Prognosis of patients undergoing emergency surgery for type A acute aortic dissection without exclusion of the intimal tear

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Objectives: To investigate the prognosis after emergency surgery for acute type A aortic dissection with an unknown entry site and to identify the predictors of postoperative aortic dilatation.

Methods: The subjects were 102 patients undergoing emergency surgery for acute type A dissection from July 2005 to October 2010. They were divided into group I (n = 45) undergoing aortic surgery without tear resection and group II (n = 57) undergoing resection that included the intimal tear.

Results: The postoperative hospital mortality was similar, 13.3% (n = 6) in group I and 12.3% (n = 7) in group II. Of the 102 patients, 69 underwent follow-up computed tomography scanning after discharge, and the aortic diameter was significantly increased in group I compared with that in group II (P = .035). Dilatation of the descending aorta occurred in 21 patients (30.4%). Multivariate logistic regression analysis revealed that a patent false lumen (P = .027) and nonexclusion of the entry site (P = .012) were independent risk factors for aortic dilatation. No difference was found in the freedom from aorta-related clinical events at 4 years, with a rate of 89.9% in group I and 74.4% in group II. Also, no difference was found in the 4-year actuarial survival rate between groups I and II (86.4% and 78.5%, respectively).

Conclusions: The prognosis of patients without exclusion of the entry site was acceptable. Careful follow-up is needed for patients with a patent false lumen or nonexcluded entry because of the risk of aortic dilatation.

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The management of acute type A aortic dissection (AAAD) is problematic, and it is still unclear how extensive the aortic resection should be for patients with this life-threatening condition. Our fundamental strategy for AAAD involves excision of the intimal tear. In most patients, ascending aortic or proximal arch replacement is sufficient because the intimal tear is generally located in the concavity of the transverse part of the arch.1 When the tear is located in the aortic arch, however, total arch replacement should be performed to achieve tear excision. If the intimal tear is not identified anywhere from the ascending aorta to the distal arch, our treatment strategy has been to simply replace the proximal arch and conduct careful follow-up after surgery. However, a risk exists of the residual aorta expanding because the intimal tear has not been resected. In the present study, we reviewed the data from patients undergoing aortic resection for AAAD without tear excision and assessed their medium-term outcomes.

METHODS

From July 2005 to October 2010, 116 patients with AAAD underwent emergency surgery at our institutions. Contrast computed tomography (CT) was performed in all patients as soon as they were referred to the hospital. This was followed by transthoracic echocardiography to detect pericardial effusion and to assess for aortic regurgitation and cardiac function. Even if the initial CT scan revealed a thrombosed false lumen, we recommended emergency surgery. Patients were transferred to the operating room as soon as possible after informed consent to surgery was obtained. Of the 116 patients, 7 who had undergone total arch replacement and 7 with Debakey type II aortic dissection were excluded from the present study.

In 45 patients, the intimal tear was not located anywhere from the ascending aorta to the distal arch; thus, aortic resection did not include the tear (group I). The remaining 57 patients, with the entry site located in the ascending aorta or proximal aortic arch, underwent resection that included the tear and ascending aortic or hemiarch replacement (group II). The institutional review board approved the reporting of the information obtained from our retrospective study.

Surgical Procedure

We previously reported the surgical technique.2-5 Cardiopulmonary bypass was implemented after cannulation of the femoral artery. A 2-stage venous cannula was inserted into the right atrium. The ascending aorta was then opened longitudinally under moderate hypothermic arrest (28°C) without cerebral perfusion. Replacement of the ascending aorta or hemiarch replacement was performed with a Dacron graft after both the distal and the proximal stumps of the aorta were reinforced with Teflon felt and gelatin resorcin formalin glue. Antegrade systemic circulation was re-established through a side branch of the graft after completion of the open distal anastomosis.

CT Follow-up

Enhanced CT scanning was performed at our outpatient clinic 1 month after surgery, and CT was repeated annually thereafter. The maximum...
The postoperative hospital mortality was also similar at cuspid valve. No differences were found in the incidence of patient underwent separate aortic valve replacement for a bi-
gitation because of marked dilatation of the aortic root. One shorter in group I than in group II. A modified Bentall pro-
time, and circulatory arrest time were all significantly 
significantly older than those in group I (Table 1). The average 
showing treatment. Sixty-nine patients underwent follow-up 
survivors did not undergo enhanced CT scanning owing to 
to which the patient had been transferred.

