Influence of False Lumen Status on the Prognosis of Acute Type A Aortic Dissection without Urgent Surgical Treatment

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Aim: Recently, much attention has been focused on partial thrombosis of the false lumen in patients with acute aortic dissection. However, its effect on clinical outcomes in these patients, especially in case of acute type A aortic dissection, has not been clearly elucidated. This study evaluated the influence of the false lumen status, including partial thrombosis, on short-term clinical outcomes in acute type A aortic dissection patients without urgent surgical treatment.

Methods: Sixty-two patients (29 males, mean age 73 ± 13 years) with acute type A aortic dissection who did not receive urgent surgical treatment at four hospitals were enrolled. Patients were divided into three groups based on the false lumen status on enhanced computed tomography image (complete thrombosis, n=28; partial thrombosis, n=27; patent, n=7). Patients with partial thrombosis were further divided into two groups (thrombus-dominant, n=15; flow-dominant, n=12).

Results: The short-term mortality rate (in-hospital and 30-day) was significantly higher in patients with a patent false lumen, while no significant difference was seen between the other two groups. Patients with flow-dominant partial thrombosis had significantly higher short-term mortality rate than those with thrombus-dominant partial thrombosis (in-hospital, p=0.001 and 30-day, p<0.001).

Conclusions: The short-term mortality rate in acute type A aortic dissection patients without urgent surgical treatment was lower in patients with partial thrombosis of the false lumen than in those with a patent false lumen. Furthermore, patients with flow-dominant partial thrombosis had higher mortality rate than those with thrombus-dominant partial thrombosis.

Key words: Type A aortic dissection, False lumen status, Partial thrombosis

Introduction

A recent report showed that partial thrombosis of the false lumen is an independent predictor of long-term mortality in patients with acute type B aortic dissection⁶. Thereafter, much attention has been focused on partial thrombosis of the false lumen in patients with acute aortic dissection⁷-⁸. However, the issue about partial thrombosis of the false lumen has not been clearly elucidated. Furthermore, the extent of partial thrombosis has not been fully studied in these patients⁹.

Type A dissection is associated with higher mortality, and often involves hemodynamic instability⁹-¹¹. Therefore, research focused on type A dissection may contribute towards improving our understanding of the significance of false lumen status in patients with acute aortic dissection. However, urgent surgical repair is generally indicated for type A dissection⁹, and data regarding false lumen status in type A dissection patients who do not undergo urgent surgical treatment are scarce.

Aim

The aim of this study was to evaluate the influence of the false lumen status, including partial thrombosis, on short-term clinical outcomes in acute type A aortic dissection patients without urgent surgical treatment.
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**Methods**

Data of acute type A aortic dissection patients who were admitted and received initial medical treatment in four hospitals (Nagoya University Hospital, Yokkaichi Municipal Hospital, Toyota Memorial Hospital, and Handa City Hospital) between 2004 and 2013 were examined ($n=62$). Acute type A aortic dissection was defined as any non-traumatic dissection involving the ascending aorta and presenting within 14 days of the onset of symptoms. The diagnosis was confirmed by enhanced computed tomography (CT) immediately after emergency admission. Urgent surgical treatment was generally considered for all patients, and the final decision was based on various factors, including each patient’s comorbidities and general condition. Initial medical treatment was defined as treatment not involving any surgical intervention during the first four days of admission. Blood pressure was controlled to maintain systolic blood pressure below 120 mm Hg immediately after admission, using continuous intravenous infusion and oral administration of antihypertensive drugs.

This study was performed according to the guidelines of the Declaration of Helsinki and approved by the local Ethics Committee, which waived the requirement for written informed consent. Imaging results were interpreted at each patient’s hospital by experienced cardiologists and radiologists. On imaging, the status of the false lumen was classified as completely thrombosed if no flow was present, as partially thrombosed if both flow and thrombus were present, and as patent if flow was present in the absence of thrombus. Thus, all the patients were divided into three groups based on the status of the false lumen on initial CT image: patent, partial thrombosis, and complete thrombosis (Fig. 1). Furthermore, patients with partial thrombosis of the false lumen were divided into two groups, thrombus-dominant partial thrombosis if more than 50% of the false lumen was thrombosed of the total length of dissected aorta on visual inspection, and flow-dominant partial thrombosis in the remaining cases.

