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Morphology and Outcomes of Total Endovascular Treatment of Type B Aortic Dissection with Aberrant Right Subclavian Artery

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WHAT THIS PAPER ADDS

Aberrant right subclavian artery (ARSA) is a common congenital variant of the aortic arch. However, the incidence of ARSA simultaneously combined with type B aortic dissection is still rare. To date, no standard therapy has been established. This retrospective case series analysed the morphology and outcomes of total endovascular treatment of type B aortic dissection with ARSA. The study suggested that ARSA was associated with steep artic arch. Total endovascular treatment for these patients was feasible and safe. Moreover, stent grafts with better flexibility and appropriate extension of proximal landing zone with parallel graft technique were suggested.

Objectives: To characterize the morphology of type B aortic dissection with aberrant right subclavian artery (ARSA) and present early and midterm outcomes of total endovascular treatment for affected patients.

Methods: From January 2010 to December 2015, patients with ARSA and type B aortic dissection treated with total endovascular techniques were enrolled. The angle of the aortic arch was measured on pre-operative CTA. Sixty age and gender matched normal aortic arch patients with type B aortic dissection served as controls. Primary outcomes were technical success, 30 day mortality, and late survival. Secondary outcomes included in hospital morbidity, re-intervention rate, and patency of the subclavian artery.

Results: A total of 13 patients (8 men, 5 women; mean age 58 years) were included. The mean angle of the aortic arch in patients with ARSA was significantly smaller than in normal aortic arch patients (117.2° ± 10.8° vs. 124.2° ± 9.4°, respectively; $p = .024$). Simple thoracic endovascular aortic repair (TEVAR) and TEVAR plus a parallel graft technique were performed in six and seven patients, respectively. Primary technique success was achieved in 11 of the 13 (84.6%) patients. A bird beak configuration occurred significantly more frequently in patients with ARSA than in normal aortic arch patients (91.7% vs. 48.3%, respectively; $p = .035$). The median follow-up time was 36 months. One patient received a secondary procedure because of a new onset entry tear at the distal end of the stent graft. No posterior circulation stroke, permanent spinal cord ischaemia, or ischaemia of the upper arm was observed.

Conclusions: Type B aortic dissection with ARSA was associated with a steep aortic arch. Total endovascular treatment for these patients was feasible and safe. Stent grafts with better flexibility and appropriate extension of the proximal landing zone with a parallel graft technique are suggested based on the observed outcomes.

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INTRODUCTION

The typical aortic arch branching pattern consists of the brachiocephalic trunk, left common carotid artery, and left subclavian artery (LSA). Aberrant right subclavian artery (ARSA), arising directly from the descending thoracic aorta, is a congenital variant of the aortic arch. It was first described by Hunauld in 1735 and occurs in 0.4–2% of the population.[1] Patients with ARSA are usually asymptomatic, but it carries the risk of aneurysmal dilatation and dissection.[2] Aneurysm of ARSA occurring at the level of origin, known as the Kommerell diverticulum, accounts for nearly 60% of ARSA cases.[3] However, the coexistence of ARSA and type B aortic dissection is rare, and ARSA is often detected as an unexpected finding during pre-operative imaging.

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Despite its rarity, this clinical condition is quite urgent and intractable. Only a few case reports have been published, and most of these patients were treated by open surgery or a hybrid technique.[4–10] However, thoracic endovascular aneurysm repair (TEVAR) has become a widely accepted and preferred alternative to open surgery for the treatment of type B aortic dissection because of its relatively low associated mortality and morbidity.[11] Recently, endovascular management strategies have been evolving, including development of the chimney technique, periscope technique, fenestrated and branched stent grafts. Nevertheless, to date, the efficacy and safety of these new techniques applied to patients with type B aortic dissection and anatomical abnormalities remains unclear. Therefore, this study retrospectively reports the clinical characteristics and outcomes of patients with ARSA and type B aortic dissection undergoing total endovascular treatment at a single centre. To the authors' knowledge, this study is the first and largest case series regarding total endovascular treatment for these patients.

