We conclude that clinicians should be aware of syncope as a possible symptom in the relatively uncommon condition of papillary fibroelastoma of the tricuspid valve. Diagnosis by echocardiography followed by surgical excision of the tumor should be advised in all cases.

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MULTIPLE SMALL FENESTRATIONS CREATED DURING CONSTRUCTION OF THE TOTAL CAVOPULMONARY CIRCULATION: SUBSEQUENT COURSE AND SPONTANEOUS CLOSURE

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Fenestration of the baffle between the systemic and pulmonary venous atria at the time of construction of the total cavopulmonary circulation is reported to lower morbidity and risk of takedown of the connection and decrease mortality.¹⁻³ Cardiac output is maintained by right-to-left shunt across the fenestration and right atrial pressure is lowered, but with consequent persisting systemic desaturation.¹⁻³ A single fenestration has usually been created.¹⁻⁵ Fenestration size has most frequently been 3.5² to 4 mm,^{1,3,4} with a corresponding cross-sectional area of 9.6 to 12.6 mm², but has varied from 2.7 mm³ to 9 mm⁴ with cross-sectional areas of 5.7 to 63.9 mm². Transcatheter device closure¹⁻⁴ or surgical closure with a snare placed around the fenestration⁵ has been performed at variable times after the initial operation. Spontaneous closure of fenestrations has been noted,^{1,2} more commonly in the smaller fenestrations.³ We placed multiple small fenestrations with a total combined cross-sectional area similar to that resulting from a single 3.5 to

4 mm fenestration to achieve a similar oximetric and hemodynamic outcome, but in the hope that early spontaneous closure would occur, avoiding the need for further interventions.

Five patients aged 2.8 to 5.9 years had multiple small fenestrations created in the baffle at the time of total cavopulmonary connection. All operations were performed by the same surgeon. Fenestrations were created in the polytetrafluoroethylene membrane used for the right atrial lateral tunnel with the use of a 2.5 mm punch (Scanlan) or cut with a blade, approximately 3 mm apart, before the patch was incorporated in the right atrial closure. Postoperative mean right atrial pressures 24 to 48 hours after the operation and saturations at hospital discharge were recorded. The hospital stays were 7 to 19 days. All patients were evaluated electively 5 to 10 months after the procedure to establish the status of the multiple small fenestrations. Four patients were studied with transesophageal echocardiography and one patient with transthoracic echocardiography. Saturations with the patients breathing air were determined by transcutaneous pulse oximetry at follow-up.

Results are presented in Table I and include diagnosis and previous operation, fenestration size and number, postoperative right atrial pressures and saturations, and the status of the fenestrations and saturations at follow-up. Transesophageal echocardiography provided excellent imaging of the baffle wall permitting delineation of each of the small fenestrations when present. In patient 1 the

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Table 1. *Diagnoses, perioperative data, and postoperative follow-up*

Patient No.	Age (yr)	Diagnosis and previous operation	Fen size (mm)	Fen No.	Total CSA (mm ²)	Mean RAP (mm Hg)	Postop. sat (%)	Time to follow-up (mo)	Follow-up sat (%)	Study echo	Status MSF (No.)
1	5.5	DILV, VSD, TGA, SPS	2	2	6.2	20	85	10	85	TEE	Closed
2	2.8	TGA, VSD, PS, atrial septectomy	2	4	12.6	12	88	9	95	TEE	Closed
3	4.2	DILV, LTGA, VSD, PAB, BDG	2.5	2	9.8	17	91	8	96	TEE	Closed
4	5.9	DORV, VSD, PAB, BDG	2.5	3	14.7	12	88	7	91	TEE	Open (3)
5	3.8	DILV, TGA, VSD, PAB	2.5	3	14.7	15	85	5	90	TTE	Open (3)

Fen, Fenestration; *CSA*, cross-sectional area; *RAP*, right atrial pressure; *sat*, saturation; *MSF*, multiple small fenestrations; *DILV*, double-inlet left ventricle; *VSD*, ventricular septal defect; *TGA*, transposition of the great arteries; *SPS*, subpulmonary stenosis; *PS*, pulmonary stenosis; *LTGA*, levo-transposition of the great arteries; *PAB*, pulmonary artery banding; *BDG*, bidirectional Glenn shunt; *DORV*, double-outlet right ventricle; *TEE*, transesophageal echocardiography; *TTE*, transthoracic echocardiography.

early postoperative period was complicated by clot formation in the left ventricular apex, and the patient received and continues to receive warfarin sodium. The thrombus spontaneously diminished in size and disappeared. No evidence of embolism was apparent at any stage. Recurrent pericardial effusions in the postoperative period necessitated creation of a pericardial window. Transesophageal echocardiography at 10 months demonstrated the fenestrations to be closed, but the transcutaneous saturation was 85%. Peripheral venous injection of agitated isotonic saline solution in the left arm resulted in the immediate appearance of contrast in the pulmonary venous chamber, suggesting the presence of a systemic venous connection directly to the left atrium. In patient 5 the proximal left coronary artery was thought to be damaged during dissection around the pulmonary artery for its ligation, and the left internal thoracic artery was grafted to the left coronary artery during the repair. Cardiac catheterization performed 5 months after the operation demonstrated complete obstruction of the internal thoracic artery with normal filling of the left coronary artery from the aorta.

Multiple small fenestrations (2 to 2.5 mm) were created in our small group of patients, and in three of five patients the fenestrations had closed spontaneously at 8, 9, and 10 months after the operation, including the patient who was receiving full anticoagulant therapy. In two of these three patients the fenestrations were the smaller (2 mm diameter) of those placed. These three patients had fenestrations with a smaller total cross-sectional area and were those with the longest time to follow-up. In patients with

persisting patency of the multiple small fenestrations, all the fenestrations were open.

We believe multiple small fenestrations in the total cavopulmonary circulation may have a high rate of spontaneous closure, avoiding the need for subsequent intervention, and time may play a role in the rate of closure. Residual desaturation should not be assumed to be due to surgically created communications.

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