Acute aortic dissection versus aortic root aneurysm: comparison of indications for valve sparing aortic root reconstruction

K. Kallenbach*, R.G. Leyh, R. Salcher, M. Karck, C. Hagl, A. Haverich

Department of Thoracic and Cardiovascular Surgery, Hannover Medical School, Hannover, Germany

Received 20 October 2003; received in revised form 12 January 2004; accepted 14 January 2004

Abstract

Objectives: To prove whether different indications for valve sparing aortic root reconstruction may have an impact on the outcome and longevity of the repair. Methods: From July 1993 to March 2003, the reimplantation technique for valve sparing aortic root reconstruction was applied to 232 patients. In 44 patients, indication for operation was acute aortic dissection type A (AADA). These patients were compared with 44 randomised patients operated for aortic root aneurysm (root) by matched pair analysis with respect to age, gender, time point of operation and presence of Marfan’s syndrome. Peri- and post-operative courses with focus on survival and valvular stability were analysed. Results: Pre-operative grade of aortic insufficiency was 2.4 ± 1 in root vs. 1.5 ± 1.7 in AADA (P = 0.004). Mean CPB-time (214 ± 60 vs. 171 ± 42 min; P < 0.001), aortic cross clamp time (158 ± 40 vs. 129 ± 39 min; P = 0.001) and stay on ICU (5.2 ± 9 vs. 1.7 ± 1 days; P = 0.034) were longer for AADA, while hospitalisation was comparable (14 ± 10 vs. 14 ± 7 days; P = 0.88). Five patients (11.4%) from AADA died peri-operatively compared to no patient from root (P = 0.055). None of the early deaths were valve-related. Re-thoracotomy rate was 6.8% for both groups. Mean follow-up was 19 ± 21 months for AADA vs. 28 ± 21 months for root (P = 0.038). Survival at 3 years was 88 ± 3% for AADA and 100% for root (P = 0.028). Freedom from valvular reoperation was 97 ± 2.7% for root and 97 ± 3% for AADA at 3 years (P = 0.44). At last investigation, mean grade of aortic insufficiency for AADA was 0.2 ± 0.3 compared to 0.3 ± 0.3 for root (P = 0.34). Conclusions: Regardless of the underlying indication, the aortic valve preserving reimplantation technique can be performed with favourable functional results.

Keywords: Aortic aneurysm; Aortic dissection; Valves; Aorta; Valve reconstruction

1. Introduction

Aortic valve sparing reimplantation, first described by David and Feindel in 1992 [1], has gained wide acceptance for replacement of an aneurysmatic aortic root in patients with morphologically unimpaired valve cusps. Midterm results of this technique demonstrate excellent clinical outcome with a low reoperation rate due to incompetence of the reconstructed aortic valve [2,3]. Indications for the aortic root implantation procedure have increased recently,
the majority of patients. On the other hand, in patients with chronic aortic root aneurysm the cusps are exposed to an increased stress and strain due to dilation of the aortic root. This is not true for AADA in the majority of cases, where cusps were free of stress and strain due to normal root diameter. Excellent hemostasis, the complete removal of diseased aortic root tissue and avoidance of lifelong anticoagulation post-operatively are convincing advantages of valve sparing techniques. In contrast, prolonged operation times for valve reconstruction and the demanding technique, applied under emergency conditions in the middle of the night, may bear an additional risk for the patient, who might benefit from a short and simple operation due to his unstable status. Recently, we and others reported our first results using the reimplantation technique in patients with AADA, demonstrating relatively low perioperative mortality and favourable clinical outcome [5,6,8,9]. All reports have been designed as retrospective studies focusing on the technical hurdles and the postoperative follow-up solely in patients operated for AADA. The aim of this study was to prove whether different indications for use of the reimplantation technique may influence the clinical outcome and the longevity of the reconstructed aortic valve. Therefore, we compared the outcome of elective patients operated for aneurysms of the aortic root with emergency patients operated for AADA using a case-matched analysis of 44 patients, all treated with the valve sparing reimplantation technique.

