

Review

State-of-the-Art Surgical Management of Acute Type A Aortic Dissection

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ABSTRACT

Acute type A aortic dissections still present a major challenge to cardiac surgeons. Although surgical management remains the gold standard, operative mortality remains high, including in experienced centres. Nevertheless, recent advances in the understanding and management of various aspects of these complex operations are expected to improve overall patient outcomes. The Canadian Thoracic Aortic Collaborative (CTAC) represents a group of surgeons with interest and expertise in the management of patients with aortic diseases. The purpose of this state-of-the-art review is to detail our approach to the contemporary surgical management of acute type A aortic dis-

RÉSUMÉ

Les dissections aortiques aiguës de type A représentent encore un défi important pour les chirurgiens cardiaques. Bien que la prise en charge chirurgicale demeure l'étalon or, la mortalité opératoire demeure élevée, y compris dans les centres spécialisés. Néanmoins, les récentes avancées en matière de compréhension et de prise en charge des divers aspects de ces opérations complexes devraient améliorer les résultats cliniques globaux des patients. Le CTAC (Canadian Thoracic Aortic Collaborative) représente un groupe de chirurgiens qui ont un intérêt et une expertise dans la prise en charge des patients souffrant de maladies aortiques. L'objectif de cette revue de pointe

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See page 107 for disclosure information.

Operative mortality remains high in patients presenting with acute type A aortic dissection. However, recent advances in the understanding and management of various aspects of these complex operations are expected to improve overall patient outcomes. The purpose of this state-of-the-art review is to detail the contemporary surgical management of acute type A aortic dissection. We focus specifically on cannulation strategies, cerebral protection, and extent of proximal and distal resection, and discuss specific clinical scenarios such as

sections. We focus specifically on cannulation strategies, cerebral protection, and extent of proximal and distal resection. In addition, specific clinical scenarios—including malperfusion, intramural hematomas, and surgery in octogenarians—are explored.

malperfusion and intramural hematomas. Although this document represents a detailed review of the surgical management of acute type A dissection by surgeons across Canada with a specific interest in the management of aortic pathologic conditions, these are neither guidelines nor specific recommendations.

Surgical Principles

Medical therapy for type A dissection is associated with 60% 30-day mortality; thus, surgical repair is indicated for most patients presenting with an acute type A aortic dissection.^{1,2} The primary goal of surgical treatment in patients with acute type A aortic dissection is to reduce the risk of aortic rupture or proximal extension of the dissection by replacing the ascending aorta and proximal arch using a synthetic presealed woven polyester vascular graft. This also serves to prevent or correct coronary malperfusion, acute aortic insufficiency, and cardiac tamponade. In addition, the primary intimal tear, which can be located in the ascending aorta or the arch, should be resected or excluded at the time of surgery.

To achieve successful aortic repair, the fragile dissected aortic layers should be reconstituted proximally and distally by meticulous use of fine continuous or interrupted sutures, with or without reinforcement, to obliterate the false lumen. The result is the redirection of aortic blood flow into the true aortic lumen both proximally and distally, thus increasing the likelihood of reperfusion of aortic branches previously compromised by static or dynamic obstruction.

When aortic valve regurgitation is present, aortic valve competence is often achieved through reconstruction of the sinuses of Valsalva with resuspension of the commissures.³ Nevertheless, depending on involvement of the aortic root, the discovery of a pre-existing aortic root aneurysm, or the presence of underlying connective tissue disorders, complete aortic root replacement with reimplantation of the coronary ostia is often indicated. Separate aortic valve replacement and supracoronary aortic graft replacement is now rarely used in patients with acute type A aortic dissections but may be appropriate in very selected high-risk patients in whom the sinuses can be spared but aortic valve competence cannot be achieved using other techniques.

In almost all cases, a brief period of deep hypothermic circulatory arrest is used to allow direct inspection of the aortic arch and secure distal aortic reconstruction of a portion of (hemiarch repair) or the entire aortic arch using the elephant trunk technique or one of its variants.⁴ Furthermore, to ensure adequate blood flow to various parts of the body before, during, and after repair, arterial pressure in the right and left radial arteries as well as the femoral artery should be monitored throughout the case. Finally, satisfactory hemostasis

est de présenter en détail notre approche de la prise en charge chirurgicale contemporaine des dissections aortiques aiguës de type A. Nous nous concentrons particulièrement sur les stratégies de cannulation, la protection cérébrale et l'étendue de la résection proximale et distale. De plus, nous explorons des scénarios cliniques précis, à savoir la malperfusion, les hématomas intramuraux et la chirurgie chez les octogénaires.

remains one of the main technical challenges of surgical repair of acute type A aortic dissections because of the friable dissected aortic tissue and the coagulopathy that may exist secondary to a number of factors (long cardiopulmonary bypass times, moderate to deep hypothermia, preoperative state of the patient, and consumption of coagulation factors by the dissection process itself).

Cannulation Strategies

Several arterial cannulation strategies have been advocated in the operative management of acute type A aortic dissection. Currently these include femoral, right axillary, left axillary, central aortic, and, less commonly, apical cannulation. The choice of cannulation site is dictated by patient-specific factors, including extent of dissection and whether or not a potential cannulation site is involved, presence of malperfusion, hemodynamic instability (shock or tamponade), age, peripheral vascular disease, and a history of stroke.

For years, the femoral artery has served as the cannulation site of choice for many surgeons, including those with expertise in aortic surgery.⁵ Accessing the femoral vessels is fairly easy and allows for the rapid institution of cardiopulmonary bypass in hemodynamically unstable patients. However, there is a potential risk of retrograde embolization, stroke, and malperfusion with femoral artery cannulation. In addition, use of the femoral artery implies using either isolated deep hypothermic circulatory arrest or separate cannulation of the head vessels during circulatory arrest to achieve cerebral flow.

Recent studies, however, have suggested a benefit of right axillary artery cannulation with respect to short- and long-term outcomes after aortic arch surgery.^{6,7} Whenever possible, we consider the right axillary artery as the cannulation site of choice. The right axillary artery is uncommonly affected by the acute dissection process or pre-existing atherosclerotic disease and may be cannulated either directly or by sewing an end-to-side 8- or 10-mm polyester graft to the artery. Right axillary cannulation lowers the risk associated with retrograde aortic flow and its attendant complications and facilitates the use of selective antegrade cerebral perfusion. However, this technique may be time-consuming, especially in obese patients, and this should be weighed against the urgency of the operation. In addition, injury to the brachial plexus, arm hyperperfusion, or seroma formation, although rare in experienced hands, are potential complications. Use of the innominate artery, provided that it is not dissected, offers advantages similar to those of the right axillary artery while eliminating some of the concerns over the added length of the procedure.⁸

Alternative approaches for arterial cannulation include direct aortic cannulation under echographic guidance using a

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