



Fig 4. Final angiogram demonstrating reconstructed right and left pulmonary arteries.

Comment

There is no consensus on the optimal management strategy for severe branch PAS. Results with both BA and operation have been somewhat unpredictable. Lock and colleagues [3-5] reported a low success rate and significant complications for BA using low-pressure balloons. High-pressure balloons improved results, but the mean increase in vessel diameter was only 37%. Investigators in the Valvuloplasty and Angioplasty of Congenital Anomalies Registry performed BA in 156 patients and reported significant complications in 21 patients, including five procedure-related deaths [6]. Although vessel diameter increased in successful cases, this afforded only minor reductions in proximal PA pressure. More recently, O'Laughlin and associates [7] combined BA with expandable intravascular stents. The short-term results are encouraging, but long-term results are unclear.

Considerable progress has been made in surgical angioplasty of small and stenotic pulmonary arteries, primarily in conditions including pulmonary atresia/ventricular septal defect with multiple aortopulmonary collateral arteries. These techniques include PA reconstruction using autologous pericardium, native arterial angioplasty, and unifocalization [8]. In this case, these methods were favored due to concern that BA had significant potential for postreperfusion pulmonary edema and hemorrhage. The surgical approach allowed simultaneous correction of all stenoses in one lung, minimizing the risk of reperfusion injury. Operation successfully reduced right ventricular and PA pressures to normal and achieved appropriate distribution of pulmonary blood flow.

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Repair of Traumatic Tricuspid Valve Insufficiency by Trabecular Muscle Elevation

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A technique is described for repair of traumatic tricuspid valve insufficiency; it was applied successfully in a young adult with a flail anterior leaflet due to chordal rupture. The technique consists of resuspension of the flail leaflet with autogenous trabecular muscle bundles and additional annuloplasty.

(*Ann Thorac Surg* 1995;59:740-2)

Valve replacement has been the usual surgical approach for traumatic tricuspid valve insufficiency. During the last decade, more patients have benefited from repair of the tricuspid valve [1-4]. In this report we present a technique for repair of the tricuspid valve that was applied successfully in a patient with traumatic tricuspid valve insufficiency.

A 25-year-old man from Alaska who was known to have a heart murmur secondary to blunt chest trauma that had occurred during an ice hockey game several years ago recently experienced progressive fatigue and exercise limitation. The patient denied a history of rheumatic fever or infective endocarditis. A chest radiogram showed cardiomegaly. The rhythm was sinus. Two-dimensional echocardiography revealed severe tricuspid valve regurgitation due to prolapse of a flail anterior leaflet, a greatly dilated right atrium and right ventricle,

Accepted for publication July 20, 1994.

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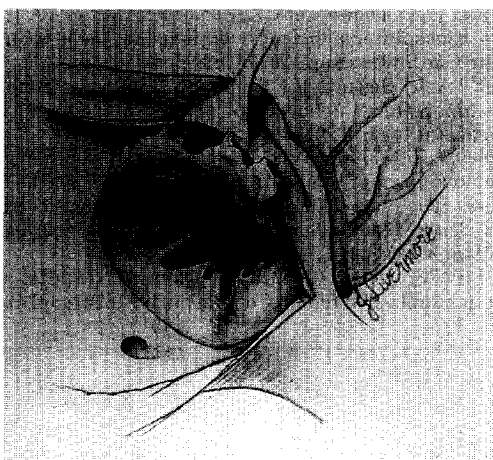


Fig 1. Flail anterior leaflet of tricuspid valve with chordal remnants.

and mildly diminished right ventricular function. These findings were confirmed at cardiac catheterization; the pressures in the right atrium and right ventricle were normal.

At operation, the echocardiographic findings were confirmed. The anterior leaflet of the tricuspid valve was flail due to rupture of all its chordae tendineae (Fig 1). Chordal remnants were present along the entire edge of the anterior leaflet. The anterior papillary muscle was severely contracted and atrophied. There was marked dilatation of the tricuspid annulus.

The anterior leaflet was reconstructed by elevation of autogenous trabecular muscle bundles (Fig 2). Two well-developed trabecular muscle bundles, which at both ends were attached to the anterior wall of the right ventricle, were divided at their attachments closest to the tricuspid valve. The appropriate length of the muscle bundles was determined by gently distending the right

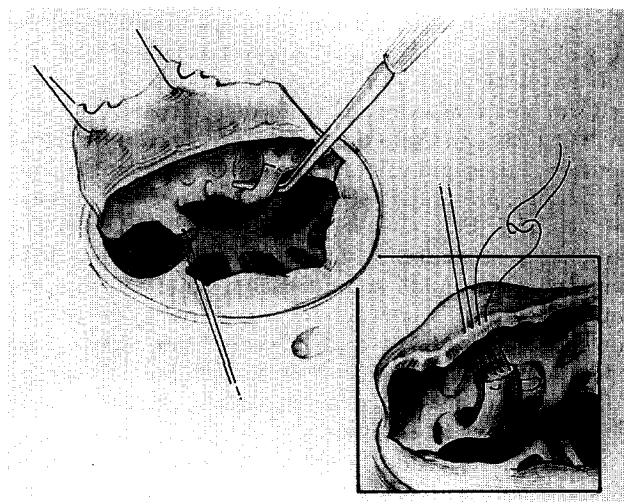


Fig 2. Repair of anterior leaflet. Two well-developed trabecular muscles are divided at their attachments closest to the anterior leaflet. The elevated muscle bundles are sutured to the undersurface of the edge of the anterior leaflet (inset).