2. Methods and patients

2.1. Patients

Between July 1993 and March 2003, 232 patients were operated at our institution using the aortic valve sparing reimplantation technique. For aneurysm of the aortic root or ascending aorta, 188 patients with a mean age of 52 ± 18 (9–83) years were operated on. One hundred and eighteen (63%) patients were male, and 44 (23%) were diagnosed for Marfan’s syndrome following the Gent-criteria. At our institution, the first patient was operated with the reimplantation technique for the indication of AADA in August 1995. Since then, a total of 44 patients admitted to our institution with AADA were treated with this technique. Their mean age was 54 ± 13 (20–77) years, 29 (66%) were male, and four patients (9%) had Marfan’s syndrome. To analyse the influence of different indications on clinical outcome and longevity of the reconstructed valve, we established matched pairs to compare individual cases presenting with similar pre-operative conditions, but different indications for operation: for each of the 44 patients operated on for AADA (group AADA), we matched 44 patients from the group root, all operated for aortic root aneurysm. Matching criteria were gender, age at operation (±5 years), time point of operation (±2 years), and presence of Marfan’s syndrome. Using this method, 88 patients in 44 matched pairs were identified. If more than one potential match partner from root hit the match criteria for a patient from AADA, the computer programme randomly selected the patient to be matched. Demographic data of the final study group after establishment of matched pairs are listed in Table 1.

<table>
<thead>
<tr>
<th></th>
<th>Root</th>
<th>AADA</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients</td>
<td>n = 44</td>
<td>n = 44</td>
<td></td>
</tr>
<tr>
<td>Gender, male (%)</td>
<td>29 (66)</td>
<td>29 (66)</td>
<td>1.0</td>
</tr>
<tr>
<td>Age (years)</td>
<td>54 ± 13</td>
<td>54 ± 13</td>
<td>0.89</td>
</tr>
<tr>
<td>Marfan’s syndrome (%)</td>
<td>4 (9)</td>
<td>4 (9)</td>
<td>1</td>
</tr>
<tr>
<td>Malperfusion</td>
<td>0</td>
<td>(23%)</td>
<td>0.001</td>
</tr>
<tr>
<td>Cardiogenic shock</td>
<td>0</td>
<td>(25%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Pre-op grade of AI</td>
<td>Mean 2.37 (0–4)</td>
<td>Mean 1.52 (0–4)</td>
<td>0.004</td>
</tr>
</tbody>
</table>

AI, aortic insufficiency.

For patients in AADA, diagnosis of AADA was established by computed tomography scans and/or transesophageal echocardiograms. Most patients were diagnosed in external hospitals and transferred to our institution for emergency surgery. Pre-operative grade of aortic insufficiency was determined in 33 patients by transthoracic or transesophageal echocardiogram. The final decision for valve preserving aortic replacement was made by the surgeon intraoperatively and did not depend on the presence of aortic insufficiency. Routine intraoperative control of aortic valve function was determined with transesophageal echocardiography in 35 patients.

For patients from root, our standard indications for aortic valve reimplantation have been aneurysms of the ascending aorta or aortic root larger than 5–6 cm in diameter, a tricuspid aortic valve without gross structural defect, and absence of severe cusp prolapse or asymmetry. Recently, we liberalized our indications for valve preservation towards bicuspid valves and also smaller root diameters (>4 cm) in Marfan patients with a family history of acute aortic dissection. Coronary angiography, aortic root angiograms, transthoracic echocardiography, and computed tomography scans or magnetic resonance images were performed routinely in elective cases. If pre-operative echocardiographic evaluation by a cardiologist found the aortic cusps unpaired, reconstruction had been considered. As for patients from AADA, the final decision to preserve the aortic valve was made by the surgeon after inspection of valve cusps and root geometry.

2.2. Surgical technique

The operative techniques used for this procedure were recently described by our group [6,10]. In patients...
presenting with AADA, the anaesthesiologist placed arterial lines in both radial arteries and one femoral artery for detection of peripheral malperfusion during the procedure. During preparation for the procedure, one leg was also surgically prepped and draped in all patients for vein graft harvest if required. Prior to median sternotomy and pericardiotomy, the left femoral artery was dissected for arterial cannulation in unstable patients with pericardial effusion. In stable situation, cannulation of the ascending aorta and the right atrium for extracorporeal circulation was undertaken. Cooling to a rectal temperature of 28–30 °C was initiated and myocardial protection was conducted with repetitive doses of cold blood cardioplegia in an antegrade fashion after aortic cross clamping and transection of the ascending aorta above the commissures. After careful inspection, the decision for reconstruction of the aortic valve depended on the morphological appearance of the cusps and root geometry. In case of dissection of the root involving the commissures, the wall layers were readapted with GRF-glue.

