A Novel Technique of Single Patch Repair of Right Partial Anomalous Pulmonary Venous Return to the Superior Vena Cava by Right Atrial Edge Rotation

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In patients with partial anomalous pulmonary venous return of the right superior pulmonary veins to the superior vena cava, surgical repair generally consists of either intraatrial baffle with or without caval enlargement, or superior caval transection and cavoatrial anastomosis to the right atrial appendage.

We discuss here a novel technique of superior caval enlargement without need for patch material or reimplantation.


Partial anomalous pulmonary venous return is present when one to three of the pulmonary veins drain into the right atrium or its tributaries. Although uncommon, it is also highly underreported owing to its asymptomatic course until later in life. In 87% to 97% of patients, an interatrial communication is also present [1, 2]. For those patients with anomalous drainage of the right superior pulmonary veins into the superior vena cava (SVC), surgical repair comprises two technically important components: (1) closure of the atrial septal defect (ASD) with redirection of anomalous pulmonary vein flow into the ASD through the creation of an unobstructed baffle, and (2) prevention of narrowing or obstruction of the SVC.

Multiple repair techniques have been described, with the most common and consistent being the intraatrial baffle with or without patch enlargement of the SVC, or superior caval transection and cavoatrial anastomosis as described by Gustafson and colleagues [3].

We describe a novel surgical technique for SVC enlargement that, in applicable patients, simplifies the technique of caval enlargement with fewer suture lines, eliminates the use of autologous or nonautologous tissue for enlargement of the SVC, and does not involve any circumferential vessel anastomosis.

Technique

After standard midline sternotomy and full heparinization, arterial and bicaval venous cannulations are performed. The SVC cannula is placed as high and as far away as possible from the anomalous right pulmonary veins. Cardiopulmonary bypass is then established with moderate hypothermia. The aorta is then clamped, followed by a single dose of cold antegrade cardioplegia to achieve arrest.

A J-shaped incision is made beginning at the body of the right atrium heading posterior toward the lateral edge of the right atrium (Fig 1). The incision is then continued cephalad up to the level of the anomalous right superior pulmonary veins.

Care is taken to avoid inadvertent injury to the sinoatrial node by staying at the lateral border of the SVC. After retraction of the right atrium, the anomalous pulmonary veins as well as the ASD are clearly visualized. A patch of glutaraldehyde-treated pericardium (or nonautologous material if pericardium is not available) is used to close the ASD and redirect the superior pulmonary veins into the ASD through creation of an intraatrial baffle.

Attention is now turned toward closure of the SVC and right atrium. A point is chosen (B) along the SVC incision, and this is rotated upward to become the new starting point for closure of the SVC (Fig 2). This right atrial edge rotation effectively widens the SVC inflow at the expense of minimal loss in right atrial size. The suture line is continued downward until the incision is completely closed (Fig 3).

The patient is rewarmed, the aortic clamp is removed, and the patient is weaned off cardiopulmonary bypass with appropriate inotropic support if needed. Intraoperative echocardiography ascertains adequacy of cardiac function and SVC inflow, as well as integrity of the ASD baffle.

Comment

This technique was originally conceptualized to avoid the occasional SVC obstruction seen after cavoatrial...
anastomosis to the right atrial appendage, when the right atrial appendage is technically difficult to reposition, and when a single patch technique would likely narrow the SVC [4, 5]. Similar techniques of single patch repair with SVC enlargement or rerouting through reorientation of native atrial tissue have been described, such as the atriocavoplasty technique by De Leon and associates [6]. We prefer an incision along the lateral aspect of the SVC just anterior to the superior pulmonary veins because it avoids the traditional course of the artery to the sinus node as well as the sinus node itself. However, although they do not appear to affect overall outcome in most series, it is duly recognized that any incision that crosses the cavoatrial junction (anterior or lateral) may increase the incidence of sinoatrial dysfunction [5]. As an additional goal, we aimed to devise a technique that is applicable in the near majority of situations, easily reproducible, and with fewer suture lines.

A limitation of the right atrial edge rotation technique, however, is that it may not be suitable for patients with very high and widely spaced right superior pulmonary veins such that the intraatrial baffle itself cannot be suitably placed without obstruction. Thus appropriate patient selection is paramount to success.

We believe that this technique is widely applicable, will be useful for several scenarios, and is at least equal in efficacy to all currently accepted techniques. Five patients have undergone this operation, and there has been no early sinoatrial dysrhythmia or SVC obstruction at 6 months to 1 year of follow-up. Continued application of this technique, and accumulation of more data, will ultimately establish its usefulness as well as other limitations.

Initial results are favorable for the right atrial edge rotation repair of partial anomalous pulmonary venous return of the right superior pulmonary veins into the SVC with no inflow obstruction, no early sinoatrial dysrhythmia, fewer
suture lines, and excellent postoperative recovery. We look forward to both the midterm and long-term results as we continue to apply this technique in a wider range of patients.

References