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Fate of distal aorta after acute type A aortic dissection repair: Change and persistency of postoperative false lumen status

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ABSTRACT

Background: The role of false lumen patency related to aortic growth, re-interventions, and post-discharge mortality in the chronic phase of repaired type A acute aortic dissection (TAAAD) remains controversial. We investigated the role of postoperative false lumen patency during long-term follow-up.
Methods: Based on postoperative CT images of 70 candidates, 58 eligible patients without alteration of false lumen status were assigned into three groups: complete patency, partial patency, and complete thrombosis. Aortic growth of 7 levels was analyzed.
Results: Persistent complete patency in post-operative TAAAD presents faster expansion of aortic diameter (95% CI, 0.35 to 11.52; $P = 0.038$; B = 5.935) and more patients with growth rate > 5 mm/year ($P = 0.029$). The persistent status of false lumen does not predict post-discharge mortality ($P = 0.479$). History of coronary artery disease (CAD) is the only independent predictor of post-discharge mortality.
Conclusions: In TAAAD patients without change of postoperative false lumen status, completely patent false lumen presents faster aortic growth and more patients with growth rate > 5 mm/year. False lumen status does not correlate with late survival. Here we provide an insight into persistent postoperative false lumen in TAAAD patients and may help cast light on aortic dissection in this specific subgroup to improve their late outcomes.

1. Introduction

Acute aortic dissection (AAD) is a lethal cardiovascular emergency associated with high rates of morbidity and mortality [1–4]. The clinical presentation of AAD at the onset varies depending on the pathological anatomy and resulting complications [3,5]. Early diagnosis and intervention of AAD remains essential to early and late survival. In-hospital mortality has been reported from 5% to 30% at high-volume centers with long-term survival (excluding in-hospital mortality) reported from 88.4% to 98.5%, 74.3% to 96%, and 61.1% to 90.7% at 1, 5, and 10 years [6–11].

Studies have shown heterogeneous results regarding the effect of false lumen patency on aortic expansion. Since the growth rate of aortic diameter in the chronic phase after acute type A repair affects the possibility of re-intervention and post-discharge mortality [2,3,12], determining which predictor would exacerbate the enlargement of aortic diameter is of clinical importance. The beneficial role of completely thrombosed false lumen was mentioned by studies while patency of false lumen was considered to have an adverse effect on aortic dilation and survival. Whether partial patency or complete patency of false lumen is a risk factor of aortic diameter enlargement in patients after acute type A aortic dissection repair or chronic phase of type B aortic dissection has been a topic of debate [12–14]. As far as we were concerned, previous studies had mentioned the conversion of false lumen morphology yet with scarce data about its effect on aortic expansion and late outcomes. Through studying postoperative aortic growth in the chronic phase, we would like to clarify the risk factors for patients who have gone through acute type A aortic dissection repair, and elucidate the impact of false lumen morphology on aortic expansion and late outcome of the patients.

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2. Methods

This study was conducted in the Division of Cardiovascular Surgery, Kaohsiung Medical University Hospital. The Institutional Review Board (IRB) approved the study without requirement of obtaining informed consent from the patients. The basic characteristics of the patients and CT images were recorded by means of retrospective systematic chart review and analyzing all postoperative CT scans.

From March 1997 to December 2013, 188 consecutive patients who had been diagnosed with TAAAD and undergone further operation to repair the dissection were enrolled in our database. We used computed tomography (CT) for all follow-up imaging studies. After being discharged, patients who had at least 2 postoperative CT scans with at least 5 months between them were considered as candidates. Among the 70 candidates, we excluded 12 patients with change of false lumen status in the postoperative follow-up CT images. Finally, 58 eligible patients with persistent postoperative false lumen morphology were enrolled (Fig. 1) (Online Fig. 1).

2.1. Image analysis

2.1.1. False lumen status

CT images were analyzed and measured separately by two different members of the research group (Fang-Yi Lin and Yu-Hsuan Tseng). Based on the enhanced CT images, we divided the status of false lumen into three different types: completely patent false lumen (CPFL), partially patent false lumen (PPFL), and completely thrombosed false lumen (CTFL) [11–13]. Completely patent false lumen presents blood flow in the false lumen without the presence of thrombus. Partially patent false lumen shows flow as well as thrombus. Completely thrombosed false lumen presents no blood flow [11]. Based on the false lumen morphology in all of the CT images after repair, we categorized the enrolled 58 patients who had persistent false lumen status into three groups: completely patent false lumen (group A), partially patent false lumen (group B), and completely thrombosed false lumen (group C).

2.1.2. Aortic segments and aortic yearly growth rate analysis

Aortas were analyzed based on the following 7 segments as our previous description [12]: aortic arch, proximal descending thoracic aorta, middle descending aorta, distal descending aorta, proximal abdominal aorta (suprarenal), middle abdominal aorta (infrarenal), and terminal aorta (Online Fig. 2).

The growth rate of aortic diameter and the largest diameter perpendicular to the outer contour of aorta on each segment were documented and analyzed. We calculated the growth rate of aortic diameter between the first postoperative CT scan after repair and the last follow-up CT scan. The yearly growth rate of aorta was calculated in the following manner: the difference between initial postoperative (D1) and final postoperative (D2) aortic diameter measurements was divided by the time interval (T) between the two CT images, i.e., aortic growth rate $= (D2 - D1) / T$.