After assessing the suitability of valve reconstruction, excision of the coronary ostia and resection of aortic sinuses up to a remnant of 2–3 mm, as well as extensive external dissection and mobilization of the aortic root, followed. Prosthetic diameters were calculated from the diameter of the left ventricular outflow tract and the height of the aortic cusps. Practically, the annulus was sized with a Hegar dilator and the sinotubular junction with a valve of the aortic cusps. Practically, the annulus was sized with a Hegar dilator and the sinotubular junction with a valve of the aortic cusps. Proximal anastomosis was performed with 12 threads of 3–0 coated polyester fibre (Ethibond®, Ethicon Inc., Hamburg, Germany) used as a horizontal mattress suture beneath the valve. The valve cuff was then reimplanted into the Dacron prosthesis using three 4–0 polypropylene sutures (Prolene®, Ethicon Inc.). Umost care was taken to achieve correct cusp geometry and sufficient height of commissural resuspension within the prosthesis. If necessary, dissected coronary artery ostia were reconstructed using GRF-glue. Reimplantation of coronary ostia button into the Dacron graft completed the root reconstruction. In cases with acute type A dissection of the aorta or large aneurysm involving the aortic arch, deep hypothermic circulatory arrest or, more recently, moderate hypothermic circulatory arrest with cold (15 °C) antegrade cerebral perfusion was utilized. Depending on the expansion of the dissection, the diseased aortic wall was either reconstructed with GRF-glue or removed and the arch replaced by a second Dacron prosthesis. In case of more extensive distal dissection or aortic aneurysms, an elephant trunk extension of the arch prosthesis into the proximal descending aorta was used.

2.3. Follow-up

Before hospital discharge and at follow-up, valve function was re-evaluated using transthoracic colour Doppler echocardiography. Valve morphology as well as systolic and diastolic functions was assessed in accordance with published criteria [11]. Aortic regurgitation was assessed semiquantitatively as follows: 0, none; I, minimal; II, mild; III, moderate; IV, severe. Infectious, thromboembolic, and bleeding complications were recorded as required by the guidelines of the American Association for Thoracic Surgery/Society of Thoracic Surgeons [12].

After aortic valve reconstruction, patients were anticoagulated with coumadin or aspirin (at the discretion of the individual surgeon) to prevent thromboembolic complications for 3 months. Thereafter, anticoagulation therapy was discontinued.

Patient’s performance was assessed either directly or in a telephone-interview in regard to the classification of the New York Heart Association (NYHA).

2.4. Statistical analysis

Continuous variables are expressed as mean ± SD. All data analyses were performed with SPSS 11.0 for Windows (SPSS Inc., Chicago, IL, USA). Demographic and baseline variables were analysed using Student’s t-test for continuous variables. Comparison between groups was performed using χ² test for the analysis of contingency-tables. Kaplan–Meier analysis was used for the evaluation of time-related variables. Differences between survival curves were evaluated with log-rank statistic. Statistical significance of differences in aortic insufficiency and NYHA-class between groups was tested using Mann–Whitney signed rank test for normally distributed data. A value of \( P < 0.05 \) was considered significant.

3. Results

3.1. Peri-operative results

There was no peri-operative mortality in root, but five patients (11.4%) from AADA died peri-operatively. The difference between groups just failed to reach statistical significance (\( P = 0.055 \)). None of these deaths were related to the reconstructed valve. One patient was initially treated with streptokinase for suspect of acute myocardial infarction in an external hospital and diagnosed for AADA with a delay of 3 days. During immediate initiated transport to the OR she was resuscitated prior to establishment of extracorporeal circulation. After aortic valve reimplantation, replacement of the aortic arch, reconstruction of the supraaortic branches with GRF-glue, ligation of the left subclavian and left vertebral arteries and implantation of
a Y-prosthesis into the abdominal aorta due to peripheral malperfusion complicated the procedure. She died shortly after transferral to the ICU for multiorgan failure. Another patient died 4 days after an uneventful operation and early post-operative course due to massive cerebral edema. A third patient, treated with replacement of the aneurysmatic abdominal aorta before, was diagnosed for a type A dissection reaching from the aortic valve annulus to the abdominal graft with 1 day delay. After aortic valve reconstruction and fenestration of the dissection membrane in the aortic arch, distal malperfusion required laparotomy showing severe ischemia of the bowel. After additional fenestration of the proximal abdominal aorta, distal pulses resolved completely. However, diffuse bleeding and hemodynamic instability let to exitus in tabula. Two other patients were transferred to the ICUs of peripheral hospitals after post-operative stabilization at our institution. One gentleman, who showed already early post-operatively neurological symptoms, was diagnosed for multiple cerebral infarction and died 26 days post-operatively. Another patient died on post-op day 8 for sepsis and renal failure. In all patients, function of the reconstructed valve was sufficient, as determined by intraoperative transesophageal echocardiography.

