

A New Patch for the Norwood Procedure

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The problems related to the pediatric pulmonary homograft availability and the possible transmission of viral infection led us to design a new patch for aortic enlargement in the Norwood procedure for hypoplastic left heart syndrome. This sterile bovine pericardial patch is not expensive and can be tailor-made.

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The hypoplastic left heart syndrome is characterized by various degrees of underdevelopment of the left heart [1, 2]. The enlargement of the aorta with a pulmonary homograft patch [3] has remained substantially the same over time. This choice is the consequence of the need to use a thin, easy-to-handle hemostatic tissue to reconstruct the aortic arch with regular and unfolding margins. In fact, these are the most frequent positions of the occurrence of pressure gradients and restenosis. The high costs and difficult availability of small-sized homografts led us to use a bovine pericardial patch trimmed and tailored to substitute the pulmonary homograft as described by the original technique.

Technique

During the cooling phase, to reach a 18°C esophageal temperature, the aortoplasty patch is trimmed from a bovine pericardial patch. After doubling the patch on itself, the dimensions are as follows and shown in Figure 1: a = pulmonary diameter; b = length of the ascending aorta from the valvular plane to the origin of the brachiocephalic trunk; and c = distance between the ascending and descending aorta 1 cm after the ductal zone. The line describing the concavity of the neo-arch is drawn to equalize the dimensions of the patch to half of the circumference of the pulmonary artery. The aortic arch part is nearly 1 cm wide (d), with a gradual reduction in the descending portion up to 0.7 cm (e). The patch is trimmed according to these parameters, obtaining two equal parts. These measurements are always a bit larger than needed to permit the surgeon to optimize the patch later when the aorta and the pulmonary artery are opened. These parts are sutured in their concavity with a

double running 7-0 monofilament suture using many stop-stitches. The external side of the suture is then reinforced with Glubran histoacrylic glue (GEM, Viareggio, Italy) to obtain a perfect hemostasis (Fig 2). During the hypothermic cardiocirculatory arrest, the diminutive aorta is longitudinally opened up to 1 cm distally of ductal tissue and reconstructed with the previously trimmed patch with a running monofilament suture. The patch will be cut to adapt it to the appropriate dimensions of the patient. At the level of the proximal portion of the pulmonary artery the patch is adequately trimmed and the anastomosis is completed incorporating also the proximal part of the pulmonary artery previously sutured to the base of the ascending aorta (Fig 3). The numerous stop-stitches and the histoacrylic glue used on the suture line of the two layers of the pericardial patch allow us to trim it as we like, also interrupting the suture without danger of dehiscence. The operation is then finished in the usual manner.

Comment

The crucial point for palliation in the hypoplastic left heart syndrome using to the Norwood procedure is the

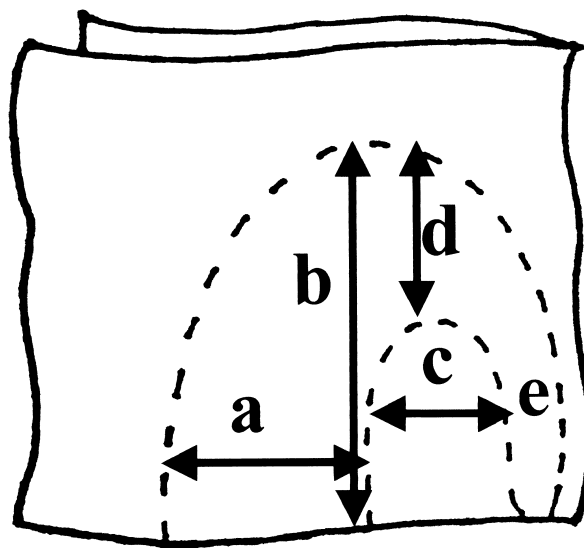


Fig 1. Operative technique. a = pulmonary diameter; b = length of the ascending aorta from the valvular plane to the origin of the brachiocephalic trunk; c = distance between the ascending and descending aorta up to 1 cm after the ductal zone; d = 1 cm; e = 0.7 cm. The described measures are reported on the two layers of pericardial patch.

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Fig 2. The finished bovine pericardial patch.

enlargement plasty of the hypoplastic aorta, which seems the most frequent position of recoarctation on follow-up, with up to 8.1% in the experience by Pigott and colleagues [3] using homograft. In the report by Jonas and

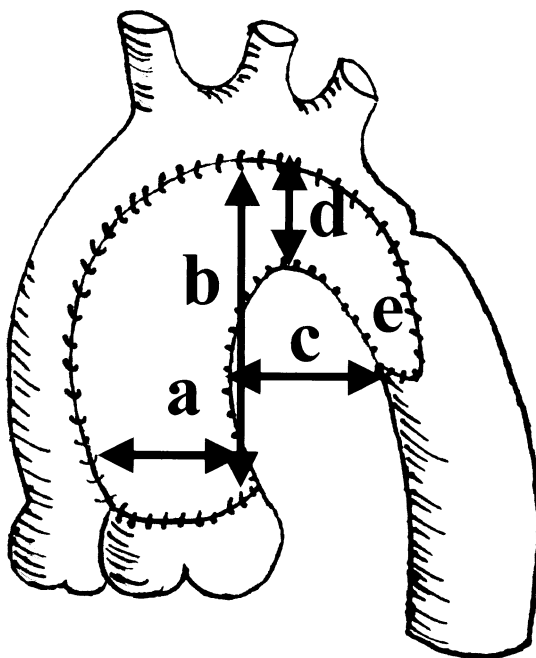


Fig 3. The aortic enlargement is obtained with the described patch. The measures are specified in the text. a to e as in Figure 1.

associates [4], biologic material seems to be better than prosthesis for aortic enlargement patch or than conduits between the pulmonary truncus and the aortic arch. The biologic tissue is easier to trim, more hemostatic, and with a lower incidence of recoarctation on follow-up. Pulmonary homograft has always been considered the best material because it is already trimmed with an aortalike shape, allowing easy reconstruction of the neo-aorta with a curve as natural as possible. This favors a laminar flow and reduces the incidence of complications [3, 4]. On the other hand, homografts are not so easy to find and they have higher costs. The possibility of viral transmission through biologic tissues, screening of which is always available for homografts, is impossible with bovine pericardial patch sterilized with glutaraldehyde. For these reasons, the use of a bovine pericardial patch seems to be promising. It has the advantages of the biologic material without the complications of a homograft, being at low costs and easy to find and trim. Our technique erases the difficulties of adapting a bidimensional patch to the concavity of the aortic arch without outline irregularities and folds, which can alter surgical results. In this way the patch curvature is regular and can be calibrated to perfectly adapt to the aorta, which is not so easy to obtain with a pulmonary homograft that has a well-defined curvature. We treated 12 patients with hypoplastic left heart syndrome with this technique. Sternal closure was delayed to the fifth postoperative day and no patient was reoperated for bleeding from the patch. The total amount of bleeding was comparable with patients treated with other techniques. Seven patients reached the second stage operation at an average interval of 7 months. The absence of recoarctation or patch calcifications and a normal growth of the native aorta were always demonstrated during the second operation. For these reasons and for the simplicity of tailoring, obtained during the cooling phase of the operation without ischemic or cardiocirculatory arrest time prolongation, we propose our technique for the aortic enlargement in the Norwood procedure.

References

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