Outcomes of patients who declined surgery for acute Stanford type A aortic dissection with patent false lumen of the ascending aorta†

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Abstract

OBJECTIVES: This study aimed to evaluate the outcomes of patients who did not undergo initial aortic surgery for acute Stanford type A aortic dissection with a patent false lumen of the ascending aorta.

METHODS: Inpatient and outpatient records were retrospectively reviewed.

RESULTS: We identified 195 patients with acute type A aortic dissection with a patent ascending false lumen between January 1998 and March 2016. Of these, 137 underwent aortic surgery, 16 died before surgery and 42 declined aortic surgery. The ages of the patients who underwent and those who declined aortic surgery were 60.0 ± 10.6 years and 72.3 ± 12.4 years, respectively. The mortality rate of those who underwent and those who declined aortic surgery was 15 and 62% at 30 days and 19% and 67% at 90 days, respectively (P < 0.0001). In the 58 patients who did not undergo initial aortic surgery, the maximum aortic diameter was correlated with survival (P = 0.0037). At follow-up (3.7 ± 4.5 years; range 0–16.4 years), survival at 1, 5 and 10 years in those who underwent and those who declined initial aortic surgery was 78, 68 and 49%, and 29, 24 and 12%, respectively (P < 0.0001).

CONCLUSIONS: In this study of patients with acute Stanford type A aortic dissection with a patent false lumen of the ascending aorta, the mortality of those who declined initial aortic surgery was 62% at 30 days and 67% at 90 days, respectively, and a smaller aortic diameter was significantly associated with better survival.

Keywords: Acute type A aortic dissection • Medical treatment • Outcome

INTRODUCTION

Previous reports on medical treatment for acute type A aortic dissection have shown unfavourable outcomes [1–3] and emergency surgery on the aorta is recommended on the guidelines [4, 5]. However, for extremely high-risk patients with advanced age, mal-perfusion or shock, it is sometimes difficult to judge the benefits of initial aortic surgery [6, 7]. Recent studies reported that acute type A dissection with a thrombosed false lumen is less prone to rupture compared with those with a patent false lumen [8, 9]. Therefore, for high-risk acute type A dissection patients with thrombosed ascending false lumen, initial medical treatment can be an option, and if the thrombosed false lumen recanalizes or the ulcer-like projection becomes larger, surgery can be more safely performed in the subacute phase. The decision to operate on an extremely high-risk patient with a patent false lumen of the ascending aorta who seems unfit for surgery is challenging. In older populations, physicians may be concerned about performing aortic surgery in such extremely high-risk patients with acute aortic dissection because the treatment goal is survival with the least amount of impairment possible. Information about the outcome of surgically untreated patients with acute type A aortic dissection is sparse, and less is known about the natural history in the acute period of surgically untreated type A aortic dissection with a patent ascending false lumen.

The objective of this study was to evaluate the outcomes of patients who did not undergo surgery for acute Stanford type A aortic dissection with a patent false lumen of the ascending aorta to better understand the benefit of initial surgical treatment.

MATERIALS AND METHODS

Patients and methods

From January 1998 to March 2013, 516 patients presented to Kitasato University Hospital with a diagnosis of acute Stanford type A aortic dissection. Among these, 225 patients had...
developed cardiopulmonary arrest on arrival and the remaining 291 were transferred alive. Of these 291 patients, 95 patients had a thrombosed false lumen of the ascending aorta on computed tomographic (CT) angiography and the remaining 196 had a patent ascending false lumen. One patient was transferred to another hospital, and the remaining 195 patients treated at Kitasato University Hospital were selected for detailed analysis and included in this study. All 195 patients and/or their family were informed that initial aortic surgery is recommended for survival, except in the cases of 3 patients who underwent initial palliative surgery followed by delayed aortic repair. Two patients underwent initial bypass surgery of the superior mesenteric artery for severe abdominal malperfusion syndrome, and another patient underwent surgical right carotid angioplasty for true lumen occlusion resulting in coma following left hemiplegia.

Patient medical records were retrospectively reviewed for demographics, diagnosis and complications at initial presentation. All patients underwent CT angiography at presentation, and these CT images were used for measuring the aortic diameter. The false lumen of the ascending aorta was defined as patent if there was an extensive contrast enhancement in the false lumen at the early or delayed phase. A thrombosed false lumen with an ulcer-like projection was not considered patent.

Early mortality and late survival were compared between patients who underwent and those who declined initial aortic surgery, not including those who wished to have surgery but died preoperatively. Survival factors of patients who did not undergo initial aortic surgery were analysed and included both non-surgical patients and preoperative death patients.

