When you look at a small group of patients, you can still learn a lot when you look closely at them. Can you tell us something that you learned when you looked closely at those 13% strokes? For example, would you have used CPB in those patients or done something else to protect their brains during the operation that we can learn from when we're in that situation when we think we need to use this hybrid technique?

Dr Preventza. That's an excellent point. We also use the hybrid technique when we believe that the patient is too high risk to undergo hypothermic circulatory arrest. It's true that our hybrid group had higher neurologic events, and this is the Achilles' heel of this procedure. Although there is an incidence of stroke in the hybrid cases, representing in part a learning curve, we believe it would have been even higher under circulatory arrest in this group of patients with significant comorbidities, and it should not deter us from pursuing these alternative therapies. When we look back at our results, the patients in the hybrid group had more prior strokes compared with the patients who had the

traditional open repair. On the multivariable analysis, history of stroke was one of the independent risk factors for stroke or a permanent neurologic event.

Dr Roselli. Sure. So the strokes that you saw, were they atheroembolic or related to low flow? You said you decreased the pressure down to 50 to 60 mm Hg. You could see how if you used partial CPB to support flow to the brain that you could protect the brain better or something like that. Did you find any of those details in your analysis?

Dr Preventza. The patients in the hybrid group had more atherosclerotic aneurysms. We do keep the mean blood pressure at 50 to 60 mm Hg when we perform the proximal anastomosis, and we have a partial occluding clamp on the ascending aorta. When we reconstruct the head vessels, we keep the MAP at 90 to 100 mm Hg, and we follow the near-infrared spectroscopy.

Dr Roselli. Sure.

Dr Preventza. Your point is well taken.

Dr Roselli. Thank you.

EDITORIAL COMMENTARY

Zone 0 hybrid arch exclusion: What for?

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In their article entitled, "Total Aortic Arch Replacement: A Comparative Study of Zone 0 Hybrid Arch Exclusion versus Traditional Open Repair," which appears in the current issue of the *Journal*, Preventza and coworkers¹ report on a rarely addressed matter. Although retrospective and observational, this study represents a very interesting attempt to point out whether either technique for total aortic arch repair (TAAR) might be superior to the other. This sort of comparison and assessment seems to be more and more important in an era in which hybrid and endovascular procedures are increasingly being used worldwide.

To establish their comparison and to make it the least questionable possible, Preventza and coworkers¹ have used a fine and appropriate methodology. They have, indeed, included 2

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Central Message

If there is no difference in outcome between conventional aortic arch and zone 0 hybrid repair, should the hybrid technique be used?

See Article page 1591.

See Editorial page 1399.

large enough cohorts of patients (274 undergoing open repair and 45 undergoing hybrid procedures) operated on during the same recent period. They have conducted a multivariate analysis of the predictors of adverse events in those 2 groups. Moreover, they have compared 25 patients in each cohort through propensity-matched pairs.

As it is, the article appears to be clearly organized and well written. The comparison seems relevant, and the reported data support the conclusions.

Indeed, at the end of their comparative analysis, Preventza and co-workers come to the following conclusion:

“Among contemporary cases, both traditional and hybrid TAAR had acceptable results;” “Permanent adverse outcome was not significantly different between the 2 groups. Procedure type is not an independent predictor of permanent stroke;” and “Prior cardiac disease, past or current smoking and congestive heart failure predict adverse outcomes for TAAR.”

The readers should be convinced!

Not totally though, as some points remain either unclear or yet unresolved.

One of the major points of interrogation is still the definition of the “risky patient.” As in most (if not all) articles dealing with hybrid procedures and endovascular repair, a precise definition of this particular but frequent condition is never indicated. No risk scores (euroSCORE, Society of Thoracic Surgeons score, American Society of Anesthesiologists physical status score, etc) or frailty criteria are given to define clearly the preoperative condition of the patient. Moreover, the threshold beyond which those scores or criteria would preclude open surgery is never objectively defined, and the decision seems to remain only a matter for the subjective judgment of the surgical team.

Although it is quite likely that the statistical analysis is reliable, with this study coming as it does from a very active and renowned department of surgery, one may well wonder whether the differences in the numbers of patients and events between the 2 cohorts might not be a source of bias and weakness. For instance, despite the fact that this finding is not statistically significant, there is indeed an obvious trend for the neurologic complications to be more frequent in the “hybrid” group than in the “open surgical”

group. Could this trend have become a significant difference with an increased number of cases in the analysis?

It seems also somewhat intriguing that the circumstances of the procedure (either open or hybrid) were found to have no influence on the immediate outcomes. Indeed, daily practice and experience, as well as the literature, have largely proved that “emergency” conditions create a clearly higher risk of adverse events and poor outcomes in the treatment of aortic pathology. If we consider that almost half of the hybrid procedures were carried out in emergency, this could explain why those procedures that were apparently less invasive, shorter, and carried out without Cardiopulmonary bypass in most cases, had the same rate of adverse events than the open surgical ones. In this regard, it could have been quite informative if Preventza and coworkers¹ had provided the readers with the results according to the circumstances in both emergency and open surgical groups.

It is also somewhat surprising that, at least according to the current study, the only risk factors of adverse events after TAAR were previous cardiac disease, smoking, and severe chronic heart failure. These risks hold true for any kind of important cardiovascular surgery (or even other types of surgery) and are not related specifically to aortic arch repair.

Last, but not least, Preventza and coworkers¹ do not discuss the respective costs of both techniques. Looking at the rates of complications and the lengths of the stays in the intensive care unit and hospital, it seems that the hospital expenses would have been similar other than the cost of the prosthesis, which seems to be about 10-fold higher for the endoprosthesis than for the conventional Dacron polyester fabric graft in most industrial countries.

Anyhow, if we do not take into account the points of criticism developed here and totally accept the statements and conclusions of Preventza and coworkers,¹ one question immediately comes to the mind: “If open surgical and zone 0 hybrid replacements of the aortic arch result in the same immediate and midterm outcomes, on which basis and arguments should we abandon the conventional technique in favor of the hybrid one?”

So far, we do not have the answer.

Reference

1. Preventza O, Garcia A, Cooley DA, Haywood-Watson RJ, Simpson K, Bakaeen FG, et al. Total aortic arch replacement: a comparative study of zone 0 hybrid arch exclusion versus traditional open repair. *J Thorac Cardiovasc Surg.* 2015;150:1591-600.