Surgical Treatment or Conservative Therapy for Stanford Type A Acute Aortic Dissection with a Thrombosed False Lumen

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Objectives: Optimum treatment for acute aortic dissection (AAD) with a thrombosed false lumen (thrombosed AAD) remains controversial. We evaluated the outcome of thrombosed AAD according to treatment strategy.

Materials and methods: We examined 280 patients with AAD, of which 30 had thrombosed AAD. We compared computed tomography findings, cardiac performance, and clinical course in 28 of these patients. Patients were divided into three groups for the comparison: Group E (emergency surgery), Group C (conservative therapy), and Group S (conservative therapy switched to emergency surgery).

Results: In Group E (n = 13), one patient died and 12 survived. In Group C (n = 10), all patients were discharged, of which two died of cancer and two of the remaining eight survivors underwent subsequent elective surgery. In Group S (n = 5), one patient died and four survived following surgery.

Conclusions: It was hard to predict re-dissection or rupture following conservative treatment for thrombosed AAD. Basically, we should perform emergency surgery following the diagnosis of thrombosed AAD, particularly in complicated cases such as those with pericardial effusion, tamponade, and large aorta. Conservative therapy has a very limited application in patients with the initial stages of thrombosed AAD.

Keywords: acute aortic dissection (AAD), AAD with a thrombosed false lumen (thrombosed AAD), surgical treatment, conservative therapy

INTRODUCTION

Recently, surgical treatment for Stanford type A acute aortic dissection (AAD) has yielded a good prognosis.1–5 However, the optimum treatment for AAD with a thrombosed false lumen (thrombosed AAD), which accounts for 10%–30% AAD cases, remains controversial.6–10 Reportedly, conservative treatment yields better outcomes compared with surgery for thrombosed AAD.11–15 However, patients undergoing conservative treatment often require emergency intervention for severe conditions, including cardiac tamponade, shock, and organ ischemia.16–18 These comparisons of surgical and conservative outcomes are controversial; therefore, we evaluated the outcome of thrombosed AAD according to treatment strategy, namely conservative and surgical treatment strategies. This study highlights the therapeutic criteria followed for conversion from conservative to surgical therapy in cases of thrombosed AAD.

MATERIALS AND METHODS

We examined 280 patients with AADs from June
1998 to June 2008 at our institute (Department of Cardiovascular Surgery, St. Marianna University School of Medicine, Kawasaki, Japan). Of the 280, 30 patients were diagnosed with Stanford type A AAD, with a thrombosed false lumen.

A clotted false lumen was confirmed by early- and late-phase enhanced computed tomography (CT).\textsuperscript{19,20} Although we did not use transesophageal echocardiography, aortography, or magnetic resonance angiography during diagnosis,\textsuperscript{21} we used transthoracic echocardiography to detect other cardiac complications such as cardiac tamponade, aortic valve regurgitation, or asynergy of left ventricular wall motion. We selected conservative treatment on the basis of the following criteria:

- Presence of thrombosed false lumen as detected by early- and late-phase CT with no ulcer-like projections or organ ischemia
- Ascending aortic diameter of <50 mm
- Stable hemodynamic state without massive pericardial effusion (<10 mm thickness) and with adequate pain relief

Two patients were excluded from this study: one with cerebral infarction and one who rejected surgery. After exclusion, 28 patients satisfying the above criteria were enrolled in this study, of which 15 were treated medically (Group C: conservative therapy), and 13 were treated surgically (Group E: emergency surgery). However, following adverse events, five patients from group C required recategorization into Group S (conservative therapy switched to emergency surgery). The 28 patients were, therefore, divided into three groups: Group E (n = 13), Group C (n = 10), and Group S (n = 5).

All patients in Group E underwent emergency surgery. Cardiopulmonary bypass was performed with both a prosthetic vascular graft anastomosed to the femoral or axillary artery and two cannulations into the right atrium through the superior and inferior vena cava. We performed the procedures without aortic cross-clamping; however, we used retrograde cold blood cardioplegia via the coronary sinus and retrograde cerebral perfusion for brain protection by snaring of the superior vena cava.\textsuperscript{22–24} We did not excise the outer membrane of the ascending aorta until systemic circulatory arrest at a rectal temperature of 20°C was achieved. Selection of an entry site for the operative procedure was crucial. When the entry site was the ascending aorta, ascending aortic replacement was undertaken, whereas when the entry site was the aortic arch, ascending aortic and aortic arch replacement with reconstruction of three neck vessels, namely the brachiocephalic arterial trunk, left common carotid artery, and left subclavian artery, was undertaken using the selective cerebral perfusion method.\textsuperscript{22–24} When no entry site was found in either the ascending aorta or aortic arch, ascending aortic replacement was undertaken.

Proximal anastomoses preceded peripheral anastomoses.

All patients in Group C were treated for systolic blood pressure <100 mm Hg. Patients were instructed to take complete bed rest for 48 hours after onset. CT was performed on admission and 48 hours after admission; thereafter, a gradual rehabilitation program was initiated. Two additional CT examinations were performed one and two weeks later, respectively, following which they were discharged. After discharge, the patients underwent regular monitoring at an outpatient clinic.

