Advances in surgery for acute type a aortic dissection
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Chapter 1

GENERAL INTRODUCTION
Definition

Acute type A aortic dissection is one of the most lethal events affecting the thoracic aorta. An aortic dissection is characterized by separation of the inner and outer layer of the media in a course parallel to that of the flow of blood. The separation starts suddenly, when blood leaves the normal aortic channel through an intimal tear which acts as a point of entry, and produces a false channel. Patients are considered to have an acute type A aortic dissection when the process is less than 14 days old and when the ascending aorta or aortic arch are involved in the dissecting process, irrespective of the site of the primary tear or distal extension of the dissection.

History

The first clinical description of acute aortic dissection was by Morgagni more than 200 years ago [1]. Laennec introduced the term dissecting aneurysm in 1826.

Surgical approaches have only been initiated in the last 50 years when cardiopulmonary bypass became available. Bahnson and Spencer proposed the operative procedure, which is carried out today, in 1960 [2].

The first successful repair of acute ascending aortic dissection with aortic incompetence was reported by Morris and colleagues in Houston in 1963 [3]. Subsequently, management strategies and techniques have steadily evolved. Similarly, diagnostic imaging modalities like computed tomography scanning, transesophageal echocardiography and magnetic resonance imaging were developed and used. A major contribution to the modern treatment of aortic dissections has been made by Debakey, who devised a commonly used classification of aortic dissections [4].
The classification of dissections of the aorta is based on the anatomic location and extent of the disease. Initially the DeBakey’s classification (Figure 1) was generally accepted, who differentiated between dissections involving the ascending aorta with involvement of the aortic arch (DeBakey type I) or without involvement of the aortic arch (DeBakey type II). Involvement of only the descending aorta was called DeBakey type III [4]. This classification seemed logical in terms of operative difficulty and risk. Nowadays the classification according to the Stanford group (Figure 1) is more practically and clinically used because they have focused on the fundamental prognostic difference of a dissection with involvement of the ascending aorta (Stanford type A), which was
considered an indication for emergency surgical intervention, and a dissection beyond the origin of the left subclavian artery (Stanford type B), requiring surgery only under special circumstances [5]. Besides those two worldwide best-known classifications, several other authors have proposed different, adapted classifications. However, those alternative classifications, based on the nature or location of the intimal tear [6,7] and distal or retrograde extension of the dissection [8], have not influenced surgical treatment decisions and therefore they have never been well accepted.

Incidence and natural history

Acute type A dissection occurs at least two times more often in men than in women. It affects individuals of all ages but most patients presenting with an acute type A dissection are between 50-55 years of age [4,9]. Dissection in patients younger than 40 years of age is usually associated with the Marfan syndrome, bicuspid aortic valve, coarctation of the aorta or pregnancy. The overall incidence of this disease is estimated by several authors to be 5-20 per million population [6,10].

The prognosis of untreated dissections of the proximal aorta is extremely poor. The largest collective review ever published of 963 patients with untreated aortic dissection showed a 50% mortality within the first 48 hours. At 1 month 84% died, at 3 months 90% and within the first year 92% died. After 9 years all patients were dead, most of them due to rupture of their affected aorta [11]. These findings are confirmed by the results of several other autopsy series of other authors, yielding a hourly mortality rate ranging from 1 to 2% [12,13,14]. Most patients die acutely from false channel rupture with consequent hemopericardium, hemomediastinum or hemothorax. Later in the early period, patients may die from delayed rupture or organ dysfunction secondary to arterial occlusion.

Because of this severe prognosis and the time critical aspect of this disease without treatment, the importance of early diagnosis and prompt therapy can not be overemphasized.
Preoperative evaluation and management

Rapid accurate diagnosis of acute type A aortic dissection, recognition of complications and the ability to plan appropriate surgical therapy are crucial for life saving patient management. Transesophageal echocardiography has emerged as an excellent tool for rapid and accurate diagnosis of acute type A aortic dissection and is currently the diagnostic method of choice. This in addition to transthoracic echocardiography, computed tomography, aortography and magnetic resonance imaging in patients who are hemodynamically stable. In appropriate hands it reliably diagnoses dissection, determines entrance points, identifies branch vessel compromise, assesses function and morphology of the aortic valve, the diameter of the aortic root and the presence of pericardial fluid or tamponade. Its value as a screening tool in patients presenting with symptoms suggestive of aortic dissection has been clearly demonstrated [15,16]. If the lesion is not seen on echocardiography but the history is strongly suggestive, additional testing in the form of magnetic resonance imaging or a contrast-base modality will yield the diagnosis in about 98% of instances, as long as the patient is in a hemodynamically stable condition. Contrary to general recommendations for its presentation the majority of patients with aortic dissection have less than classic presentations. This means that a high index of suspicion is necessary, and imaging procedures are essential to detect patients with this disease. Only 20% of patients who present with a classic “tearing” pain as an initial symptom are diagnosed with an acute type A aortic dissection. Such is the highly variable clinical presentation of the disease. The majority present with symptoms more consistent with myocardial ischemia or non cardiac illness [17].