2.2. Statistical analysis

Clinical characteristics were compared between groups by χ^2 test for categorical variables and by univariate linear regression analysis for continuous variables. Univariate linear regression was performed to understand the relationship between postoperative false lumen status and mean aortic yearly growth rate. In the multivariate linear regression analysis of mean aortic yearly growth rate, clinical characteristics associated with postoperative false lumen status ($P < 0.05$) were included along with false lumen status as variables to find out the independent factor associated with aortic expansion. Simple and multivariate logistic regression was calculated to reveal characteristics related to aortic growth rate > 0.5 cm/year. Kaplan–Meier curve analysis demonstrated the survival of three patient groups while log-rank test showed the association between survival rate and false lumen status. False lumen status and clinical characteristics marginally suggesting association to long-term survival rate ($P < 0.2$) were chosen as variables in Cox regression analysis to determine the predictors of long-term mortality. Statistical significance was set as P value <0.05. IBM® SPSS® Statistics version 20 was used for all data analyses.

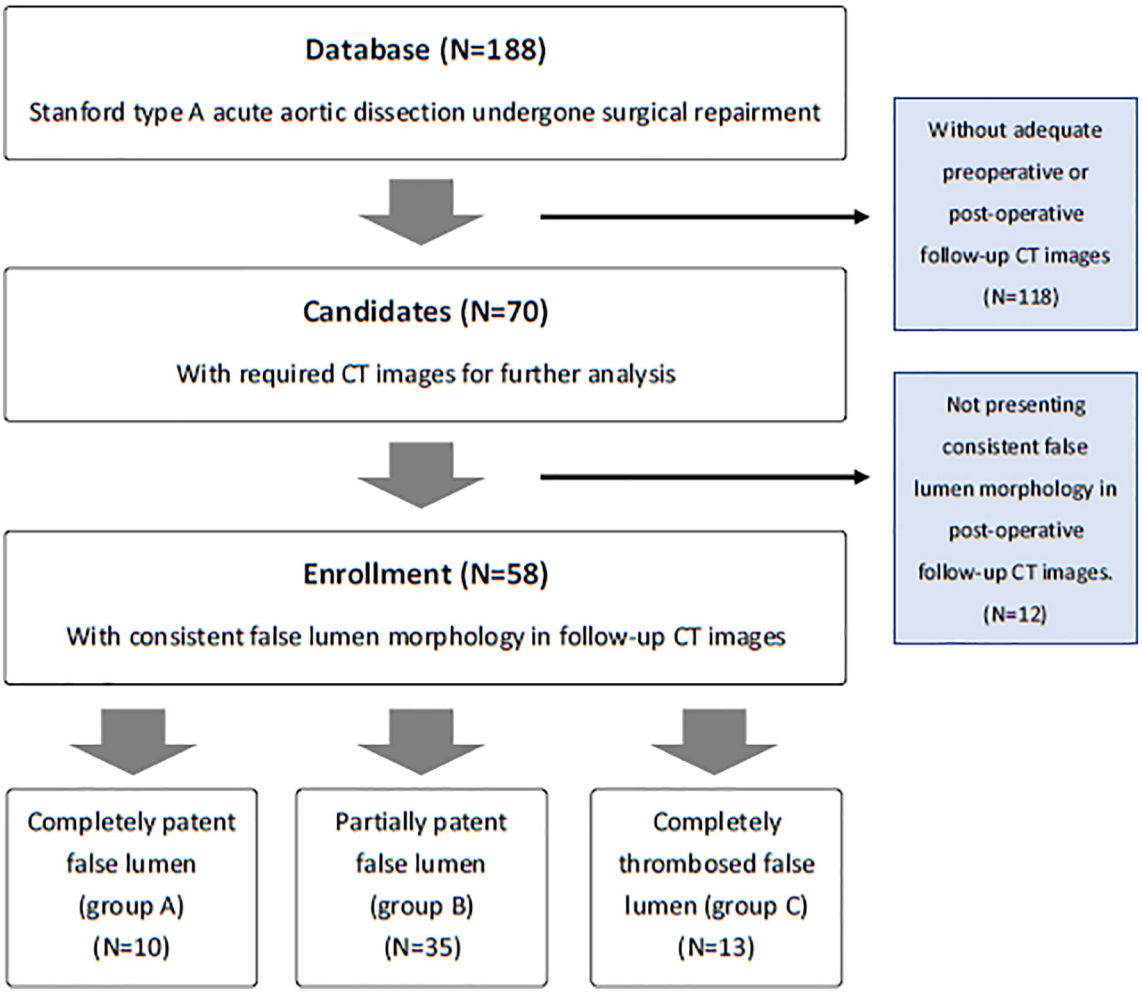

Fig. 1. Enrollment diagram of 188 patients. From March 1997 to December 2013, there were 188 consecutive patients diagnosed with TAAAD and undergone surgical repair in the database. Among the 70 candidates, 12 patients without consistent false lumen status in the postoperative CT scans were excluded. Finally, there were 58 eligible patients with persistent false lumen morphology in all postoperative CT images.