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 dissection. We focus specifically on cannulation strategies, cerebral protection, and extent of proximal and distal resection, and discuss specific clinical scenarios such as

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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.

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. 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 preseal 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. 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 (hemiaroch repair) or the entire aortic arch using the elephant trunk technique or one of its variants. 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 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. 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. 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 sewn 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.

Alternative approaches for arterial cannulation include direct aortic cannulation under echographic guidance using a
Seldinger technique, as well as transapical cannulation. None of these techniques is recommended as the initial cannulation strategy of choice.

Independent of which cannulation site is chosen, intraoperative transesophageal echocardiographic imaging plays a central role in determining the direction and distribution of flow between true and false lumens. The adequacy of true lumen perfusion may be inferred by monitoring the flow in the arch and thoracic descending aorta before and immediately after initiating cardiopulmonary bypass. Additionally, adequacy of brain perfusion may be monitored through either cerebral oximetry or transcranial Doppler assessment of the middle cerebral artery.

Cerebral Protection

Deep hypothermia and circulatory arrest at systemic temperatures between 15°C and 20°C has traditionally been the cornerstone of neuroprotection in aortic surgery. Deep hypothermia affords 20-30 minutes of safe cerebral anoxia, which is often sufficient to complete an open distal or hemiarch repair. Increased cerebral ischemic times beyond 30 minutes, without adjunct cerebral perfusion, are associated with an increased risk of neurological injury.

Retrograde cerebral perfusion through the internal jugular vein was originally proposed as an alternative means of supplying blood flow to the brain during circulatory arrest. However, concerns over ‘precrebral steal’ through collaterals and cerebral edema secondary to high-pressure flow have limited its use. Currently, the sole indication for retrograde cerebral perfusion is to flush debris and air from the brachiocephalic vessels whenever embolic events are suspected.

Selective antegrade cerebral perfusion has emerged as the preferred method of adjunct cerebral protection. Its use is made simpler through axillary or innominate cannulation, in which a clamp or occluding loop is placed at the origin of the innominate artery, thus allowing antegrade flow through the right common carotid artery at a rate of 10-15 mL/kg/min. Retrograde flow through the left carotid artery and an increase in left-sided brain oximetry as a result of this technique are suggestive of distribution of blood flow into both hemispheres. In a significant number of individuals, however, the circle of Willis is not fully developed, and uneven flow may result. In these circumstances, direct cannulation of the left carotid artery using a balloon-tipped catheter may provide more homogeneous blood supply to the brain. With most corrective aortic repair procedures being completed within 45 minutes, no clear benefit has been shown with bilateral vs unilateral antegrade techniques. Nevertheless, when systemic circulatory arrest is expected to extend beyond 45 minutes or when cerebral oximetry indicates poor perfusion to the left side of the brain after initiation of unilateral antegrade perfusion, a bilateral antegrade approach may be beneficial to further optimize cerebral perfusion.

Routine use of selective antegrade cerebral perfusion has led to a shift toward moderate hypothermia (21°C-28°C) over deep hypothermic circulatory arrest (15°C-20°C). Moderate hypothermia allows for shorter cooling and rewarming times, thereby reducing overall cardiopulmonary bypass times. In addition, it potentially reduces the incidence of severe coagulopathy and systemic inflammatory response often observed with deep hypothermia and prolonged cardiopulmonary bypass times. Reports of systematic use of moderate hypothermia with selective antegrade cerebral perfusion in acute type A dissection suggest the safety and efficacy of this strategy. However, one must consider the risk of spinal cord ischemia at warmer temperatures, especially with prolonged periods of circulatory arrest.

Management of the Aortic Root

Although the primary tear is often distal to the sinotubular junction in acute type A aortic dissections, the dissection process may extend into the aortic root to the level of the coronary ostia. The traditional approach, aimed at reducing the complexity and length of the operation, has been to replace the supracoronary aorta in conjunction with commissural resuspension (with or without separate aortic valve replacement), thus leaving the native sinuses of Valsalva intact. Although some studies suggest good freedom from late proximal reoperation using this strategy, more complete resection of sinus tissue at the time of surgical repair should be considered in particular cases.

