Summary

This thesis focuses on the surgical treatment of acute type A aortic dissection, a catastrophic disease that remains difficult to treat.

During the past years, several therapeutic and diagnostic advances have been introduced to improve the treatment outcomes. These include deep hypothermic circulatory arrest (DHCA), open distal anastomosis, aortic root reconstruction, and antegrade selective cerebral perfusion (ASCP). However, despite these advances, perioperative mortality and morbidity remain considerably high. This thesis examines our results managing patients with acute type A dissection with special emphasis on the management of aortic root dissection, aortic arch dissection, cerebral protection, and lower extremity malperfusion.

Chapter 1 gives the definition of acute type A aortic dissection and provides a general introduction to this thesis.

Chapter 2 is an analysis of the short-term results of 252 consecutive patients operated on for acute type A aortic dissection between 1974 and 1999. The determinants of operative mortality were studied using multivariate statistical methods to predict the individual risk. Operative mortality was 25%. Iatrogenic dissections, cardiopulmonary resuscitation and extended extracorporeal circulation times were associated with increased operative mortality. Patients with iatrogenic dissections were frequently intubated and sedated which might cause a delay between onset of symptoms and diagnosis. Prompt surgical treatment might prevent cardiogenic shock and cardiopulmonary resuscitation. The aortic valve should be preserved if morphologically normal and without a dilated annulus, however the use of an aortic valve prosthesis or Bentall procedure when applicable seemed to benefit early survival, perhaps because they prevent from prolonging extracorporeal circulation time and proximal anastomosis bleeding or secondary repair after unsuccessful aortic valve resuspension. Additionally postoperative neurological events were studied. Avoiding the appliance of an aortic cross-clamp and using antegrade selective cerebral perfusion seemed to benefit neurological outcome. We advocate an open distal technique using DHCA if the arrest time is anticipated to be less than 30 minutes, otherwise ASCP should be used. Clamping of the aorta is avoided but might be safely applied if bilateral radial artery pressure, electro-encephalogram and bilateral transcranial doppler monitoring are
available. The clamping zone should always be excised.

Chapter 3 gives an overview of 27-years experience with surgery for acute type A aortic dissection. Between 1974 until 2001, 243 survivors of surgical treatment were followed. Total cumulative follow-up was 1292 patient-years with a median of 4.4 years. Median survival time was 16.0 years. The long-term results of those patients were acceptable. Survival after 20 years was 39.4% and freedom from cardiovascular reoperation was 41.9%. The incidence of stroke after 20 years was 3.8%. Advanced patients age at initial surgery and postoperative hemodialysis influenced the survival. The multiple changes in operative techniques, methods of perfusion and cerebral protection did not substantially change the long-term results. Any reduction of late mortality rate in patients who survived surgery for acute type A dissection, therefore, might come from close surveillance of the aorta, treatment with beta-blockers, and earlier recognition of risk factors such as hypertension and aortic dilatation, followed by elective operation with lower mortality and morbidity.

Chapter 4 evaluates the multivariate preoperative risk analysis, intended to, retrospectively, assess the relationship between preoperative risk factors and operative mortality. Based on the developed logistic regression model, the individual chances of operative mortality can be predicted by using the permutations iatrogenic dissection, cardiopulmonary resuscitation and drained pericardial tamponade. The latter seemed to benefit survival. Adequate circulation improves survival, therefore prompt surgery should prevent hemodynamic deterioration resulting from pericardial tamponade, but it must be conceded that draining pericardial tamponade before surgery might be faster and more effective.

Chapter 5 is an analysis of the results of aortic valve preservation during surgical intervention for acute type A aortic dissection with involvement of the aortic root. From 1976 to 1999, 121 patients were operated with various techniques for aortic root reconstruction and followed for a mean of almost 4 years. Ten percent of the patient population underwent aortic valve replacement during follow-up but only one was due to intrinsic aortic valve pathology. Nine reoperations were due to aortic root dilatation. The use of fibrinous glue for aortic root reconstruction and the presence of an aortic valve annulus more than 27 mm were associated with a statistically significant higher incidence of aortic root operation. There was a trend
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towards better durability using GRF-glue over Teflon felt for aortic root reconstruction.

