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SPECIAL EDITION

Controversies in Surgery for Thoracic Aorta

How should we manage type A aortic dissection?

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Abstract
The outcome of surgery for acute aortic dissection is improving, but many debates remain as to the optimal treatment. These include the necessary extent of the operation proximally and distally, as well as the use of endovascular technologies.

Keyword Aortic dissection

Introduction

The moniker acute type A aortic dissection (ATAAD) denotes the presence of an intimal tear in the ascending aorta leading to separation of the layers of the aortic wall and creation of a false channel limited either to the ascending aorta (Debakey II) or extend into the aortic arch or the descending aorta (Debakey I). Modes of death include frank rupture and hemorrhage or cardiac tamponade or due to malperfusion syndromes involving the coronary, cerebral, visceral, renal, or lower extremity vasculature. Typically time-related mortality rates are quoted as 1% per hour for the first 48 h, although these data derive form autopsy studies and, therefore, omit the small percentage of individuals who survive unrecognized dissection [1–3]. In-hospital mortality rates for patients managed medically remain high, and accordingly, surgery remains the treatment of choice for acute type A dissection. The outcomes of surgical repair of type A aortic dissection have improved over time with the International Registry of Acute Aortic Dissections (IRAD) database reporting surgical mortality for patients with ATAAD decreasing from 17.5% in the years 1996–2003, to 12.2% in 2010–2016 [4]. As our understanding of the disease process continues to evolve and new technologies emerge, debate continues regarding the optimal approach to treating this condition.

Should we operate on all patients with ATAAD?

In-hospital mortality for patients managed medically for ATAAD approaches 60% in the current era [5]. While surgery has been shown to improve outcomes for all groups of patients presenting with ATAAD, including the elderly, there may be some patients who are unsuitable for any surgical intervention, e.g., extremely frail, several other life-limiting co-morbidities, or patients who refuse surgery. After an honest and compassionate discussion with the patient and family, these patients should be treated aggressively with a strict antihypertensive regimen and effective pain control. Unless contraindicated, beta blockers must be included to provide anti-impulse therapy.

The patients most likely to survive non-operative approach are those without evidence of malperfusion, tamponade, or heart failure related to aortic regurgitation. It is often suggested that the previous cardiac surgery may provide some protection from free rupture of ATAAD, although this remains unproven. Unlike the previous reports with near fatal outcomes of these patients within the first year, a recent IRAD publication reported 3-year survival of 68% for patients who were discharged alive from the hospital after non-operative management of ATAAD [6]. This compares to a 3-year survival for patients discharged alive after an operation for ATAAD of 90.5 ± 3.9% [6].

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A particularly challenging group of patients are those presenting with cerebral malperfusion. While mortality rates in patients presenting with CVA and coma are significantly higher than patients who present without brain injury, the outcomes are still superior with surgery than with medical management. In an IRAD study, 100% patients presenting with coma and 76% of patients presenting with CVA died when they were managed medically, whereas mortality after surgical treatment was 44 and 27%, respectively [7]. Similarly, Tsukube et al. found an in-hospital mortality of 13% in patients who underwent the early surgical repair vs 67% in patients who were initially treated medically. In addition, full recovery of consciousness occurred in 79% of patients who underwent the early repair as opposed to 16% in patients initially managed medically [8]. The time interval from onset of symptoms to relief of cerebral malperfusion has been shown to be of utmost importance with the majority of patients demonstrating either improvement or stability of neurologic status if the repair is performed within 10 h of presentation [9]. Intriguingly, there was no incidence of hemorrhagic conversion of stroke noted in the above studies. In addition, the severity of stroke (NIHSS score > 11) is also predictive of lack of neurological improvement after surgery, which is significantly associated with poor long-term survival (33 ± 12 vs 84 ± 7% at 5 years) [10]. Thus, an early operation should be offered to most patients with ATAAD who present with neurological malperfusion absent complete neurological devastation, in which case expectant management may be appropriate.

What is the ideal extent of proximal and distal aortic resection for patient with ATAAD?

Traditionally, the operative strategy for repair of ATAAD is directed towards preventing or treating the immediate life-threatening complications of ascending aortic dissection (Table 1). This has led to the current paradigm of emergency ascending aortic replacement for most patients presenting with a type A dissection. Although ascending aortic replacement with resection of the primary tear site, aortic valve resuspension, and an open distal anastomosis under circulatory arrest is considered the "standard" operation for an acute type dissection, there are circumstances when the patients may require (or benefit) from a more aggressive proximal or distal reconstruction.

