

# Compression of the Pulmonary Artery During Transesophageal Echocardiography in a Pediatric Cardiac Patient

Sergey Preisman, MD\*, Yakov Yusim, MD\*, David Mishali, MD†, and Azriel Perel, MD\*

\*Department of Anesthesia and Intensive Care, and †Department of Cardiac Surgery, Sheba Medical Center, Sackler School of Medicine, Tel Aviv University, Tel Aviv, Israel

**T**ransesophageal echocardiography (TEE) is an important diagnostic and monitoring tool during pediatric cardiac surgery. However, this method is not completely free of complications, some of which can be life threatening. The following case report describes the occurrence of acute hemodynamic compromise caused by the insertion of a TEE probe.

## Case Report

A 2-yr-old female patient (body weight 6.45 kg) was scheduled for pulmonic valve replacement. Her medical history included complete repair of the tetralogy of Fallot at the age of 7 mo, which included the replacement of the pulmonic valve with a xenograft with a diameter of 13 mm.

Preoperative transthoracic echocardiography showed a narrowing of the xenograft with a pressure gradient of 60–70 mm Hg, severe right ventricular and atrial dilation, patent foramen ovale, and severe tricuspid regurgitation. Preoperative chest radiograph revealed cardiomegaly.

The patient arrived at the operating room well sedated after premedication with IV midazolam 0.65 mg. Blood pressure (BP) was 90/50 mm Hg, with a sinus rhythm of 120 bpm, and SpO<sub>2</sub> was 88%–92% (fraction of inspired oxygen, 1.0). After the IV administration of 0.1 mg of atropine, general anesthesia was induced by IV injection of 1 mg of midazolam and 0.1 mg of fentanyl. Neuromuscular blockade was achieved with the use of 1.6 mg of pancuronium. After intubation, mechanical ventilation was started in a pressure-control mode, with a fraction of inspired oxygen of 1.0, a peak airway pressure of 20 cm H<sub>2</sub>O, an inspiratory/expiratory ratio of 1:2, and a respiratory rate of 20 breaths/min. The right femoral vein and the left radial artery were cannulated percutaneously. After anesthetic induction, the patient was stable, with a BP of 100/50 mm Hg, a heart rate (HR) of 100 bpm, an SpO<sub>2</sub> of 88%–92%, and an ETco<sub>2</sub> of 25 mm Hg.

A TEE biplane probe with a 9-mm diameter (T7506B; Hewlett-Packard, Palo Alto, CA) was inserted. Over the next 2 min, ETco<sub>2</sub> decreased gradually to 0, with a simultaneous decrease of the BP to 50/20 mm Hg, the HR to 40 bpm, and the SpO<sub>2</sub> to 80% (see Fig. 1). During this time, there were no changes in tidal volume, in any other ventilation variable, or in breath sounds. After IV injection of 0.2 mg of atropine and 0.003 mg of adrenaline and removal of the TEE probe, the patient was stabilized, and the ETco<sub>2</sub> trace reappeared and increased to 50 mm Hg.

A second attempt to insert the TEE probe was made. The insertion of the probe again caused an immediate decrease of ETco<sub>2</sub> and arterial desaturation, with no changes in hemodynamic variables. The TEE probe was removed, and the ETco<sub>2</sub> normalized. Insertion of a 2.5-mm-diameter nasogastric feeding tube was followed by a similar decrease in ETco<sub>2</sub>. It was immediately removed.

Surgical exploration revealed severe stenosis (diameter of 1 mm) of the main pulmonary artery at the bifurcation site. After correction of the defect by replacement of the pulmonary valve and enlargement of the pulmonary artery, the TEE probe was reinserted. No difficulties were encountered this time, and the patient was successfully weaned from cardiopulmonary bypass.

