Aortic Arch Advancement and Ascending Sliding Arch Aortoplasty for Repair of Complex Primary and Recurrent Aortic Arch Obstruction

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The optimal treatment of patients with complex coarctation of the aorta and hypoplastic aortic arch is controversial. Children undergoing repair of obstructive arch lesions are at lifelong risk of recurrence. Multiple techniques have been described to address complex primary and recurrent coarctation. Our approach at Texas Children's Hospital (Houston, TX) has been to address these lesions in an anatomic fashion via median sternotomy, under cardiopulmonary bypass using the techniques of aortic arch advancement and ascending sliding arch aortoplasty. Anatomic repair of complex primary or recurrent aortic obstruction is safe and produces a favorable repair with a low rate of recurrence. Both operations restore normal arch contour using native aortic tissue. The decision of which particular surgical strategy to use depends on the patient's age, anatomy, and the elasticity of the tissue.
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Introduction

The optimal treatment of patients with complex coarctation of the aorta (CoA) and hypoplastic aortic arch is controversial. Children undergoing repair of obstructive arch lesions are at lifelong risk of recurrence, which may in some way be related to incomplete relief of the original lesion at the time of the initial operation or late failure of patch material.[1]

Multiple techniques have been described to address complex primary and recurrent coarctation.[1,2] Our approach at Texas Children's Hospital (Houston, TX) has been to address these lesions in an anatomic fashion via median sternotomy, under cardiopulmonary bypass (CPB).[3] The techniques of aortic arch advancement (AAA) and ascending sliding arch aortoplasty will be described in this article.

Arch advancement and sliding arch aortoplasty for complex and recurrent arch obstruction.

Central Message

Aortic arch advancement and ascending sliding arch aortoplasty allow a favorable anatomic reconstruction in the repair of complex primary and recurrent aortic arch obstruction with good results.

Indications

The definition of arch hypoplasia and its significance is controversial. For children, including neonates, with CoA and hypoplasia limited to the distal arch (between the left common carotid artery and left subclavian artery, resection with an extended end-to-end anastomosis via left thoracotomy is preferred.

Neonates and infants with CoA and hypoplasia of the proximal arch or associated intracardiac lesions are managed with AAA. Our working definition of proximal arch hypoplasia is a diameter (in millimeters) less than the patient's weight (in kilograms) plus one, measured between the innominate

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and left common carotid artery arteries by 2-dimensional echocardiography. The operating surgeon routinely reviews the images to confirm the measurements. When there is absence of the proximal arch, as is the case with a common brachiocephalic trunk, the distal arch must be determined to be adequate if an end-to-end anastomosis is to be used.

Beyond infancy, elasticity of the aorta is reduced significantly and anastomotic tension is of concern in attempting AAA. At Texas Children's Hospital over the last 10 years, children beyond infancy with complex primary or recurrent CoA have been managed with ascending aortic sliding arch aortoplasty. This technique allows an anatomic repair avoiding the use of patch material and restores a normal arch contour.

Surgical Technique

Setup and general considerations

Both the AAA and ascending aortic sliding arch aortoplasty techniques are performed via a median sternotomy on CPB and deep hypothermia (18°C) for visceral organ protection. Since 2000 we have typically avoided the use of circulatory arrest, although it is sometimes necessary. The majority of procedures have been performed with the use of selective cerebral perfusion (SCP) through a graft sutured to the innominate artery. This provides ideal exposure and does not distort the ascending aorta, which is often mildly hypoplastic. Additional ductal arterial

