Cut well, sew well, do well: Does the 4-branch total arch technique for great vessel reconstruction influence long-term outcomes?

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In this issue of the *Journal*, Ikeno and colleagues¹ present long-term follow-up on 655 patients undergoing total arch replacement using a 4-branched graft to reconstruct the great vessels. The results in the hands of this experienced team of aortic surgeons are admirable. The operative mortality was 5.2%, and risk of permanent neurologic deficit (PND) was 3.7% when using antegrade cerebral perfusion and moderate systemic hypothermia as adjuncts for cerebral and end-organ protection. These early outcomes are even more impressive when considering that approximately one quarter of their patients underwent complicated arch surgery in the setting of an acute type A dissection (n = 149, 22.7%) or with age 80 years or greater (n = 127, 19.3%). However, Ikeno and colleagues' mandate was not to focus on perioperative results but to provide long-term metrics to support the potential superiority of this complex arch surgery. Was this goal achieved and what messages should we take away from their detailed analysis?

Five-year and 10-year survivals, freedom from repeated (proximal) reoperation, and freedom from additional (downstream) aortic reoperation were calculated from this cohort in whom 97% of operative survivors had a follow-up for a mean of 5 years. Although the frequency of follow-up imaging and the decision making for reinterventions are not specifically outlined, the results are strikingly similar to those previously reported by these authors and others focused on improving the performance of safe and durable arch reconstruction.²⁻⁴ Five-year survival in these 655 patients was 73.1% at 5 years and 58% at 10 years. Those with degenerative pathology were older and sicker, so, not surprisingly, they had a less robust long-term outcome when compared with those having a 4-branch arch graft placed for acute or chronic dissections. The usual suspects negatively influenced life span on multivariable analysis: age, preoperative glomerular filtration rate, concurrent surgery, postoperative PND, tracheostomy, and need for dialysis. Five-year freedom from proximal

Four-branched total arch replacement.

Central Message

Outcomes are consistently good for patients in need of aortic arch reconstruction. Surgical technique does not predict short- or long-term results.

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reoperations was worse in those undergoing surgery for an acute dissection (93.4%). However, there were few reoperations for arch suture line pseudoaneurysms (8/625, 1.2%), one definite benefit of eliminating as much diseased tissue as possible and minimizing anastomotic tension by debranching. Freedom from downstream surgery at 5 years (87.4%) did not benefit from this aggressive proximal operation, particularly the chronic dissections that required late reintervention more than 25% of the time. So is a 4-branch total arch the proper operation for a broad spectrum of patients with arch pathology? Is the need for reoperation after a 4-branch less than that witnessed with far less complicated hemiarch repair? Are there technical issues with this approach that influence patient selection and the incidence of postoperative complications known to affect survival (the central message here)? Finally, on the basis of age, preoperative risk factors, and the need for concomitant procedures, should certain populations avoid open surgery in favor of an endovascular approach?

A cohort of patients similar to those in the study by Ikeno and colleagues¹ underwent hemiarch reconstruction rather than total arch resection.⁴ A greater percentage of these 426 patients had underlying degenerative pathology, a marker of increased age and greater comorbidity. Operative mortality and incidence of PND were 3.1% and 0.9%, respectively. Five-year survival was nearly identical at

72.5%. The need for any aortic reoperation within 5 years occurred in 32 of the 413 operative survivors (7.5%). Like those undergoing a 4-branch total arch, a majority were downstream procedures (30/32, 94%) and few ($n = 2$) were for recurrent arch pathology (2 = residual dissection, 0 = pseudoaneurysm). The mean times on cardiopulmonary bypass (135 vs 193 minutes) and under circulatory arrest (27 vs 44 minutes) were substantially shorter when comparing hemiarch with the 4-branch technique. It is possible this could have contributed to the reduced incidence of PND, tracheostomy, and need for hemodialysis seen when performing a hemiarch, important risk factors known to reduce long-term survival.

What is evident from these comparisons is that surgeons know what to do in whom. Selecting well, in addition to cutting and sewing well, usually leads to patients doing well both immediately after surgery and long-term. Regardless of the technique chosen for open arch repair, the results are reproducible and durable. On occasion, those in need of extensive concomitant surgery might be better served by hemiarch repair with shorter times under circulatory arrest and on pump. The corollary that younger patients with dissections (despite higher acuity) should have more extensive total arch reconstruction also may

hold true. Regardless, hybrid repairs are not reliable enough to supplant either option and should be considered only when extreme patient comorbidity precludes a reasonable opportunity for success. The risk of PND is still too high with an endovascular approach when in propensity-matched populations, disabling strokes occur with alarming frequency.^{5,6}

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