



# TEE to Facilitate Anesthetic Management During Thoracotomy In a Patient with Severe Pulmonary Hypertension and Pulmonary Venous Obstruction

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## Introduction

The lateral decubitus position (LDP), one-lung ventilation (OLV) and prevention and treatment of hypoxemia continue to present challenges to the anesthesiologist, particularly in the patient with pulmonary hypertension. We describe the utility of intraoperative transesophageal echocardiography (TEE) in the management of a patient with severe pulmonary hypertension and pulmonary vein stenosis undergoing thoracotomy for tissue diagnosis.

## Case Report

A 47-year-old, 62 kg female with pulmonary hypertension presented for right thoracotomy and resection of mediastinal lymphadenopathy. The patient had progressive dyspnea over six months and worsening hypoxemia. Preoperative computed tomography scan revealed ground-glass opacifications within the lung bases bilaterally and mediastinal lymphadenopathy. The patient had a right heart catheterization that demonstrated PA pressure of 80/37 mmHg and PVR of 891 (dyne sec cm) which was unresponsive to nitric oxide therapy. After induction of anesthesia, arterial blood gas results on two-lung ventilation (100% FiO<sub>2</sub>) were **pH 7.44, PaCO<sub>2</sub> 37, PaO<sub>2</sub> 453, HCO<sub>3</sub> 24**. The patient underwent right lower lobe wedge resection which was complicated by intermittent severe episodes of hypoxemia, hypercarbia, and acidosis. The initial arterial blood gas results after one-lung isolation (100% FiO<sub>2</sub>) were **pH 7.25, PaCO<sub>2</sub> 60, PaO<sub>2</sub> 97, HCO<sub>3</sub> 26**.

An intraoperative TEE examination showed significant right atrial and ventricular dilatation, severe tricuspid and pulmonary regurgitation, stenosis of the pulmonary veins except for the left upper pulmonary vein, severely reduced right ventricular systolic function, and a calculated PASP of 108 mmHg (Figure 1). The peak velocity of the left upper pulmonary vein was 257 cm/s (Figures 2 & 3). The surgeon was notified and we instituted frequent recruitment maneuvers, intermittent dual-lung ventilation, hyperventilation, CPAP to the nondependent lung, and PEEP to the dependent lung, while monitoring right ventricular function. At the end of the procedure, the right lung was re-expanded, and the patient was successfully extubated and transferred to the surgical intensive care unit.