Table 1 Acute causes of death from a type A dissection

Anatomic complication	Treatment strategy
Cardiac tamponade	Emergent surgery
Free rupture of aorta	Aortic replacement
Coronary malperfusion	Aortic root repair
Acute severe aortic regurgitation	Restoration of aortic valve competency

What can we agree on?

Most surgeons agree that an aortic root reconstruction or extended arch replacement is indicated when the intimal tear extends into the root or the arch, or if the aorta is frankly aneurysmal (> 4.5 cm) at the time of the operation for ATAAD. In addition, root replacement is also indicated in the presence of a known connective tissue disorder such as Marfan's syndrome.

Proximal extent of operation

In general, a more aggressive approach to both proximal and distal extent of repair in Marfan patients is likely justified. In a study from the IRAD database, in-hospital mortality after ATAAD in patients with Marfan's Syndrome was similar to the patients without Marfan's syndrome (13.9 vs 16.6%, $p = 0.265$) and 5-year survival in the two groups was also similar, although the patients with Marfan's syndrome were much younger (38.2 ± 13.2 years) as compared to patients without (63 ± 14 years). In addition, freedom from reintervention at 5-year follow-up after hospital discharge due to either ATAAD or acute type B dissection is much lower in patients with Marfan's syndrome (44.7%) as compared to general population (81.5%) [11]. In a more detailed study of subsequent need for proximal and distal reintervention after ATAAD in Marfan's patients, Rylski et al. reported a much lower freedom from proximal reintervention after supracoronary aortic replacement (60 ± 13%) than after a Bentall or Valve sparing root replacement (88 ± 5%) at 10-year follow-up. At 20 years, only 20 ± 16% pf patients were free from proximal reintervention [12]. In patients who presented with Debakey I dissection, freedom from descending aortic replacement was 65 ± 8, 80 ± 10% in patients who presented with a Debakey II dissection at 10-year follow-up. In addition to being a risk factor for requiring reinterventions, the presence of Marfan's syndrome has also been found to be an independent predictor of occurrence of recurrent aortic dissections (hazard ratio of 8.6; 95% CI 5.8–12.8) [13].

In most cases of ATAAD, however, the aortic root does not require reconstruction. The aortic valve can be resuspended in approximately 60–80% of the patients [14–16]. Limited replacement of the non-coronary sinus can be performed if the entry tear does not extend to the left or the right coronary sinus. Coronary artery grafting may be necessary if it is not possible to reconstruct the coronary buttons. Aortic valve replacement may be required if there is primary valvular pathology. The prosthetic choice for aortic valve replacement in this setting has not been extensively studied; however, the decision-making is generally guided by the same principles as during elective aortic valve replacement, with mechanical prosthesis being favored for younger patients and bioprosthetic valves for older patients or those with co-morbidities. The presence of a bicuspid aortic valve does not mandate aortic valve replacement if the valve is functionally normal. In a comparison study of BAV patients that either underwent valve resuspension or valve replacement for ATAAD, Rylski et al. reported similar in-hospital mortality (15.4 vs 15.1%) and long-term survival rates (68 vs 65% at 5 years and 54 vs 51% at 10 years) between the two groups, respectively. There were no valve-related reoperations in the resuspension group at a median follow-up of 5 years [17].

Recently, the results of valve sparing root replacement (VSRR) during repair of acute aortic dissection have been reported. Leshnower et al. [18] reported in-hospital mortality and stroke rate of 4.7% each for 43 patients who underwent David V VSRR for ATAAD. At a mean follow-up of 40 months, freedom from 2 + AI was 94%, and freedom for AVR was 100%. Yang et al. [19] reported a mortality rate of 3% and a 10-year survival of 98% at 10 years in 40 patients who underwent a David-type VSRR for aortic dissection. The largest series of VSRR for aortic dissection was recently reported by Beckmann et al. [20] comprising of 109 patients who underwent David I procedure for aortic dissection over a period of 22 years. The authors reported in-hospital mortality rate of 11% and an aortic valve-related reoperation rate of 13% over a mean follow-up of 8.3 years. It should be noted that these series comprise of relatively small number of carefully selected patients. In all these studies, VSRR was performed in only 7–14% of all patients who presented with type A aortic dissection [18–20]. These studies demonstrate that VSRR can be safely performed in a select group of patients with acceptable mid-to-long-term results. Careful patient selection is key and VSRR should be avoided in older, unstable patients or patients with malperfusion where prolonged cross-clamp times can be detrimental. These operations can be technically challenging and time-consuming, and should preferably be performed by surgeons who are experienced at performing this operation in the elective setting.