MATERIALS AND METHODS

Study design

A retrospective review was performed based on the institutional database for patients with ARSA and type B aortic dissection. The study protocol was approved by the institutional ethical review committee. Consecutive patients with type B aortic dissection who were admitted to the study centre for emergency or elective endovascular repair between January 2010 and December 2015 were identified. Patients with ARSA and type B aortic dissection treated by a totally endovascular technique were enrolled in this study, including patients with underlying connective tissue disorders and those who had previously had aortic surgery. The retrospective design of the study meant that informed consent was not required from individual patients.

All patients were evaluated pre-operatively by computed tomography angiography (CTA) with a 320 slice multidetector CT scanner (Aquilion One Vision, Toshiba Medical Systems, Tokyo, Japan). CTA images were reconstructed in three dimensional projections for analysis (Vitrea Workstation, Version 3.1, Toshiba Medical Systems, Tokyo, Japan). At the study centre, the maximum aortic diameter was determined by the average of the longest and shortest diagonals of the cross section perpendicular to the centreline of the aorta, including true and false lumens. The longitudinal distance along the aortic centreline between the distal end of the LSA ostium and the tip of the inner curve of the aortic arch was measured by one radiologist. A similar method was used for recording the distance between the LSA and the primary entry (Fig. 1). For these patients, if the primary entry was proximal to the tip of the inner curve, the proximal landing zone was defined as the longitudinal distance between the LSA and the primary entry. If the primary entry was distal to the tip of the inner curve, then the proximal landing zone was measured as the longitudinal distance between the LSA and the tip of the inner curve. The location of the ARSA was determined as the distance between the distal end of the LSA ostium and the middle of the ARSA ostium. The diameter of the vertebral artery origin was also measured on pre-operative CTA. In the case of

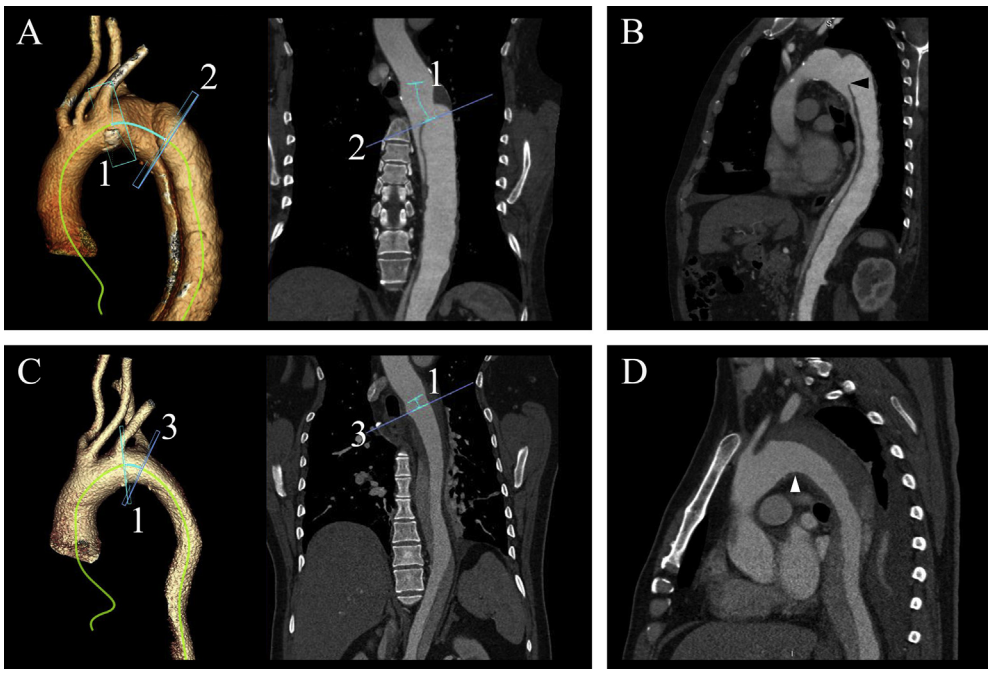

Figure 1. Measurements under three dimensional reconstruction. The green line indicates the aortic centreline. (A) The longitudinal distance between the distal end of the LSA ostium (Panel 1) and primary entry (Panel 2). (B) Sagittal image showing the primary entry (black arrowhead). (C) The longitudinal distance between the distal end of the LSA ostium (Panel 1) and the tip of the inner curve of the aortic arch (Panel 3). (D) Sagittal image showing the tip of the inner curve of the aortic arch (white arrowhead).

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