The optimal modality for brain protection during aortic arch replacement has long been debated worldwide among cardiovascular surgeons involved in aortic surgical repair. Two distinctive modes of perfusion technique, antegrade cerebral perfusion (ACP) and retrograde cerebral perfusion (RCP), have been utilized to enhance the safety of the deep hypothermic circulatory arrest (DHCA) technique. Both ACP and RCP have additional brain protective effects, but both techniques carry potential risks characteristic to each, such as thromboembolism with ACP and brain edema with RCP. No consensus has been reached on which procedure provides better clinical brain protection. Even in the recently conducted meta-analysis, the lack of some of the important baseline data prevented a comparison of clinical outcomes of ACP and RCP based on more similar baseline data.

Tokuda and the group of the Japan Cardiovascular Surgery Database (JACVSD) Organization used the database to conduct nationwide retrospective observational analyses to identify the optimal brain protection strategy by comparing the 2 methods, ACP and RCP, during ascending aortic repair for acute type A aortic dissection over the period of recent 5 years. They performed comparative evaluation between 2 groups divided by the method used for brain protection from the overall cohort. In addition, risk-adjusted analysis and propensity-matched pairs analysis were also conducted. Inability to perform a randomized control trial in such an acute aortic syndrome was, thus, well compensated by means of propensity-matched analysis. Although derived from a retrospective analysis, this report contains valuable information, because no randomized trial comparing 2 brain protection methods have yet been performed. The article by Tokuda et al focuses on the short-term outcome after ascending aortic repair for acute type A aortic dissection. The primary outcome measured by the JACVSD was operative mortality, and the secondary outcomes included major morbidity, which was defined as the occurrence of any of 5 postoperative in-hospital complications: stroke; reoperation for bleeding; need for mechanical ventilation >24h because of respiratory failure; renal failure with newly required dialysis; and mediastinitis. They found that there were no significant differences between the 2 groups regarding the incidence of operative mortality or neurologic complications and that postoperative ventilation time was significantly longer in the ACP group than the RCP group. This was true for the total cohort of patients as well as for the risk-adjusted analysis and propensity-matched pairing analysis.

Recently, another propensity-matched analysis was carried out by a group from Duke University to examine the superiority of ACP or RCP in proximal (hemi-) arch replacement using DHCA. They found that equivalent early and late outcomes can be achieved with ACP and RCP. Their study design was single institutional retrospective analysis, so had an associated inherent bias. The number of matched patients was 80 in each arm and still contained multiple pathological conditions of the aorta. In that regard, the article by Tokuda et al may have much greater scientific impact on the consideration for the better selection of brain protection modality, because the subjects of their study were confined to those undergoing replacement of the ascending aorta for acute dissection only and the number in each arm was 1,320.

One should be aware that RCP could yield equivalent mortality and neurological morbidity to ACP when the surgical procedure is limited to ascending aortic replacement excluding arch vessel reconstruction or root replacement. Another reason that concomitant complex procedures were excluded was the safety time limit to employ RCP. Therefore, the effectiveness of RCP cannot be extended to an adjunctive technique for total aortic arch replacement based solely on this report. In fact, ACP and RCP were utilized equally well with DHCA; it seems that hypothermia was the key component and the perfusion technique might not be essential as long as brain protection time does not exceed approximately 30min. A minor criticism of the article is that there are no available data on the duration of brain protection or distal circulatory arrest. As the authors recognized, the lack of information about the duration of brain circulatory arrest in RCP or selective cerebral perfusion time in ACP is a major weak point. It cannot be overemphasized that one-third of patients with acute type A dissection underwent total aortic arch replacement in Japan. Therefore, the data presented by Tokuda et al do not necessary reflect comprehensive data covering the entire cohort with acute aortic dissection as stated in the limitations.

Interestingly, the authors demonstrated that the postoperative ventilation time was significantly longer in the ACP group. They referred the reason for poor respiratory conditions after surgery in the ACP patient group to the adverse effect of lon-
ger cardiopulmonary bypass. However, lower temperature was employed in the RCP group to secure brain protection, which is generally considered to be associated with postoperative respiratory dysfunction. The authors speculated that the higher temperature observed in the ACP group might be associated with poorer lung protection during open distal technique. To further explore the possible mechanism responsible for the difference in postoperative respiratory condition, the 2 perfusion techniques need to be examined under identical body temperatures, which could not be tested even with their propensity-matching methodology because 1.9°C of temperature difference remained between the 2 groups even after propensity-matching.

With regard to the neurologic dysfunction, the occurrence of PND was more frequent than TND in both the ACP and RCP groups, which is not in accordance with general observations and results documented in the literature. It is also noted that the frequency of TND was relatively on the low side, especially in the RCP group. RCP has been reported to carry an increased risk of postoperative TND compared with ACP in some previous studies. These discrepancies might be related to the lack of standardizing of clinical endpoints, as highlighted in the recent publication from the International Aortic Arch Surgery Group. Nonetheless, the clinical advantage of RCP demonstrated in the article of Tokuda’s group is solid, which evokes further debate even in the era with the established technology of ACP.

References