Distal extent of operation

While an open distal anastomosis proximal to the innominate artery is generally accepted as the standard of care, most surgeons would agree that a more aggressive partial or total arch replacement is reasonable in patients with connective tissue disorder cases, or if the arch is aneurysmal. Aortic arch replacement also becomes technically necessary when the intimal tear extends on to the greater curvature of the aortic arch. There is more debate recently regarding the appropriate distal extent of resection for a patient with acute Debakey I dissection even in the absence of these scenarios. Arguments center around the incidence of late distal reoperations for residual aortic disease. Residual dissections can evolve into complex aneurysms of the aortic arch and the descending aorta (Fig. 1). There are three issues to be considered as we try to answer this question: (1) What is the rate of the distal reoperations in patients after hemiarch repair, and does a more aggressive operation reduce that risk? (2) Does a more extensive operation add morbidity and mortality to an already complex operation? (3) What is the operative risk associated with distal reoperation late after a hemiarch operation?

The fate of the distal aorta: what is the reintervention rate?

Long-term mortality rate is higher among survivors of type A dissection repair as compared to normal population, with aortic events accounting for significant numbers of those deaths [21]. Accordingly, a focus on the residual aorta is appropriate. Omura et al. [22] reported a much lower freedom from distal “aortic event” rate after a hemiarch or partial repair (64 ± 8%) as compared to total arch replacement (92 ± 5%) at 10 years. The definition of “aortic event” in this study, however, included aortic arch diameter of > 5 cm in addition to distal reinterventions. Freedom from surgery on the distal aorta was 92 ± 5% in the total arch group vs and 83 ± 5% in the partial arch group, which was not statistically significant ($p = 0.2$). Rylski et al. [23] reported a freedom from distal aortic reintervention of 89, 97, and 100% ($p = 0.44$) at 5 years in patients undergoing isolated ascending, hemiarch, or a total arch replacement, respectively, for acute type A dissection, and Geirsson et al. [24] reported a freedom from reoperation of 76% at 10 years after surgery for type A dissection. In a publication from the IRAD database comparing 907 patients who underwent ascending aortic or hemiarch replacement compared with 334 patients who underwent an extended aortic arch replacement, freedom of death, aortic rupture, and reintervention rate were 71% in the ascending/hemiarch group and 76% in extended arch group ($p = 0.54$) at 5 years [25]. Furthermore, In a recent meta-analysis of over 2000 patients comparing hemiarch vs total arch replacement for ATAAD, there was no significant difference between the two groups in terms of aortic reintervention or freedom from aortic reoperation [26]. These data suggest that although the distal aortic reintervention