Figure 1. Tricuspid Regurgitant Jet

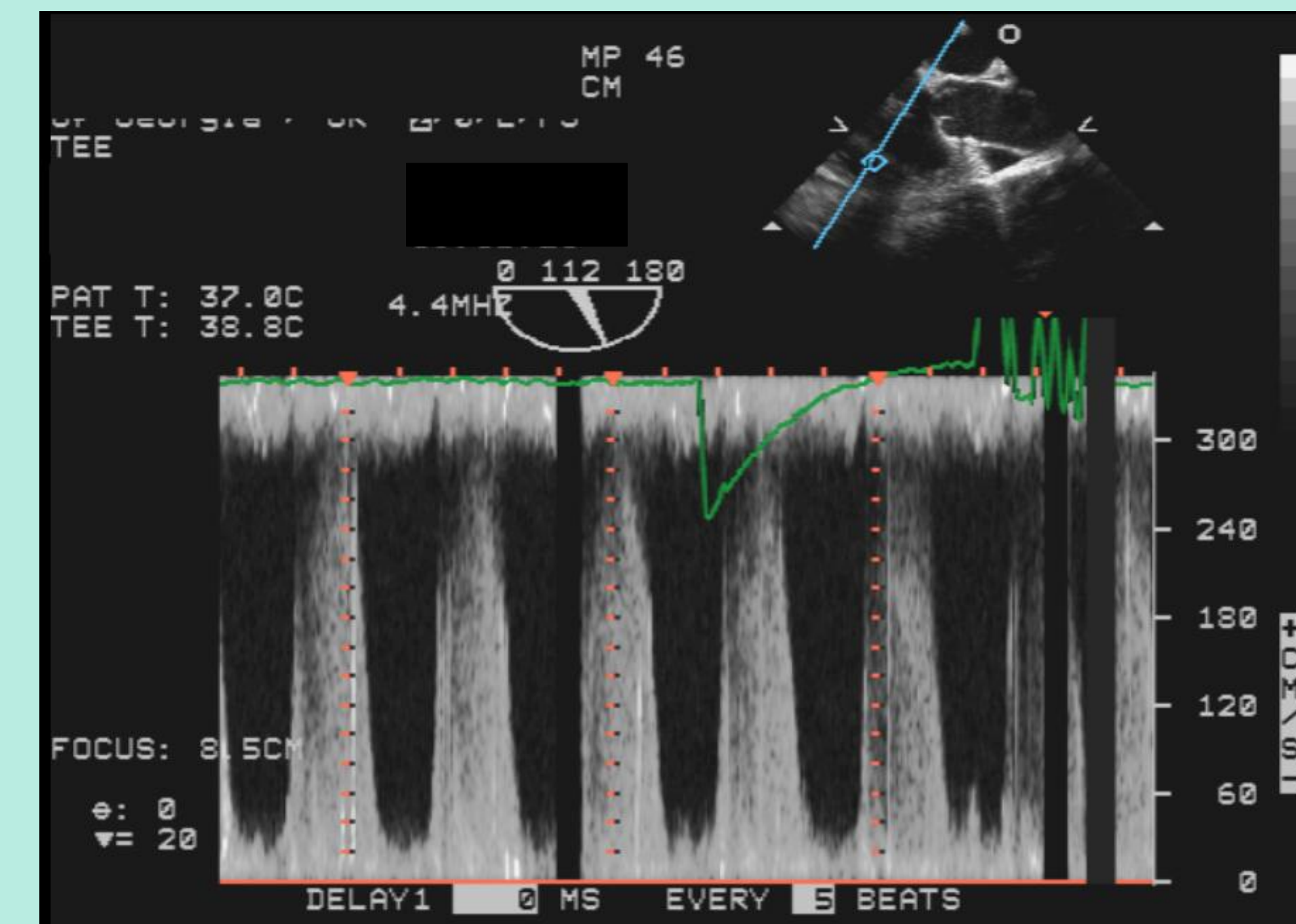


Figure 2. Left Upper Pulmonary