Aorta-related death was defined as death due to rupture, malperfusion or in-hospital mortality after aortic surgery. An aortic event was defined as aorta-related death, aortic intervention including both open aortic surgery and stent grafting, aortic enlargement with maximum diameter greater than 60 mm, aortic rupture, impending rupture or formation of anastomotic pseudoaneurysm.

Statistical analysis

JMP 12 software (SAS Institute, Cary, NC, USA) was used to perform statistical analyses. Continuous variables were presented as means ± standard deviations. Student’s t-test was used to analyse differences in continuous variables. Fisher’s exact test was used to compare categorical variables. Kaplan–Meier analysis was used to assess survival, freedoms from aorta-related death and aortic events, and the log-rank test was used for comparison between groups. A P-value < 0.05 was considered statistically significant.

RESULTS

Figure 1 shows the breakdown of the patients who presented with acute Stanford type A aortic dissection. Of the 195 patients with a patent false lumen of the ascending aorta, 137 underwent emergency aortic surgery (surgical group), 16 wished to have surgery but died preoperatively (preoperative death group) and 42 declined aortic surgery (non-surgical group) after receiving an adequate explanation of the nature of the disease and the risks and benefits involved in surgical treatment. The mean age of the overall patients was 63.0 ± 12.1 years (range: 36-90 years). Table 1 shows the profiles of the patients in the surgical and non-surgical groups. Patients in the non-surgical group were significantly older and a higher incidence of haemodynamic deterioration and new neurological disorders than the surgical group. Of the 137 patients in the surgical group, 6 patients presented with a malperfusion syndrome other than brain malperfusion; 4 of these underwent emergency aortic surgery and died and the remaining 2 with abdominal malperfusion syndrome underwent initial bypass surgery of the superior mesenteric artery, followed by aortic repair after 18 and 24 days. Both patients were sedated and ventilated until aortic surgery and became long-term survivors. The patient who had surgical right common carotid angioplasty recovered consciousness and underwent total arch replacement the following day. She also became a long-term survivor. Among the 42 patients in the non-surgical group, 29 had any of hypotension, new dissection-related neurological disorders and malperfusion syndrome; 14 were in a coma and 4 were in profound shock with systolic blood pressure <60 mmHg. Other than these 29 patients, 2 had significant comorbidities: 1 had impaired activities of daily life due to severe polymyositis and the other had renal cell carcinoma with sternal metastasis.

Figure 1: Breakdown of patients who presented with acute Stanford type A aortic dissection.
The age of these 31 patients was 70.7 ± 12.6 years (range: 42–89), and the age of the remaining 11 patients who did not wish to undergo aortic surgery was 77.1 ± 10.7 years (range: 54–90). Nine patients in the non-surgical group underwent palliative procedures; 7 underwent pericardial drainage for significant pericardial effusion causing haemodynamic deterioration, 1 underwent femoro-femoral bypass for malperfusion, and 1 underwent iliac stenting for malperfusion.

Kitasato University Hospital built a building in 2014 with a new system so that patients can be directly transferred from the casualty to the operation theatre. Before that, among the 122 patients who intended to have emergency surgery, 15 (12.3%) died preoperatively. In the new system, only 1 patient out of 31 (3.2%) died before the operation ($P = 0.20$).

Mortality in the surgical and non-surgical groups was 15 and 62% at 30 days and 19 and 67% at 90 days, respectively ($P < 0.0001$). The cause of 30-day mortality in the non-surgical group was rupture in 14 cases, cerebral malperfusion or stroke in 7 cases, visceral malperfusion in 4 cases, and arrhythmia in 1 case. In the non-surgical group, survival at 2, 7, 30, and 90 days was 55, 43, 38, and 33%, respectively.

Factors for survival beyond 90 days were analysed in the 58 patients in the preoperative death group and non-surgical group (Table 2). The maximum diameter of the ascending aorta was 44 mm in patients who survived and 51 mm in those who died ($P = 0.0037$). Patients with an initial aortic diameter of 45 mm or less had significantly better early survival than those with a diameter of 50 mm or greater (Table 3). Age, sex, winter season and DeBakey type did not affect survival beyond 90 days. Three of 9 patients who underwent initial palliative surgery survived beyond 90 days.

The 179 patients in the surgical and non-surgical groups were followed up for 3.7 ± 4.5 years (range: 0–16.4 years). Survival at 1, 5, and 10 years was 78, 68, and 49%, respectively, in those who underwent initial aortic surgery and 29, 24, and 12%, respectively, in those who declined initial aortic surgery ($P < 0.0001$); the rate of freedom from aorta-related death at 1, 5, and 10 years was 80, 75, and 65%, respectively, in those who underwent initial aortic surgery and 38, 38, and 33%, respectively, in those who declined initial aortic surgery ($P < 0.0001$); the rate of freedom from aortic events at 1, 5, and 10 years was 71, 54, and 44%, respectively, in those who underwent initial aortic surgery and 33, 24, and 21%, respectively, in those who declined initial aortic surgery.