All patients were assessed for the occurrence of short-term clinical events, including all-cause death and late surgical treatment related to aortic dissection. Data are presented as mean ± standard deviation. Categorical variables are expressed as count and percentages. Categorical data were compared using the $\chi^2$ test or Fisher exact test. Continuous data were compared using an unpaired $t$ test. Among the three groups, continuous data were compared using analysis of variance. Kaplan-Meier estimates were generated to describe outcome time-course. The log-rank test was used to compare differences. A $p$-value of <0.05 was considered statistically significant. All analyses were performed with the SPSS 18.0 software package (SPSS, Chicago, IL, USA).

**Results**

The mean age of the enrolled patients was 73 ± 13 years (Table 1). Majority of these patients (83.9%) had history of hypertension; only 1.6% had diabetes. Previous aortic dissection (12.9%) and aortic aneurysm (19.4%) were not uncommon.

Table 1 shows baseline characteristics of patients stratified according to the status of the false lumen, and major reasons for the initial medical treatment. On CT imaging, the false lumen was found to be completely thrombosed in 28 patients (45.2%), partially thrombosed in 27 (43.5%), and patent in 7 (11.3%). There were no significant differences in age, sex, clinical characteristics, and clinical presentations among the three groups.
Table 1. Patient characteristics

| Characteristic                                      | All \( n = 62 \) | Complete \( n = 28 \) | Partial \( n = 27 \) | Patent \( n = 7 \) | \( P \)-value |
|-----------------------------------------------------|------------------|------------------------|----------------------|-------------------|--------------|
| Age, years                                          | 73 ± 13          | 72 ± 11                | 72 ± 15              | 78 ± 8            | 0.49         |
| Men                                                 | 29 (46.8%)       | 11 (39.3%)             | 15 (55.6%)           | 3 (42.9%)         | 0.47         |
| Hypertension                                        | 52 (83.9%)       | 27 (96.4%)             | 20 (74.1%)           | 5 (71.4%)         | 0.05         |
| Dyslipidemia                                        | 16 (25.8%)       | 8 (28.6%)              | 8 (29.6%)            | 0 (0%)            | 0.25         |
| Diabetes                                            | 1 (1.6%)         | 0 (0%)                 | 0 (0%)               | 1 (14.3%)         | 0.02         |
| Current smoker                                      | 13 (21%)         | 4 (14.3%)              | 8 (29.6%)            | 1 (14.3%)         | 0.34         |
| Hemodialysis                                        | 2 (3.2%)         | 1 (3.6%)               | 1 (3.7%)             | 0 (0%)            | 0.88         |
| Marfan syndrome                                     | 2 (3.2%)         | 0 (0%)                 | 2 (7.4%)             | 0 (0%)            | 0.26         |
| Previous aortic dissection                          | 8 (12.9%)        | 2 (7.1%)               | 4 (14.8%)            | 2 (28.6%)         | 0.30         |
| Previous aortic aneurysm                            | 12 (19.4%)       | 4 (14.3%)              | 8 (29.6%)            | 0 (0%)            | 0.14         |
| Previous cardiac surgery                            | 4 (6.5%)         | 0 (0%)                 | 4 (14.8%)            | 0 (0%)            | 0.06         |
| Chest/back pain                                     | 53 (85.5%)       | 26 (92.9%)             | 21 (77.8%)           | 6 (85.7%)         | 0.28         |
| Abrupt onset of pain                                | 45 (72.6%)       | 22 (78.6%)             | 20 (74.1%)           | 3 (42.9%)         | 0.16         |
| Migraton of pain                                    | 8 (12.9%)        | 3 (10.7%)              | 5 (18.5%)            | 0 (0%)            | 0.38         |
| Hypotension                                         | 17 (27.4%)       | 7 (25.0%)              | 7 (25.9%)            | 3 (42.9%)         | 0.62         |
| Any neurologic deficit                              | 15 (24.2%)       | 4 (14.3%)              | 8 (29.6%)            | 3 (42.9%)         | 0.20         |
| Aortic valve regurgitation                          | 15 (24.2%)       | 6 (21.4%)              | 6 (22.2%)            | 3 (42.9%)         | 0.47         |
| Widest diameter of ascending aorta, mm              | 49.0 ± 8.1       | 48.3 ± 8.7             | 48.4 ± 7.7           | 53.8 ± 6.3        | 0.25         |
| Pericardial effusion                                | 29 (46.8%)       | 13 (46.4%)             | 12 (44.4%)           | 4 (57.1%)         | 0.83         |
| Reason for nonoperative management                  |                  |                        |                      |                   |              |
| Refusal of operation (dementia, fraility, high age) | 23 (37.1%)       | 8 (28.6%)              | 12 (44.4%)           | 3 (42.9%)         |              |
| Delay in diagnosis                                  | 3 (4.8%)         | 1 (3.6%)               | 0 (0%)               | 2 (28.6%)         |              |
| Extensive comorbidity                               | 8 (12.9%)        | 0 (0%)                 | 6 (22.2%)            | 2 (28.0%)         |              |
| Encephalopathy                                      | 2                | 2                      |                      |                   |              |
| Advanced cancer                                     | 1                | 0                      |                      |                   |              |
| Prior thoracic surgery                              | 3                | 0                      |                      |                   |              |
| Thrombosis of the false lumen in ascending aorta    | 25 (40.3%)       | 18 (64.3%)             | 7 (25.9%)            | 0 (0%)            |              |
| Other                                               | 3 (4.8%)         | 1 (3.6%)               | 2 (7.4%)             | 0 (0%)            |              |

