THE BENEFITS OF SURGICAL ATRIAL SEPTOSTOMY GUIDED BY TRANSESOPHAGEAL ECHOCARDIOGRAPHY IN PEDIATRIC PATIENTS

Hiroyoshi Komai, MD, Yasuaki Naito, MD, Keiichi Fujiwara, MD, and Shigeru Uemura, MD, *Wakayama, Japan*

With the recent developments of smaller probes, transesophageal echocardiography (TEE) has become a safe and beneficial tool for diagnosing and monitoring heart disease in small children. At some institutes, TEE is also used for catheter intervention of congenital heart disease. We successfully performed closed atrial septostomy in 2 children using TEE during the operation.

Clinical summaries

PATIENT 1. Soon after birth, a boy was found to have a double-outlet right ventricle, pulmonary atresia, ventricular septal defect, and patent ductus arteriosus. He had undergone a right modified Blalock-Taussig shunt at the age of 4 months. One year after the operation, follow-up echocardiography revealed mitral stenosis (parachute mitral valve) and significant left atrial dilatation. Eventually he was referred to the surgical team because of the development of heart failure. He had tachypnea, cold sweats, and mild cyanosis. A continuous heart murmur was audible at the right sternal border. As the left ventricle was not large enough to tolerate systemic circulation, we thought the only way to save his life was to perform atrial septostomy, even though the 2-ventricle repair might fail in the future. From the preoperative echocardiographic findings the atrial septum was thick and no atrial communication was present. Thus we planned surgical septostomy instead of catheter intervention.

At the time of the operation, he was 1 year 7 months old and weighed 6.9 kg. After the induction of anesthesia and

intratracheal intubation, a pediatric biplane TEE transducer probe (V 705B, Acuson Corporation, Mountain View, Calif) was inserted without any difficulty. The TEE probe was 9.5 mm wide at the transducer portion (the widest part). The probe was connected to an Acuson computed sonography 128XP echocardiography system and monitored. A median sternotomy was performed and a purse-string suture was placed on the right atrial wall just posterior to the appendage. A small microsurgery scalpel was inserted through the purse-string suture to the right atrium and proceeded to the center of the atrial septum, guided by a longitudinal atrial TEE view (Fig 1). The atrial septum appeared projected convexly toward the right atrial cavity, indicating high left atrial pressure. When the tip of the scalpel reached the septum, it had to be pushed hard. The septum was so thick that a great deal of effort was needed to make a small incision. The scalpel was then removed and our septostomy knife was inserted to widen the incision. After additional bougienage, a 4.5-mm incision was made and observed by color Doppler echocardiography through TEE (Fig 2). The septum projection was reduced, showing that the left atrial pressure had decreased with the left-to-right shunt at the atrial level. We could evaluate the effects of each procedure accurately with TEE. Recovery was uneventful after the operation, and the symptoms of heart failure disappeared.

PATIENT 2. A boy was found to have transposition of the great arteries and ventricular septal defect soon after birth. Because cardiac catheter study revealed he had a single coronary artery, he underwent pulmonary artery banding at the age of 1 month. After the operation the arterial saturation gradually decreased because of the restricted foramen ovale. He had cyanosis and tachypnea. A systolic murmur was audible at the left sternal border. We performed TEE-guided atrial septostomy in the same fashion as in patient 1, but through a right thoracotomy. At the time of the operation, he was 9 months of age and weighed 6.7 kg. After the procedure we noticed from the color Doppler TEE view that we could not obtain enough atrial communication, so we immediately changed to a Blalock-Hanlon septostomy. After the operation

From the Departments of Thoracic and Cardiovascular Surgery and Pediatrics, Wakayama Medical College, Wakayama, Japan.

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Address for reprints: H. Komai, MD, Department of Thoracic and Cardiovascular Surgery, Wakayama Medical College, 811-1, Kimiidera, Wakayama, Japan 641-0012.

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Fig 1. The TEE during atrial septostomy. Although the septum was thick and difficult to incise, the scalpel accurately proceeded toward the septum under TEE guidance. SC, Scalpel; SPT, atrial septum.

the patient's oxygen saturation increased from 60% to over 80%. He recovered with only mild cyanosis.

Discussion. With the recent advance in miniaturizing probes, TEE has been used in infants and even newborn patients.^{1,2} In contrast to its use in adults, TEE has been used effectively for monitoring congenital heart disease in children, rather than diagnosing it. TEE during catheter intervention has been reported and shown to be an accurate and safe tool.³ Intraoperative use of TEE has been widely accepted in adults and is now being extended to children.^{4,5} In the present cases, we chose TEE-guided closed atrial septostomy because the septum was too thick to perforate by means of the transcatheter method. Like others, we always try to avoid the use of extracorporeal circulation for palliative procedures. With the help of real-time TEE imaging, we easily recognized where the knife was proceeding in the atrial cavity, what size of incision we obtained, and how effective the procedure was during the operation. As in patient 2, not only could we perform the procedure safely, but we were also able to evaluate the results immediately and institute additional

Fig 2. A postoperative view of the transesophageal Doppler echocardiogram showing the left-to-right shunt flow through the incision made in the septum. RA, Right atrium; LA, left atrium.

procedures when appropriate. Although this method is not applicable in many patients, we believe it should be the method of choice in patients who need atrial septostomy.

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