Evolving Knowledge About Age and Hypothermic Circulatory Arrest in Aortic Surgery

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In ascending aortic surgery, progress in surgical and perfusion technology is continuous and quiet and does not produce frequent reports of short-term success. Changes in strategy show their effects years after their implementation, and may then be recommended to the broad community to adapt therapeutic strategy and thus to improve overall outcome. An example is the report by the Berne group in the current issue of Circulation on the effect of age on mortality and neurological injury in patients after surgical repair with hypothermic circulatory arrest in acute and chronic proximal thoracic pathology. Traditionally, age has been associated with a higher risk for both mortality and neurological injury, as has been shown by large databases such as the International Registry of Acute Aortic Dissection (IRAD). As a consequence, some centers refuse surgery in elderly patients because of dismal results, especially loss of quality of life, which has emerged as one of the most important surrogates for treatment success.

However, the aforementioned reports stem from a time when deep hypothermic circulatory arrest was used as the only adjunctive technique for brain protection. Improvements in modern surgical therapy of aortic aneurysms include several important changes: subclavian artery perfusion, heparin-coated circuits for cardiopulmonary bypass, and most important, antegrade cerebral perfusion via the subclavian artery or selective perfusion catheters of supraaortic branches. Antegrade cerebral perfusion allows operating on the aortic arch in moderate hypothermia, thus reducing the side effects of deep hypothermia (eg, coagulopathy, inflammatory reactions). Additionally, concomitant treatment of the descending thoracic aorta with an open placement of a stent graft enables even more extensive repair of pathologies of the entire thoracic aorta. Commercially available trifurcated prostheses facilitate surgical aortic arch repair with excellent long-term durability. Reinstallation of cardiopulmonary bypass via a sidearm of the prosthesis ensures a more physiological body perfusion, which is an important issue in aortic dissections. Besides the advances in the surgical technique, anesthesiological management improved substantially. Near-infrared spectrometry allows noninvasive real-time neuromonitoring, which enables the surgeon to react promptly in case of malperfusion. In addition, blood coagulation management contributed significantly to achieve a satisfying hemostasis and consequently to reduce postoperative bleeding complications (including pericardial tamponade). Routine use of transesophageal echocardiography in the operating room is important for both a comprehensive diagnosis (eg, valvulopathies or regional wall motion abnormalities, especially in emergency settings) and postoperative quality control of surgical reconstructions.

In the current issue of Circulation, the Berne group has adopted a concept of warmer circulatory arrest temperatures in combination with a perfusate temperature of 20°C at an early time point and has adhered to this protocol for years. It has been shown by others that these operations, regardless of their acute or chronic state, can be performed successfully with excellent long-term results in younger patients. The specific merit of this report is the transfer of these results to elderly patients because physicians have been reluctant, even recently, to subject elderly patients to this kind of surgery.

We think that the concept of a biologically based, not age-based, treatment approach is a wise one if the underlying thoracic aortic pathology is the only limiting disease in these patients, which makes sense in many ways. As a clinical observation, it remains interesting and unanswered why many patients presenting with acute and chronic proximal thoracic aortic pathology rarely show obliteratorive components of atherosclerosis, such as coronary artery disease or carotid artery stenosis.

The definite merit of the Berne report is that it demonstrates comparable good outcomes after deep hypothermic circulatory arrest for hexagenarians and septuagenarians in terms of perioperative mortality (10% versus 14% in acute aortic dissections and 1.7% versus 2.3% in chronic aortic aneurysms) and neurological complications (18% versus 20% in acute dissections and 8% versus 12% in chronic aortic aneurysms). For acute presentation, this finding is well in line with the results of the German Registry for Acute Aortic Dissection Type A Investigators (GERAAD), who noted a 30-day mortality of 16% and neurological complications in 14% of the patient group of septuagenarians. In the GERAADA registry, the step into the next decade of octogenarians with acute aortic dissection was associated with a marked increase in mortality and neurological complication rates. A very similar finding for acute surgery is reported by the Berne group (2 patients; perioperative mortality, 50%; neurological complications, 50%). Therefore, conclusions regarding the management of very elderly patients should be drawn with...
caution. In the specific group of the very elderly with acute dissection, we are still confronted with very limited numbers, reflecting substantial refusal of referral to surgery. Historically, and on the basis of unfavorable perioperative outcome, the diagnosis of acute aortic dissection in octogenarians has been considered a relative contraindication for surgical treatment. Perhaps an important gain of knowledge will come to the surgical community through a recent meta-analysis with pooled data from 308 octogenarians with acute aortic dissection type A (mortality, 36.7%; stroke rate, 11.9%). These new data basically support the historical opinion that acute aortic dissection type A in octogenarians remains a relative contraindication for surgical treatment. However, the IRAD registry gives clear evidence that conservative treatment of acute aortic dissection type A—regardless of the age group—has excessive mortality compared with surgery. In light of the GERAADA information that elderly patients are referred in a markedly advanced state of disease, we may speculate that excessive mortality/morbidity in octogenarians with acute dissections may be related in part to delayed diagnostics and subsequently delayed referral. We believe that this specific disease in the elderly needs more awareness at the time of initial admission to hospital. Additionally, there is still room for a broader interdisciplinary communication to offer each individual patient the optimal therapeutic management between emergency physicians and surgeons.

In contrast, elective surgery with hypothermic circulatory arrest in chronic aortic aneurysms operative mortality is, not surprisingly, lower than in emergency cases (2%–6% versus 15%). Accordingly, stroke rates for elective and emergency aortic arch repair are 2% to 7% and 14%, respectively. Not surprisingly, advanced age also is a risk factor within this specific group. Safi et al recently reported that age >72 years is associated with increased mortality after thoracic aneurysm operations. A carefully review of the literature shows that information on age as a risk factor for mortality in hypothermic circulatory arrest is scarce. A strength of the present article by the Berne group is that it underlines that advanced age is not a contraindication for this type of surgery. On the basis of the assumption that the indexed aortic diameter nomogram (cm/m² body surface area) published by Davies et al is a valid guideline, in very elderly patients at high risk of rupture, we strongly consider surgical therapy. Nevertheless, patients with advanced age and moderate- to high-risk comorbidity profile require individual assessment of operative benefit to risk.

Finally, we would like to risk a glimpse into the future of these treatment strategies. Surgical strategies for restorative approaches are highly developed, so the next frontiers seem to be further modifications of perfusion protocols with regard to core and cerebral (and consecutively spinal) perfusion temperatures. Urbanski et al recently published a potentially important step by approaching even mild hypothermic circulatory arrest. Further investigations are warranted for the evaluation of this technique, especially in an emergency setting. Other novel techniques such as hybrid off-pump therapy of aortic arch aneurysms including aortic arch debulking in high-risk patients combined with endovascular stent graft placement are considered alternative therapeutic approaches.

In general, because of the increase in life expectancy, surgeons will progressively be confronted with a growing population of elderly patients referred for aortic surgery. For these patients, mortality and, perhaps more important, operation-related morbidity affecting quality of life will gain increased importance in the allocation of value-based medicine. We should remember that Santini et al noted comparable quality of life in patients >75 years of age who underwent surgical treatment of an acute aortic dissection type A compared with normal population. Perhaps we should learn from recent developments in catheter-based aortic valve interventions, in which the patient’s frailty index was added to clinical scores (eg, EuroSCORE or Society of Thoracic Surgeons Score).

In summary, the present article by the Berne group adds significant knowledge to an evolving specialty at a very high level and justifies that each patient with aortic disease be evaluated for surgical therapy independently of age.

Disclosures

None.

References


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