Vein Turbulent Flow

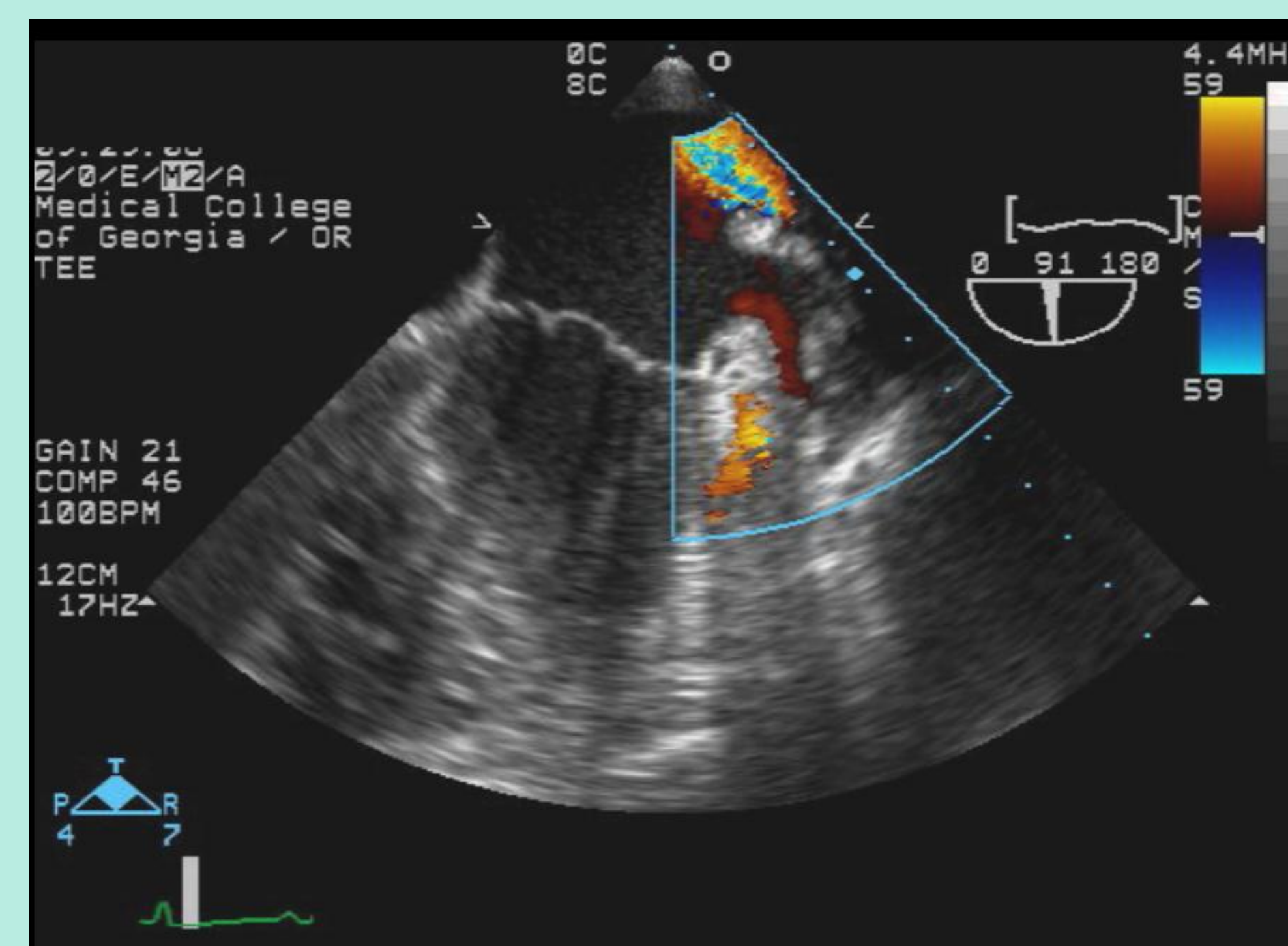
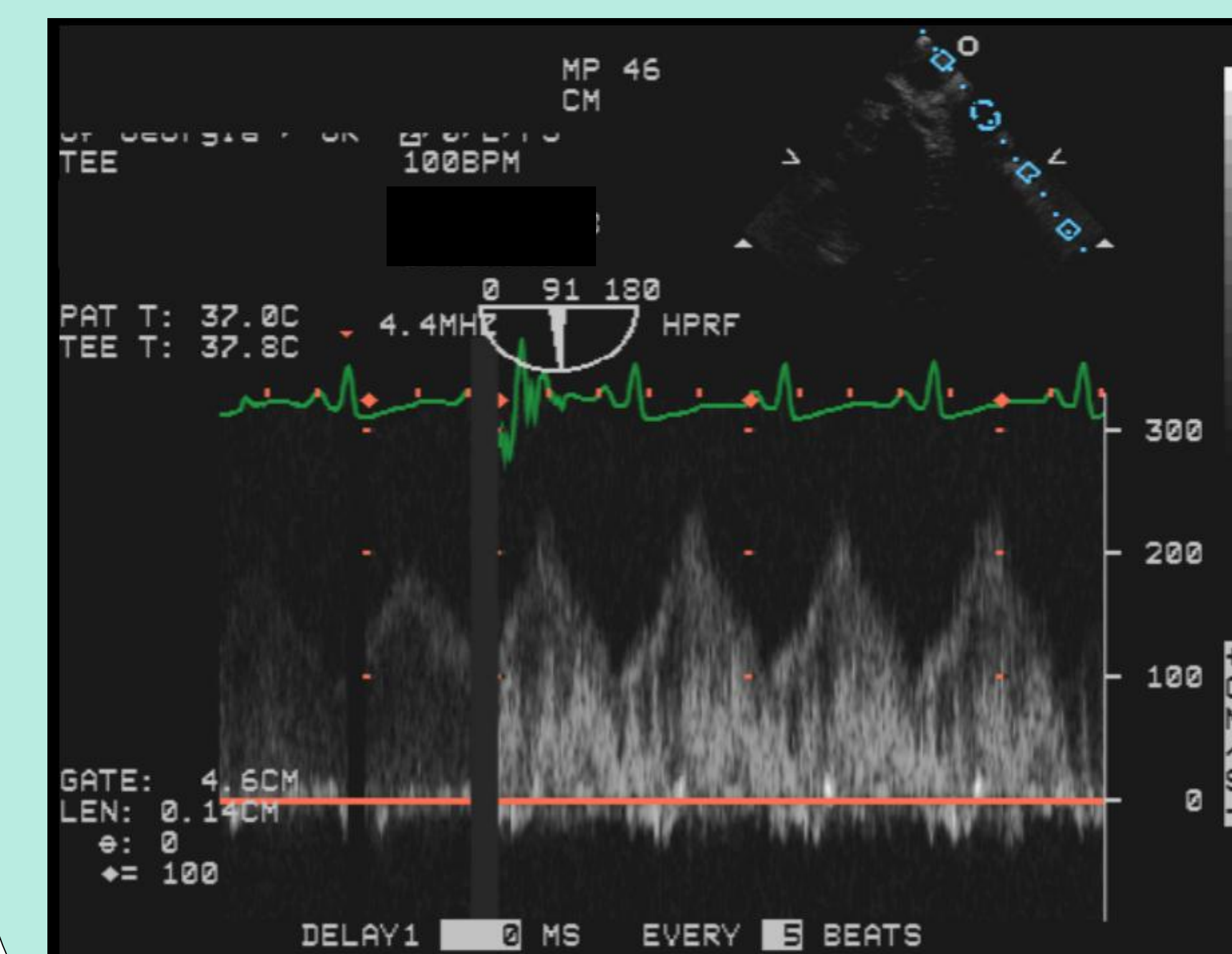