Statistical Analysis
Continuous variables are reported as the mean ± standard deviation. For comparison 
and death.

Operative mortality was defined as any death within 30 days after sur-
ry in or outside the hospital. In-hospital mortality was defined as any 
change. Dilatation of the descending aorta was defined as an increase in the 
maximal diameter by 5 mm or more during the follow-up period. Aorta-
related clinical events were defined as aneurysmal change, reoperation, and death.

RESULTS
The clinical profile and dissection characteristics of the 2 
grup II had significantly greater rates of moderate to severe aortic 
regurgitation (P = .016) and a patent false lumen in the asc-
cending aorta (P = .015). Group II patients were also signifi-
cantly older than those in group I (Table 1). The average 
duration of cardiopulmonary bypass, aortic crossclamp 
time, and circulatory arrest time were all significantly 
shorter in group I than in group II. A modified Bentall pro-
cedure was performed in 3 patients with severe aortic regur-
gitation because of marked dilatation of the aortic root. One 
patient underwent separate aortic valve replacement for a bi-
cuspid valve. No differences were found in the incidence of 
postoperative neurologic deficits, pneumonia, deep sternal 
wound infection, or renal failure between the 2 groups. 
The postoperative hospital mortality was also similar at 
13.3% (6 patients) in group I and 12.3% (7 patients) in 
group II (Table 2).

Of the 89 survivors, 2 died within 5 months after dis-
charge from the hospital of cerebral infarction and rupture 
of the thoracic aortic aneurysm, respectively. Eight of the 
Survivors did not undergo enhanced CT scanning owing to 
renal insufficiency, contrast medium allergy, or other rea-
sons. Ten survivors were referred to other hospitals for on-
going treatment. Sixty-nine patients underwent follow-up 
CT scanning after discharge. The interval between surgery 
and the final CT scan was 12 to 59 months (mean, 33.0 ± 
13.4). On the initial postoperative CT scans, the incidence 
of a patent false lumen and the aortic diameter was similar 
in the 2 groups. However, the extent of aortic dilatation over 
time was significantly greater in group I than in group II 
(Table 3).

Dilatation of the descending aorta occurred in 21 pa-
ients (30.4%), and the site of dilatation was the distal 
arch in 12. Multivariate analysis revealed that a patent 
false lumen (odds ratio, 3.91; 95% confidence interval, 
1.17–13.16; P = .027) and excision of the tear (odds ratio, 
0.21; 95% confidence interval, 0.06–0.71; P = .012) were 
significant predictors of dilatation of the descending aorta. 
Two patients in each group developed an aneurysmal 
change of the residual aorta. In group I, 1 patient required 
total arch replacement because of rapid expansion of the 
aorta from 49 mm to 67 mm within 3 months, and 1 under-
went descending aortic replacement 3 years after the 
initial operation. In group II, 1 patient underwent replace-
ment of the descending aorta 1 year after the initial oper-
ation, and 1 refused surgery for an aneurysm with 
a diameter of 61 mm. In group I, 1 patient died of sepsis 
32 months after surgery; however, no late deaths occurred 
in group II.

No difference was found in the freedom from aorta-
related clinical events at 4 years (81.9% in group I and 
74.4% in group II; Figure 1). Also, no difference was found 
in the 4-year actuarial survival rate (86.4% in group I and 
78.5% in group II; Figure 2).

DISCUSSION
According to our management protocol, the chief priori-
ties of emergency surgery for AAAD are primary excision 
of the intimal tear and avoidance of serious complications. 
Several investigators have advocated routine extended or 
total aortic arch resection for the initial surgical manage-
ment of AAAD, irrespective of the location of the intimal 
tear. Although they have achieved satisfactory results, it 
is important to remember that AAAD is a lethal 
condition, and the first priority is to ensure that the patient 
lives. If the acute event is not fatal, this constitutes 
success, regardless of possible later aortic problems. 
Extended resection will necessarily increase the already-
high operative risk. Ehrlich and colleagues reported that 
the site of the intimal tear did not influence the outcome, al-
though mortality was greater when the resection was more 
extensive. Bachet and colleagues reported that closure of 
the entry site at the initial emergency operation led to a 
lower reoperation rate. Westaby and colleagues also ad-
vocated the policy of primary tear excision (ie, the “conser-
ervative pathology-oriented approach”). The only concern is 
that it remains unclear how extensive the resection should 
be if no intimal tear can be identified from the ascending 
aorta to the aortic arch.

