Adventitial inversion technique for type A aortic dissection distal anastomosis

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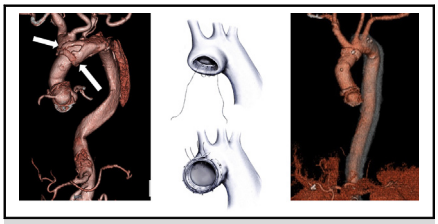
ABSTRACT

Objective: Anastomosis in dissected aorta management remains challenging. The patent false lumen of remnant aorta influences the growth of the residual aorta after hemiarch replacement. We evaluated the beneficial effect of adventitial inversion technique for distal anastomotic reinforcement of hemiarch replacement in acute type A aortic dissection.

Methods: From 2006 to 2014, 90 patients with DeBakey type I aortic dissection who underwent hemiarch replacement for acute type A aortic dissection management at the National Cerebral and Cardiovascular Center were retrospectively analyzed. Patients were divided according to the technique used: the adventitial inversion technique in group A and the original Sandwich method with Teflon felt in group S. Surgical variables and aortic morphology from distal aortic anastomosis were evaluated by computed tomography after surgery.

Results: The mean follow-up time was 2.2 ± 2.1 years with a follow-up rate of 91.1%. Cardiopulmonary bypass time was 208.2 ± 93.9 minutes in group A and 220.6 ± 93.9 minutes in group S; lower body circulatory arrest time was 51.6 ± 10.2 minutes in group A and 54.5 ± 17.8 minutes in group S. No significant differences were observed between groups. The overall hospital mortality rate was 10.0%. Postoperative false lumen thrombosis rate at proximal descending aorta on enhanced delayed phase computed tomography was significantly higher in group A than in group S.

Conclusions: The adventitial inversion technique may facilitate thrombotic closure of the distal false lumen in acute type A aortic dissection management by hemiarch replacement. (J Thorac Cardiovasc Surg 2016;151:1340-5)



Adventitial inversion versus felt sandwich method in AAD.

Central Message

The adventitial inversion technique may facilitate thrombotic closure of the distal false lumen.

Perspective

In hemiarch replacement for AAD, the postoperative false lumen thrombosis rate at proximal descending aorta early postoperative enhanced CT was significantly higher in the adventitial inversion group than in the sandwich method group.

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Acute type A aortic dissection (AAD) is a surgical emergency with a poor prognosis. For the surgical treatment of AAD, it is essential that the integrity of the aortic wall is restored to achieve secure graft anastomoses, complete hemostasis, and obliteration of the false lumen. A number of reapproximation methods have been introduced; however, the method with the greatest efficacy for thrombosis of the false lumen has yet to be demonstrated. At the time of hemiarch replacement for AAD, patent false lumen at the remnant aorta occasionally is found (Figure 1). The direct forward flow at the distal anastomotic site may contribute to maintaining the patency of the false lumen left in the remnant aorta.[1] David and colleagues[2] reported that a patent false lumen is a major cause of late mortality and morbidity in these patients.

The purpose of this study was to retrospectively evaluate the beneficial effect of the adventitial inversion technique for distal anastomotic reinforcement of hemiarch replacement in AAD.

MATERIALS AND METHODS

Patients

A total of 258 patients underwent surgery for AAD at the National Cerebral and Cardiovascular Center from January 2006 to December 2014.

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Abbreviations and Acronyms
AAD = acute type A aortic dissection
CT = computed tomography
TAR = total arch replacement

Among them, hemiarch replacement was performed in 125 patients. Thirty-five patients with DeBakey type II and retrograde type III aortic dissection were excluded, and 90 patients (mean age, 73.1 ± 8.5 years; 35 were male) with DeBakey type I aortic dissection were retrospectively analyzed. Table 1 summarizes the aortic dissection type and preoperative patient characteristics. Organ malperfusion occurred in 22 patients; 13 had cerebral blood flow impairment, 6 had acute myocardial infarction, 3 had renal ischemia, 1 had spinal ischemia, and 1 had leg ischemia. A total of 21 patients went into shock, and 12 patients had cardiac arrest requiring preoperative cardiopulmonary resuscitation.

Patients were divided into 2 groups on the basis of the method of distal anastomotic reinforcement: The adventitial inversion technique was used in group A (n = 36), and the original sandwich method with Teflon felt was used in group S (n = 54) (Figure 2). No significant difference in age, sex, preoperative shock or frequency of preoperative thrombosed dissection, or organ malperfusion was observed between the 2 groups (Table 1). Some surgeons started to use the adventitial inversion technique in 2006. However, the sandwich technique also was used by other surgeons according to preference for a while. The initial experiences of the adventitial inversion were found to be impressive. Since 2013, all patients have received the adventitial inversion technique. Selection of either technique is not related to the anatomy or dissection morphology. The frequency of the false lumen thrombosis at the proximal descending aorta and the diameter of the descending aorta were evaluated retrospectively in 81 patients with contrast-enhanced computed tomography (CT) imaging (group A, n = 33; group S, n = 48). False lumen thrombosis was measured by postoperative contrast-enhanced CT imaging before discharge. The diameter of descending aorta was measured by plain CT 1 year after operation with a mean follow-up of 0.9 ± 0.3 years. Use of these data for research was approved by the National Cerebral and Cardiovascular Center Institutional Review Boards.

