Best evidence topic - Aortic and aneurysmal

Is close radiographic and clinical control after repair of acute type A aortic dissection really necessary for improved long-term survival?

Franziska Albrecht, Friedrich Eckstein, Peter Matt*

Division of Cardiac Surgery, University Hospital, Spitalstrasse 21, CH-4031 Basel, Switzerland

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Summary

A best evidence topic in cardiac surgery was written according to a structured protocol. The question addressed was whether radiographic and clinical control after surgery for acute type A aortic dissection (AAD) is needed for improved long-term survival. Altogether, 118 relevant papers were identified using the reported search, of which seven represented the best evidence to answer the question. The author, journal, date and country of publication, patient group studied, study type, relevant outcomes and results of these papers are tabulated. We conclude that most patients after surgery for AAD remain at risk for dissection-related aortic complications. Late aortic growth is often slow and linear, but the occurrence of major aortic events is unpredictable and can initially present more than a decade postoperatively. Risk factors for rapid late aortic enlargement and reoperations include patent or partially thrombosed false lumen, large aortic size, Marfan syndrome and younger age. Whether performing a more extensive first procedure (e.g. aortic arch replacement ± elephant trunk) can be translated into improved outcome and a lower incidence of aorta-related reoperations remains to be elucidated. Aortic reoperation rates range between 10% and >20% within the first 10 years. Optimal systolic blood pressure control (<120 mmHg), including β-blocker therapy, seems to decrease late aortic dilatation and the incidence of aortic reoperations. Close and careful lifelong surveillance of patients after AAD repair including radiographic and clinical controls to evaluate the status of the remaining aorta, and thus to facilitate adaptations of medical therapy and planning of timely reoperations seems mandatory for improved long-term survival. A suggested timeframe for computed tomographic (CT) imaging after surgery for AAD is before discharge, at six and 12 months postdissection and, if stable, annually thereafter. Patients with large aneurysms (aortic diameter ≥50 mm) should be maintained at radiographic intervals of six months or less. If the thoracic aneurysm is moderate in size and remains stable over time, magnetic resonance imaging instead of CT-scanning is reasonable to minimize the patient’s radiation exposure.

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Keywords: Aortic dissection type A; Surgery; Outcome; Aortic growth; Reoperation

1. Introduction

A best evidence topic was constructed according to a structured protocol, which has been fully described [1].

2. Three-part question

In [patients after surgery for acute type A aortic dissection] is [close radiographic and clinical control] necessary compared to [symptom-only based investigations] for improved [long-term survival]?

3. Clinical scenario

A 64-year-old man undergoes emergency surgery for acute type A aortic dissection (AAD). The postoperative course is uneventful. A computed tomographic (CT) scan before discharge shows an unremarkable aortic prosthesis and a patent residual false lumen in the aortic arch and descending aorta. The maximum diameter of the thoracic aorta is 45 mm. You ask yourself how often this patient should undergo radiographic and clinical control to identify early dissection-related aortic complications and to achieve improved long-term survival?

4. Search strategy

Medline 2000–2010 was searched using Pubmed to obtain the relevant papers, with the terms [surgery] AND [acute type A aortic dissection] AND [long-term survival].

5. Search outcome

A total of 118 relevant papers were found, from which seven were selected as representing the best evidence to answer the clinical question (Table 1).

6. Results

We reviewed seven studies including clinical and radiographic (mainly CT-scanning) long-term data of 1250 patients after surgery for AAD. Geirsson et al. [2] analyzed 221 patients after surgery for AAD. Freedom from proximal reoperations was 95.1% and 77.8% at five and 10 years, respectively. Aortic valve
Table 1. Best evidence papers

