Intraoperative transesophageal echocardiographic detection of intracardiac thrombus and pulmonary embolism during orthotopic liver transplant

Amie Hoefnagel

ABSTRACT

Introduction: Transesophageal echocardiography (TEE) utilization during liver transplantation is beginning to gain favor in many medical centers. The intraoperative course during liver transplant includes periods of increased and decreased peripheral vascular resistance, large amounts of third spacing, high volume replacement needs, and the possibility of acute right heart failure and circulatory collapse at reperfusion. Additionally, these patients may have underlying systolic dysfunction and coronary artery disease. Intraoperative TEE provides the anesthesiologist with the only single monitoring modality that can be used to diagnose all of these. Fear of bleeding complications due to esophageal varices, and the lack of provider competency with TEE are often cited as reasons to avoid TEE in this patient population.

Case Report: This is a case of an intracardiac thrombus and pulmonary embolism in a 44-year-old male undergoing orthotopic liver transplantation for Laennec's cirrhosis.

Conclusion: In this case, the routine use of intraoperative TEE provided for diagnosis of a massive intracardiac thrombus and pulmonary embolism during the dissection phase of liver transplantation, adding to the growing body of case reports supporting TEE as a diagnostic tool during orthotopic liver transplantation.

International Journal of Case Reports and Images (IJCRI)

International Journal of Case Reports and Images (IJCRI) is an international, peer reviewed, monthly, open access, online journal, publishing high-quality, articles in all areas of basic medical sciences and clinical specialties.

Aim of IJCRI is to encourage the publication of new information by providing a platform for reporting of unique, unusual and rare cases which enhance understanding of disease process, its diagnosis, management and clinico-pathologic correlations.

IJCRI publishes Review Articles, Case Series, Case Reports, Case in Images, Clinical Images and Letters to Editor.

Website: www.ijcasereportsandimages.com

CASE REPORT

PEER REVIEWED | OPEN ACCESS

Intraoperative transesophageal echocardiographic detection of intracardiac thrombus and pulmonary embolism during orthotopic liver transplant

Amie Hoefnagel

ABSTRACT

Introduction: Transesophageal echocardiography (TEE) utilization during liver transplantation is beginning to gain favor in many medical centers. The intraoperative course during liver transplant includes periods of increased and decreased peripheral vascular resistance, large amounts of third spacing, high volume replacement needs, and the possibility of acute right heart failure and circulatory collapse at reperfusion. Additionally, these patients may have underlying systolic dysfunction and coronary artery disease. Intraoperative TEE provides the anesthesiologist with the only single monitoring modality that can be used to diagnose all of these. Fear of bleeding complications due to esophageal varices, and the lack of provider competency with TEE are often cited as reasons to avoid TEE in this patient population. **Case Report:** This is a case of an intracardiac thrombus and pulmonary embolism in a 44-year-old male undergoing orthotopic liver transplantation for Laennec's cirrhosis. **Conclusion:** In this case, the routine use of intraoperative TEE provided for diagnosis of a massive intracardiac thrombus and pulmonary embolism during the dissection

phase of liver transplantation, adding to the growing body of case reports supporting TEE as a diagnostic tool during orthotopic liver transplantation.

Keywords: Intracardiac thrombus, Orthotopic liver transplantation, Pulmonary embolism, Transesophageal echocardiography

How to cite this article

Hoefnagel A. Intraoperative transesophageal echocardiographic detection of intracardiac thrombus and pulmonary embolism during orthotopic liver transplant. Int J Case Rep Images 2015;6(6):348–351.

doi:10.5348/ijcri-201559-CR-10520

INTRODUCTION

There are several reports of pulmonary embolism (PE) and/or intracardiac thrombus (ICT) during the intraoperative period of liver transplantation [1]. Patients with end-stage liver disease (ESLD) have defective coagulation due to impaired synthesis of clotting factors. They also have increased rates of fibrinolysis, increased concentrations of tissue plasminogen activator (tPA) and decreased concentrations of tPA-specific inhibitor [2]. Given the complexity of the balance between coagulation, anticoagulation, and fibrinolysis combined with the stresses of a major abdominal surgery with large volume loss, multiple vascular anastomosis, transfusion of blood product, exposure to citrate toxicity, and the presence of intracardiac monitors, it is quite amazing that these events are as rare as they are. TEE is the only diagnostic modality available to the anesthesiologist for intraoperative evaluation of PE and ICT, providing the ability to directly visualize thrombus and to garner information about the physiologic cardiac affects [3].