Operation times were significantly longer for AADA. However, additional procedures such as arch replacement and elephant trunk extension into the descending aorta were performed more often in AADA. Operation times and additional surgical procedures are listed in Table 2.

Re-thoracotomy for bleeding was required for three patients (6.8%) in both groups, respectively. In AADA, significant more neurological complications were observed than in root post-operatively [six patients (18%) vs. one patient (2.4%); \( P = 0.04 \)]. ICU-stay was longer for patients operated for AADA than for root (5 ± 9 vs. 2 ± 1 days; \( P = 0.034 \)). However, the time of hospitalisation was comparable (14 ± 10 days for AADA vs. 14 ± 7 days for root; \( P = 0.88 \)).

### Table 2

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Root</th>
<th>AADA</th>
<th>( P )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bypass time (min)</td>
<td>171 ± 42</td>
<td>214 ± 60</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>X-clamp time (min)</td>
<td>129 ± 39</td>
<td>158 ± 40</td>
<td>0.001</td>
</tr>
<tr>
<td>Circulatory arrest (min)</td>
<td>25 ± 125</td>
<td>37 ± 20</td>
<td>0.12</td>
</tr>
<tr>
<td>CABG (%)</td>
<td>7 (16)</td>
<td>3 (7)</td>
<td>0.179</td>
</tr>
<tr>
<td>Arch replacement (%)</td>
<td>17 (39)</td>
<td>38 (86)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Elephant trunk (%)</td>
<td>4 (9)</td>
<td>8 (18)</td>
<td>0.214</td>
</tr>
<tr>
<td>Trusssler plasty (%)</td>
<td>5 (11)</td>
<td>0</td>
<td>0.055</td>
</tr>
<tr>
<td>MVR (%)</td>
<td>1 (2)</td>
<td>0</td>
<td>0.315</td>
</tr>
<tr>
<td>Fenestration (%)</td>
<td>0</td>
<td>1 (2)</td>
<td>0.315</td>
</tr>
</tbody>
</table>

X-clamp, aortic cross clamp; CABG, coronary artery bypass grafting; MVR, mitral valve reconstruction.

### 3.2. Post-operative follow-up

Although patients were matched by the time point of operation, follow-up was longer for patients from root with 29 ± 20 (1–97) vs. 19 ± 21 (1–90) months for patients from AADA due to earlier termination of follow-up by death or reoperation. During follow-up, four patients from AADA died, but none from root. All four patients died during the first post-operative year, and none of the death was related to the reconstructed valve. Latest echocardiography showed sufficient reconstructed valves for all four patients. One female patient was paraplegic post-operatively and died on post-op day 40 in a neurological rehabilitation centre for unknown reasons. Another patient was discharged post-operatively to a peripheral hospital. She recovered well and died for unclear reasons during rehabilitation on post-op day 48. After an uneventful post-operative course after valve reconstruction, arch replacement and extension of an elephant trunk into the descending aorta, one gentleman died on post-op day 46 for rupture of the descending aorta. Another patient died 10 months post-operatively due to onset of ventricular fibrillation. Actuarial survival was 100% for root after 3 and 5 years, and 88 ± 5% for AADA at 3 and 5 years. This difference was found to be significant (log rank, \( P = 0.026 \)). Actuarial survival for both groups is shown in Fig. 1.