When one or more of the sinuses of Valsalva is severely damaged by the dissection process, the patient has Marfan syndrome or other connective tissue disorder, a large root aneurysm is present, the patient has severe annuloaortic ectasia, or the valve needs to be replaced for other reasons (such as moderate-severe aortic stenosis), complete aortic root replacement with reimplantation of the coronary ostia is indicated. This may be accomplished using either a composite valve graft or a valve-sparing aortic root replacement technique, as described by Yacoub et al. and David and Feindel. When the involvement of the aortic root is limited to the noncoronary sinus of Valsalva, isolated replacement of the noncoronary sinus of Valsalva in conjunction with replacement of the tubular ascending aorta (commonly termed a “uni-Yacoub”) is a simple technique that may be adequate.

In the setting of acute aortic dissection in young patients with normal valve leaflets, valve-sparing aortic root replacement using David and Feindel’s reimplantation technique might be the optimal technique, allowing for complete removal of all diseased tissue and a lower incidence of late reintervention for aortic root or aortic valve problems. Recent evidence from experienced centres confirms that valve-sparing aortic root reconstruction can be performed in acute type A dissection with good short- and long-term outcomes.

Occasionally, the origins of the coronary arteries, in particular that of the right coronary artery, may be severely dissected to the point that direct reimplantation of one or more these ostia may be technically difficult and compromise myocardial blood flow. In these situations, direct ligation of the affected ostium in combination with one or more bypass grafts might be considered as an option.

Management of the Aortic Arch and Extent of Aortic Treatment

The optimal management of the aortic arch in an acute type A aortic dissection is highly variable and should be tailored to the patient’s clinical presentation, the anatomy of
the arch, and distal aortic anatomy. Important anatomic details to consider include the location and extent of the intimal tear, the size of the aortic arch and distal aorta, collapse of the distal true lumen, and the presence of dynamic or static obstruction of the branch vessels of the aortic arch or distal aorta.

Standard hemiarch replacement

For patients with a tear localized to the ascending aorta who have a normal-caliber aortic arch without distal malperfusion, the standard surgical repair involves a hemiarch replacement with an open distal anastomosis under circulatory arrest (Fig. 1). This repair mandates direct inspection of the aortic arch and the orifices of the arch vessels to ensure the absence of distal tears. Elimination of proximal aortic tissue up to the orifice of the innominate artery and an aggressive bevel of the lesser curvature of the arch extending distally to the level of the ligamentum arteriosum are the hallmarks of a true hemiarch repair. Unfortunately, the term has been used quite liberally over the years, and in many reports includes simple open distal anastomoses at the origin of the innominate artery, leaving ascending aortic tissue at risk of future dilatation or dissection. Although the standard hemiarch repair is often curative for dissections limited to the ascending aorta and proximal arch, this repair requires long-term—surveillance imaging in patients with more extensive arch and descending thoracic aortic involvement to ensure stability of the distal aorta, particularly during the early postoperative period. Although more limited repairs of the ascending aorta performed with the clamp in place have historically been described, these should be avoided because they do not allow for direct inspection of the arch and invariably leave a remnant of diseased ascending aorta.

Total arch replacement

The standard indications for a total arch replacement in an acute dissection include the presence of an extensive intimal tear throughout the arch and arch vessels that is not amenable to primary resection and dilatation of the arch. Although no strict size criteria for replacement have been established, we suggest that an arch with a caliber of > 45 mm should be given consideration for replacement at the time of initial repair. This, however, should be tailored to each patient based on several criteria, including clinical presentation, patient age, surgeon experience, and cannulation strategy. The island or en-bloc technique for reimplantation of the arch branch vessels is often problematic in an acute dissection because of the poor quality of the dissected tissues or the presence of a tear along the greater curvature of the arch, or both. The integrated 4-branched graft technique of Kazui et al.25 or the trifurcated or Y-graft technique proposed by Spielvogel et al.26 have become the preferred approaches for managing the supra-aortic vessels in an acute dissection. Although reimplantation or extra-anatomic bypass of the left subclavian artery is desirable, it may be ligated if it is not easily accessible as long as the left vertebral artery is not felt to be a dominant vessel based on preoperative imaging.

