Inclusion or Mini-root Homograft Aortic Valve Replacement

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The insertion of a cryopreserved aortic homograft valve by the mini-root or inclusion cylinder technique is used less frequently than either the scalloped free-hand technique or the total root replacement. Indications for the use of the mini-root or cylinder inclusion technique are relatively infrequent. This procedure is a compromise between the scalloped technique and the root technique and is, therefore, useful in patients who have an aortic root that measures 27 mm to 31 mm in diameter and, thus, would be a bit large for the scallop technique. The mini-root is also somewhat helpful in the moderately distorted aortic root. It has the advantage of an inclusion technique, and therefore, bleeding from the root after insertion is not seen. In some situations, the mini-root inclusion technique may solve problems of distortion, enlarged or bulbous sinuses of Valsalva, or small root abscesses.
**SURGICAL TECHNIQUE**

The cryopreserved homograft is thawed in the usual fashion. The upstream or muscular portion of the graft is trimmed in the usual way. The tubular portion of the ascending aorta of the graft is transected approximately 5 mm above the supercommissural ring.

Preparation for and institution of cardiopulmonary bypass is done normally, generally necessitating only a single venous cannula. Usually a left atrial vent is placed, and the aorta is clamped in its distal tubular portion. A transverse aortotomy is made, extending the incision obliquely, midway into the noncoronary sinus. At this point, antegrade ostial cardioplegia supplements a previous dose of retrograde cardioplegia. The aortic valve is resected to result in a pliable, noncalcified aortic root. If the root is moderately enlarged (27 to 31 mm) a cylinder technique may be chosen. In general, we use a continuous suture for the upstream suture line, usually a 4-0 prolene. This is sited proximal (on the left ventricular aspect) to the base of the valve leaflets. The suture line is horizontal and does not reflect the scalloping of the residual base of the aortic leaflets. This proximal suture line is placed posteriorly by sewing from within the homograft cylinder, forehand from the patient left to right, establishing a continuous posterior row of sutures, from left ventricular outflow tract inside-outside to homograft outside-inside.
The graft having been lowered into the aortic root is now positioned so that the anterior portion of this proximal continuous suture line is placed from left to right, from outside-in, inside-out, aortic root to homograft cylinder.
The anterior continuous suture line is shown. It is imperative that this suture line also be horizontal and on the ventricular side of the base of the aortic leaflets.
(A) A button a bit larger than the orifice of the left coronary artery is removed appropriate to that orifice in the homograft cylinder. From inside, the posterior suture line, using 5-0 or 6-0 prolene, is begun from the patient's left to right to anastomose the left coronary orifice to the graft. The anterior portion of the suture line is continued outside-in, from graft to coronary ostium, and tied. (B) A similar procedure is performed to attach the right coronary artery to the homograft cylinder using a button in the cylinder and dividing the suture line into posterior and anterior portions.
An alternative technique can be used when the coronary ostia, either both or simply the left, are located slightly more distally in the native aortic root. In this case, the distal suture line can follow a somewhat scalloped course by removing a bit of the sinus wall in the left coronary sinus and/or right coronary sinus of the graft. Thus, separate coronary ostial anastomoses to the cylinder are avoided, but in fact this remains an inclusion technique, and cylinder concept is maintained. When the alternative scalloping technique is used, it is often appropriate to use several anchoring sutures to obliterate dead space in the right and left sinus of Valsalva. These are simply placed and are tied either within the space between the recipient and graft aorta or outside the recipient aorta.
6 The downstream or distal suture line must maintain (other than where scalloped) a consistent horizontal relationship to the upstream or proximal suture line. Firm good bites of both the graft and recipient aorta are taken to insure a water tight nonleaking seal. Because the ostial anastomoses use a good deal of space within their respective sinuses, additional anchoring sutures are not necessary to obliterate dead space.

7 When the distal suture line is approximately three-fourths complete, closure of the aortotomy is begun. The aortotomy is closed as usual, but the closing suture incorporates a bit of the homograft cylinder wall in the first 3 to 5 bites.
COMMENTS

The mini-root or inclusion technique provides some advantages for the distorted aortic root and in situations where surgical landmarks may have been obliterated by previous operations or infection. A further advantage is that bleeding from the aorta is virtually eliminated. Care must be taken to eliminate dead space between the two cylinders, particularly in the sinuses of Valsalva when the alternative method has been used. The technique has disadvantages in that it is a bit more cumbersome than either the scalloped technique or the total root replacement and is applicable to only those patients with rather large aortic roots.

8 When the aortotomy closure has reached the distal edge of the homograft cylinder, the downstream homograft recipient horizontal suture line is completed so that the homograft tube and the recipient aorta are as one cylinder within another. Closure of the aortotomy then proceeds as usual, in our technique using a second 4-0 prolene suture, placed from patient’s left to right to meet the first 4-0 prolene from patient’s right to left.