Interactive Cardiovascular and Thoracic Surgery 33 (2021) 662–664
doi:10.1093/icvts/ivab145 Advance Access publication 10 May 2021

Cite this article as: Zivkovic I, Micovic S, Bojovic Z, Peric M. Surgical reconstruction of the dissected innominate artery using extra-anatomic aorto-axillar bypass. Interact CardioVasc Thorac Surg 2021;33:662–4.

Surgical reconstruction of the dissected innominate artery using extra-anatomic aorto-axillar bypass

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Received 11 February 2021; received in revised form 26 March 2021; accepted 12 April 2021

Abstract

The innominate artery is the most commonly affected supra-aortic vessel in the acute ascending aorta dissection. The brachiocephalic vessels, separated from the true lumen, need reimplantation. The fragile vessel tissue might be challenging to reconstruct. Cerebral blood flow could be restored using an extra-anatomic bypass.

Keywords: Acute aortic dissection • Innominate artery • Extra-anatomic bypass

INTRODUCTION

Acute aortic dissection type A involves supra-aortic vessels in varying frequencies (5–43%), and the innominate artery (IA) is the most commonly affected vessel [1, 2]. Interruption of the normal blood flow through the dissected vessel increases the perioperative stroke incidence and significantly influences the early and long-term outcomes [3]. If the dissection involves IA, surgical reconstruction and prompt restoration of the cerebral perfusion are mandatory to avoid neurological complication [4]. Fragile tissue of the dissected vessel is a major surgical challenge; thus, the IA's ligation followed by extra-anatomic bypass might be a valuable surgical option [5].

We present the surgical technique of aorto-axillar bypass after unsuccessful reimplantation of the dissected IA.

CASE PRESENTATION

The 68-year-old female was admitted for severe chest pain, headache and hypotension. The medical history revealed hypertension and previous acute myocardial infarction (treated by percutaneous coronary intervention 12 months before).

Transthoracic echo revealed a flap in the ascending aorta, severe aortic regurgitation and normal ejection fraction. Computer tomography confirmed acute ascending aorta dissection with propagation into the aortic arch and IA (Fig. 1A).

The patient underwent an urgent surgical procedure. The cardiopulmonary bypass was instituted using the right axillary artery and right atrial appendage for cannulation. The patient was cooled down to 26°C. After entering into the hypothermic circulatory arrest, IA and left carotid artery were snared and occluded at the take-off. Antegrade cerebral perfusion was started via a right axillary artery. After opening the ascending aorta, the left carotid artery's direct antegrade perfusion was added using a balloon catheter for retrograde cardioplegia. The dissection entry was detected above the right coronary artery, with propagation into the root, ascending aorta and IA. Thus, aortic root, ascending aorta and hemiarch were resected. The dissected IA was debranched away from the false lumen. Surgical reconstruction of the ascending aorta and hemiarch was performed using a conduit Dacron prosthesis. After completing the distal hemiarch anastomosis, an additional arterial cannula was inserted into the graft side-arm, and cardiopulmonary bypass was reinstituted (Fig. 1B). Antegrade cerebral perfusion and circulatory arrest time were 45 min. The proximal part of the aorta was reconstructed using the Bentall–De Bono technique using a composite valve graft. After finishing the proximal anastomosis, the cross-clamp was removed (cross-clamping time 65 min). The IA reconstruction was attempted; however, the suture line disrupted due to the fragile dissected tissue. IA was ligated. The weaning from the heart–lung machine was uneventful. Cardiopulmonary bypass time was 160 min. After decannulation, the side-arm graft was tunnelled through the first intercostal space above the right lung and anastomosed to the axillary artery canulation site (Fig. 2A). Cerebral perfusion was controlled using near-infrared spectroscopy throughout the procedure.

The postoperative course was uneventful, with the exception of discrete left-hand paraparesis that ultimately resolved. A duplex scan showed normal flow in the right axillar and common carotid arteries, as well as the good position and patency of the extra-anatomic bypass (Fig. 2B and C). The patient was discharged from the hospital on the 20th postoperative day. There are no cardiological and neurological adverse events during 12 months of follow-up.