Beyond the arch

In addition to the standard indications for total arch and more extensive distal repairs described here, one may consider an extended distal repair to improve early and late outcomes after acute type A aortic dissection. The goals of an extended distal repair are to seal tears extending beyond the transverse arch and to improve obliteration of the false lumen of the thoracic aorta. Theoretical benefits include a reduction in early malperfusion and prevention of late distal aortic dilatation, reintervention, and mortality. Although we do not advocate wide use of this approach in patients with acute type A dissections because of its inherent risks and complexity, in centres with adequate expertise, it may be reasonable to consider an extended distal repair in the following circumstances: evidence of distal malperfusion, presence of primary intimal tear in the distal arch or descending aorta, young patients, and dilated arch or descending thoracic aorta in patients with known connective tissue disorders.

The distal anastomosis may be constructed with or without an elephant trunk (classic or frozen), depending on the size of the overall aorta as well as the size of the true lumen beyond the arch. The classic elephant trunk is facilitated by the use of a collared graft that permits tailoring of the skirt to match the
caliber of the arch as well as displacement of the distal anastomosis to a more technically facile proximal location between the left common carotid and left subclavian arteries. The frozen elephant trunk involves the deployment of a distal endovascular stent graft in the true lumen at the time of circulatory arrest. This is usually performed without direct visualization of the distal landing zone and may be done over a wire. There are multiple emerging techniques using a frozen elephant trunk for the treatment of acute type A aortic dissection that vary regarding the extent of arch replacement and the method of stent graft deployment. These techniques are depicted in Figure 2 and may be classified into 2 broad categories based on whether the stent graft is deployed through an open arch during circulatory arrest (open stent graft) or with the aid of intraoperative fluoroscopy after termination of cardiopulmonary bypass. Irrespective of whether the classic or frozen elephant trunk is used, a remnant or a delayed-onset distal aortic pathologic condition may necessitate a second-stage open or endovascular completion repair.

Prospective trials of extended aortic repair vs hemiarch replacement are currently not available. The studies that do

Figure 2. (A) Open stent graft and total arch replacement with antegrade stent graft placed in the descending thoracic aorta at time of circulatory arrest. (B) Open stent graft and hemiarch replacement with antegrade stent graft placed in the descending thoracic aorta at time of circulatory arrest. (C) Closed stent graft with hybrid arch. Proximal rerouting of arch vessels to sinotubular junction and endovascular stent graft deployment into ascending aortic graft with fluoroscopy after weaning from cardiopulmonary bypass. (D) Closed stent graft with hybrid arch replacement. Arch replaced surgically to the level of left subclavian artery and polyester proximal landing zone created for stent graft in transverse arch. Images courtesy of Dr Jehangir Appoo. Reproduced with permission.
exist are inherently small, prone to bias, and confounded by dissimilar repair techniques and heterogeneous patient populations, thus making comparisons of these techniques challenging. Table 1 presents a summary of the contemporary results of extended distal repair for type A dissection.

**Dealing with malperfusion**

End-organ malperfusion is reported in 18%-33% of patients with acute type A aortic dissections. Malperfusion may involve all major aortic branches and thus potentially result in coronary, brain, spinal cord, visceral organ, or limb ischemia. In patients with advanced age and hemodynamic instability on arrival, malperfusion constitutes one of the major risk factors for mortality in acute type A aortic dissection. A high index of suspicion for malperfusion is critical to identify it, both on clinical examination and imaging studies. This should be done before surgery and regularly thereafter to rule out signs of new-onset malperfusion, a frequent cause of perioperative mortality in patients with acute type A dissection. On physical examination, focal neurological changes, paraplegia, a distended and tender abdomen, discordant blood pressure readings, or pulseless extremities are all suggestive of malperfusion. The electrocardiogram may demonstrate signs of myocardial ischemia. The absence of arterial organ branch perfusion on preoperative computed tomographic imaging is greatly indicative of malperfusion.

Malperfusion may be described as dynamic, static, or mixed. In dynamic malperfusion, which is the most frequent type, the overpressurized false lumen pushes the septum toward the true lumen and may ultimately collapse the true lumen and obstruct the origin of one or more arterial branches. When true lumen collapse occurs above the level of the diaphragm, a pseudococartation or aortic obstruction occurs, resulting in dynamic distal organ malperfusion. Conversely, static malperfusion results from stenosis or occlusion of an organ arterial branch owing to a local process within the organ artery, such as dissection, intramural hematoma, or thrombosis.