<table>
<thead>
<tr>
<th>Author, date and country</th>
<th>Patient group</th>
<th>Outcomes</th>
<th>Key results</th>
<th>Comments</th>
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<tr>
<td>Geirsson et al., 2007, Ann Thorac Surg, USA, [2]</td>
<td>221 consecutive patients, between 1993 and 2004, single institution report</td>
<td>Aortic reoperation rate</td>
<td>12.2% in 10 years</td>
<td>Aortic valve resuspension techniques are durable in most patients, and long-term survival is similar to that of those with aortic root replacement. Proximal reoperations are more common in patients with preoperative cardiac malperfusion. In contrast, younger patients and those with DeBakey type I dissection showed a higher rate of distal reoperations. In-hospital mortality of initial surgery 12.7%, In-hospital mortality of reoperations 18.2% (proximal aorta) 31.2% (distal aorta). Actuarial survival (for all patients) 79.2% at 1 year 62.8% at 5 years 46.3% at 10 years.</td>
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<td>Halstead et al., 2007, J Thorac Cardiovasc Surg, USA, [3]</td>
<td>179 consecutive patients, between 1986 and 2003, single institution</td>
<td>Aortic growth rate per year</td>
<td>0.8 mm/year at the aortic arch, 1.0 mm/year at the descending aorta, 0.8 mm/year at the abdominal aorta Risk factors for rapid aortic growth rate Initial aortic diameter ( \geq 40 ) mm, patent false lumen, male sex Aortic reoperation rate and site of reoperation 17% in 17 years, five patients at the aortic root and 25 at the distal aorta Risk factor for aortic reoperation Marfan syndrome Overall hospital mortality after initial surgery 13.4% In-hospital mortality of reoperations 4% Actuarial survival rates (for hospital survivors) 90.7% at 1 year 77.9% at 5 years 66.2% at 10 years. Secondary aortic dilatation is often slow and linear, but unpredictable. The likelihood for aortic reoperation is increased in patients with Marfan syndrome, without effect on late survival. The sum of deaths in all patients caused by rupture, graft infection and unknown causes represents 40% of late deaths indicating that close and careful follow-up seems mandatory for improved long-term prognosis.</td>
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| Immer et al., 2005, Eur J Cardiothorac Surg, Switzerland, [4] | 64 patients with at least three CT-scans postoperatively and DeBakey type I dissection, between 1994 and 2002, single institution report | Aortic growth rate | 40.6% with no aortic progression, 42.2% with slight progression (10–20 mm over 60 months), 17.2% with important progression (>20 mm over 60 months) Risk factors for aortic progression Younger age, female sex, dissection of supraaortic branches, preoperative cerebral, visceral or peripheral malperfusion, patent false lumen Aortic reoperation rate 14.1% Younger age, dissection involving the supraaortic branches and/or combined with malperfusion and patent false lumen favour secondary dilatation. Late aortic enlargement occurred in the majority of patients in the first 24 months after initial surgery. (Continued on next page)
Table 1. (Continued)

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<td>Kimura et al., (2008), J Thorac Cardiovasc Surg, Japan, [5]</td>
<td>243 consecutive patients, between 1997 and 2006, single institution report</td>
<td>Aortic growth rate per year</td>
<td>Patients with patent false lumen: 1.1 mm/year (arch), 1.9 mm/year (proximal descending), 1.3 mm/year (distal descending), 1.6 mm/year (abdominal)</td>
<td>Patent false lumen is a strong predictor for late aortic dilatation, however it is not necessarily associated with rapid secondary aortic dilatation needing reoperation. Long-term outcomes were acceptable and did not differ according to the status of the residual lumen</td>
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<td>Zierer et al., (2007), Ann Thorac Surg, USA, [6]</td>
<td>201 consecutive patients, between 1984 and 2006, single institution report</td>
<td>Aortic growth rate per year (in those demonstrating aortic expansion)</td>
<td>Aortic diameter, elevated systolic blood pressure (&gt;140 mmHg, SBP), patent false lumen</td>
<td>Aortic expansion is most common in the descending aorta. Timing of onset of aortic enlargement is unpredictable, and therefore requires lifelong radiographic follow-up. Small aneurysms (&lt;35 mm diameter) seldom demonstrate aortic growth at &lt;1 year intervals, whereas aneurysms ≥50 mm demonstrate aortic growth even within intervals of 6 months or less. Optimal blood pressure control (SBP &lt;120 mmHg) and β-blocker therapy decrease the incidence of aortic enlargement and late reoperation</td>
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Risk factor for rapid aortic growth: Patent false lumen
Predictive factors for residual patent false lumen:
- Age <70 years (odds ratio (OR) 4.5), limb ischemia (OR 2.4), male sex (OR 1.4), smoking (OR 1.3)
- Freedom from distal reoperation: 99% at 1 year, 97.4% at 5 years, 89.5% at 10 years
- Risk factors for aortic reoperation: Patent false lumen, Marfan syndrome
- In-hospital mortality of initial surgery: 7.3%
- Actuarial survival rate (with in-hospital deaths): 89.5% at 1 year, 79.5% at 5 years, 71.3% at 10 years
- Aortic reoperation rate and site of reoperation: 15% in up to 170 months, 7 at the aortic root or arch and 15 at the descending aorta
- Freedom from reoperation (among operative survivors): 95% at 1 year, 90% at 5 years, 74% at 10 years, 65% at 15 years
- Predictors of late reoperation: Marfan syndrome (OR 10.4), non-resected primary tear (OR 4), absence of postoperative β-blocker therapy (OR 3.3), elevated SBP
- Operative mortality of initial surgery: 16%
- Actuarial survival rate (for all operative survivors): 90% at 1 year, 76% at 5 years, 59% at 10 years, 49% at 15 years