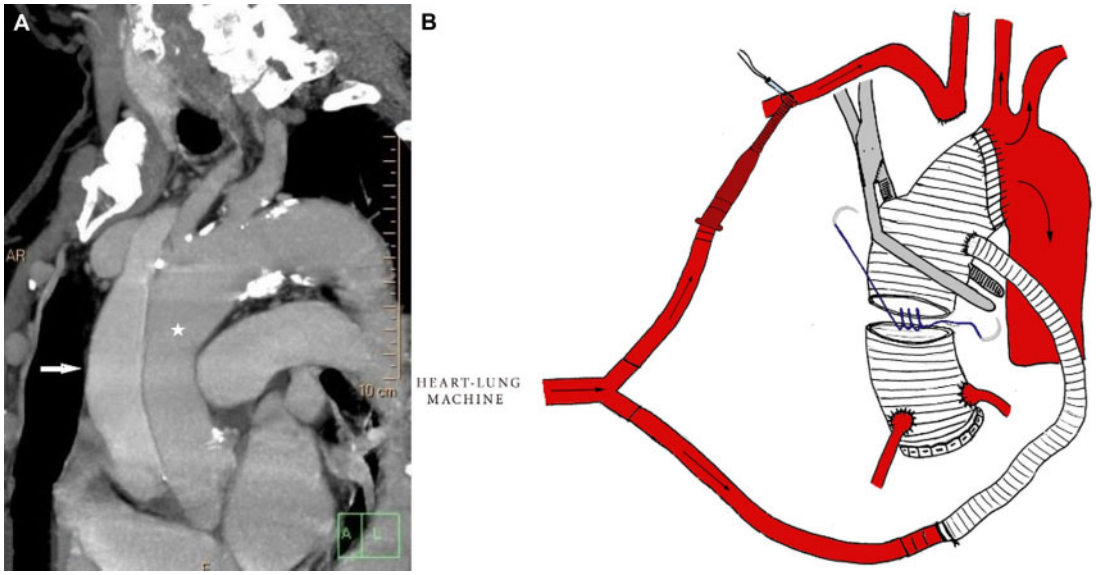

Figure 1: (**A**) Computer Tomography contrast scan revealed ascending aorta dissection with propagation into the innominate artery. (**B**) Schematic illustration of the cannulation strategy. White arrow—false lumen of aorta; asterisk—true lumen of aorta.

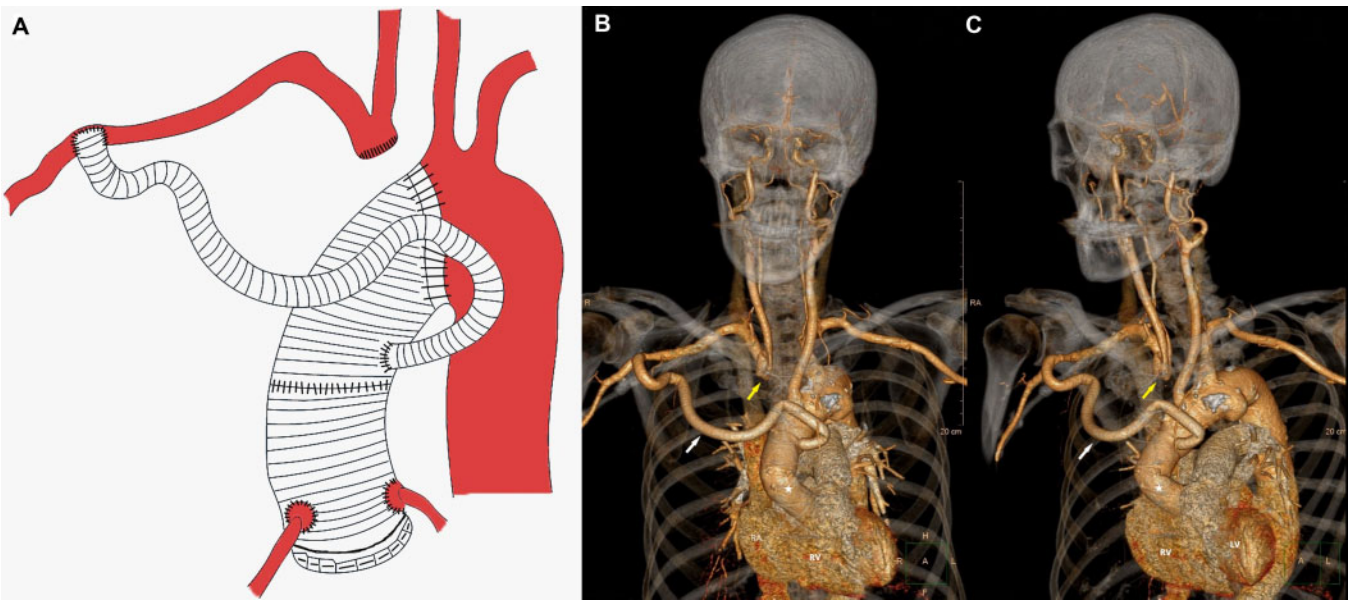

Figure 2: (**A**) Schematic illustration of the aorto-axillar bypass. (**B** and **C**) Volume-rendering 3D reconstruction notices the reconstructed ascending aorta and the extra-anatomic bypass position. White arrow—extra-anatomic bypass; yellow arrow—innominate artery.

DISCUSSION

The acute ascending aorta dissection remains one of the most lethal conditions. Propagation of the dissection into the supra-aortic branches with cerebral malperfusion presents a significant risk for perioperative and long-term mortality [3]. The immediate reconstruction and restoration of the cerebral blood flow minimize cerebral adverse events [1]. If the involved supra-aortic vessels arise from the true lumen, conventional repair restores the cerebral blood flow. However, if dissection separates vessels from the true lumen, direct vessel reimplantation or vascular graft interposition is mandatory to restore normal blood flow [1, 4, 5]. The aorto-carotid bypass could be one treatment option in patients with carotid artery stenosis or fragile tissue [1]. The neck incision and preparation increase trauma and operative time. Using the axillary artery canulation site for the termino-lateral anastomosis of the aorto-axillar extra-anatomic bypass reduces trauma and operative time. This option eliminates additional preparation and allows easy tunnelling of the graft through the first intercostal space. The main disadvantage of this technique is adequate measurement of the graft length, thus preventing graft kinking or twisting. The aorto-axillar bypass could be a straightforward and reasonable bail-out procedure after failed direct anastomosis of debranched IA.

Conflict of interest: none declared.

Reviewer information

Interactive CardioVascular and Thoracic Surgery thanks the other, anonymous reviewer(s) for their contribution to the peer review process of this article.

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