Dynamic malperfusion is treated by resecting the primary intimal tear and redirecting the flow toward the true lumen. Static malperfusion, in contrast, will persist despite resection of the primary intimal tear and restoration of arterial flow in the true lumen. Owing to the complexity of the dissection, the site of the primary intimal tear, and the cannulation site selected, one may encounter malperfusion after initiation of cardiopulmonary bypass. Electrocardiographic tracings, cerebral saturation, upper and lower extremity blood pressure, and true lumen size on intraoperative transesophageal echocardiography should be closely monitored after initiation of cardiopulmonary bypass. In the event of significant changes, malperfusion induced by cardiopulmonary bypass flow should be suspected, the patient should be weaned from cardiopulmonary bypass if possible, and an alternative or additional arterial cannulation site should be sought. Studies suggest that perfusion through the right axillary artery offers better true lumen flow. However, an incidence of malperfusion of 3.5% has been reported in patients with right axillary cannulation, especially when the right subclavian artery is dissected.

In patients with preoperative malperfusion, restoration of organ blood flow should be assessed immediately after completion of the operation. With the widespread establishment of hybrid operating rooms, one may consider opting for a completion angiogram in such situations. It should be noted that in most instances, malperfusion resolves with removal of the intimal tear and re-establishment of the true lumen. In the event that malperfusion persists, branch stenting or extra-anatomic bypass should be considered emergently.

Management of cerebral malperfusion with clinical manifestations of stroke or coma remains controversial. Pocar et al. reported recovery of 4 of 5 patients with preoperative coma. Similarly, in 14 patients with preoperative stroke, Estrera et al. showed postoperative recovery in 8 cases. To enhance brain flow restoration in patients with common

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**Table 1. Review of publications for extended distal repair of acute type a dissection**

<table>
<thead>
<tr>
<th>Author (reference)</th>
<th>Year</th>
<th>Type of repair</th>
<th>N</th>
<th>30-day/in-hospital mortality (%)</th>
<th>Permanent stroke (%)</th>
<th>Permanent SCI (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yun et al.</td>
<td>1991</td>
<td>Total arch</td>
<td>7</td>
<td>29 NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Kazui et al.</td>
<td>2000</td>
<td>Total arch</td>
<td>70</td>
<td>16 2.9</td>
<td>1.4</td>
<td></td>
</tr>
<tr>
<td>Takahara et al.</td>
<td>2002</td>
<td>Total arch</td>
<td>37</td>
<td>8.1 0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Ohtsuki et al.</td>
<td>2002</td>
<td>Total arch</td>
<td>24</td>
<td>33.3 12.5</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>Watanuki et al.</td>
<td>2007</td>
<td>Total arch</td>
<td>54</td>
<td>3.7 5.6</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Kim et al.</td>
<td>2011</td>
<td>Total arch</td>
<td>44</td>
<td>13.4 15.9</td>
<td>2.3</td>
<td></td>
</tr>
<tr>
<td>Mizuno et al.</td>
<td>2002</td>
<td>Open stent graft and total arch</td>
<td>9</td>
<td>11.1 11.1</td>
<td>22.2</td>
<td></td>
</tr>
<tr>
<td>Tsagakis et al.</td>
<td>2010</td>
<td>Open stent graft and total arch</td>
<td>68</td>
<td>13 10</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Ma et al.</td>
<td>2013</td>
<td>Open stent graft and total arch</td>
<td>398</td>
<td>7.8 2.5</td>
<td>2.5</td>
<td></td>
</tr>
<tr>
<td>Katayama et al.</td>
<td>2015</td>
<td>Open stent graft and total arch</td>
<td>120</td>
<td>6 3</td>
<td>2</td>
<td></td>
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<tr>
<td>Roselli et al.</td>
<td>2013</td>
<td>Open stent graft and hemiarch</td>
<td>17</td>
<td>0 0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Pan et al.</td>
<td>2013</td>
<td>Open stent graft and hemiarch</td>
<td>27</td>
<td>0 0</td>
<td>0</td>
<td></td>
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<tr>
<td>Chen et al.</td>
<td>2014</td>
<td>Open stent graft and hemiarch</td>
<td>122</td>
<td>4.93 0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Preventza et al.</td>
<td>2014</td>
<td>Open stent graft and hemiarch</td>
<td>25</td>
<td>12 12</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Vallabhajosyula et al.</td>
<td>2014</td>
<td>Open stent graft and hemiarch</td>
<td>62</td>
<td>14 8</td>
<td>1</td>
<td></td>
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<tr>
<td>Dietrich et al.</td>
<td>2005</td>
<td>Closed stent graft</td>
<td>1</td>
<td>0 0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Marullo et al.</td>
<td>2010</td>
<td>Closed stent graft</td>
<td>15</td>
<td>4.2 0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Kent et al.</td>
<td>2012</td>
<td>Closed stent graft</td>
<td>1</td>
<td>0 0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Chang et al.</td>
<td>2013</td>
<td>Closed stent graft</td>
<td>21</td>
<td>4.8 0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

