

patients with cirrhosis, awaiting liver transplantation,<sup>1</sup> with an emphasis on the high morbidity and mortality with variceal bleeding. Such patients may require a transoesophageal echocardiogram (TOE) to assess cardiorespiratory abnormalities potentially precluding a transplant, as well as for intraoperative haemodynamic monitoring and for investigation for endocarditis. However, the safety of performing a TOE in such patients is debated by clinicians due to the perceived risk of postprocedural bleeding.<sup>2</sup> Three small studies have analysed post-TOE bleeding complications in patients with varices, having reported no bleeding in 26, 14 and 23 patients.<sup>3–5</sup> We hypothesised that direct external trauma by the echocardiographic probe is unlikely to cause significant bleeding, as variceal bleeding is primarily caused by wall tension, a function of increasing variceal diameter and internal pressure.<sup>6</sup> We therefore audited post-TOE bleeding rates at an Australian liver transplant referral centre in patients who had both varices or portal hypertension and a TOE based on International Classification of Diseases 10 coding from 1995 to 2010.

This project was approved by the Austin Hospital Research Ethics Unit (Project Number H2011-04346.) All patients had consented to have a TOE and endoscopies as per nationally accepted guidelines. Kruskal–Wallis multivariate statistical analysis was performed to determine any factors predicting the usefulness of TOEs, using the Minitab statistics program (V.15, Minitab Inc, Pennsylvania, USA).

Sixty TOEs were performed on 51 patients. Seventy percent of TOEs were performed in men, and patients were a median age of 56.4 years. Child–Pugh scores of A, B and C were present in 30%, 36% and 33%, respectively, and the median Model for End-Stage Liver Disease (MELD) score was 17.1. Underlying causes of portal hypertension included alcoholic cirrhosis (27%), viral hepatitis (12%), non-alcoholic steatohepatitis (8%) and cryptogenic cirrhosis (8%). Cirrhosis was diagnosed at a median of 7.6 years prior to TOE. TOEs were performed at a median time of 150 days from variceal diagnosis, with 70% within 1 year. Seventy-three percent were for investigation of endocarditis.

Seventy-eight percent of patients had oesophageal varices seen on endoscopy, and 22% had radiological evidence of portal hypertension. When varices were seen on endoscopy, 30% had both gastric and oesophageal varices, 57% had large varices (>5 mm in diameter as per American Association for the Study of Liver Diseases definitions<sup>7</sup>) and 26% had stigmata of acute bleeding including red spot, red wales, clots and active spurting. Importantly, 53% of TOEs were performed without prior variceal treatment, such as liver transplantation, endoscopic banding or transjugular intrahepatic portosystemic shunting. We did not analyse if patients were taking  $\beta$ -blockers or nitrates. However, our study included more

## To TOE or not to TOE? That is the question in patients with portal hypertension and varices

We read with interest your recently published review by Cardénas and Ginès on

objective risk factors for variceal bleeding, namely, variceal size and cirrhosis score at time of TOE.

There was no variceal bleeding 2 weeks after any TOE. Ours is, to our knowledge, the only study analysing for such late bleeding. TOEs were useful in changing clinical management in 50% of cases by guiding medication regimens or surgical procedures (table 1). Multivariate analysis did not reveal any factors that predicted whether a TOE would be useful, with factors analysed including: patient gender; cause and duration of portal hypertension; alcohol use; transplantation status; body mass index; MELD and Child-Pugh score at time of TOE; variceal size and site; and indication for TOE. We therefore suggest that TOEs in patients with varices or portal hypertension should be performed if clinically indicated, as no bleeding rates occurred even if large varices and/or acute stigmata of bleeding were present.

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## REFERENCES

1. **Cardenas A**, Gines P. Management of patients with cirrhosis awaiting liver transplantation. *Gut* 2011;**60**:412–21.
2. **Hilberath JN**, Oakes DA, Sherman SK, *et al.* Safety of transesophageal echocardiography. *J Am Soc Echocardiogr* 2010;**23**:1115–27; quiz 220–1.
3. **Spier BJ**, Larue SJ, Teelin TC, *et al.* Review of complications in a series of patients with known gastro-esophageal varices undergoing transesophageal echocardiography. *J Am Soc Echocardiogr* 2009;**22**:396–400.
4. **Suriani RJ**, Cutrone A, Feierman D, *et al.* Intraoperative transesophageal echocardiography during liver transplantation. *J Cardiothorac Vasc Anesth* 1996;**10**:699–707.
5. **Vedrinne JM**, Duperré S, Bizollon T, *et al.* Comparison of transesophageal and transthoracic contrast echocardiography for detection of an intrapulmonary shunt in liver disease. *Chest* 1997;**111**:1236–40.
6. **D'Amico G**, Garcia-Pagan JC, Luca A, *et al.* Hepatic vein pressure gradient reduction and prevention of variceal bleeding in cirrhosis: a systematic review. *Gastroenterology* 2006;**131**:1611–24.
7. **Garcia-Tsao G**, Sanyal AJ, Grace ND, *et al.* Prevention and management of gastroesophageal varices and variceal hemorrhage in cirrhosis. *Hepatology* 2007;**46**:922–38.