Pediatr Cardiol 27:134–136, 2006
DOI: 10.1007/s00246-005-1063-8

Pediatric Cardiology

Temporary Pulmonary Vein Stenosis During Intraoperative Transesophageal Echocardiography in Total Cavopulmonary Connection

M. Kostolny,[1] C. Schreiber,[1] R. Henze,[3] M. Vogt,[2] R. Lange[1]

German Heart Centre Munich, Technical University, Clinic of Cardiovascular Surgery[1], Paediatric Cardiology and Congenital Heart Disease[2], Department of Anaesthesiology[3], Lazarettstrasse 36, 80636, Munich, Germany

Abstract. Two patients operated on by one of the authors (MK) developed hemodynamic instability after otherwise uneventful completion of total cavopulmonary anastomosis with an extracardiac tube. In both, a stenosis of the right pulmonary veins was demonstrated during routine intraoperative transesophageal echocardiography. The transesophageal probe was found to be the underlying problem. Apparently, the pulmonary veins became compressed between the probe and the extracardiac conduit.

Key words: Transesophageal echocardiograpy — Extracardiac conduit

Intraoperative transesophageal echocardiography (TOE) in surgery for congenital heart defects is well established [3]. It is also routinely used at our institution.

We report on negative hemodynamic effects after implantation of an extracardiac tube at completion of a total cavopulmonary anastomosis during intraoperative TOE in two patients.

Case 1

A 16-month-old male patient (11.4 kg) with tricuspid atresia IIc had two previous operations, including Damus–Kaye–Stensel and shunt as a neonate and a bidirectional Glenn anastomosis at the age of 7 months. Preoperative catheterization demonstrated suitability for the completion of total cavopulmonary connection. At operation, an 18-mm extracardiac tube (Gore Tex W.L. Gore & Associates, Flagstaff, AZ, USA) was inserted.

Routine intraoperative TOE was accompanied by hemodynamic instability with a rise in central venous pressure and decreased arterial pressure. A stenosis of the right pulmonary veins with a gradient of 12 mmHg was detected (Fig. 1). After a lengthy search for a possible cause, the TOE probe was identified as being the underlying cause for the pulmonary vein stenosis.

Correspondence to: M. Kostolny, *email:* kostolny@dhm.mhn.de

Its withdrawal immediately improved hemodynamics. The patient had an uneventful postoperative recovery without signs of pulmonary vein stenosis and had good ventricular function on echocardiography before discharge.

Case 2

A 3-year-old female patient (9.6 kg) with tricuspid atresia IIc had two previous operations, including a Damus–Kaye–Stensel anastomosis with patch plasty of the hypoplastic pulmonary arteries as the first stage and a bidirectional Glenn anastomosis at the age of 4 months as a second stage. At operation, an 18-mm tube was inserted.

The TOE probe provoked the same hemodynamic instability as in the first patient (Fig. 2). After the probe had been removed, the operation was completed uneventfully. The patient also had an uncomplicated postoperative recovery with good ventricular function on echocardiography before discharge.

In both patients, a multiplane pediatric 8.0 MHz phased array probe (GE Ultrasound Europe, Solingen) was utilized.

Discussion

Patients with a functional single ventricle usually undergo a staged conversion toward completion of total cavopulmonary anastomosis. The trend is an early completion of Fontan circulation to provide unloading of the systemic ventricle and to preserve its function. At our institution, an extracardiac conduit modification of this operation is used [4].

Intraoperative echocardiography is a useful tool to detect residual defects, and it provides a detailed view of intracardiac anatomy [3]. Normal or abnormal structures, such as an aberrant right subclavian artery, can be compressed during examination [1]. Also, compression of a pulmonary venous confluence with a transesophageal probe is a well-recognized complication in total anomalous pulmonary venous connection [2]. To our knowledge, probe compression of pulmonary veins when creating a total cavopulmonary connection has not been documented.