Abbreviations and Acronyms
AAAD = acute type A aortic dissection
CT = computed tomography
Fundamentally, the aim of emergency surgery for AAAD is to prevent subsequent complications, such as myocardial infarction, acute aortic regurgitation, and cardiac tamponade, or to relieve existing complications associated with the risk of sudden death. An emergency procedure that involves opening the pericardium and replacement of the ascending aorta or hemiarch replacement is enough to salvage the patient, even if the intimal tear remains in the distal arch or descending aorta. In the present study, the hospital and late mortality rates of both groups were low, and aortic resection for AAAD without excision of the intimal tear was not associated with an increased incidence of reoperation, although nonexclusion of the entry site was an independent risk factor for late aortic dilatation.

Postoperative patency and dilatation of the false lumen are also important issues, which has been emphasized recently by several reports. Kimura and colleagues reported that the patent false lumen influenced postoperative aortic enlargement. In the present study, the false lumen was patent in 53.6% of all patients, and no difference was found in the patency rate between the 2 groups. This was considered to be acceptable with reference to previous reports. David and colleagues reported that the prevalence of a patent false lumen after surgery was reduced from 91% to 59% with the open distal anastomosis technique. We believe that emergency open repair and fixation of the distal aortic stump with gelatin resorcin formalin glue decreases the patent false lumen rate and possibly improves the long-term survival of patients with AAAD. No difference was found in the freedom from reoperation on the distal aorta between our 2 groups. Therefore, we consider it is sufficient to repair type A dissection to a level at which it corresponds to type B dissection, even if the intimal tear is not located in the distal aortic arch. It has been reported that the 3-year mortality rate of patients with type B dissection (even with a patent false lumen) is only 10% to 20%. We have also reported that the long-term survival rate at 5 and 10 years for patients with type B dissection receiving medical treatment was 89.4% and 71.8%, respectively, regardless of their false lumen status. Therefore, careful observation and management of hypertension are essential for maintaining event-free survival in patients with AAAD.

### Table 1. Clinical profile and dissection characteristics

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Group I (n = 45)</th>
<th>Group II (n = 57)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical</td>
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<td></td>
</tr>
<tr>
<td>Age (y)</td>
<td>61.1 ± 12.8</td>
<td>66.7 ± 13.5</td>
<td>.035</td>
</tr>
<tr>
<td>Male gender</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Hypertension</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Smoking</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CVD</td>
<td>3 (6.7)</td>
<td>6 (10.5)</td>
<td>.495</td>
</tr>
<tr>
<td>IHD</td>
<td>3 (6.7)</td>
<td>5 (8.8)</td>
<td>.695</td>
</tr>
<tr>
<td>COPD</td>
<td>1 (2.2)</td>
<td>3 (5.3)</td>
<td>.703</td>
</tr>
<tr>
<td>Renal failure</td>
<td>4 (8.9)</td>
<td>4 (7.0)</td>
<td>.727</td>
</tr>
<tr>
<td>Dissection</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>False lumen thrombosis</td>
<td>25 (5.6)</td>
<td>18 (31.6)</td>
<td>.015</td>
</tr>
<tr>
<td>Shock</td>
<td>11 (24.4)</td>
<td>24 (42.1)</td>
<td>.062</td>
</tr>
<tr>
<td>Intubation</td>
<td>3 (6.7)</td>
<td>6 (10.5)</td>
<td>.495</td>
</tr>
<tr>
<td>CPR</td>
<td>0</td>
<td>3 (5.3)</td>
<td>.118</td>
</tr>
<tr>
<td>Moderate to severe AR</td>
<td>3 (6.7)</td>
<td>14 (24.6)</td>
<td>.016</td>
</tr>
<tr>
<td>Malperfusion</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peripheral</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cerebral</td>
<td>2 (4.4)</td>
<td>1 (1.8)</td>
<td>.425</td>
</tr>
<tr>
<td>Cardiac</td>
<td>2 (4.4)</td>
<td>5 (8.8)</td>
<td>.391</td>
</tr>
</tbody>
</table>

AR, Aortic regurgitation; COPD, chronic obstructive pulmonary disease; CPR, cardiopulmonary resuscitation; CVD, cerebrovascular disease; IHD, ischemic heart disease.