Reoperation due to morbidity of the reconstructed aortic valve was required in three patients (3.4%), one from root and two from AADA. One female patient with colitis ulcerosa from root was reoperated 1 year after initial reconstruction for aortic valve insufficiency grade III. A bacterial inflammation degenerated the valvular cusps. The aortic wall was massively thickened, fibrotic tissue almost occluded the coronary ostia. She received a valved homograft, and additional CABG was performed. After a complicated post-operative course with re-thoracotomy, resuscitation and extracorporeal membrane oxygenation due to myocardial failure for 3 days, she recovered well. A 63-year-old man was initially operated due to AADA.
His post-operative course was complicated by resuscitation and re-thoracotomy due to massive bleeding few hours post-operatively. He had to be reoperated for acute fungal endocarditis involving the aortic leaflets 4 months later. A free root replacement with an aortic homograft was performed. Another patient suffered 2 weeks after orthotopic heart transplantation from acute aortic dissection of the donor aorta. He received a non-valved, cryopreserved aortic homograft in which his native valve was reimplanted. Five years later, our patient developed aortic insufficiency grade III. In an uncomplicated re-operation, he received a biological aortic valve prosthesis. Post-operative investigation showed fibrosis of the valve, but also fibrotic endocarditis with detection of Staphylococcus epidermidis. With i.v. antibiotics, he recovered well and was discharged 4 weeks post-operatively.

Freedom from reoperation due to aortic valve morbidity was 97 ± 3% after 3 and 5 years for root and 97 ± 3% after 3 years and 65 ± 26% after 5 years for AADA. This difference was statistically not significant (log rank, \( P = 0.46 \)). Actuarial freedom from reoperation is given in Fig. 2.

Only one patient (2.4%) from root and two patients from AADA (6.1%) presented with aortic insufficiency greater than grade I at last visit (all grade II). Mean grade of aortic insufficiency differed significantly between groups pre-operatively (root 2.4 ± 1 vs. AADA 1.5 ± 1.7; \( P = 0.004 \)), but showed no significant difference at early post-op (root 0.14 ± 0.12 vs. AADA 0.17 ± 0.15; \( P = 0.7 \)) and at last visit (root 0.32 ± 0.27 vs. AADA 0.24 ± 0.31; \( P = 0.34 \)). Grade of aortic insufficiency pre-, early post-op and at last visit are plot in Fig. 3.

Post-operative performance, quantified by the NYHA-classification, was favourable at last visit and did not differ between groups (root 1.24 ± 0.19 vs. AADA 1.45 ± 0.39; \( P = 0.152 \)). All except two patients, who were judged for NYHA-class III, presented in NYHA-classes I (69%) and II (28%) at last contact.

During follow-up, no bleeding complication have been reported. In root, two (5%) thromboembolic events were documented and one (3%) in AADA. Both patients from root suffered from a transient ischemic attack but recovered completely. There was no significant difference between groups (\( P = 0.71 \)).

4. Discussion

This study analysed the impact of different indications on the outcome in patients undergoing reimplantation technique for valve-sparing aortic root reconstruction. To allow a comparison between two completely different diseases with great heterogeneity, we used a matched pair analysis of 88 patients either operated for aneurysm of the aortic root or operated for AADA. We conclude that the different indications do not influence the longevity of the reconstructed valve. Of those who survived the peri-operative period, clinical and functional outcomes are comparable during follow-up and are not influenced by the indication for operation.