In Group S, emergency CT performed because of unstable dynamics or sudden pain despite systolic blood pressure being in control. They underwent emergency surgery during their hospital stay except one patient.

**Follow-Up**

Clinical data were obtained from patients’ medical records. Each patient or his/her family was interviewed using a standardized telephone questionnaire. Follow-up was completed in all 28 cases. The longest follow-up period was 8 years.

**Statistical Analysis**

All data were expressed as mean ± standard deviation and analyzed using SPSS version 19 (SPSS Inc., Chicago, IL, USA). Homogeneity of variance was used for statistical comparison between groups. Differences between the three groups were analyzed by analysis of variance. A p value of <0.05 was considered statistically significant.

**Results**

Patient characteristics are summarized in Table 1 and Fig. 1.

Group E comprised 13 patients (seven males and six females; average age, 63.3 ± 12.0 years; range, 46–84 years). In this group, CT revealed the maximum diameter of the ascending aorta as 39.9 ± 8.5 mm (range, 30–56 mm) and the thickness of the false lumen as 11.5 ± 7.5 mm (range, 4–25 mm; Fig. 2a and 2b). Six patients exhibited pericardial effusion, of which two required drainage for cardiac tamponade before admission to the operating theatre. Operative procedures included ascending aortic replacement.
Fig. 1 Scatter Chart: The value of Diameter of the ascending aorta is shown on the horizontal axis, and the value of thickness of the false lumen is shown on the vertical axis. Rhombus dots ◆ are displayed Group E. Circle dots ● are exhibited Group C, and the triangle dots ▲ are of Group S. Two points surrounded completely shows the cases of death.

Table 1 Patient demographics and clinical data

<table>
<thead>
<tr>
<th></th>
<th>Group E</th>
<th>Group C</th>
<th>Group S</th>
<th>p-value</th>
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<tr>
<td>number</td>
<td>13</td>
<td>10</td>
<td>5</td>
<td>-</td>
</tr>
<tr>
<td>Age (years)</td>
<td>63.3 ± 12.0</td>
<td>73.7 ± 10.0</td>
<td>70.5 ± 9.3</td>
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<tr>
<td>Male/Female</td>
<td>7/6</td>
<td>3/7</td>
<td>1/4</td>
<td>.226</td>
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<tr>
<td>Diameter (mm)</td>
<td>39.7 ± 7.8</td>
<td>43.5 ± 5.0</td>
<td>39.0 ± 6.4</td>
<td>.725</td>
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<tr>
<td>Thickness (mm)</td>
<td>10.5 ± 7.3</td>
<td>7.9 ± 3.6</td>
<td>4.2 ± 1.2</td>
<td>.024</td>
</tr>
<tr>
<td>pericardial effusion</td>
<td>6</td>
<td>5</td>
<td>1</td>
<td>.305</td>
</tr>
<tr>
<td>cardiac tamponade</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>.446</td>
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Fig. 2 Enhanced CT reveals a representative image of the E group. It shows a 12-mm false-lumen thickness (a) and much pericardial effusion (b).
(n = 9), total aortic arch replacement (n = 3), and aortic root replacement (n = 1) (Table 2). Although one patient died from disseminated intravascular coagulopathy, the remaining 12 were discharged without complications. No patient died for an average of 35 ± 18 months (range, 8–66 months) during follow-up.

Group C comprised 10 patients (three males and seven females; average age, 75.1 ± 10.1 years; range, 61–89 years). In this group, CT revealed the maximum diameter of the ascending aorta as 43.7 ± 5.2 mm (range, 38–52 mm) and the thickness of the false lumen as 7.6 ± 3.7 mm (range, 3–13 mm; Fig. 3a and 3b). Five patients exhibited pericardial effusion, of which one required drainage on admission because of a lot of effusion with stable hemodynamics. The chest pain diminished after drainage and the amount of drainage gradually decreased over the next two days. Follow-up CT revealed no pericardial effusion- and no interval change in the dissected aorta. Therefore, we decided to continue conservative therapy in this patient. All patients were discharged, but two subsequently underwent elective surgery following enlargement of the ascending aorta (Table 2). Two patients died of cancer. The remaining six survived for an average of 37 ± 29 months (range: 2–67 months) during follow-up.

Group S comprised five patients (one male and four females; average age, 70.0 ± 8.1 years; range, 58–79 years). In this group, CT revealed the maximum diameter of the short ascending aorta as 39.4 ± 6.5 mm (range, 32–49 mm) and the thickness of the false lumen as 5.4 ± 2.7 mm (range, 3–10 mm; Fig. 4a and b). Two patients demonstrated a lot of pericardial effusion, requiring drainage. One of these patients was considered to be a complicated case. On the basis of her overall poor health, which was attributed to continuous dialysis for more than 30 years and a history of disuse syndrome following an old cerebral infarction, we judged that the use of cardiopulmonary bypass would subject her to high risk. Therefore, conservative treatment was initiated for this patient following pericardial drainage. The other patient already suffered from paraplegia with cardiac tamponade at the time of admission. We were apprehensive of the negative effect of cardiopulmonary bypass on spinal ischemia during surgery; therefore, we performed only