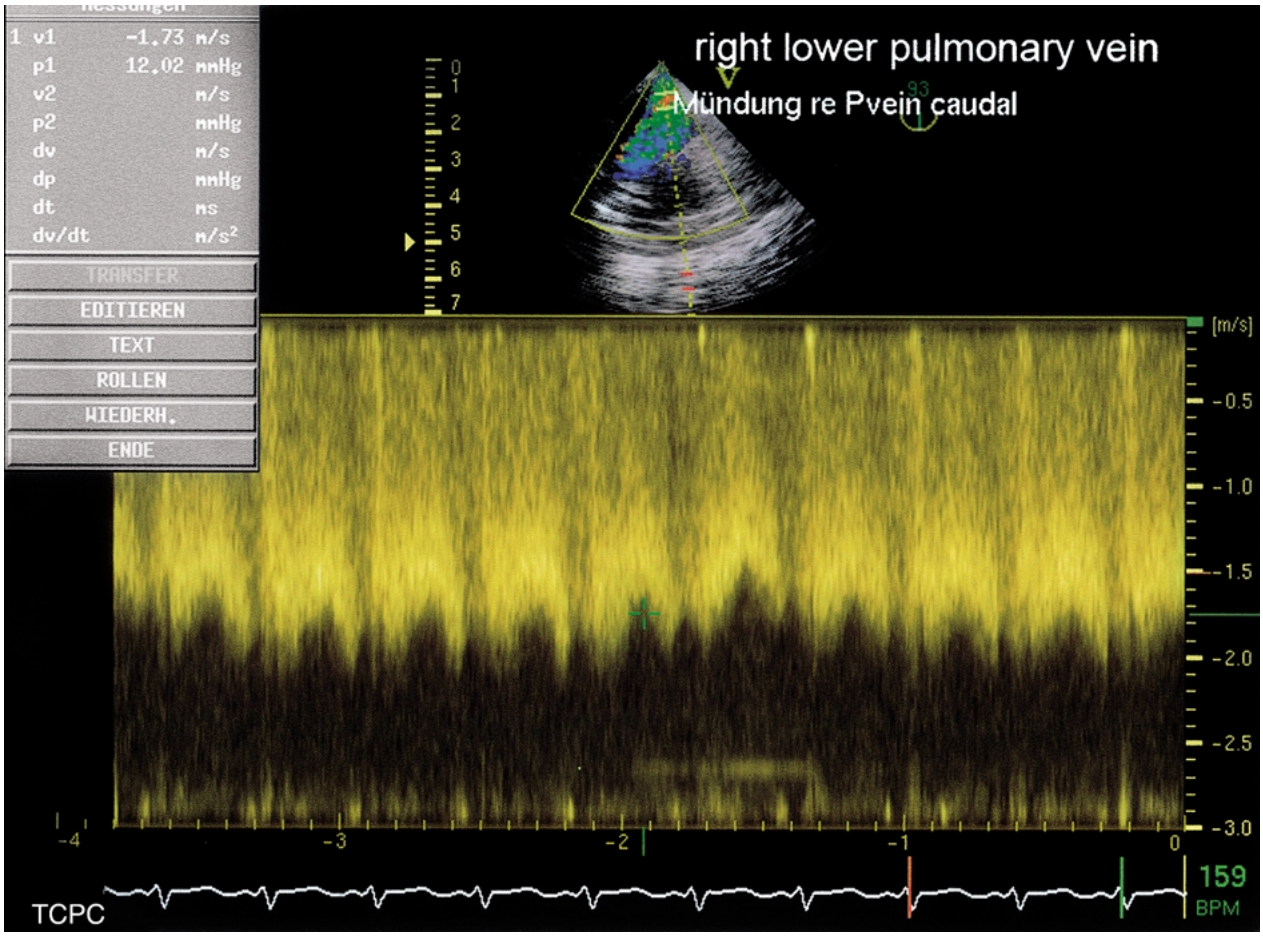

Fig. 1. Doppler flow signal demonstrating a significant gradient in the right pulmonary veins.