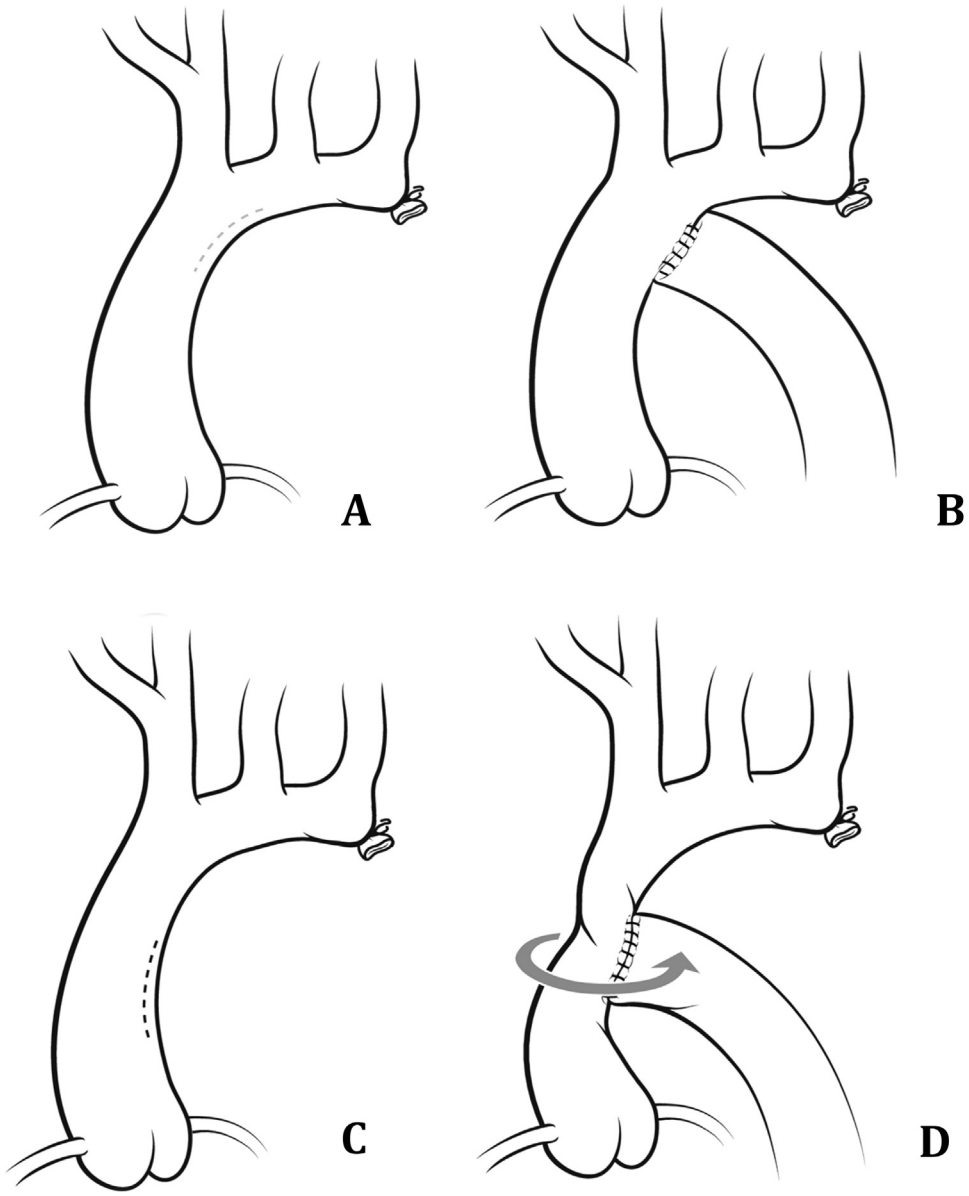

Figure 1 (A) The arteriotomy in the aortic arch advancement (AAA) ought to be just opposite to the innominate artery and in the left and posterolateral aspect, partially in the ascending aorta and partially on the arch. (B) If performed correctly, then very commonly the repair will result in normal curvature, and the former arch just becomes the brachiocephalic artery. (C) If the arteriotomy is performed too low or too anterior the end result will be a "bowtie" effect (D), which can be very significant if the ascending aorta is hypoplastic resulting in supravalvar stenosis. (Reprinted with permission from Texas Children's Hospital.)