Figure 3. Left Upper Pulmonary Vein Peak Systolic Flow



## Discussion

Pulmonary hypertension is defined as a mean PAP greater than 25 mmHg at rest or more than 30 mmHg with exercise. Hypoxemia, acidosis and hypercarbia can all lead to increases in pulmonary pressures. Anesthetic management entails maintaining the pH, PaO<sub>2</sub>, and PaCO<sub>2</sub> within normal ranges in order to avoid increases in PAP. TEE provides real-time information regarding changes in RV function, severity of tricuspid regurgitation, afterload and interventricular septal dyskinesia. One-lung isolation also increases pulmonary vascular resistance which leads to further deterioration of right ventricular function. Our patient became hemodynamically unstable as well as hypoxemic and acidotic during OLV. TEE allowed us to monitor these effects on right ventricular function. As ventricular dilation, decreases in RV systolic performance and elevation in PASP occurred, we were able to notify the surgeons and institute corrective measures. Forty-eight hours after the procedure, FiO<sub>2</sub> was weaned to 30% and the arterial blood gas results were **pH 7.41, PaCO<sub>2</sub> 34.7, PaO<sub>2</sub> 133, HCO<sub>3</sub> 21**.

Tissue biopsy demonstrated reactive changes consistent with pulmonary sarcoidosis. Sarcoidosis can lead to destruction of pulmonary capillaries by pulmonary fibrosis, and the resulting hypoxemia leads to pulmonary hypertension.

## Summary

Patients undergoing lung resection may experience worsening pulmonary hypertension that can lead to significant hemodynamic deterioration. TEE provides real-time continuous monitoring of changes in right ventricle function, pulmonary artery systolic pressure, and pulmonary venous blood flow. TEE can be useful in providing an early warning of cardiopulmonary deterioration, therefore allowing the anesthesiologist to make interventions aimed to improve right ventricle function and pulmonary artery pressure.

## References

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