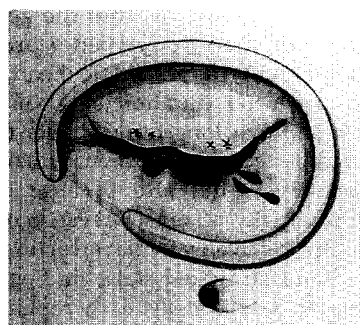


Fig 3. The repair is completed by insertion of a Carpentier-Edwards ring.

ventricle with normal saline solution and measuring the distance from the base of the muscle bundles to the normal closed position of the anterior leaflet. Subsequently, at equidistant locations from the commissures, the elevated trabecular muscle bundles were sutured to the undersurface of the edge of the anterior leaflet with interrupted 2-0 coated polyester sutures (Dacron; Meadox Medicals, Inc, Oakland, NJ) using a horizontal mattress technique. Thus, two neo-papillary muscles were created. Filling the right ventricle with saline solution produced mild residual central incompetence but the anterior leaflet did not prolapse. Therefore, an annuloplasty was added using a 36-mm Carpentier-Edwards ring (Baxter Healthcare Corp, Edwards Div, Irvine, CA), which was implanted with interrupted 2-0 Dacron sutures (Fig 3). In this manner a satisfactory repair was obtained and only trivial regurgitation was noted when the right ventricle was filled with saline solution.

The heart maintained sinus rhythm throughout an uneventful postoperative course. Early postoperative echocardiography showed an intact repair with only trivial tricuspid regurgitation. Echocardiography at 1 year postoperatively also showed a remarkable reduction in size of both the right atrium and ventricle as compared with preoperatively. One year after the operation, the patient was asymptomatic.

Comment

Traumatic tricuspid insufficiency, although rare, has been reported with increasing frequency during the last two decades [1-4]; this development is due mainly to an increase in motorized traffic, increased awareness of the relationship between chest trauma and cardiac lesions, and the wide application of two-dimensional echocardiography [5].

Although the clinical course of isolated tricuspid insufficiency is usually benign initially, right heart failure eventually develops in the majority of patients. Traditionally, this has been the indication for operation, which usually consisted of tricuspid valve replacement. Although there is limited information in the literature concerning the late results of tricuspid valve repair, we believe results should be superior with repair than after

tricuspid valve replacement, because the geometry and function of the right ventricle are better preserved and complications inherent in prosthetic heart valves are avoided. Also, a shorter duration between injury and operation may improve long-term results of operative treatment, not only because right ventricular function is then better preserved, but also because of a higher probability of feasibility of repair because of decreased likelihood that the involved valvular structures are found in a contracted and atrophied state, findings that often preclude repair [4]. Additionally, early repair limits right atrial fibrillation, which increases the likelihood that these patients can be maintained in sinus rhythm.

Although tricuspid valve repair had been performed sporadically as early as the late 1950s and 1960s [6, 7], during the last decade more patients have benefited from repair due to increased awareness that valve repair, when feasible, is superior to valve replacement, improved techniques in reparative valve surgery, and widespread use of intraoperative echocardiography. The operative technique generally will be dictated by the specific injury discovered at the time of operation. Repair usually can be effected if the injury is limited to rupture of chordae tendineae or papillary muscle or laceration of a leaflet and if the involved structures are not severely contracted or atrophied. Previously reported techniques of repair of the traumatically injured tricuspid valve consist of plication or partial resection of redundant leaflets, "mitralization" of the tricuspid valve by suturing the anterior leaflet to the septal leaflet with creation of a single anteroseptal leaflet, reinsertion of detached leaflets, plication of elongated chordae, and use of autogenous pericardial strips to replace ruptured chordae [1-4].

Limited information is available about long-term results of chordal replacement for the tricuspid valve. In children we have obtained excellent results with replacement of ruptured or elongated tricuspid chordae by polytetrafluoroethylene artificial chordae (Gore-Tex; W.L. Gore & Assoc, Newark, DE) (Van Son JAM, Hanley FL; unpublished data). Encouraging late results have been reported for chordal replacement in the mitral position, using glutaraldehyde-tanned xenograft pericardium or polytetrafluoroethylene [8]. The technique of tricuspid valve repair as reported here has the advantage that autogenous trabecular muscle bundles are used, which are abundantly present in the right ventricle, thus avoiding the use of foreign material. This technique is applicable in situations where, due to a long duration between injury and tricuspid valve repair, the anterior papillary muscle is contracted and atrophied.

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Intracardiac Extension of an Intracaval Sarcoma of Endometrial Origin

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A 52-year-old woman was diagnosed with a cardiac tumor by transesophageal echocardiography and magnetic resonance imaging. An intraoperative biopsy indicated the mass was low-grade endometrial stromal sarcoma. Successful tumor removal from the heart and inferior vena cava was accomplished with the use of hypothermic circulatory arrest. The chronically occluded infrarenal portion of the inferior vena cava was transected. The patient has no evidence of recurrent disease after a follow-up of 18 months and has no significant restriction in her daily activities.

(*Ann Thorac Surg* 1995;59:742-4)

Intercardiac masses are found in less than 0.5% of the general population [1]. We report a patient who had successful removal of a low-grade endometrial stromal cell sarcoma that extended from the iliac veins through the vena cava and into the right ventricle, with prolapse across the tricuspid valve. A 52-year-old woman, gravida IV, para IV, presented with a 5-day history of progressive left leg and thigh swelling, pain, and tenderness. The patient's past medical history was significant for a diagnosis of a low-grade endometrial stromal cell sarcoma found incidentally after a total abdominal hysterectomy for menometrorrhagia and, 2 years later, subsequent operations for local tumor recurrence. Pulmonary wedge resection was performed for metastatic disease 2 years before the present admission.

At admission to our hospital, she was normotensive, had a regular heart rate and rhythm, and was in no acute

Accepted for publication June 30, 1994.

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