The indication for the reimplantation technique in elective patients presenting with aneurysms of the ascending aorta or the aortic root is widely accepted: aneurysms larger than 5–6 cm and a morphological intact valve without severe cusp prolapse or asymmetry. Recently, in selected cases bicuspid valves and root diameter larger 4 cm in high risk patient such as Marfan’s syndrome with the family history of dissection were operated with this technique, too [2,3]. We have recently reported that neither the severity of pre-operative aortic insufficiency nor the size of the aneurysm influences the durability of the reconstructed valve [13,14]. We and others have shown that the use of reimplantation technique in patients with Marfan’s syndrome is safe in regard to valvular longevity, but bear the advantage of avoidance of lifelong anticoagulation, of which specifically these patients with younger age,
potentially necessary later operation of the downstream aorta and possible gravidity will benefit [15,16]. The indication for use of the reimplantation technique in emergency patients with acute aortic dissection remains debatable. Should such a demanding, time-consuming technique be used in an emergency situation, most often in the middle of the night? Or should the most simple and quickest technique be applied, such as the supracommissural aortic replacement or the composite replacement? Unquestionably, reconstruction of the aortic root with GFR-glue and supracommissural replacement of the ascending aorta represents probably the easiest and quickest approach, but leaves diseased aortic tissue in place ignoring the underlying aortic wall pathology. Possible redissection or aneurysm formation may bear a vital risk for the patient and may require further operation of the proximal ascending aorta. Although the mechanism of the development of secondary aneurysmatic dilatation of the aortic root after supracommissural replacement remains unclear and may be multifactorial, these aneurysms are the main reasons for reoperations due to the development of moderate to severe aortic regurgitation with an incidence of 25–45% [17,18]. In patients with structurally impaired aortic wall tissue such as Marfan’s syndrome and in those who had acute dissection with pre-existing annuloaortic ectasia on the basis of cystic medial necrosis, the incidence may be even higher and composite replacement has been recommended. The replacement of the aortic wall and the dissected ascending aorta with a composite graft carrying mechanical valve prosthesis represents an established surgical treatment with excellent results [19,20]. However, the lifelong need for anticoagulation with the risk for bleeding and possible thromboembolic events after mechanical valve replacement cause complications with an annual incidence of 2–4% in the literature [21]. These complications can be avoided by the use of the valve preserving reimplantation technique. In a recent study, we reported on a matched pair analysis of patients with ascending aortic aneurysm treated either with composite replacement or the valve sparing reimplantation technique. We observed no bleeding or thromboembolic complications in the latter group; there were significantly more events in the first post-operative year after composite replacement [22]. In addition, absence of anticoagulation is particularly appealing in patients requiring additional surgery due to aneurysmatic transformation of dissected distal aortic segments. Nevertheless, we had two patients from root who developed a transitory ischemic attack with complete recovery during follow-up. Due to the reduced number of patients in the cohort, the incidence of 5% appears to be high. However, of more than 200 patients operated with the reimplantation method for root aneurysm, we are aware of only these two neurological complications, and the high incidence in this matched paired cohort seems to be randomly high. To avoid early post-operative neurological complications by thromboembolism, most of our surgeons prefer anticoagulation with coumadin for 2 months until complete endothelialization of suture lines have completed.

We report of 3 out of 44 patients (6.8%) of both groups who needed a re-thoracotomy due to post-operative bleeding. This incidence is in agreement with earlier reports by us and others, varying between 4.4 and 6% for reexploration, thus demonstrating excellent hemostatic features of the reimplantation method [2,3]. Besides reimplantation technique, aortic root remodelling, first described by Yacoub et al. [23], is an alternative with excellent results. However, de Oliveira et al. reported of a re-thoracotomy rate of 3% for Marfan patients undergoing the reimplantation operation vs. 18% in the remodelling group. This difference was found to be statistically significant ($P = 0.01$). Miller stated in a most recent review of valve sparing aortic root replacement in patients with Marfan’s syndrome, that the reimplantation concept is better for acute aortic dissection since it is more hemostatic—the only suture lines that can bleed are the coronary buttons and the distal aortic anastomosis [24].

With no peri-operative mortality and an actuarial survival of 100% at 5 years, the outcome of elective patients operated for aortic root aneurysms is excellent. Similar results were archived by David et al. [3], who reported on one peri-operative death out of 64 patients (1.6%) treated with the reimplantation technique. Our group [2] reported on a peri-operative mortality of 2.2% in 136 elective cases. However, in this study, five patients from AADA (11.4%) died peri-operatively. Another four patients died during the first year after operation, one of them for peri-operative cerebral infarction still in hospital, and two others during rehabilitation. Actuarial survival was 88 ± 5% at 5 years. In comparison to the literature, reporting a peri-operative mortality for surgical repair of AADA of 25% [25], these data represent acceptable results. It is important to stress that reconstruction of the aortic valve did not cause any death in a direct pattern. The majority of deaths were related to cerebral and peripheral malperfusion due to the aortic dissection. At the time point of presentation for surgery at our institution, 25% of patients from AADA were in cardiogenic shock, 23% showed symptoms of cerebral or/and peripheral malperfusion.