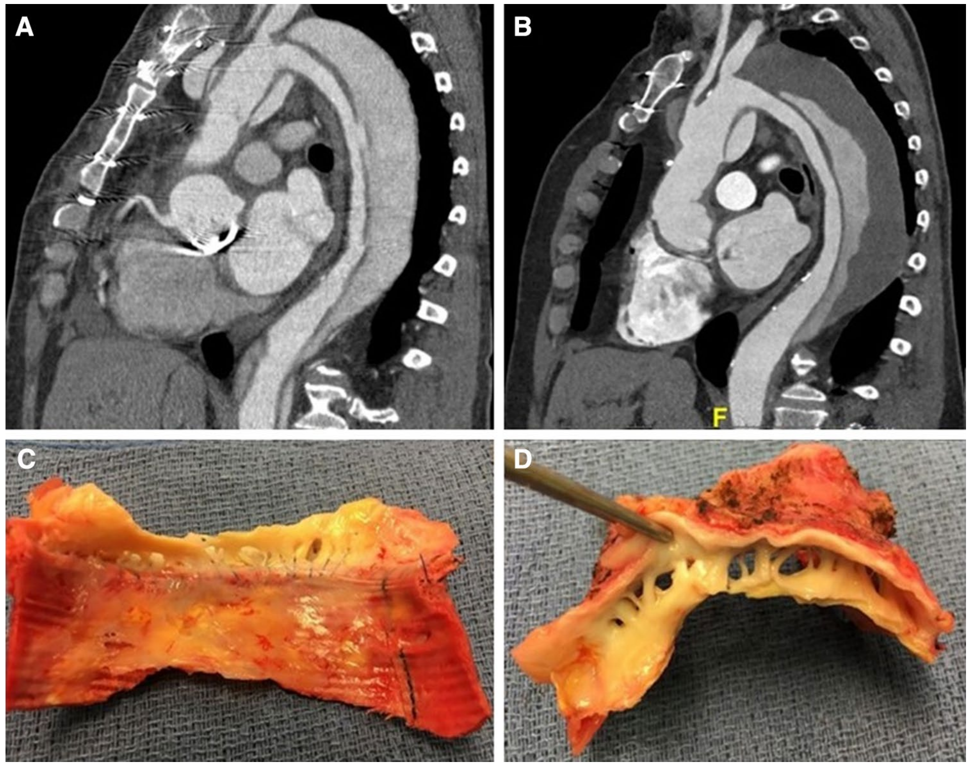

Fig. 1 **a** Residual aortic dissection with false lumen flow 3 months s/p aortic root replacement and hemiarch replacement for acute type A dissection. **b** Aneurysmal degeneration of the descending aorta 6 years s/p repair. **c, d** Multiple fenestrations are seen at the site of the hemiarch anastomosis leading to antegrade false lumen perfusion

rate may be as high as approximately 40% after repair of ATAAD, it is unclear if a more aggressive arch replacement modifies that risk. The data regarding impact on long-term mortality risk are unclear, as well. Thus, a universal approach of total aortic arch replacement for every ATAAD may be unwarranted. Identification of patients at risk for late aortic degeneration will allow for a more targeted approach for performing extended operations for patients where it may be beneficial to do so, while avoiding them in the majority of patients where it may be unnecessary.

Risk of mortality for hemiarch vs. total arch

The data regarding risk of additional mortality conferred by a more extensive operation are mixed. While some authors have reported a higher mortality risk with total arch replacement as compared to hemiarch replacement [23, 27], there was no significant difference in mortality in reports from both the IRAD and GERAADA registries [25, 28]. Higher rate of postoperative renal failure, pneumonia, and neurological complications have been reported after total arch replacement in some studies [26, 27]. There is no doubt that total aortic arch replacement is a more technically demanding operation requiring more technical expertise and longer cardiopulmonary bypass and cross-clamp times. Patient selection probably played a key role in obtaining similar mortality outcomes in patients undergoing total arch replacement for ATAAD. Surgeon experience is also critical in making these decisions, and even at centers that avidly support aggressive arch replacements, these operations are only performed by a select group of aortic surgeons [29].

Outcomes after late distal reoperations for patients with ATAAD

Several authors have reported the outcomes of reoperations after the previous repair of ATAAD with most series reporting risk of mortality of 0–12%, although mortality rate as high as 31% has been reported [21–24, 30–32]. Roselli et al. [32] reported a stroke rate of 4.6 and 5.1% risk of renal failure requiring dialysis among 305 patients requiring distal aortic replacement after previous ATAAD repair. Kimura et al. [30] reported no in-hospital mortality, stroke, or spinal cord ischemia in 43 distal reoperations. In most series, majority of the reoperations were performed electively, and the risk of mortality is lower than when the reoperations are performed in the urgent or emergency setting [23, 30, 31]. These data underscore the need for continued follow-up of patients after ATAAD repair to detect aortic growth, and to recommend the early, elective intervention.

Role of the patent false lumen after repair and the impact of the frozen elephant trunk

