LETTERS TO THE EDITOR

Cryopreserved homograft monocusp valves for reconstruction of the right ventricular outflow tract

To the Editor:

Bigras and associates¹ presented their data with the use of monocusp valves in repair of tetralogy of Fallot in the July issue of the Journal. They concluded that transannular patch repair with three different monocusp valves, used to reconstruct the pulmonary valve orifice or the right ventricular outflow tract 2 standard deviations smaller than normal, neither prevents short-term postoperative pulmonary insufficiency nor improves immediate postoperative outcome. Monocusp valves tailored too wide were believed to be one cause of the observed early postoperative pulmonary insufficiency.

Since July 1990 we have used cryopreserved valved homografts to reconstruct the right ventricular outflow tract (RVOT) in 65 patients (mean age 4.3 years; range 3 months to 36 years) with tetralogy of Fallot (27/65; 42%), double-outlet right ventricle (15/63; 23%), pulmonary atresia (10/65; 15%), congenitally corrected transposition of the great arteries (3/65; 5%), truncus arteriosus (5/65; 6%), and complex pulmonary stenosis (5/65; 6%). Homograft conduits (29/65; 45%) were used if the RVOT was missing or not suitable for surgical in situ reconstruction owing to severe malformation. A transannular monocusp homograft patch (36/65; 55%) was used if age-related dimensions of the RVOT measured during the operation by Hegar dilators could not be achieved either by infundibular resection or commissurotomy. In growing patients the largest size homograft technically implantable was used at times. The operative mortality was 9.2% and was due to low cardiac output in six patients and to sepsis in one. The mean pressure gradient over the RVOT was successfully reduced from 70 ± 22 mm Hg to 10 mm Hg. As in Bigras' study, the pulmonary valve insufficiency (assessed by color flow Doppler echocardiography) was significant. In the early postoperative period, moderate pulmonary insufficiency was found in 48% of monocusps and moderate to severe insufficiency in 24%. After 34 ± 13 months (range 14 to 60), moderate to severe pulmonary regurgitation was found in 52% of monocusps but in only 8% of valved homograft conduits ($p = 0.005$). As suggested by Bigras and associates,¹ the degree of oversizing in monocusp valves was significantly associated with the development of late pulmonary regurgitation ($r = 0.86$; $p = 0.005$). One child had to be reoperated on after 18 months because of aneurysmal dilatation of a homograft conduit causing severe pulmonary regurgitation. In six of 52 (11.5%) children, two with a valved conduit and four with a monocusp valve, severe stenosis at the distal homograft-pulmonary artery anastomosis developed after 16 ± 4 months, necessitating balloon dilatation or reoperation in three patients each. Explanted homografts were acellular, nonvital, and calcified. Immuno-

histochemistry revealed the presence of T-cell as well as B-cell lymphocytes.

Pericardial monocusp valves used for RVOT reconstruction are reported to provide excellent early hemodynamic function.² Nevertheless, the study presented by Bigras and coworkers,¹ as well as our own results,³ fails to demonstrate an improved outcome with the use of monocusp valves. Late monocusp valve regurgitation is significant, which might be reduced by avoiding monocusp oversizing. In the case of a missing or severely diseased RVOT, reconstruction with a cryopreserved homograft conduit achieves good surgical results.⁴ However, the use of cryopreserved monocusp homografts fails to prevent pulmonary regurgitation either early and late after the operation. Furthermore, a disturbingly high incidence of late distal anastomotic stenosis was observed when monocusp valves were used to enlarge the pulmonary artery, which led us to abandon this particular technique for RVOT reconstruction.

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Cost reduction by combined carotid endarterectomy and coronary bypass

To the Editor:

I read with great interest the article by Daily and associates¹ in the June 1996 issue of the Journal, in which they examined the cost effectiveness of doing first-time isolated carotid endarterectomy, coronary bypass, or com-

bined procedures, and I would like to share my experience.