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<td>Fattouch et al., (2009), Ann Thorac Surg, Italy, [7]</td>
<td>224 consecutive patients, between 1992 and 2006, report from two institutions</td>
<td>Aortic growth rate per year</td>
<td>Patients with patent false lumen: 2.8 mm/year Patients with occluded false lumen: 1.1 mm/year Patients with Marfan syndrome: 2.4 mm/year Patients without Marfan syndrome: 0.8 mm/year</td>
<td>Patent false lumen is a predictor of late aortic dilatation, retreatment and death, particularly in those with Marfan syndrome or with descending aortic diameter &gt; 45 mm</td>
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<td>Risk factors for rapid aortic growth</td>
<td>Patent false lumen, Marfan syndrome</td>
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<td>Aortic reoperation rate and site of reoperation</td>
<td>22.7% in a mean follow-up of 88.44 months, 9 at the aortic root and 34 at the descending aorta</td>
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<td>Freedom from reoperation on the descending aorta</td>
<td>Patients with patent false lumen: 89.3% at 1 year, 72.2% at 5 years, 63.7% at 10 years Patients with thrombosed lumen: 99% at 1 year, 97.2% at 5 years, 94.2% at 10 years Patients with Marfan syndrome: 97.2% at 1 year, 84.3% at 5 years, 74.5% at 10 years Patients without Marfan syndrome: 98.2% at 1 year, 89.5% at 5 years, 86.4% at 10 years</td>
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<td>Risk factors for aortic reoperation</td>
<td>Patent false lumen (HR 15.2), Marfan syndrome (HR 3.5), descending aorta diameter &gt; 45 mm (HR 5.8)</td>
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<td>In-hospital mortality</td>
<td>15.6%</td>
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<td>Actuarial survival rate (for entire population)</td>
<td>97.7% at 1 year, 88.2% at 5 years, 79.8% at 10 years</td>
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<tr>
<td>Song et al., (2010), J Thorac Cardiovasc Surg, Korea, [8]</td>
<td>118 consecutive patients, between 1997 and 2007, single institution report</td>
<td>Aortic growth rate per year</td>
<td>0.34 mm/year (aortic arch), 0.51 mm/year (descending aorta), 0.35 mm/year (abdominal aorta)</td>
<td>Partial thrombosis of the false lumen is a strong predictor of rapid aortic growth, increased reoperation rate and decreased long-term survival. Total arch replacement was associated with a lower incidence of partially thrombosed false lumen, and those patients had no aorta-related reprocedures</td>
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<td>Risk factor for rapid aortic growth</td>
<td>Partially thrombosed and patent false lumen</td>
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<td>Aortic reoperation rate and site of reoperation</td>
<td>13.4% in 10 years, two patients at aortic arch and descending aorta, six at descending aorta, two at the thoracoabdominal aorta, three at the abdominal aorta</td>
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<td>Freedom from distal aortic reprocedures (for all hospital survivors)</td>
<td>94.6% at 1 year, 78.8% at 5 years, 66.1% at 10 years</td>
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resuspension techniques were durable and survival was similar to that after aortic root replacement. Freedom from distal reoperation was 86.5% and 75.4% at five and 10 years, respectively. Patients <45 years, and those with DeBakey type 1 dissection had a higher risk of distal reoperation. In-hospital mortality of reoperation was 18.2% in proximal reoperations, and 31.2% in distal reoperations. Long-term survival was 79.2%, 62.8%, and 46.3% at one, five and 10 years, respectively.

