repeated aortic intervention at a more proximal arch location. The right-sided approach to the aortic arch provides excellent exposure and facilitates repair of recurrent obstruction.

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EDITORIAL COMMENTARY

The “right” way to repair recoarctation after the Norwood operation

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Residual lesions after Norwood stage I palliation for hypoplastic left heart syndrome are associated with poor outcomes. Aortic arch obstruction or recoarctation may result in depressed right ventricular function or increased atrioventricular valve regurgitation, putting the patient at an increased risk of death. The frequency of recurrent coarctation after Norwood reconstruction is significant, with the Single Ventricle Reconstruction trial reporting an incidence of 18% in a group of 549 patients.¹ In that trial, 97 patients with recoarctation underwent a total of 131 aortic interventions (92 by balloon aortoplasty and 39 surgically), with 39% of the patients undergoing balloon aortoplasty needing another aortic intervention. At evaluation before stage II of Norwood palliation, patients with recoarctation had higher pulmonary arterial pressures, higher pulmonary vascular resistance, and increased heart volumes, as measured echocardiographically.

Surgical data have been presented reporting a decreased incidence of recurrent coarctation after a modification of Norwood stage I palliation.^{2,3} The techniques involve complete mobilization of the aortic arch, head vessels, and proximal descending aorta to limit tension. The

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Central Message

Aortic recoarctation negatively affects hypoplastic left heart syndrome palliation. Martin and colleagues present an innovative approach for surgical correction.

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coarctation and ductal tissue are completely excised. The proximal descending aorta is then spatulated both anteriorly and posteriorly (interdigitating technique) in the hope of decreasing the rate of recoarctation. When recurrent coarctation does occur, it is treated either with balloon aortoplasty for more discrete lesions or with surgical intervention for complex recoarctations and lesions not responsive to catheter-based procedures. The

surgical approach is commonly through a median sternotomy, with patch augmentation of the anterior leftward aspect of the distal aortic arch. An alternative approach for recurrent coarctations distal to the left subclavian artery is patch augmentation of the aorta extending onto the subclavian artery through a left thoracotomy.

In this issue of the *Journal*, Martin and colleagues⁴ report a novel approach to treating recurrent coarctation that begins with a median sternotomy and exposure of the rightward posterior aspect of the coarctation. Patch augmentation is performed essentially 180° opposite the original patch area done at the time of the Norwood stage I procedure. Martin and colleagues⁴ report good results in a series of 12 patients, without any reports of recurrent laryngeal nerve injury or distal aortic arch recoarctation. There appear to be a number of benefits to this approach. The first is that the avoidance of the previous patch area will likely be associated with less adhesion formation. One also could argue that the risk to the recurrent laryngeal nerve would be decreased as well. Finally, the risk of compression to the left bronchus would be low.

In summary, the incidence of recoarctation after Norwood stage I palliation continues to be significant and is associated with considerable morbidity. Aggressive surgical techniques should therefore be undertaken to limit this complication. If recurrent coarctation is identified, timely intervention should be undertaken in the hope of reducing the detrimental effects of this lesion. Martin and colleagues⁴ present an innovative surgical approach that we should all consider when faced with this situation.

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