Table 2 shows baseline characteristics of patients with thrombus-dominant partial thrombosis and flow-dominant partial thrombosis. The patients with thrombus-dominant partial thrombosis tended to be older with higher rates of aortic regurgitation and pericardial effusion; however, no statistically significant differences were seen.

Fig. 2 shows Kaplan-Meier survival curves indicating freedom from all-cause death (2A), and all-cause death and late surgical treatment (2B) in patients stratified according to the status of the false lumen and compares the three groups (complete thrombosis, partial thrombosis, and patent). Table 3 shows details of the in-hospital outcomes. Event-free rates were lowest in patients with a patent false lumen, while no significant differences were seen between patients with complete and partial thrombosis of the false lumen.

Table 3 shows the detail of in-hospital outcomes. Patients with flow-dominant partial thrombosis had significantly lower event-free rates than those with thrombus-dominant partial thrombosis.

Discussion

This study showed that the short-term mortality rate in acute type A aortic dissection patients without urgent surgical treatment was lower in patients with partial thrombosis of the false lumen than in those with a patent false lumen. Furthermore, in case of
**Fig. 2A.** Kaplan-Meier survival curves stratified according to false lumen status (complete, partial, and patent)

The event free rate was higher in patients with partial thrombosis than patent false lumen. There was no significant difference between patients with partial thrombosis and complete thrombosis.

**Fig. 2B.** Kaplan-Meier survival curves indicating freedom from all cause death and late surgical treatment in all patients

The event free rate was higher in patients with partial thrombosis than patent false lumen. There was no significant difference between patients with partial thrombosis and complete thrombosis.

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**Table 2.** Patients characteristics (thrombus partial vs. flow partial)

|                      | Thrombus dominant partial | Flow dominant partial | P-value |
|----------------------|---------------------------|-----------------------|---------|
|                      | n = 15                    | n = 12                |         |
| Age, y               | 75 ± 14                   | 69 ± 16               | 0.33    |
| Men                  | 8 (53.3%)                 | 7 (58.3%)             | 0.80    |
| Hypertension         | 11 (73.3%)                | 9 (75.0%)             | 1.00    |
| Dyslipidemia         | 7 (46.7%)                 | 1 (8.3%)              | 0.04    |
| Diabetes             | 0 (0%)                    | 0 (0%)                |         |
| Current smoker       | 6 (40.0%)                 | 2 (16.7%)             | 0.24    |
|                      |                           |                       |         |
| Aortic valve regurgitation | 5 (33.3%)   | 1 (8.3%)              | 0.18    |
| Widest diameter of ascending aorta, mm | 48.8 ± 8.6 | 47.9 ± 6.8 | 0.77 |
| Pericardial effusion | 8 (53.3%)                 | 4 (33.3%)             | 0.44    |
|                      |                           |                       |         |
| Ends filled with thrombus in false lumen |                   |                       |         |
| Both ends            | 14 (93.3%)                | 3 (25%)               |         |
| Only proximal end    | 1 (6.7%)                  | 6 (50%)               |         |
| Only distal end      | 0 (0%)                    | 3 (25%)               |         |
Table 3. In hospital outcomes