Chapter 6 reports on the results of 122 consecutive patients who underwent surgery for acute type A aortic dissection using antegrade selective cerebral perfusion and moderate hypothermic circulatory arrest between 1995 and 2001. During surgery of acute type A aortic dissection, the use of ASCP with moderate hypothermia resulted in low neurological complication rate and an acceptable hospital mortality. Hospital mortality was 19.7%. The risk factors associated with hospital mortality and adverse neurological outcome were analyzed with multivariate statistical methods. Preoperative cardiac tamponade and neurological deficits were independent risk factors for hospital mortality and temporary neurological deficits. Both end-points were not affected by the duration of the ASCP, permitting unhurried repair of friable aortic tissues and more extended aortic replacements.

Chapter 7 examines 277 patients operated on for acute type A aortic dissection from 1986-2001; the results of 70 patients, who were operated on with extended arch replacement, were compared with the results of 207 patients who had undergone surgery limited to the ascending aorta. Operative mortality was comparable in both groups (18.6% for the patients who underwent arch replacement, 20.9% overall operative mortality) and extended replacement into the aortic arch appeared not to influence survival and late aortic arch reoperation rate. Survival of the patients after arch replacement was 40.0% at 10 years and 57.7% for the patients after surgery limited to the ascending aorta. Freedom of reoperation on the aortic arch was 77% at 10 years postoperatively for patients after arch replacement and 75.1% for patients after surgery limited to the ascending aorta. Therefore, replacement of the arch, to exclude the intimial tear, will not increase the operative risk or late outcome. None of the patients who had their aortic arch replaced with the use of antegrade selective cerebral perfusion had a new neurological complication, which means that the use of antegrade selective cerebral perfusion seemed to offer the best cerebral protection.

Chapter 8 describes 4 patients with an acute type A aortic dissection complicated with persisting lower limb ischemia, necessitating limb amputation. These patients illustrate how aspecific the initial presentation of patients with an acute type A
dissection can be and they underline the importance of recognizing the symptoms, diagnostic tools and treatment. First, the dissected aorta should be surgically repaired in order to save the patients life. Besides, lower limb ischemia can recover due to exclusion of the intimal tear and resumed antegrade bloodflow through the true lumen. If the ischemia persists postoperatively, angiography and proper revascularisation will follow, while keeping the patients hemodynamic condition optimal.

Chapter 9 reports on a patient with an occluded distal aorta due to an acute aortic dissection. Both lower limbs were successfully saved by endovascular septation of the occlusive intimal flap and application of a self expandable stent.

Conclusions and recommendations

Whenever possible, we bypass the intensive care unit, and transport the patients directly to the operating room. The operation room is then used as the place for diagnostic and therapeutic options. This includes intraoperative TEE to confirm the diagnosis as well as verification of proper circulation management and pre- and postoperative aortic valve function. Established principles for the surgical treatment of this disease are:

1. Resection of the intimal tear site and replacement of the concomitant ascending aorta or arch.

2. If the tear is not identified in the ascending aorta, inspection of the distal ascending aorta or the aortic arch should follow under circulatory arrest.

3. Open distal anastomosis technique using deep hypotherm circulatory arrest if the anticipated arrest time is less than 30 minutes. We tend to shift towards more use of antegrade selective cerebral perfusion, especially when the arrest time is expected to be more than 30 minutes.

4. Avoidance of aortic clamping. However, the aorta might be safely clamped if adequate and sufficient controls are available (bilateral radial artery pressure, electro-encephalogram, bilateral transcranial doppler monitoring). The clamping
zone should always be excised.

5. Repair or replacement of the aortic root with obliteration of the false lumen to treat potential coronary artery malperfusion and late aortic root abnormalities. Patients with Marfan's syndrome or annuloaortic ectasia should undergo a Bentall procedure or alternatively a root reimplantation procedure according to David or Yacoub.

6. Resuspension or replacement of the aortic valve. Preservation or resuspension of a morphological normal aortic valve without a dilated annulus, otherwise replacement of the aortic valve.

7. Obliteration of the false lumen at the distal anastomosis to reestablish primary flow into the true lumen. If, postoperatively, lower limb malperfusion persists, angiography and proper revascularization should follow.

8. Replacement of the aortic arch if this segment contains the intimal tear, although we might shift towards more aggressively replacing the aortic arch in a younger patient or a patient with Marfan's syndrome.