Amie Hoefnagel

Affiliations: Assistant Professor of Anesthesiology, Department of Anesthesiology, University of Rochester School of Medicine, Rochester NY, USA.

Corresponding Author: Amie Hoefnagel, 601 Elmwood Ave, Box 604, Rochester NY, 14642, USA; Ph: (585) 275-2141, Fax: (585) 276-0122; Email: amie_hoefnagel@urmc.rochester.edu

Received: 27 January 2015

Accepted: 18 February 2015

Published: 01 June 2015

CASE REPORT

A 44-year-old male presented for orthotopic liver transplantation (OLT) due to acute decompensation of Laennec's cirrhosis. He had been hospitalized for approximately three weeks with worsening mental status and acute renal failure requiring continuous veno-venous hemofiltration (CVVH). His model for end-stage liver disease score (MELD) was >40 at the time of transplantation (INR 2.2, total bilirubin 24.1 mg/dL, and creatinine 2.52).

The day prior to transplantation the patient required transfusion of several units of red blood cells (pRBCs), and fresh-frozen plasma (FFP) due to genitourinary hemorrhage after a traumatic Foley catheter placement. He was also placed on an aminocaproic acid infusion at 1 g/hr after a 5 g loading dose, which was stopped prior to surgical incision. In the operating room, bilateral radial arterial lines, a rapid infusion catheter, an introducer, and pulmonary artery catheter were placed after induction of general anesthesia. Post-induction hemodynamics were consistent with end-stage liver disease and showed an increased cardiac output and systemic vasodilation. A transesophageal echocardiogram (TEE) was performed. Initial evaluation revealed a patent foramen ovale best imaged in the midesophageal RV inflow-outflow view (Video 1, <http://www.ijcasereportsandimages.com/archive/2015/006-2015-ijcri/CR-10520-06-2015-hoefnagel/ijcri-1052006201520-hoefnagel-full-text.php>). The imaging was also positive for a hyperdynamic and under filled left ventricle.

During the dissection phase of surgery, there was a sudden drop in blood pressure with near immediate equalization of the systemic and pulmonary pressures. The end-tidal carbon dioxide fell from 34 mmHg to 10 mmHg, and mixed venous saturation fell from 78% to 58%. A midesophageal four-chamber view showed severe enlargement of the right atrium and ventricle and an intracardiac thrombus attached to the pulmonary artery catheter. There were additional TEE signs consistent with further embolization of the thrombus into the pulmonary arteries, such as a slit like, under filled left ventricle, and a continued left-ward bowing of the intra-atrial septum during the entire cardiac cycle. A slight leftward rotation of the TEE probe was used to focus on the right atrium and ventricle for better visualization of the thrombus (Figure 1). The patient developed pulseless electrical activity (PEA) that was treated with chest compressions and one dose of epinephrine. Visualization of the main pulmonary artery after chest compressions did not show thrombus. Attempts at aspiration of thrombus via the introducer and pulmonary artery catheter were unsuccessful. High doses of epinephrine were required to maintain an adequate blood pressure and the decision was made to abort the transplant. The patient's abdomen was closed, and he was transported to the surgical intensive care unit. Attempted catheter thrombectomy was aborted after pulmonary

Figure 1: The intracardiac thrombus crossing the tricuspid valve. Severe right atrial enlargement and leftward curvature of the intra-atrial septum are also seen.

angiography revealed patent main pulmonary arteries. The patient developed a clinical picture consistent with disseminated intravascular coagulopathy, worsening acidosis, and pupils became fixed and dilated. He died twelve hours after the initial thrombotic event.