One of the factors that has been shown to impact distal aortic remodeling and rate of aortic growth after proximal repair of Debakey type I ATAAD is the status of residual false lumen flow in the descending aorta. Patients with a patent false lumen have been shown to have a faster growth rate of the residual aorta [33–35]. Patency of the false lumen also negatively impacts patient survival and freedom from retreatment [30, 36]. Addition of the frozen elephant trunk (FET) to the total aortic arch replacement (TAR) has been advocated by some surgeons to induce false lumen thrombosis in the distal aorta. Shrestha et al. [37] reported a 30 day mortality rate of 13% in 52 patients who underwent a TAR with FET for ATAAD. There was an associated learning curve with mortality rates improving from 20% in first part of their series to 0% in the latter part of their series. Spinal cord ischemia rate was 4%. The same authors also reported stable total aortic diameter in the stented aortic segment and progressive increase in true lumen diameter and decrease in false lumen diameter with false lumen thrombosis rate of 100% in the stented aorta at 2 years of follow-up. Increase in true lumen diameter and decrease in false lumen diameter were also noted in the unstented distal aorta in the supraceliac portion. Ma et al. [38] reported an early mortality of 7.8%, stroke rate of 2.5%, and spinal cord injury rate of 2.5% in 398 patients who underwent TAR with FET for ATAAD. A recent meta-analysis of 1279 patients who underwent TAR with FET reported the early mortality rate of 9.2%, stroke rate of 4.8%, and spinal cord injury rate of 3.5%. False lumen thrombosis rate was noted to be 96.8% and reintervention rate was 9.6% [39]. Uchida et al. [40] demonstrated 5 year survival of 95% after FET as compared to 69% after ascending or aortic hemiarch replacement. Freedom from distal aortic events was 88% in the FET group vs 70% ($p = 0.02$) in the hemiarch group. Based on these data, a case could be made for an aggressive initial operation in patients that have features that may predict a persistent false lumen after hemiarch repair, such as a large fenestration in the proximal descending aorta or a very compressed true lumen. However, caution must be exercised, and the small but real risk of spinal cord ischemia associated with FET must be kept in mind.

What about distal malperfusion?

Malperfusion The presence of preoperative malperfusion syndromes is associated with worse postoperative outcomes. Several studies have demonstrated significantly higher mortality rates in the presence of malperfusion as compared to patients without malperfusion [28, 41, 42]. Visceral malperfusion in the setting of ATAAD presents a formidable challenge. The results with operative repair in these patients have been associated with mortality rates exceeding 40% [7, 43]. Several alternate approaches have been reported in attempts to reduce the high mortality seen in this patient population. The group at University of Michigan [44] has adopted the strategy of percutaneous fenestration or branch vessel stenting prior to surgical replacement of the ascending aorta in patients with peripheral malperfusion. In their study of 70 patients treated with this approach, 23 (33%) patients died prior to central aortic repair. In the 47 patients that survived to aortic replacement, mortality rate was similar to patients who presented without malperfusion and underwent standard surgical repair. In a different approach to patients with malperfusion, Vallabhajosyula et al. [45] demonstrated lower in-hospital mortality in patients who presented with multi-organ malperfusion and underwent antegrade TEVAR in addition to central aortic repair (58 vs 27%, $p = 0.05$). The 5-year survival was improved in this group of patients with addition of TEVAR to central aortic repair (68 vs 32%, $p = 0.03$). An alternate approach is to perform these operations in the hybrid operating room (Fig. 2), and evaluate and treat any residual malperfusion prior to leaving the operating room. Using this approach, Tsagakis et al. [46] reported in-hospital mortality of 25% in patients with visceral malperfusion that underwent endovascular repair in the hybrid operating room as opposed to 75% in patients that did not. Leshnower [47] reported successful outcome of a “TEVAR first” approach in two patients that presented with a significant malperfusion that were treated with TEVAR to reexpand the true lumen and to relieve the metabolic insult caused by malperfusion. These patients were then closely monitored and were operated on when the acidosis had resolved. All these reports comprise of small number of patients, and there is no clear indication regarding relative superiority of these techniques and treatment of ATAAD with visceral malperfusion remains an area of active investigation.

Operative strategies for extended aortic arch reconstruction in ATAAD

Several different operative strategies have been described to address the aortic arch in the setting of type A aortic dissection [48]. These are designed either for immediate treatment of patient’s condition (such as malperfusion) or for delayed benefit in terms of positive distal aortic remodeling. In addition to having the possible advantage of reducing the distal reoperation rate, some of these strategies also facilitate the distal operation, in case one