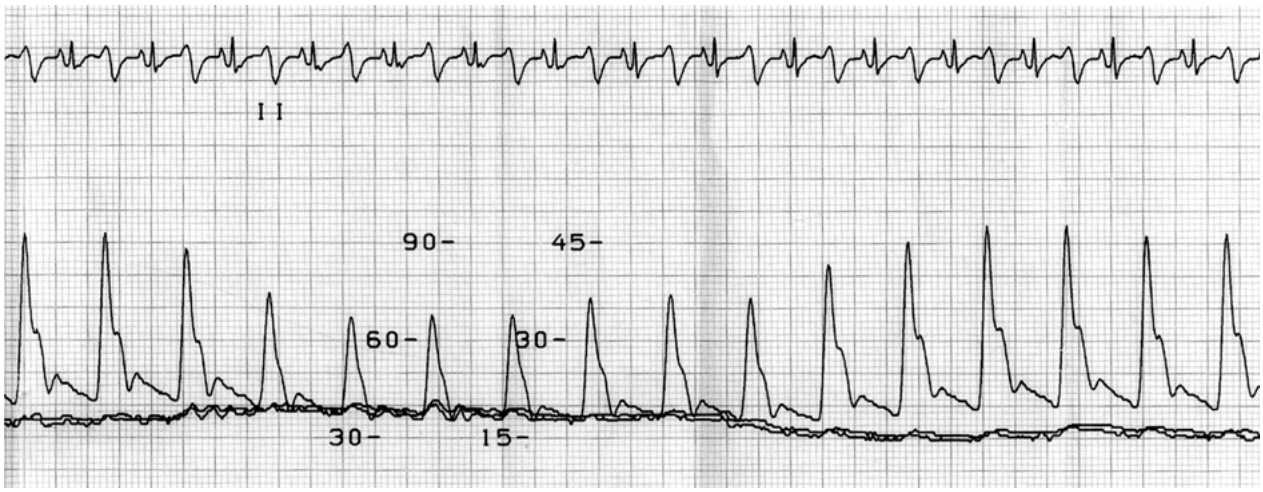

Fig. 2. Pressure recording trace demonstrates decreasing arterial pressure and an increasing central venous pressure during probe manipulation.

During examination, the probe is in close vicinity to the left atrium and especially the right pulmonary veins. The mechanism responsible for obstruction of the pulmonary veins observed in the patients pre-

sented here is presumably their compression between the esophageal probe and the extracardiac tube. As demonstrated, this can be severe enough to cause hemodynamic instability. To our knowledge, the probe used is one of the smallest pediatric multiplane probes available on the market.

We documented a reproducible cause for hemodynamic instability after completion of extracardiac total cavopulmonary anastomosis and provided an explanation of its mechanism in this selected patient group.

We still advocate routine intraoperative TOE in all patients. With our findings in mind, the examination should be focused and the probe withdrawn immediately after echocardiographic assessment.

References

1. Bensky AS, O'Brien JJ, Hammon JW (1995) Transesophageal echo probe compression of an aberrant right subclavian artery. *J Am Soc Echocardiogr 8*:964–966
2. Frommelt PC, Stuth EA (1994) Transesophageal echocardiography in total anomalous pulmonary venous drainage: hypotension caused by compression of the pulmonary venous confluence during probe passage. *J Am Soc Echocardiogr 7*:652–654
3. Rosenfeld HM, Gentles TL, Wernovsky G, et al. (1998) Utility of intraoperative transesophageal echocardiography in the assessment of residual cardiac defects. *Pediatr Cardiol 19*:346–351
4. Schreiber C, Kostolny M, Weipert J, et al. What was the impact of the introduction of extracardiac completion for a single center performing total cavopulmonary connections? *Cardiol Young 14*:140–147