Freedom of reoperation for aortic valve morbidity was 97 ± 3% at 3 years for both indications. One patient from AADA, who suffered from acute dissection of the donor aorta 2 weeks after initial heart transplantation, had to be reoperated after 5 years due to fibrotic endocarditis. The grade of aortic insufficiency at last visit did not differ between groups. By use of a matched pair analysis, which allows comparison of individual cases and resulted in relatively homogenic groups for comparison, neither the need for reoperation nor the grade of aortic insufficiency is influenced by the indication for operation. Furthermore, clinical performance during follow-up is comparable. These findings are in agreement with reports of others, who demonstrated excellent valvular stability in patients who
received the valve sparing reimplantation technique for treatment of AADA [8,9]. Due to the lack of sinuses of Valsalva, progressive leaflet degeneration has been discussed as a theoretically possible drawback of the method. However, neither echocardiographic findings nor increased valve failure after prolonged follow-up support this hypothesis. Longer follow-up is required to finally judge the valvular stability after reimplantation.

The demanding aspect of the surgical technique might represent a limitation of our strategy to operate AADA with the reimplantation technique. Thus, the surgeon on duty must be well trained in elective cases to feel confident using this technique under emergency conditions.

Rare bleeding complications early post-operatively, freedom from anticoagulation as well as complete resection of diseased tissue is particularly appealing and represent unquestionable advantages to established methods. In our centre, the described reimplantation operation advanced to the procedure of choice in patients suffering from AADA with intact valve cusps and/or aortic tissue defects. Further long-term studies must prove whether these benefits will outweigh the potential risk for reoperation.

References


Appendix A. Conference discussion

Dr T. Carrel (Bern, Switzerland): Did you have a bicuspid valve in a dissection patient? I did not see this case.

And how would you proceed? Because bicuspid valve might be associated with a higher risk of dissection in some patients at least.

Dr Kallenbach: No, we didn’t have any of this. Our goal is to use this operation in any patient, but we do not do it in all patients. If there is a bicuspid valve in this emergent situation, the surgeon might be able to accomplish a replacement.
Dr J. Bachet (Paris, France): If I remember well, a few years ago your group published a paper about, I think, 22 patients with acute dissection having a valve-sparing procedure. And the conclusions were quite negative. You were disappointed by this technique. But most patients had a remodeling procedure.

In this presentation, all patients had a reimplantation procedure. Do you think that the difference in the result is not due to the fact that we deal with dissections but that the remodeling procedure is less appropriate than the reimplantation technique?

Dr Kallenbach: All those 22 patients were operated with the reimplantation technique. We compared them to eight patients treated with the remodeling technique.

In '93, when we started with aortic reconstruction, we did five remodeling operations at Hannover and few more at Lübeck by Dr Leyh. After that, we only used reimplantation technique as published by Tirone David. Our first results published in the European Journal of Cardio-thoracic Surgery with 22 patients were very good with low reoperation rate so far and an early mortality of about 14%. We prefer the reimplantation since the remodeling technique showed more often failure in patients with acute aortic dissection.

Dr Carrel: I would ask a question about the severity of the fragmentation of fibrillin in Marfan patients. I had the privilege some years ago to see some immunohistology from the study of Vincent Gott, and I was surprised by the different degrees of the severity of the disease within excised cusp. Do you think there is a potential correlation about clinical presentation of the Marfan, or of the disease, with the involvement of fibrillin fragmentation in the cusp which could predict a bad result when this fragmentation is very high?

Dr Kallenbach: Well, the fibrillin problem is an ongoing discussion in this field. And I don’t think that you can judge from the presentation of the patient to the valve. What we can do is judge the valve before the operation by echo and look at the valve intraoperatively: What is the impression of the surgeon? And then he has to decide: Do I believe I can reconstruct this valve with a good long-term result, or not?

Looking in the literature, just recently Tirone David reported, I believe, 80 patients with Marfan syndrome who were operated with reimplantation with excellent results, even better than in the patients who had no Marfan syndrome. And we recently gave a paper at the AATS, which will be published soon, where we also compared Marfan syndrome patients with the David reimplantation technique and the Composite technique. And we also found very good result of long-term durability.

But really hard data, how to judge this, unfortunately, I don’t have that.

Dr Carrel: Would you repair mitral moderate regurgitation if you have a prolapse in an acute dissection?

Dr Kallenbach: Actually, we had two patients who got mitral valve repair. They were elective cases. We would probably repair a prolapse in a Marfan patient with acute aortic dissection if he presents in fairly stable condition without significant malperfusion.