### Table 1: Profiles of the patients who underwent and declined aortic surgery for acute Stanford type A aortic dissection with a patent false lumen of the ascending aorta ($n = 195$)

<table>
<thead>
<tr>
<th>Patient characteristics</th>
<th>Underwent surgery ($n = 137$)</th>
<th>Declined surgery ($n = 42$)</th>
<th>$P$-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years (range))</td>
<td>60.0 ± 10.6 (36–85)</td>
<td>72.3 ± 12.4 (42–90)</td>
<td>$&lt;0.0001^*$</td>
</tr>
<tr>
<td>Female sex</td>
<td>55 (40.1%)</td>
<td>23 (54.8%)</td>
<td>0.095</td>
</tr>
<tr>
<td>Malperfusion syndrome</td>
<td>6 (4.4%)</td>
<td>3 (7.1%)</td>
<td>0.44</td>
</tr>
<tr>
<td>Systolic blood pressure &lt;80 mmHg</td>
<td>1 (0.7%)</td>
<td>5 (11.9%)</td>
<td>0.0029*</td>
</tr>
<tr>
<td>New neurological disorder</td>
<td>11 (8.0%)</td>
<td>24 (57.1%)</td>
<td>$&lt;0.0001^*$</td>
</tr>
</tbody>
</table>

* $P < 0.05$.

### Table 2: Factors affecting survival beyond 90 days in patients who did not have initial aortic surgery for acute Stanford type A aortic dissection with a patent false lumen of the ascending aorta ($n = 58$, 90-day mortality 76%)

<table>
<thead>
<tr>
<th>Factor</th>
<th>Survived beyond 90 days ($n = 14$)</th>
<th>Died within 90 days ($n = 44$)</th>
<th>$P$-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>74.0 ± 8.4</td>
<td>68.7 ± 13.6</td>
<td>0.18</td>
</tr>
<tr>
<td>Female sex</td>
<td>10/14</td>
<td>19/44</td>
<td>0.066</td>
</tr>
<tr>
<td>Maximum aortic diameter (mm)</td>
<td>44.4 ± 4.3</td>
<td>50.7 ± 7.2</td>
<td>0.0037*</td>
</tr>
<tr>
<td>Winter season (October–March)</td>
<td>4/14</td>
<td>21/44</td>
<td>0.21</td>
</tr>
<tr>
<td>DeBakey II</td>
<td>4/14</td>
<td>9/43</td>
<td>0.55</td>
</tr>
</tbody>
</table>

* $P < 0.05$.

### Table 3: Early mortality according to initial aortic diameter of patients who did not have aortic surgery for acute Stanford type A aortic dissection with a patent false lumen of the ascending aorta

<table>
<thead>
<tr>
<th>Survival</th>
<th>Aortic diameter</th>
<th>Aortic diameter</th>
<th>$P$-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt; 45 mm ($n = 20$)</td>
<td>≥ 50 mm ($n = 21$)</td>
<td></td>
</tr>
<tr>
<td>7 Days</td>
<td>9/20 (45%)</td>
<td>3/21 (14%)</td>
<td>0.04*</td>
</tr>
<tr>
<td>30 Days</td>
<td>8/20 (40%)</td>
<td>2/21 (9.5%)</td>
<td>0.03*</td>
</tr>
<tr>
<td>90 Days</td>
<td>8/20 (40%)</td>
<td>1/21 (4.8%)</td>
<td>0.009*</td>
</tr>
</tbody>
</table>

* $P < 0.05$. Log-rank $P = 0.047$. 

The 179 patients in the surgical and non-surgical groups were followed up for 3.7 ± 4.5 years (range: 0–16.4 years). Survival at 1, 5, and 10 years was 78, 68, and 49%, respectively, in those who underwent initial aortic surgery and 29, 24, and 12%, respectively, in those who declined initial aortic surgery ($P < 0.0001$); the rate of freedom from aorta-related death at 1, 5, and 10 years was 80, 75, and 65%, respectively, in those who underwent initial aortic surgery and 38, 38, and 33%, respectively, in those who declined initial aortic surgery ($P < 0.0001$); the rate of freedom from aortic events at 1, 5, and 10 years was 71, 54, and 44%, respectively, in those who underwent initial aortic surgery and 33, 24, and 21%, respectively, in those who declined initial aortic surgery.
Among those who declined initial aortic surgery, 2 patients underwent graft replacement of the enlarged ascending aorta 4 and 6 years after the onset at the ages of 82 and 78, but both died within 90 days after aortic surgery.