While working at the Ospedale San Michele in Cagliari, Italy, from 1988 to 1992, I used the combined procedures in all 24 patients referred with associated coronary and carotid disease. Twenty-one of these patients were found to have unilateral (18 patients) or bilateral (3 patients) carotid stenosis greater than 60% during work-up for coronary revascularization. Carotid endarterectomy was indicated whether neurologically symptomatic or asymptomatic. Three other patients were referred for bilateral (2 patients) or unilateral (1 patient) carotid artery disease and were found to have triple vessel coronary artery disease with or without left main coronary artery stenosis during work-up for carotid endarterectomy. None of these patients had an incipient myocardial infarction or stroke at the time of the operation. Only one patient with carotid disease was treated with the combined procedure, that is, the most critical or symptomatic stenosis.

The endarterectomy was performed during hypothermia. Rationale for this type of combined procedure was twofold: (1) more comfort for the patient to have two lesions treated in a single operation and hospital stay and (2) possibly less risk of neurologic accidents related to the carotid crossclamp at moderate hypothermia.

Some technical details need to be mentioned. All of the procedures were conducted in the same standardized fashion¹: The carotid artery was dissected before the sternum was split, with an average time of 20 minutes. Cardiopulmonary bypass was started and increased in a gradual fashion, keeping the venous line partially clamped to avoid any hypotension. Therefore, during the whole cooling time (to 28° C), the heart was always kept partially filled and was ejecting to maintain a pulsatile flow and the blood pressure was kept close to prebypass values (above 100 mm Hg systolic) until spontaneous ventricular fibrillation ensued. At this point, the venous line was completely opened, the aorta was clamped, and the heart was emptied through the aortic cardioplegia vent cannula. Next, 800 to 1000 ml of St. Thomas' Hospital crystalloid cardioplegic solution was infused into the aortic root, and a 200 ml additional dose was repeated after each distal anastomosis into the aortic root and into the graft. Topical cooling was used. After the last distal anastomosis and infusion of cardioplegic solution, the internal, common, and external carotid arteries were clamped and opened longitudinally and endarterectomy without shunt was performed with an average time of 15 minutes. In five patients a saphenous vein patch was used. After completion of the carotid closure, the carotid and aortic crossclamps were removed, rewarming was started, and the proximal anastomoses were performed. The cervical incision was closed at the same time as the sternum.

No patients in this group had neurologic deficits or myocardial infarctions, and all were discharged in good condition, free of symptoms. One patient did have a moderate elevation of cardiac enzymes (creatinine kinase MB) without new q-waves.

I believe this approach can be used safely if (1) a single surgeon performs both procedures, (2) the patient is not critically symptomatic from either a cardiac or a neurologic standpoint, and (3) the heart is allowed to eject

during the cooling time to keep a pulsatile flow and a pressure over 100 mm Hg systolic, thus avoiding any sudden changes in pressure or perfusion.

I am glad the referred article comes from a widely known department of thoracic surgery in the United States. For many surgeons in this country the standard of care has been the staged procedure, because some articles²⁻⁵ have reported higher morbidity and mortality for the combined procedure. Other factors may have influenced the management of these patients, including legal issues and fears of responsibility in the case of perioperative stroke, when combined procedures were performed by different surgeons.

In conclusion, from my personal experience, I believe that combined carotid and myocardial revascularization, both at moderate hypothermia, in symptomatically stable patients can be safely performed with more comfort for the patient, less cost than the staged procedure, and possibly more safety.

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Reply to the Editor:

I appreciate Dr. Aru's comments. In his series of 24 patients undergoing first-time carotid endarterectomy and coronary artery bypass grafting, the carotid endarterectomy was performed during aortic crossclamping at a body temperature of 28° C and after all distal grafts had been performed. There were no strokes or myocardial infarctions. Certainly, this degree of hypothermia may be an effective way to provide a significant element of cerebral protection during the period of internal carotid artery occlusion for performance of the carotid endarterectomy. It does, of course, extend the period of aortic crossclamping. However, inasmuch as the total number of combined cases was 24, I believe the number of cases should be extended significantly before conclusions can be drawn that are statistically meaningful. Nonetheless, this