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

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].

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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.


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 leftward 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 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.

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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.

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