ELSEVIER

Thoracic Endovascular Aortic Repair With Aortic Arch Vessel Revascularization

Yasunori Iida, Satoshi Kawaguchi, Nobusato Koizumi, Hiroyoshi Komai, Yukio Obitsu, and Hiroshi Shigematsu, Tokyo, Japan

Background: Revascularization of aortic arch vessels was performed with thoracic endovascular aortic repair (TEVAR) to preserve the endoprosthesis landing zone in 19 high-risk patients.
Methods: The operative procedure used was a bypass or transposition involving the common carotid and subclavian arteries. Homemade fenestrated stent-grafts, deployed in landing zone 0, were used for TEVAR.
Results: All lesions resolved without endoleaks. No perioperative deaths occurred; seven patients had postoperative complications. One patient with acute respiratory distress syndrome required reoperation to change the bypass route and permit tracheostomy. One patient died of pneumonia 2 months after treatment, after an anastomotic pseudoaneurysm and cerebral infarction developed and an operation was performed to obtain hemostasis. The procedure-related mortality was 5.3%.
Conclusion: Aortic arch vessel revascularization before TEVAR may permit less invasive surgery, although careful patient selection is essential.

INTRODUCTION

The use of thoracic endovascular aortic repair (TEVAR) to treat aneurysm, dissection, penetrating atherosclerotic ulcer, trauma, and fistula continues to increase and gain acceptance. Thoracic aortic disease near the left subclavian artery (LSA), which is present in up to 40% of patients undergoing TEVAR,[1] has been the focus of special concern in efforts to extend the indications for TEVAR. Recently published practice guidelines from the Society for Vascular Surgery include recommendations that the LSA be revascularized in many patients undergoing TEVAR.[2] In this article, we present our study of a subset of patients who presented with thoracic aortic pathology that was adjacent to the arch vessels and report the outcome of the hybrid therapy of TEVAR and arch vessel revascularization.

PATIENTS AND METHODS

Between December 1995 and September 2009, of 948 patients (nondissection: 689, dissection: 259; landing zone 0: 353, landing zone 1: 90, landing zone 2: 158, landing zone 3: 169, landing zone 4: 178) who underwent TEVAR in our unit, 16 men and three women (mean age: 75 years [range: 61-85]) underwent aortic arch vessel reconstruction before or concomitant with TEVAR. All revascularization procedures were done through a left supraclavicular incision that exposed both the left common carotid artery (LCA) and the LSA. In patients in whom inflow would be from the right subclavian artery (RSA) or right common carotid artery (RCA), a right supraclavicular incision or sternomastoid muscle parallel incision, respectively, was made. The proximal LSA was ligated to prevent type II endoleaks.

Homemade fenestrated stent-grafts (Najuta Endograft, Kawasumi Laboratories, Tokyo, Japan),[3] extending from zone 0 of the ascending aorta, were used in all cases. Three patients also received a Gore

Department of Vascular Surgery, Tokyo Medical University, Tokyo, Japan.

Correspondence to: Yasunori Iida, MD, PhD, Department of Vascular Surgery, Tokyo Medical University, 6-7-1 Nishishinjuku, Shinjuku-ku, Tokyo 160-0023, Japan, E-mail: y.iida@vanilla.ocn.ne.jp

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TAG thoracic endoprosthesis (WL Gore and Associates, Flagstaff, AZ) and one patient was given a Talent stent-graft (Medtronic, Minneapolis, MN). Delivery sheaths were inserted through the femoral artery, or, in case the access was problematic, the external iliac artery. Percutaneous transluminal angioplasty was performed in two patients to dilate the iliac artery and preserve the access route.

A ''tug-of-wire'' guiding technique was used preferentially.[4] This method involves inserting a long guidewire into the right brachial artery, capturing it with a snare catheter delivered through the exposed femoral artery, and pulling it through to the femoral artery. During deployment of a stent-graft at the distal arch, displacement of the device is prevented by pushing it carefully along the greater curvature of the aorta. To achieve optimal sealing of the fenestrated portion of the endoprosthesis to the aortic arch vessel, the device is landed with use of flow force. Digital subtraction angiography is performed to detect endoleaks and determine whether an additional stent-graft is needed (Figs. 1 and 2). Patients are scheduled to undergo follow-up computerized tomographic scanning 3, 6, and 12 months postoperatively and annually thereafter.

The thoracic aortic lesions that were treated affected the distal arch ($n = 14$ cases), the descending aorta ($n = 1$), or both ($n = 2$), and there were two type B dissections. The mean aneurysm size was 62 mm. Table I shows the patients' risk factors. Revascularization was performed before (two-stage strategy, in two patients) or concomitant with the TEVAR procedure (in 17 patients). One patient, who had multiple mycotic aneurysms, was treated urgently and successfully with use of a two-stage hybrid procedure, as reported previously.[5] Table II lists the specific revascularization operations.

Fig. 1. Digital subtraction angiogram showing left common carotid artery (LCA) to left subclavian artery (LSA) bypass (*arrow*). There are no endoleaks or other abnormal findings.

RESULTS

The initial success rate in the series, defined as the proportion of cases in which the thoracic aortic lesion resolved without endoleaks, was 100%. No patient died within 30 days of TEVAR, and no graft infections or occlusions developed during a mean follow-up time of 27 months (range: 1-89). Postoperative complications are shown in Table II. One patient died of pneumonia 2 months after treatment, after an anastomotic pseudoaneurysm and cerebral infarction developed and an operation was performed to obtain hemostasis. The procedure-related mortality was 5.3%. The one seroma detected in the series resolved after conservative therapy. The patient presenting with onset of disseminated intravascular coagulation underwent anticoagulation therapy and platelet transfusion and the condition was resolved completely. Because the patient with acute respiratory distress syndrome had undergone an RCA—LCA—LSA sequential bypass through a subcutaneous route in front of the trachea, a reoperation was required to change the inflow from the RCA to the RSA and allow tracheostomy. The patient with lower limb hemiparesis was discharged after rehabilitation. The anastomotic pseudoaneurysm that developed after an LCA to LSA transposition was treated successfully by reoperation. In this series, there were no patients who suffered from arm claudication or vertebrobasilar insufficiency.

DISCUSSION

TEVAR is still a relatively new procedure. The first commercially manufactured TEVAR stent-graft approved (in March 2008) by the Japanese Ministry of Health, Labor and Welfare (Gore TAG Thoracic Endoprosthesis) has been associated with outcomes superior to those obtained with open surgical repair of thoracic aortic aneurysms,[6] especially in treating lesions of the descending thoracic aorta.

When TEVAR is used to repair aneurysms in the distal arch of the thoracic aorta, an adequate endoprosthesis landing zone must be present and the aortic arch vessels must be handled appropriately.