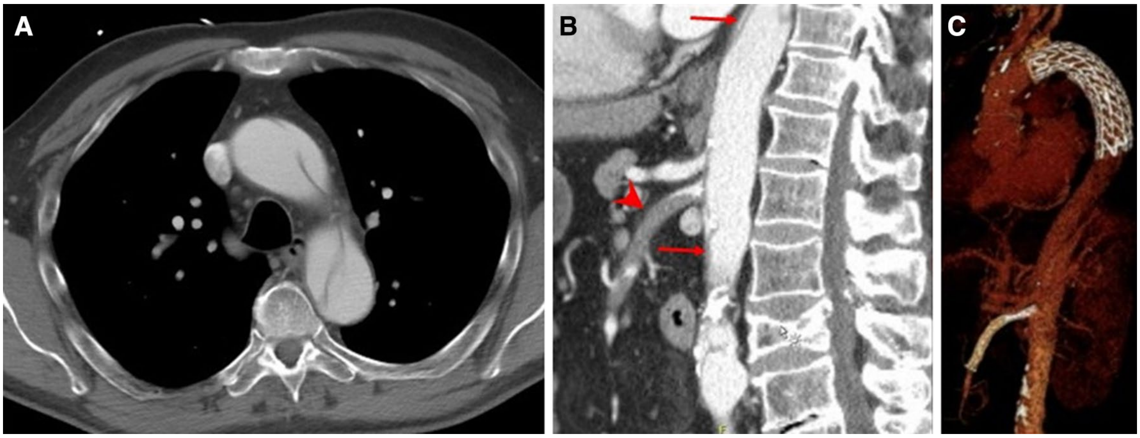

Fig. 2 Patient with Debakey I dissection (**a**) with severe true lumen compression in the descending aorta (arrows) with SMA malperfusion (arrowhead) (**b**). This patient was operated on in the hybrid OR (**c**) and underwent total arch replacement with frozen elephant trunk. After weaning off cardiopulmonary bypass, visceral vessel flow was evaluated with intravascular ultrasound and angiography. Additional SMA and right renal artery stenting was performed due to continued compromised flow

is needed. Some of the described strategies for extended aortic arch replacement are:

1. *Total aortic arch replacement ± standard elephant trunk* The rationale for performing total aortic arch replacement has been discussed above. Addition of the classic elephant trunk is not likely to provide any additional benefit in the immediate term, but can facilitate a subsequent descending aortic replacement, if necessary by shifting the operative field to the mid descending aorta, making it easier to access. The elephant trunk portion of the graft operation also provides a robust proximal landing zone for endovascular stent grafts.
2. *Total aortic arch replacement with Antegrade TEVAR (Frozen elephant trunk)* Compared to classic elephant trunk, an FET has the advantage of treating (covering) any fenestrations in the proximal descending aorta. FET has been shown to reexpand the true lumen and promote false lumen thrombosis. FET also facilitates subsequent operations, especially with endovascular approaches as it is much simpler to cannulate the stented graft with wires and catheters due to full expansion of the FET and easy visibility under fluoroscopy.
3. *Hemiarch replacement with antegrade TEVAR during circulatory arrest* This approach has the advantage of making the initial operation much simpler as compared to the two approaches above, and reducing the duration of circulatory arrest, while still providing the remodeling benefits associated with the deployment of the stent graft in the descending aorta. The disadvantage is that it leaves the aortic arch partially untreated, and susceptible to dilation in the future. There is also a possibility of developing a proximal endoleak, although this can be prevented by placing transfixing sutures circumferentially securing the TEVAR graft to the aortic wall.
4. *Total arch replacement with TEVAR after weaning from CPB* In this approach, the aortic arch is replaced with reimplantation of all the supra-aortic branches. However, an adequate landing zone is created in the aortic graft distal to the attachment of the arch vessels. The TEVAR graft is then deployed at the same operation after the patient is rewarmed and separated from bypass, or in a delayed fashion. The advantage is that fluoroscopy and angiography can be used to confirm the extent of coverage and suitability of distal landing zone.
5. *Partial (2/3rd) aortic arch replacement with creation of a zone II landing zone* In this strategy, the innominate and the left carotid arteries are reimplanted, and the distal aortic anastomosis is carried out proximal to the left subclavian artery (left in situ). Care is taken to ensure adequate length (> 2–3 cm) of graft between the take-off of the left carotid artery and the aortic anastomosis to provide a secure landing zone for a TEVAR graft in the future. In case distal aortic reintervention becomes necessary, it can be performed endovascularly by either performing a left carotid subclavian bypass, or using a branched arch endograft. The advantage of this technique is simplification of the initial operation and the possibility of monitoring these patients after their repair. Subsequent procedures can then be targeted to patients that demonstrate degeneration of their distal aorta.

What operation does this patient need tonight?