|                    | All  | Complete | Partial thrombosis | Patent |
|--------------------|------|----------|---------------------|--------|
| n                  | 62   | 28       | 27                  | 7      |
| All Partial        | n =62| n = 27   | n = 15              | n = 7  |
| Death              | 18 (29%) | 6 (21.4%) | 7 (25.9%)           | 0 (0%) |
| Late surgical treatment | 11 (17.7%) | 7 (25%) | 3 (11.1%)          | 1 (7.14%) |

*Thrombus-dominant partial thrombosis vs. Flow-dominant partial thrombosis

**Fig. 3A.** Kaplan-Meier survival curves in patients with partial thrombosis, and compared flow dominant partial thrombosis and thrombus dominant partial thrombosis.

The event free rate was lower in patients with flow dominant partial thrombosis than thrombus dominant partial thrombosis.

**Fig. 3B.** Kaplan-Meier survival curves indicating freedom from all cause death and late surgical treatment in patients with partial thrombosis.

The event free rate was lower in patients with flow dominant partial thrombosis than thrombus dominant partial thrombosis.

patients with partial thrombosis of the false lumen, those with flow-dominant partial thrombosis had higher mortality rate than those with thrombus-dominant partial thrombosis.

With regard to type B aortic dissection, some studies have shown that patients with partial thrombosis of the false lumen have higher mortality1) and aortic growth rate2, 7) than those with a patent false lumen or complete thrombosis of the false lumen. On the other hand, another study demonstrated that the growth rate of the affected aorta among the three groups is highest in patients with a patent false lumen8). We have previously reported that the long-term mortality does not significantly differ among the
there are only few studies on the status of the false lumen in patients with type A aortic dissection and especially the extent of partial thrombosis in these patients. Thus, it would be beneficial to accumulate data on this issue.

Conclusion

Patients with partial thrombosis of the false lumen did not have worse short-term clinical outcomes than those with complete thrombosis of the false lumen or a patent false lumen in case of type A aortic dissection patients without urgent surgical treatment. Furthermore, the extent of partial thrombosis might influence clinical outcomes in these patients.

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Conflict of Interest

Dr. Ishii has received lecture fees from Astellas, Daiichi-Sankyo and Otsuka. Dr. Murohara has received lecture fees from Bayer, Daiichi Sankyo, Dainippon Sumitomo, Kowa, MSD, Mitsubishi Tanabe, Nippon Boehringer Ingelheim, Novartis, Pfizer Japan, Sanofi-Aventis, and Takeda. Dr. Usui has received lecture fees from Japan Blood Products Organization, and Terumo. Dr. Komori has received lecture fees from Sanofi-Aventis, Otsuka, Daiichi Sankyo. Dr. Murohara has received unrestricted research grant for Department of Cardiology, Nagoya University Graduate School of Medicine, from Astellas, Daiichi Sankyo, Dainippon Sumitomo, Kowa, MSD, Mitsubishi Tanabe, Nippon Boehringer Ingelheim, Novartis, Otsuka, Pfizer Japan, Sanofi-Aventis, Takeda, and Teijin. Dr. Usui has receive unrestricted research grant for Department of Cardiac Surgery, Nagoya University Graduate School of Medicine, from Terumo, Medtronic, Edwards, Japan Lifeline, Senko Medical Instrument, and St. Jude Medical Japan. Dr. Komori has received unrestricted research grant for Department of Vascular Surgery, Nagoya University Graduate School of Medicine, from Sanofi-Aventis, Otsuka, Daiichi Sankyo, Eisai, and Gore Japan.
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**Review**

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