### Table 2. Surgical data and early outcome

<table>
<thead>
<tr>
<th>Variable</th>
<th>Group I (n = 45)</th>
<th>Group II (n = 57)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replacement procedure</td>
<td></td>
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<td>&lt;.001</td>
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<tr>
<td>AAR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HAR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CABG</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Modified Bentall procedure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AVR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CPBT (min)</td>
<td></td>
<td></td>
<td>&lt;.001</td>
</tr>
<tr>
<td>ACCT (min)</td>
<td></td>
<td></td>
<td>&lt;.001</td>
</tr>
<tr>
<td>CAT (min)</td>
<td></td>
<td></td>
<td>.001</td>
</tr>
<tr>
<td>Lowest rectal temperature (°C)</td>
<td></td>
<td></td>
<td>.025</td>
</tr>
</tbody>
</table>

Complications

<p>| | | | |</p>
<table>
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<tr>
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</thead>
<tbody>
<tr>
<td>Neurologic deficits</td>
<td>3 (6.7)</td>
<td>5 (8.8)</td>
<td>.695</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>3 (6.7)</td>
<td>5 (8.8)</td>
<td>.695</td>
</tr>
<tr>
<td>Renal failure</td>
<td>1 (2.2)</td>
<td>2 (3.5)</td>
<td>.703</td>
</tr>
<tr>
<td>Mediastinitis</td>
<td>0</td>
<td>1 (1.8)</td>
<td>.372</td>
</tr>
<tr>
<td>Prolonged mechanical ventilation (&gt; 24 h)</td>
<td>10 (22.2)</td>
<td>19 (33.3)</td>
<td>.217</td>
</tr>
<tr>
<td>Hospital stay (d)</td>
<td>28.3 ± 62.6</td>
<td>21.1 ± 23.2</td>
<td>.422</td>
</tr>
<tr>
<td>Operative mortality</td>
<td>3 (6.7)</td>
<td>6 (10.5)</td>
<td>.495</td>
</tr>
</tbody>
</table>

AR, Ascending aorta replacement; ACCT, aortic crossclamp time; AVR, aortic valve replacement; CABG, coronary artery bypass grafting; CAT, circulatory arrest time; CPBT, cardiopulmonary bypass time; HAR, hemiarch replacement.

### Table 3. Computed tomography findings

<table>
<thead>
<tr>
<th>Finding</th>
<th>Group I (n = 35)</th>
<th>Group II (n = 34)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aortic diameter</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial postoperative CT scan</td>
<td>39.9 ± 5.9</td>
<td>39.2 ± 6.7</td>
<td>.617</td>
</tr>
<tr>
<td>Latest CT scan</td>
<td></td>
<td></td>
<td>.091</td>
</tr>
<tr>
<td>Aortic dilatation</td>
<td>3.99 ± 5.3</td>
<td>1.44 ± 4.5</td>
<td>.035</td>
</tr>
<tr>
<td>Aortic dilatation &gt; 5 mm</td>
<td>16 (45.7)</td>
<td>5 (14.7)</td>
<td>.005</td>
</tr>
<tr>
<td>Maximal aortic diameter &gt; 50 mm</td>
<td>9 (25.7)</td>
<td>5 (14.7)</td>
<td>.256</td>
</tr>
<tr>
<td>False lumen thrombosis</td>
<td>14 (40.0)</td>
<td>16 (52.9)</td>
<td>.281</td>
</tr>
</tbody>
</table>

CT, Computed tomography.
the long term, regardless of whether entry resection has been achieved by the initial emergency surgery.

Study Limitations

The present study had several limitations, including a relatively small number of subjects and a short follow-up period. Moreover, only 69 (77.5%) of the 89 patients discharged from the hospital underwent follow-up CT scanning. In particular, a greater number of patients were lost from group II, and this might have affected the findings from the follow-up CT scanning. No differences were found in the freedom from aorta-related clinical events and survival between the 2 groups, although the aortic diameter of the patients without exclusion of the intimal tear showed significantly more expansion after medium-term follow-up. An assessment of a larger number of patients for a longer follow-up period might have affected the freedom from aorta-related events or survival. Therefore, prospective studies on a larger scale with a longer follow-up period are required.

CONCLUSIONS

We assessed the medium-term outcomes of surgery for AAAD with an unknown site of entry. The prognosis of patients without exclusion of the intimal tear was acceptable. However, it is important to perform careful follow-up, because a patent false lumen and nonexclusion of the entry are risk factors for aortic dilatation.

References