## Discussion

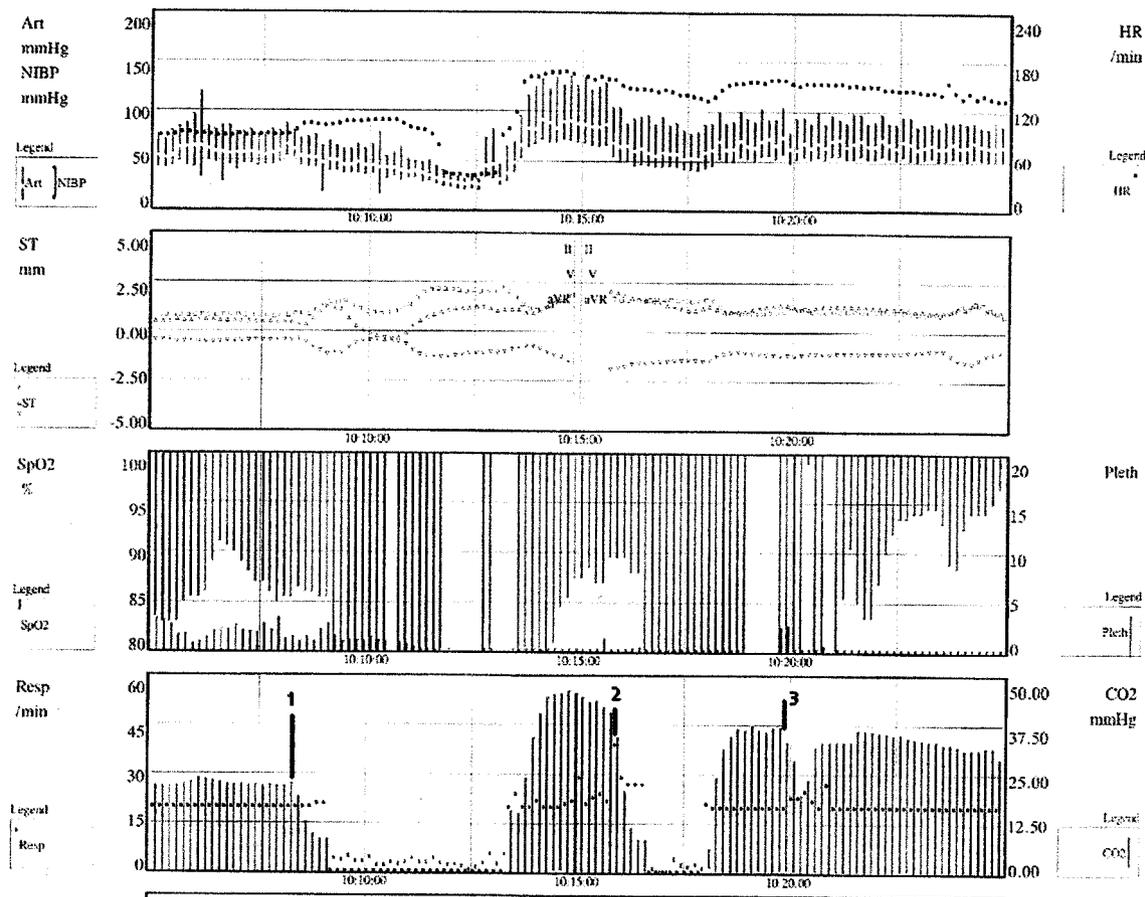
The availability of small pediatric TEE probes has allowed intraoperative TEE to be performed in infants and children of all ages. The only current limitation for intraoperative TEE monitoring is the weight of the patient, recommended by some to be  $\geq 2400$  g (1). Intraoperative TEE has a sensitivity of 86%–94% in detecting congenital heart lesions (1). With its advantages of continuous assessment of anatomy, function, and flow, TEE has become a routine monitoring and diagnostic modality in many pediatric cardiac surgical centers.

Although minimally invasive and generally safe, TEE is not free from complications. In a study involving 1650 patients, Stevenson (2) described airway obstruction in 1% and vascular compression in 0.6% of all patients. It was manifested by the dampening of

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Address correspondence to Sergey Preisman, Department of Anesthesia and Intensive Care, Sheba Medical Center, Tel Hashomer, 52621, Israel. Address e-mail to preisman@netvision.net.il. Reprints will not be available.

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**Figure 1.** Physiological changes consequent to the repeated insertion of the transesophageal echocardiography (TEE) probe and nasogastric tube (fragment from the automated anesthetic record). NIBP = noninvasive arterial blood pressure (mm Hg); HR = heart rate (bpm); Resp = respiratory rate (breaths/min). 1 = Insertion of the TEE probe (first attempt); 2 = insertion of the TEE probe (second attempt); 3 = insertion of the nasogastric tube.

the radial artery wave form after TEE probe insertion as a result of compression of the aberrant subclavian artery adjacent to the esophagus. Frommelt and Stuth (3) reported a case of severe hemodynamic compromise caused by compression of the posterior pulmonary venous confluence by the TEE probe during intraoperative evaluation in an infant with supracardiac total anomalous pulmonary venous return. Some other complications of TEE probe insertion, including dysphagia, esophageal perforation, and airway and aortic compression, have also been described (4-7).

In our case, the first symptom of the impending problem was a progressive decrease of  $ETCO_2$ , accompanied by hemodynamic deterioration. The most likely cause of the problem was a profound decrease of pulmonary blood flow due to compression of the pulmonary artery by adjacent mediastinal tissues during esophageal manipulations. Immediate complete cessation of systemic blood flow was not observed. The most probable explanation for this fact was increased right-to-left shunt via the patent foramen ovale, which temporarily supported the output of the

left ventricle by desaturated blood shunted from the right atrium. The absence of changes in the variables of ventilation allowed us to exclude airway obstruction as a cause of the problem.

In conclusion we report, for the first time, life-threatening hemodynamic deterioration due to the compression of the pulmonary artery by the TEE probe, with a subsequent critical decrease of pulmonary blood flow. Caution should be exercised during intraoperative TEE use in patients with similar anatomic conditions. A sudden decrease of  $ETCO_2$  without other signs of respiratory or airway compromise may serve as an early warning of the presence of this problem.

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