New neurologic deficits may present as a result of a malperfusion syndrome due to a dissecting process involving one or more of the aortic arch vessels. Acute cerebrovascular occlusion occurs in less than 20% of patients with acute type A aortic dissection [18]. A stroke may recover if relief of the occlusion occurs, but then reperfusion may result in intracerebral hemorrhage, swelling, cerebral injury, coma and/or brain death.

A severe form of malperfusion syndrome, due to an extensive aortic dissection with most or all of the distal aorta involved, may lead to acute obstruction of the aorta and limbs. Despite a poor clinical picture of these patients at presentation, prompt surgical intervention on the proximal aorta, restoring the perfusion to the distal aorta, can lead to a complete recovery.
Once the diagnosis has been established, and following aggressive pain control and initial treatment with agents that lower blood pressure and diminish contractility (beta-blockers in combination with intravenous nitroprusside), immediate operation is indicated in order to prevent the expected sequelae of rupture with cardiac tamponade, acute aortic regurgitation caused by loss of commissural suspension, myocardial infarction caused by coronary artery involvement, or extension of the dissection. Unless, of course, overwhelming pathologic situations are present that would contraindicate life-saving surgery, such as advanced malignancy or chronic dementia. The goal of operation is to remove the internal tear and affected portions of the aorta with a synthetic or occasionally, a biological graft. Although still debated, it is generally thought that initial femoral cannulation for cardiopulmonary bypass, opening of the aorta with inspection of the distal aorta for extension of the tear, correction of the distal problem with conversion to antegrade perfusion is an important early surgical strategy. The more complex component of decision-making relates to the management of aortic insufficiency and tears in the vicinity of the subcoronary portion of the aorta. This requires considerable decision-making and skillful surgery to provide the patient with a customized repair for the current problem that will ensure success for the future. Also, controversy exists as to the best surgical treatment and cerebral protection for acute dissections that originate or involve the transverse arch.

Postoperative care

Despite redirecting blood flow into the true lumen proximally, up to 75% of patients maintain patency of the false lumen due to distal reentry tears. Consequently, after proximal aortic repair, patients are left with the equivalent of an acute distal aortic dissection and are at risk for rupture and ischemic complications. These patients, therefore, require continuation of management of left ventricular ejection force and blood pressure. This means that beta-blockade is resumed postoperatively and fluid management is minimized. Postdissection aneurysm rupture is the leading cause of late death after repair of aortic dissections [4]. Therefore, the patients must be followed lifelong with CT scans or MRI at certain time intervals if they have persistent false lumen to detect dilatation of the diseased aorta. These patients should be on a betablocker permanently.
Chapter 1

Aim and outline of the thesis

From 1974 to 2002, more than 300 patients underwent surgical treatment for acute type A aortic dissection at the department of cardiothoracic surgery of the St. Antonius Hospital, Nieuwegein. Recent improvements in early mortality and morbidity have resulted from more expeditious diagnosis and surgical treatment, improved perioperative care and advances in surgical techniques. However, operative mortality and morbidity remain still substantial. The aim of this thesis was to summarize and to evaluate the operative results, to estimate the influence of preoperative and operation-related variables on outcome, to assess the benefits of various surgical modalities and to examine long-term postoperative aorta- and surgery-related events.

Chapter 2 reviews our experience of surgical management of 252 patients over a 25-year period, in order to assess the determinants of operative mortality and morbidity after surgery for acute type A aortic dissection.

Chapter 3 investigates our experience in the surgical management of patients with acute type A aortic dissection over a 27-year period, with special emphasis on long-term outcome and modalities of late death.

Chapter 4 reports the development of a scoring system to predict operative mortality for individual patients with acute type A aortic dissection.

Chapter 5 studies the durability of aortic valve preservation and root reconstruction in 121 patients with type A aortic dissection and involvement of the aortic root.

Chapter 6 focuses on 122 patients undergoing surgery for acute type A aortic dissection with the aid of antegrade selective cerebral perfusion and moderate hypothermic circulatory arrest and determines the risk factors associated with hospital mortality and adverse neurologic outcome.

Chapter 7 reports our experience with surgery for acute type A aortic dissection with involvement of the aortic arch and determines the influence of arch replacement on operative mortality and morbidity, and long-term outcome.

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Chapter 8 describes four patients with acute type A aortic dissection who illustrate the aspecific initial presentation and importance of recognizing and treatment of lower limb ischemia as a first symptom of this disease.

Chapter 9 presents the endovascular treatment of a patient with lower extremity malperfusion due to acute aortic dissection.

Chapter 10 elaborates upon the aforementioned studies.
References