Halstead et al. [3] revealed postsurgery aortic growth rates of 0.8 mm/year (aortic arch) and 1 mm/year (descending aorta). Risk factors for rapid enlargement of the distal aorta were male gender, initial aortic size >40 mm and patency of the false lumen. There was a 17% reoperation rate in 17 years follow-up. One (4%) perioperative death occurred among those reoperations. The sum of deaths caused by aortic rupture, graft infection, and unknown causes represented 40% of late deaths corresponding to a two-fold increase in long-term deaths compared with healthy controls.

Immer et al. [4] found that younger age, female gender, dissection of the supraaortic branches, preoperative mal-perfusion or persistent patent false lumen were all risk factors for late aortic dilatation. Over a period of 60 months, aortic growth of up to 20 mm was seen in 42.2%, and of more than 20 mm in 17.2%, among whom more than 80% required aortic reoperation. Secondary aortic dilatation occurred in the majority of patients within the first 24 months.

Kimura et al. [5] showed that the aortic growth rate is higher in patients with a residual patent false lumen compared with those with a thrombosed lumen. Freedom from distal aortic reoperation for all hospital survivors was 99%, 97.4% and 89.5% at one, five and 10 years, respectively. Patients within the thrombosed group showed a tendency to fewer distal reoperations compared with the patent group. Actuarial survival with in-hospital deaths was 89.5%, 79.5% and 71.3% at one, five and 10 years, respectively, and was similar in patients with a patent lumen and those with a thrombosed false lumen.

Zierer et al. [6] revealed that Marfan syndrome, non-resected primary tear, absence of postoperative β-blocker therapy, and systolic blood pressure (SBP) of more than 140 mmHg at late follow-up were predictors of late reoperation. Risk factors for aortic growth were aortic diameter, elevated SBP and patent false lumen. Moderate aneurysms (35–49 mm) rarely showed growth at <6-month intervals, whereas aneurysms ≥50 mm demonstrated growth in <6 months. Most important, the timing of the onset of aortic enlargement was unpredictable. Optimal blood pressure control (SBP <120 mmHg) decreased the incidence of secondary aortic dilatation from 34 to 14%, and decreased the incidence of late reoperation from 35 to 8%. Freedom from reoperation at 10 and 15 years was 79% and 75%, respectively, with β-blocker therapy, and 57% and 25%, respectively, without β-blocker therapy.

Fattouch et al. [7] found a reoperation rate of 22.7% in a mean follow-up of 88±44 months. Predictors for aortic reoperation were aortic size >45 mm, patent false lumen and Marfan syndrome. Actuarial survival rates for the entire population were 97.7%, 88.2% and 79.8% at one, five and 10 years, respectively.

Song et al. [8] showed freedom from distal reoperations rates of 94.6%, 78.8% and 66.1% at one, five and 10 years, respectively. They revealed that partial thrombosis compared with completely patent or thrombosed false lumen is a strong predictor of rapid aortic growth, poor long-term survival and aorta-related reoperations. Patients with total arch replacement showed a lower incidence of partial thrombosis in the distal aorta and no aorta-related reoperations. However, the operative mortality of the initial surgery was relatively high with 17.8%. Whether such an aggressive initial approach can be translated into improved outcome remains to be elucidated.

7. Clinical bottom line

Patients after repair of AAD often show persistent dissection of the remaining aorta and subsequently, are at risk for aortic complications. Late aortic growth is often slow and linear, but the occurrence of major aortic events is unpredictable. Aortic reoperation rates range between 10% and more than 20% within the first 10 years. Optimal SBP control (SBP <120 mmHg), including β-blocker therapy, seems to decrease late aortic dilatation and the incidence of aortic reoperations. Whether ATII receptor blockers and ACE inhibitors may lead to additional benefits (e.g. stabilization of the aortic wall) requires further studies [9]. Close and careful surveillance of patients after AAD repair including radiographic and clinical controls to evaluate the status of the remaining aorta, in order to adapt medical therapy and to plan timely reprocedures seems mandatory for improved long-term survival.
References