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Table 2  Operative procedures

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Number of Cases</th>
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<tr>
<td>Total aortic arch replacement</td>
<td>5 (Group E 3/ Group S 2)</td>
</tr>
<tr>
<td>Ascending aorta replacement</td>
<td>12 (Group E 10/Group S 2)</td>
</tr>
<tr>
<td>Aortic root replacement</td>
<td>1 (Group E 1)</td>
</tr>
</tbody>
</table>

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Fig. 3  Enhanced CT reveals a representative image of the C group. It shows a 3-mm false-lumen thickness (a). It dismissed the dissection of the ascending aorta seven days later (b).
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The pericardial drainage relieved both patients from pain; however, the former patient died from aortic rupture prior to surgery. The remaining four patients underwent emergency surgery during their hospital stay. The observation period to recanalization, uncontrollable cardiac tamponade, development of a large ulcer-like projection (ULP), or enlargement of the dissected aorta was 5.4 ± 3.4 days (range, 1–9 days) despite systolic blood pressure being in control (Tables 2 and 3). They were discharged following surgery, and they survived for an average of 51 ± 14 months (range: 38–67 months) during follow-up.

**Discussion**

AAD is the most common aortic catastrophe. Left untreated, approximately 33% patients die within 24 hours, whereas, 50% die within 48 hours. The 2-week mortality rate approaches 75% in patients with undiagnosed AAD.1–3) Type A dissections require surgery, while type B dissections can be medically managed in most circumstances. Although thrombosed AAD can be managed conservatively, data on suitable conservative treatment strategies are scarce.6,8,11–15) In addition, its etiology and pathogenesis are poorly understood.26) In the present guideline, the conservative treatment standard is not declared as thrombosed AAD. However, the surgical treatment standard is insisted upon.3) We report the midterm results of our study on the management of thrombosed AAD, particularly from the perspective of initial management strategies.

As a result, the difference between Group C and Group S was not clear.

Essentially, even if the initial CT scan reveals thrombosed AAD, emergency surgery should be recommended. We performed CT examinations three times a week: on admission, forty-eight hours later, and seven days later. Then next CT examination was performed two weeks later. However, we could not predict re-dissection and rupture. It was considered better to perform emergency surgery rather than to conduct CT exam more frequently.

Furthermore, in this study, we expected that a stable hemodynamic state without massive pericardial effusion (< 10-mm thickness) was one of the conditions that may have required conservative treatment; however, it was
very difficult to continue conservative management. Indeed, surgical mortality and morbidity rates are especially high in the elderly compared to younger patients.2)

Conservative therapy is often intentionally administered not only to elderly patients but also to patients with a poor general condition. Even when conservative treatment was chosen in the acute stage of cases, judged to be high risk of emergency surgery, the results of cases that were able to continue conservative treatment were satisfactory. However, when emergency surgery was possible, we should consider that it was not desirable to apply conservative treatment particularly, even if there was either a short diameter of the ascending aorta or a thin thickness of the false lumen with thrombosed AAD. It is essential for us to manage each patient, case-by-case. If the maximum diameter of the short ascending aorta is expanded, even less than 40 mm, during progress observation, it will be performed emergency surgery as possible as we can. This was because deciding the correct large diameter was very difficult.

There are some advantages of an elective surgery over an emergency surgery. First, vulnerable arterial walls may harden during the waiting phase of elective surgery. Second, the postoperative course of elective surgery is usually uneventful following further examinations such as evaluation of coronary artery disease. Third, there is scope for the patient to achieve physical fitness before elective surgery, considering that it is essential to be physically fit to undergo emergency surgery. However, there are always some disadvantages of an elective surgery. First, because there is always a risk of an unstable hemodynamic state, it may be too late to save the life. Second, the patient would rehabilitate slowly and deliberately remaining dissected of the ascending aorta. Third, the anxiety of patients may appear to be delirium, which does not maintain effective rehabilitation. Actually, in this study, one patient died prior to surgery, indicating that neither re-dissection nor rupture is predictable. At the moment, the relationship between diameter and thickness was not elucidated.

This study had a few limitations. First, it was inappropriate to come to any definite conclusions on the basis of just two indices, i.e., the maximum diameter of the short ascending aorta and the thickness of the false lumen. Second, the patient number was limited. In fact, we found no significant difference between the three groups in this study (Table 1). Third, neither transesophageal echocardiography nor MRA, both of which indicate the entry site of AAD much better than enhanced CT,21) were used in our study patients. Accurate knowledge of the exact entry site of AAD would greatly assist in treatment selection.

In conclusion, the outcomes of conservative and surgical treatment strategies for thrombosed AAD are associated with satisfactory outcomes; however, the use of conservative treatment may be limited to the initial stages of thrombosed AAD, and not all patients can undergo successful conservative treatment because neither re-dissection nor rupture is predictable. Basically, we should perform emergency surgery following the diagnosis of thrombosed AAD, particularly in complicated cases such as those with pericardial effusion, tamponade, and large aorta.

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DISCLOSURE STATEMENT

None of the authors has any financial or other potential conflicts of interest to declare.

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