DISCUSSION

TEE is the only diagnostic modality available to the anesthesiologist for intraoperative evaluation of PE and ICT. An intracardiac thrombus is defined as an echo dense, discrete, mass that is seen during both systole and diastole. The mass must be discrete from the endocardium. Treatment of intracardiac thrombi involves anticoagulation and serial monitoring with echocardiography to follow resolution. Occasionally with large thrombi, or ones that further embolize to the pulmonary circulation, surgical removal may be considered [4]. Unlike intracardiac thrombus, direct visualization of pulmonary thrombus on TEE is seen in roughly one-quarter of patients with known pulmonary emboli [5]. Therefore, indirect markers are utilized for diagnosis. Right ventricular dysfunction, leftward bowing of the intra-atrial septum, and moderate to severe tricuspid regurgitation all have high sensitivity for PE [5, 6]. McConnell's sign--akinesia of the RV free wall with sparing of the apex-- (Video 2, <http://www.ijcasereportsandimages.com/archive/2015/006-2015-ijcri/CR-10520-06-2015-hoefnagel/ijcri-1052006201520-hoefnagel-full-text.php>) has a sensitivity of 77% and specificity of 94% for PE [7]. Additional criteria consistent with PE include RV dilation with an RV/LV end-diastolic diameter >1, or an RV end-diastolic diameter >30 mm [8]. To obtain these values the transgastric mid short axis-view is used. From this view the transgastric right ventricular apical short-axis view can be found by advancing the transducer slightly, rotating the probe to the right and antiflexing it. This

view will allow for better measurement of the right ventricle [9]. Additional TEE signs consistent with PE are pulmonary artery systolic pressure >30 mmHg and a tricuspid regurgitant velocity >2.8 m/s [8].

Another indirect echocardiographic sign of acute PE is the 60/60 sign—pulmonary artery acceleration time of <60 milliseconds with a maximal tricuspid regurgitant pressure gradient of <60 mmHg. The pulmonary artery acceleration time is the interval between the onset of systolic flow in the pulmonary artery and its peak velocity. This is measured with pulsed-wave Doppler (PW) interrogation of the pulmonary artery. Several TEE views can be utilized for this measurement including the midesophageal ascending aorta SAX, upper esophageal aortic arch LAX, or the transgastric RV inflow-outflow view [10].

CONCLUSION

In this case intraoperative Transesophageal echocardiography (TEE) allowed for diagnosis of massive intracardiac thrombus (ICT) and pulmonary embolism (PE) within moments of its occurrence. Unfortunately, this patient did not survive the event, however, the rapid diagnosis allowed for re-allocation of the donor organ and a successful transplant for a different patient.

Author Contributions

Amie Hoefnagel – Substantial contributions to conception and design, Acquisition of data, Analysis and interpretation of data, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published

Guarantor

The corresponding author is the guarantor of submission.

Conflict of Interest

Authors declare no conflict of interest.

Copyright

© 2015 Amie Hoefnagel. This article is distributed under the terms of Creative Commons Attribution License which permits unrestricted use, distribution and reproduction in any medium provided the original author(s) and original publisher are properly credited. Please see the copyright policy on the journal website for more information.

REFERENCES

1. Garg A, Armstrong WF. Echocardiography in Liver Transplant Candidates. *JACC Cardiovasc Imaging* 2013 Jan;6(1):105–19.
2. Warnaar N, Molenaar IQ, Colquhoun SD, et al. Intraoperative pulmonary embolism and intracardiac

thrombosis complicating liver transplantation: A systematic review. *J Thromb Haemost* 2008 Feb;6(2):297–302.