Operation

All operations were performed on an emergency basis. Extracorporeal circulation was instituted by placement of arterial cannulae in the femoral and right axillary artery, venous cannulae in the superior vena cava and inferior vena cava, and a left ventricular venting cannula via the right superior pulmonary vein. Once moderate or deep hypothermia was achieved, retrograde cardioplegia was induced and the ascending aorta was opened. No aortic clamps were used; under circulatory arrest, the primary tear was resected whether in the ascending aorta or transverse arch. Antegrade selective cerebral perfusion was used in all cases and performed through a distal part of right axillary artery after clamping the base of brachiocephalic artery, with a balloon-tipped cannula inserted directly in the left common carotid artery and left subclavian artery.

Distal Aortic Reinforcement and Anastomosis

Group A received the adventitial inversion technique (Figure 2). The adventitia was trimmed to 1.0 cm longer than the level of the intimal edge. The redundant adventitia then was inverted into the aortic lumen and tacked to the luminal surface of the intima using 5-0 polypropylene running sutures at the proximal aortic arch level.

Group S received the sandwich method (Figure 2). Teflon felt was placed outside the adventitia and inside the intima. The sandwich anastomosis was reinforced using 2 layers of 4-0 polypropylene interrupted mattress sutures.

The reinforced aorta was then sutured end-to-end to a Dacron tubular graft using 4-0 polypropylene continuous sutures. Biological glue was applied to the distal anastomosis and not used for the reinforcement of aortic layers or obliteration of the false lumen in either technique.

Proximal Reinforcement and Anastomosis

After completion of the distal anastomosis, the arterial cannula was shifted to the prosthetic graft and cardiopulmonary bypass was reconstituted. The ascending aorta was transected at a level 1 to 2 cm distal to

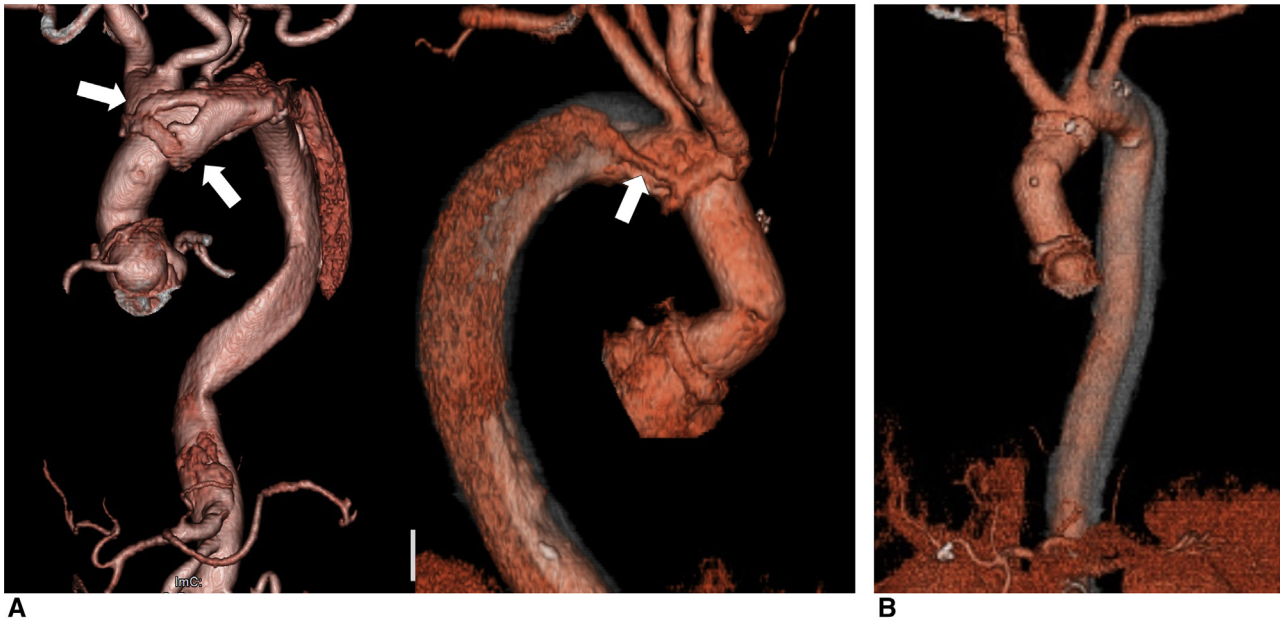

FIGURE 1. Postoperative 3-dimensional enhanced CT. A, *Arrows* indicate postoperative false lumen patency at remnant aorta. B, False lumen on the arch remains thrombosed with effective aortic reinforcement.