NA, not applicable; SCI, spinal cord ischemia.
Special Considerations

Intramural hematoma

In the ascending aorta, intramural hematomas (IMHs) result from rupture of the vasa vasorum within the outer third of the aortic media, allowing for accumulation of blood or clot, or both, within the aortic wall in the absence of an intimal defect. In most centres in North America and Europe, patients presenting with acute type A IMH are managed identically to those with acute type A aortic dissection because of the high risk of complications in these patients. The rationale behind this approach is to prevent rupture and cardiac tamponade as well as to reduce the risk of IMHs evolving into a classic aortic dissection. This approach has been challenged by some, particularly in Asia, where medical therapy is advocated for selected patients with uncomplicated acute type A IMH. If a patient with acute type A IMH is treated medically, early monitoring in the intensive care unit followed by close serial imaging studies is mandatory for the first year after the event.

Surgery in octogenarians

In the past decade, some authors have reported prohibitively high mortality rates with surgical treatment of acute type A aortic dissection in octogenarians, as well as poor functional status in survivors, prompting a debate regarding appropriateness of surgery in these patients. In contrast, several expert centres have reported excellent survival and quality of life in selected octogenarians. According to recent International Registry of Acute Aortic Dissection data, < 50% of patients > 80 years with acute type A aortic dissection are treated surgically. In the registry, mortality was significantly lower in octogenarians treated surgically compared with those managed medically. Currently, we believe that age alone is not a contraindication for surgery. These patients should be treated surgically unless shock, malperfusion, or significant comorbidities are present.

Known or suspected coronary artery disease

Patients with atherosclerotic risk factors are at higher risk for concomitant coronary artery disease. Although it may be known, in most cases it can only be suspected at the time of presentation. A preoperative coronary angiogram is not recommended because it can delay surgical intervention, but more importantly, using wires in the aorta down to the root can extend the dissection or cause entry tears, including into the coronary ostia. If a preoperative computed tomographic scan is available, the presence or absence of calcium in the coronary tree is a helpful adjunct, along with any corresponding regional wall motion abnormalities on intraoperative transesophageal echocardiography. When in doubt, concomitant coronary artery bypass grafting using saphenous vein grafts is a safe and effective approach.

Dedicated aortic teams

Although some large-volume institutions have developed special expertise and significant experience in caring for patients with diseases of the thoracic aorta that have translated into excellent surgical outcomes, acute type A aortic dissection has continued to challenge cardiovascular surgeons, with an in-hospital mortality risk still ranging from 15%-30%. Positive volume-outcome relationships have been consistently demonstrated in cardiac surgery. Two recent reports using the US Nationwide Inpatient Sample showed an inverse relationship between hospital/surgeon volume and operative mortality for patients with acute type A aortic dissection. These findings were corroborated by results from individual centres in which aortic surgery was managed by a dedicated team, thus resulting in significant improvements in early outcomes, especially in the treatment of acute type A aortic dissections. These data represent compelling evidence toward the concept of concentrating aortic surgical activity to a limited number of surgeons dedicated to the study and management of patients with aortic pathologies, which should translate into more tailored care and better outcomes. It also raises an important question about the role of air evacuation of patients with acute type A dissections to centres of expertise. Although delaying surgery to transfer the patient may put some at risk, the overall risk/benefit balance...
likely weighs in favour of more centralized care in dedicated centres.

**Conclusions**

In conclusion, although the surgical principles of acute type A dissection remain unchanged, the surgical techniques have evolved over the years and will continue to do so as endovascular technologies evolve. Although there may be some differences in specific management strategies, we, the Canadian Thoracic Aortic Collaborative, believe at this time that the outlined principles correspond to the state-of-the-art management of acute type A aortic dissections.

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**Disclosures**

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**References**


Supplementary Material
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