Reintervention after endovascular repair for aortic dissection: A systematic review and meta-analysis

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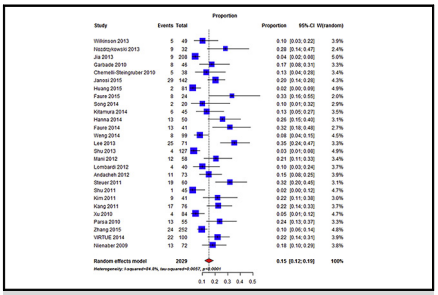
ABSTRACT

Objectives: Thoracic endovascular aortic repair has been chosen as a less-invasive alternative to open surgery for the treatment of aortic dissections; however, the advantages have been challenged by the postoperative reintervention during the follow-up period. This study aimed at evaluating the incidence, reasons, and potential risk factors for reintervention.

Methods: Studies reporting reintervention after endovascular repair were identified by searching PubMed and Embase in accordance with preferred reporting items for systematic reviews and meta-analyses guidelines, and by reviewing the reference lists of retrieved articles. Sensitivity analysis and subgroup analyses were performed to determine the sources of heterogeneity. Funnel plot and Egger's test were used to determine the publication bias.

Results: A total of 27 studies encompassing 2403 patients with aortic dissection were identified. The pooled incidence of reintervention after endovascular repair was 15% (95% confidence interval, 12-19) during 33.7 months of follow-up. The 3 most common reasons for reintervention were endoleak (33.2%), false lumen perfusion and aortic dilation (19.8%), and new dissection (6.9%). The potential factors for reintervention were the mean age of onset and diabetes mellitus determined by performing a single meta-regression analysis ($P < .001$ and .044, respectively).

Conclusions: Current data suggest that the incidence of reintervention after endovascular therapy is relatively high during midterm follow-up. Advanced age of onset is a risk factor and diabetes mellitus is a protective factor of reintervention after endovascular therapy. The possible mechanism that diabetes mellitus protects patients from reintervention should be explored further. (J Thorac Cardiovasc Surg 2016;■:1-10)



The overall incidence of reintervention after TEVAR.

Central Message

The pooled estimated incidence of reintervention after endovascular repair was 15%, and the 3 most common reasons were endoleak, false lumen perfusion and aortic dilation, and new dissection.

Perspective

The incidence of reintervention after endovascular repair was relatively high during midterm follow-up. For patients with aortic dissection with an advanced age of onset, more elaborate operation and close postoperative care are required to lower the reintervention rate and improve the prognosis of aortic dissection.

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The estimated annual incidence of aortic dissection is 2 to 6 per 100,000 individuals, and the prevalence appears to be increasing independently of the aging population.[1] The advent of thoracic endovascular aortic repair (TEVAR) has altered the management algorithm for aortic dissections.[2] Because TEVAR is associated with lower risks of mortality and morbidity, the procedure has been chosen as a less-invasive alternative to traditional open surgery for the treatment of complicated type B aortic dissections in recent years, especially in elderly patients with greater comorbidities.[3,4] However, the advantages of TEVAR have been challenged by the postoperative adverse events, such as endoleak, stent-graft migration, retrograde type A aortic dissection (RTAD), and distal redissection. In most situations, these events require reintervention to save lives

Scanning this QR code will take you to a video for the article, supplemental figures, and tables.

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Abbreviations and Acronyms
CI = confidence interval
RTAD = retrograde type A aortic dissection
TEVAR = thoracic endovascular aortic repair

or obtain a better prognosis. It is conceivable that the prognosis of TEVAR could be improved after determining the reasons and potential risk factors of reintervention. To date, nonetheless, no systematic review and meta-analysis of reintervention after TEVAR for aortic dissections have been performed.

In the current study, we systematically reviewed all available published data reporting reintervention after TEVAR in patients with aortic dissection and pooled the data for analyzing the incidence, reasons, and potential risk factors for reintervention.

