory values of bilirubin, creatinine, and INR. Higher MELD scores have been associated with increased bleeding risk and decreased survival rates. The patients in Spier et al's study were moderately ill, with an average MELD score of 18 (a patient with a MELD score $\geq$ 10 is eligible for liver transplantation evaluation).

The reason Spier et al's[3] paper is important, even though it describes a retrospective analysis of only 14 patients, is that there is a paucity of data on these patients in the literature. Although two retrospective reviews of large groups of patients undergoing TEE have been published, involving >10,000 examinations each, neither

From the University of Chicago, Chicago, IL.

Reprint requests: Kirk T. Spencer, MD, The University of Chicago, 5841 S Maryland, MC5084, Chicago, IL 60637 (E-mail: *kspencer@uchicago.edu*).

0894-7317/$36.00

doi:10.1016/j.echo.2009.02.011

of these series specifically addressed the issue of safety in patients with esophageal varices.[4,5] My group's laboratory does not consider esophageal varices to be an absolute contraindication to TEE, so a group of patients with varices were undoubtedly included in our study, but the data focused on perforation, not bleeding.[5] The second study reported 2 bleeding complications during TEE (neither variceal). However, this was a much older study, and 10 of 15 centers included considered esophageal varices an absolute contraindication to TEE, so few patients with varices were probably included.[4] Finally, a study of 1,500 patients during an initial experience with TEE focused on the inability to intubate. The investigators did not list any bleeding episodes, although they did not state whether patients with varices were excluded.[6]

Performing TEE in patients with esophageal varices is an issue not only for cardiologists in echocardiography laboratories but also for anesthesiologists with sufficient training in TEE, who may be performing TEE intraoperatively at the time of liver transplantation. In this group of patients, esophageal varices are not uncommon. The use of TEE has gained popularity for monitoring patients undergoing orthotropic liver transplantation, in whom rapid hemodynamic changes may occur.[7] Studies of TEE during liver transplantation surgery have shown improved monitoring of volume status and myocardial function, with significant changes in therapy resulting from findings on TEE.[7] A small study of 23 patients with esophageal varices undergoing intraoperative TEE during liver transplantation reported no bleeding episodes.[8] Another study comparing the ability of transthoracic echocardiography (TTE) and TEE to detect intracardiac shunting in 37 patients with liver disease included 26 patients with known varices (including 2 patients with grade 3 varices). This study also reported no clinically significant gastrointestinal bleeding.[9]

As with any clinical test, the assessment of risk is only one part of the equation. The other aspect is the potential benefit of the procedure. Although Spier et al[3] state that TEE was able to answer the clinical questions in all cases, it is difficult to know how strongly indicated the procedures were. The majority of the indications (11 of 14) were to evaluate for endocarditis. Although endocarditis is an accepted indication for TEE, there remains a broad range of clinical importance and pretest probability in patients with suspected endocarditis referred for TEE.[10] It is difficult to get a sense of the "urgency" of TEE from the data provided. The fact that all 11 studies for endocarditis had negative results would suggest that the threshold for performing TEE might have been low. Importantly, Spier et al make it clear that the clinical questions were not adequately answered on TTE. Although a strategy of direct TEE (without preceding TTE) has been proposed for certain conditions, it seems prudent, as Spier et al suggest, that TTE precede TEE in all patients with esophageal varices.

The article by Spier et al,[3] along with the literature on liver transplantation patients and reviews of the safety of TEE, all add to the growing body of evidence that TEE can be performed safely in patients with esophageal varices. This is a change from the position taken by 10 of 15 European centers in 1991, considering esophageal varices a contraindication for TEE.[4] On the other hand, the message from this article should not be that TEE is uniformly safe in patients with esophageal varices; their presence remains a relative contraindication for TEE. The experience is simply too limited, and the full range of variceal severity, coagulopathy, and liver disease are not adequately represented.

When selecting which patients with varices can be safely examined with a transesophageal echocardiographic probe, several factors need to be considered:

1. It seems prudent that patients with esophageal varices have a strong clinical indication for TEE and that the results of TEE (whether normal or abnormal) be expected to affect patient management, risk stratification, or liver transplantation evaluation. The clinical question should also be one that cannot be answered with other imaging modalities that do not require esophageal intubation, such as TTE, cardiac computed tomography, or cardiac magnetic resonance imaging.
2. In nonemergency situations, it is reasonable that endoscopy be performed prior to TEE in patients with advanced cirrhosis or established varices. There are screening guidelines for patients with established diagnoses of cirrhosis as well as guidelines for repeat endoscopy in those with known varices. It would seem that as long as patients fall within the surveillance timing guidelines and remain clinically stable, repeat endoscopy specifically to "clear for" TEE is not required.
3. It seems reasonable that subjects with grade 1 and 2 varices be considered for TEE. The risk/benefit ratio of imaging patients with higher grade varices using TEE remains unclear.
4. It would seem reasonable that the INR and platelet count be taken into consideration when assessing the risk of performing TEE in patients with esophageal varices. The coagulation spectrum seen in Spier et al's[3] study is a reasonable starting point for patients with varices undergoing TEE: a platelet count of $\geq$50,000 if the INR is $>$2 and a platelet count of $>$35,000 if the INR is $<$2.
5. A history of variceal bleeding should not be a contraindication to TEE. However, because a history of variceal bleeding is a risk factor for rebleeding (with the greatest risk in the first 48 hours after the index bleed), it would seem prudent that endoscopic evaluation be performed and clinical stability be established before TEE.
6. It would seem reasonable that transgastric views not be obtained routinely in patients with esophageal varices. Although unique transesophageal echocardiographic perspectives can be obtained from this view, such as continuous-wave Doppler evaluation of the aortic valve or visualization of the more distal thoracic aorta, these data can be obtained with other noninvasive techniques. The development of varices is most common in the distal esophagus and stomach. In addition, varices develop deep within the submucosa in the midesophagus but become progressively more superficial in the distal esophagus. Because varices at the gastroesophageal junction are the most superficial, they are probably the most likely to be disrupted by the transesophageal echocardiographic probe and bleed.

In conclusion, the findings of Spier et al[3] help in the assessment of risk and benefit for clinicians deciding whether TEE should be performed in patients with esophageal varices. The characterization of these patients supports what many labs have been doing on a case-by-case basis. If a patient has an important indication for TEE, which cannot be answered first with TTE or any other noninvasive technique, then TEE should not be contraindicated by the presence of esophageal varices.

REFERENCES

1. Shanewise JS, Cheung AT, Aronson S, Stewart WJ, Weiss RL, Mark JB, et al. ASE/SCA guidelines for performing a comprehensive intraoperative

multiplane transesophageal echocardiography examination: recommendations of the American Society of Echocardiography Council for Intraoperative Echocardiography and the Society of Cardiovascular Anesthesiologists Task Force for Certification in Perioperative Transesophageal Echocardiography. J Am Soc Echocardiogr 1999;12:884-900.

2. Merli M, Nicolini G, Angeloni S, Rinaldi V, De Santis A, Merkel C, et al. Incidence and natural history of small esophageal varices in cirrhotic patients. J Hepatol 2003;38:266-72.
3. Spier B, Larue SJ, Teelin TC, Leff JA, Swize LR, Borkan SH, et al. Review of the complications in a series of patients with known gastro-esophageal varices undergoing transesophageal echocardiography. J Am Soc Echocardiogr 2009;22:397-401.
4. Daniel WG, Erbel R, Kasper W, Visser CA, Engberding R, Sutherland GR, et al. Safety of transesophageal echocardiography—a multicenter survey of 10,419 examinations. Circulation 1991;83:817-21.
5. Min JK, Spencer KT, Furlong KT, DeCara JM, Sugeng L, Ward RP, et al. Clinical features of complications from transesophageal echocardiography: a single-center case series of 10,000 consecutive examinations. J Am Soc Echocardiogr 2005;18:925-9.
6. Chan K, Cohen G, Sochowski R, Baird M. Complications of transesophageal echocardiography in ambulatory adult patients. J Am Soc Echocardiogr 1991;4:577-82.
7. Krenn CG, De Wolf AM. Current approach to intraoperative monitoring in liver transplantation. Curr Opin Organ Transplant 2008;13:285-90.
8. Suriani RJ, Cutrone A, Feierman D, Konstadt S. Intraoperative transesophageal echocardiography during liver transplantation. J Cardiothorac Vasc Anesth 1996;10:699-707.
9. Vedrinne JM, Duperret S, Bizollon T, Magnin C, Motin J, Trepo C, et al. Comparison of transesophageal and transthoracic contrast echocardiography for detection of an intrapulmonary shunt in liver disease. Chest 1997;111:1236-40.
10. Douglas PS, Khandheria B, Stainback RF, Weissman NJ, Brindis RG, Patel MR, et al. ACCF/ASE/ACEP/ASNC/SCAI/SCCT/SCMR 2007 appropriateness criteria for transthoracic and transesophageal echocardiography. J Am Soc Echocardiogr 2007;20:787-805.