DISCUSSION

Medical treatment for acute Stanford type A aortic dissection is associated with very poor outcomes [1–3], with a classical and popular saying of ‘1% per hour mortality’ [2]. Therefore, surgical treatment is classified as recommendation class I in the guideline [5], and there has never been any risk score reported regarding medical treatment for acute type A dissection, whereas some risk models of surgical mortality for acute type A dissection have been published [10–13]. However, not all patients die within 100 h. According to the report from the International Registry of Acute Aortic Dissection, in-hospital mortality of patients who did not receive surgery was 58% [3], i.e. 42% of the patients were discharged without having surgical treatment. Surgical treatment for acute type A dissection is also associated with significant risk, with reported early mortality of 9–27% [10, 13–15]. Malperfusion, coma, shock, tamponade, myocardial ischaemia and advanced age are known risk factors for early postoperative mortality [10–13].

Recent progress in multi-detector CT devices, in combination with early and delayed contrast enhancement techniques, has enabled precise examination of the condition of the false lumen. Favourable outcomes with initial medical treatment for acute type A aortic dissection with a thrombosed false lumen of the ascending aorta have been reported in Japan and Korea [8, 9]. Therefore, initial medical treatment is justified for high-risk patients with acute type A dissection with thrombosed ascending false lumen. The question raised here is, ‘How bad is medical treatment for acute type A dissection with a patent ascending false lumen?’ There have been no studies focusing on this point. In the present study, to precisely analyse survival factors of patients with surgically untreated acute type A aortic dissection, data from patients who wished to undergo initial aortic surgery but died preoperatively were combined with data from those who declined to undergo initial aortic surgery because these patients with preoperative mortality would have died irrespective of treatment option.

In our cohort, 42 out of 195 patients and/or their family declined aortic surgery despite being provided with an explanation of the poor prognosis of surgically untreated acute type A aortic dissection. Patients with risk factors for early postoperative mortality, such as advanced age, hypotension, dissection-related neurological disorder and malperfusion, had a higher tendency to decline aortic surgery; these decisions may have also depended on the information provided by physicians. Recently, a novel cannulation method for brain malperfusion [16] and initial bypass strategy for visceral malperfusion [17] have been reported with promising outcomes. These new strategies may improve early outcomes of acute type A dissection with preoperative neurological disorder or malperfusion, shifting the decision of the patients towards initial surgical treatment.

Among patients who declined aortic surgery, 9 underwent a palliative procedure for life-threatening complications including cardiac tamponade and malperfusion. These ‘cost-effective’ procedures should improve the early outcome of surgically untreated acute type A aortic dissection. However, the rates of 90-day survival and freedom from aorta-related death of patients who declined initial aortic surgery were 33 and 38%, respectively. Thus, even with additional palliative procedures, medical treatment for acute Stanford type A aortic dissection with a patent false lumen of the ascending aorta (Fig. 2–4) is justified for high-risk patients with acute type A dissection with a patent ascending false lumen. The question raised here is, ‘How bad is medical treatment for acute type A dissection with a patent ascending false lumen?’ There have been no studies focusing on this point. In the present study, to precisely analyse survival factors of patients with surgically untreated acute type A aortic dissection, data from patients who wished to undergo initial aortic surgery but died preoperatively were combined with data from those who declined to undergo initial aortic surgery because these patients with preoperative mortality would have died irrespective of treatment option.
false lumen of the ascending aorta is associated with very poor outcomes. Nevertheless, 1 in 4 patients survived the early period without having aortic surgery. The only survival factor observed in this study was smaller initial aortic diameter. Initial aortic diameter is associated with early and late outcomes in acute type A dissection with thrombosed ascending false lumen [8] and is also associated with late outcomes in type B aortic dissection [18–20]. Similarly, larger aortas are significantly associated with early mortality in acute type A dissection with a patent false lumen, as shown in this study.

The present study demonstrated that patients who declined surgery had an approximately 3-fold greater risk of mortality and a 2-fold greater risk of aorta-related death compared with those who underwent surgery at any time. Although the 2 groups differed in mean age, it was shown that initial aortic surgery unquestionably improves both early and late outcomes of acute type A aortic dissection with a patent false lumen of the ascending aorta. Therefore, sole medical treatment should only be recommended in a situation where the ascending aorta is not dilated and the predicted risk of mortality of the initial aortic surgery is comparable to or greater than the risk of the early mortality or aorta-related death with medical treatment, i.e. 60–70%.

This study has some limitations. This is a single-centre retrospective study, and the number of patients was not large enough to permit intention-to-treat analysis.

In conclusion, in acute Stanford type A aortic dissection with a patent false lumen of the ascending aorta, the mortality rate of the patients who declined initial aortic surgery was 62% at 30 days and 67% at 90 days, respectively, and a smaller aortic diameter was significantly associated with survival beyond 90 days.

Conflicts of interest: none declared.

REFERENCES