To summarize, when deciding upon the distal extent of aortic repair for patient with acute aortic dissection, attempt should be made to place the patient into one of the following three categories:

1. Is the arch aneurysmal, or does the primary tear extend into the aortic arch, or does the patient have a connective tissue disease like Marfan's syndrome? In this scenario, a more aggressive aortic arch replacement is justified.
2. Does the patient have signs of visceral malperfusion? If so, then a more aggressive treatment of the distal aorta is mandated with a focus on treatment of the malperfusion. This can be addressed either with a more aggressive aortic arch replacement, reexpansion of the true lumen in the descending aorta, or direct visceral branch stenting. In critically ill patients, consideration must be given to correction of malperfusion either prior to or simultaneously with central aortic repair.
3. In the absence of the above two conditions, the goal of a more aggressive treatment of the aortic arch is to effect distal aortic remodeling and decrease the rate of aortic reinterventions in the future. These patients should be carefully selected as they have the most to lose. As we have discussed above, the rate of distal aortic reintervention, although significant, is not universal. Majority of patients do not require an aortic reintervention, especially if false lumen thrombosis occurs. Not only these operations are complex, and more time-consuming, they also expose the patient to a small, but real risk of paraplegia. It requires thoughtful decision-making before exposing these patients to immediate increased risk for an uncertain benefit in the future. In this scenario, aggressive operations are probably best reserved for young patients, who are, otherwise, hemodynamically and metabolically stable, and have anatomic features that will predispose them to a higher chance of aneurysmal degeneration of distal aorta, such as a large fenestration in the proximal descending aorta, severely compressed true lumen, or increased total aortic diameter. Staging operations that would facilitate endovascular treatment of the descending aorta can also be considered.

If the patient does not fit into any of the above three clinical scenarios, then the patient is probably best served with an aggressive hemiarch under hypothermic circulatory arrest. It must be acknowledged that although congruent with the EACTS vascular domain position paper on this topic, these recommendations are only supported by weak data (Class of recommendation IIa or IIb, level of evidence C) [49]. No matter what the initial strategy is adopted, it is critical that all patients with repair of aortic dissection are followed longitudinally to monitor aortic growth, so that an intervention can be planned electively if needed. As discussed above, most patients can safely undergo a distal reintervention in the elective setting at a center that specializes in aortic surgery.

Endovascular management of type A

Open surgery remains the mainstay of treatment for acute type A aortic dissection and should be offered to most patients, including the elderly. However, there are some patients in which surgical treatment may be deemed extremely high risk or futile. Endovascular treatment approaches have been applied to a small number of these patients at select centers. The data from these treatments are limited to case report and small series [50–52]. The application of endovascular therapies for the ascending aorta is currently limited by anatomical and technical challenges posed by the dynamic nature of the ascending aorta and proximity of vital structures to the intended landing zones (aortic valve, coronary arteries, and supra-aortic branches) and lack of specially designed endografts to address these issues.

Centralized care for type A

Acute aortic dissection is a complex problem and sharp surgical acumen, and decision-making is necessary to obtain a desirable outcome. Studies of volume-outcome relationship for treatment of ATAAD demonstrate better outcomes for patients treated at high-volume centers and by high-volume surgeons [53, 54]. Anderson et al. reported a decrease in 30-day/in-hospital mortality from 33.9 to 7.7% after institution of an acute aortic dissection team with only select surgeons performing these operations [55]. However, centralization of care for this emergent problem poses its own sets of challenges. The advantage of reduction in mortality with care being provided at an aortic center must be balanced with the risk of mortality due to the delay in treatment associated with the transfer. Establishment of regional care models and standardized care protocols has been shown to decrease the time from symptom onset to diagnosis and from diagnosis to surgical treatment [56]. Dedicated transfer protocols and outreach programs to referring centers that can expedite patient transfer may provide the best solution to provide ideal care for the patient.

Conclusion

Acute type A dissection remains a daunting clinical problem with a significant rate of associated morbidity and mortality. The operation must cater to the emergent need of the patient, but must also be guided by the available surgical expertise and logistical institutional constraints. While extended operations may be necessary in some clinical scenarios (extension of intimal tear, aneurysmal aorta, or presence of connective tissue disorder), a "standard" repair may be best for other patients. Malperfusion must be treated aggressively. It must be remembered that the ultimate goal of surgical intervention for patients with acute type A aortic dissection is an alive patient.

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