3. Kang YG, Martin DJ, Marquez J, et al. Intraoperative changes in blood coagulation and thromboelastographic monitoring in liver transplantation. *Anesth Analg* 1985 Sept;64(9):888–96.
4. Esposito R, Raia R, De Palma D, Santoro C, Galderisi M. The role of echocardiography in the management of the sources of embolism. *Future Cardiol* 2012 Jan;8(1):101–14.
5. Rosenberger P, Shernan SK, Body SC, Eltzschig HK. Utility of intraoperative transesophageal echocardiography for diagnosis of pulmonary embolism. *Anesth Analg* 2004 Jul;99(1):12–6.
6. Vieillard-Baron A, Qanadli SD, Antakly Y, et al. Transesophageal echocardiography for the diagnosis of pulmonary embolism with acute cor pulmonale: A comparison with radiologic procedures. *Intensive Care Med* 1998 May;24(5):429–33.
7. McConnell MV, Solomon SD, Rayan ME, Come PC, Goldhaber SZ, Lee RT. Regional right ventricular dysfunction detected by echocardiography in acute pulmonary embolism. *Am J Cardiol* 1996 Aug 15;78(4):469–73.
8. Sekhri V, Mehta N, Rawat N, Lehrman SG, Aronow WS. Management of massive and nonmassive pulmonary embolism. *Arch Med Sci* 2012 Dec 20;8(6):957–69.
9. Kasper J, Bolliger D, Skarvan K, Buser P, Filipovic M, Seeberger MD. Additional cross-sectional transesophageal echocardiography views improve perioperative right heart assessment. *Anesthesiology* 2012 Oct;117(4):726–34.
10. Lau G, Ther G, Swanevelde J. Echo rounds: McConnell's sign in acute pulmonary embolism. *Anesth Analg* 2013 May;116(5):982–5.

ABOUT THE AUTHOR

Article citation: Hoefnagel A. Intraoperative transesophageal echocardiographic detection of intracardiac thrombus and pulmonary embolism during orthotopic liver transplant. Int J Case Rep Images 2015;6(6):348–351.

Amie Hoefnagel is Assistant Professor of anesthesiology at the University of Rochester School of Medicine, in Rochester, NY, USA. Her research interests include uses of transesophageal echocardiography in non-cardiac surgery, and multi-modal peri-operative pain treatment.

Access full text article on
other devices

Access PDF of article on
other devices

Edorium Journals: An introduction

Edorium Journals Team

About Edorium Journals

Edorium Journals is a publisher of high-quality, open access, international scholarly journals covering subjects in basic sciences and clinical specialties and subspecialties.

Invitation for article submission

We sincerely invite you to submit your valuable research for publication to Edorium Journals.

But why should you publish with Edorium Journals?

In less than 10 words - we give you what no one does.

Vision of being the best

We have the vision of making our journals the best and the most authoritative journals in their respective specialties. We are working towards this goal every day of every week of every month of every year.

Exceptional services

We care for you, your work and your time. Our efficient, personalized and courteous services are a testimony to this.

Editorial Review

All manuscripts submitted to Edorium Journals undergo pre-processing review, first editorial review, peer review, second editorial review and finally third editorial review.

Peer Review

All manuscripts submitted to Edorium Journals undergo anonymous, double-blind, external peer review.

Early View version

Early View version of your manuscript will be published in the journal within 72 hours of final acceptance.

Manuscript status

From submission to publication of your article you will get regular updates (minimum six times) about status of your manuscripts directly in your email.

Our Commitment

Six weeks

You will get first decision on your manuscript within six weeks (42 days) of submission. If we fail to honor this by even one day, we will publish your manuscript free of charge.

Four weeks

After we receive page proofs, your manuscript will be published in the journal within four weeks (31 days). If we fail to honor this by even one day, we will publish your manuscript free of charge and refund you the full article publication charges you paid for your manuscript.

Mentored Review Articles (MRA)

Our academic program "Mentored Review Article" (MRA) gives you a unique opportunity to publish papers under mentorship of international faculty. These articles are published free of charges.

Favored Author program

One email is all it takes to become our favored author. You will not only get fee waivers but also get information and insights about scholarly publishing.

Institutional Membership program

Join our Institutional Memberships program and help scholars from your institute make their research accessible to all and save thousands of dollars in fees make their research accessible to all.

Our presence

We have some of the best designed publication formats. Our websites are very user friendly and enable you to do your work very easily with no hassle.

Something more...

We request you to have a look at our website to know more about us and our services.

We welcome you to interact with us, share with us, join us and of course publish with us.

Edorium Journals: On Web

Browse Journals

CONNECT WITH US