VIDEO 1. How did we choose the topic of reintervention after endovascular therapy?

MATERIALS AND METHODS

This systematic review and meta-analysis were performed in accordance with the standards set forth by the statement from the Preferred Reporting Items for Systematic Reviews and Meta-Analyses.[5] Because this study was a systematic review and meta-analysis based on published articles, ethical approval was waived by the Institutional Review Board of Changhai Hospital. Video 1 shows the topic selection process of reintervention after endovascular therapy.

Data Sources and Search Results

The PubMed and Embase databases were searched from inception to June 2, 2015, restricted to studies in English and on humans. There were no restrictions on the year or type of publication. The search strategy was amended for each database (Table E1). A hand search also was performed of all the references in the included studies for potential valuable and relevant publications.

Study Selection

The inclusion criteria were (1) patients with aortic dissection requiring another intervention after TEVAR, (2) at least 10 patients in the study, and (3) at least 6 months of follow-up. On the basis of the guidelines, case reports, conference abstracts, reviews, systematic review, and meta-analyses, other researches and other diseases were excluded. After full-text articles were assessed for eligibility, the mixed pathology including both aortic dissections and aneurysms was excluded.

Data Extraction and Outcome Definitions

Two investigators independently assessed studies for inclusion criteria and extracted data using a standard form. Disagreements were resolved by consensus with internal authors at designated consensus meetings. Data were extracted pertaining to the baseline demographics, comorbidities, follow-up period, study design, years of enrollment, incidence and reasons for reintervention, prior aortic intervention rate, technical success rate, in-hospital/30-day mortality, and oversizing of the stent graft.

The outcomes were the incidence, reasons, and potential factors for reintervention after TEVAR during follow-up. Reintervention was defined as the second intervention for the management of complications after the initial TEVAR, not including the second-stage operation. Potential risk factors were defined as the factors for reintervention determined by single meta-regression analyses on the variables of age, male gender, follow-up period, technical success, in-hospital/30-day mortality, prior aortic intervention, Marfan syndrome, and comorbidities. Type I endoleak was defined as a sealing failure at 1 of the attachment sites of the graft to the vessel wall (proximal leak, type Ia; distal, type Ib), whereas type III endoleak was defined as a device failure in the form of dysjunction of the components of a modular graft system (type IIIa) or a defect in the fabric of the graft (type IIIb). New dissection referred to the new-onset and metachronous dissection separate from the initially treated aortic dissection, which precluded the RTAD or stent graft–induced dissection. Persistent perfusion of the false lumen meant the blood flow persistently entered into the false lumen through the distal reentry tears, which resulted in aortic dilation or rupture.

Data Synthesis and Statistical Analysis

The amount of heterogeneity was estimated using I^2 statistics, which indicates the percent of heterogeneity across studies that cannot be explained by chance variation alone. I^2 greater than 50% was considered to indicate high heterogeneity. Sensitivity analysis was performed, and a random-effect model was chosen when heterogeneity was greater than 50%. Publication bias was assessed through a funnel plot, and Egger's regression test was applied.

The values were expressed as numbers, percentages, and median/mean. Potential factors for reintervention were determined by a single meta-regression analysis using STATA version 12.0 (StataCorp LP, College Station, Tex). The pooled estimated incidence of reintervention after TEVAR was performed using R-project (version 3.2.0, http://www.r-project.org/). The probability values were 2 tailed, and the null hypothesis was rejected for P values less than .05.

RESULTS

Study Selection and Characteristics

The literature search identified 293 potentially relevant studies, as shown in the flow diagram in Figure 1. Of these, 29 full-text articles were assessed for eligibility. Finally, 27 studies comprising 2403 patients with aortic dissection (2029 TEVAR, 44 open surgery, and 330 medication cases) between 1995 and April 2013 were included in the meta-analysis.[3,6-31]

The patients' characteristics and comorbidities are summarized in Table 1. Almost all of the patients were