How to do it: direct true lumen cannulation technique of the ascending aorta in acute aortic dissection type A†

Lars O. Conzelmann*, Ernst Weigang, Uwe Mehlhorn and Christian F. Vahl

Department of Cardiothoracic and Vascular Surgery, Medical Center of the Johannes Gutenberg-University Mainz, Mainz, Germany

* Corresponding author. Department of Cardiothoracic and Vascular Surgery, Medical Center of the Johannes Gutenberg-University Mainz, Langenbeckstr. 1, 55131 Mainz, Germany. Tel: +49-6131-173208; fax: +49-6131-173626; e-mail: conzelma@uni-mainz.de (L.O. Conzelmann).

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Abstract

In acute aortic dissection type A (AADA), direct true lumen cannulation (DTLC) of the ascending aorta is a fast and safe cannulation site providing antegrade perfusion of the supraaortic and visceral vessels. An Overholt clamp is passed around the ascending aorta to place a Mersilene® tape for later securing of the arterial cannula. After draining venous blood into the cardiopulmonary bypass system (CPB), the ascending aorta is transected and the aortic lumen inspected. The true lumen is identified and an arterial cannula inserted directly. Finally, the cannula is secured with the previously placed tape and CPB is initiated. DTLC can be used as arterial cannulation standard technique in operations for AADA.

Keywords: Aorta/aortic · Aortic dissection · Surgery · Emergency

INTRODUCTION

In acute aortic dissection type A (AADA), peripheral cannulation sites (e.g. femoral, subclavian, axillary or carotid artery) are considered as standard approaches for arterial access [1–3]. Central cannulation sites are emerging alternatives with good results [4–6]. Here, we describe the technical aspects of direct true lumen cannulation (DTLC) of the ascending aorta, an arterial cannulation technique first described in the 1990s by Borst et al. [7].

MATERIALS AND METHODS

Prior to anaesthesia, patients are placed in standard supine position. Anaesthesia management was described previously [6]. Following median sternotomy, the pericardium is opened slowly, preventing a sudden blood pressure increase due to decompression of pericardial tamponade, which may provoke acute rupture of the ascending aorta. During careful dissection between the adventitial layers of the ascending aorta and the pulmonary artery, it is of utmost importance that the adventitial layer of the aorta remains intact. An Overholt clamp is passed around the ascending aorta coming from the pulmonary artery separating the adventitial layers between aorta and pulmonary artery (Supplementary Video 1) to place a Mersilene® tape (Johnson & Johnson Medical GmbH, Norderstedt, Germany) around the ascending aorta for later snaring of the arterial cannula. A standard 36/50Fr two-stage cannula (Type V112, Sorin Group, Munich, Germany) is inserted into the right atrium.

Venous blood is drained rapidly into the venous reservoir until the systolic blood pressure is <30 mmHg. After Trendelenburg positioning, the ascending aorta is transected between the sinotubular junction and the innominate artery while maintaining the back wall of the ascending aorta. Thus, the ascending aorta and the aortic arch can be inspected and the true lumen identified. A standard 24Fr arterial cannula (HK46SM91V, Maquet, Hechingen, Germany) can be directly inserted into the true lumen during slow forward perfusion and secured with the Mersilene® tape (Supplementary Video 2). The plastic ring around the arterial cannula, which usually prevents excessive introduction of the cannula during regular aortic cannulation, is retracted back to 5 cm below the tip, so that the arterial cannula cannot slip through the Mersilene® tape. This cannulation process requires <2 min of circulatory arrest and is performed in normothermia and under prior pure oxygen ventilation. After snaring the arterial cannula, cardiopulmonary bypass system (CPB) is established and the body cooled depending on the extent of the dissection and the surgery it requires. Antegrade perfusion of the brain, visceral organs and extremities through the true lumen is thus established. Instantly, selective antegrade cardioplegia is performed. The diseased tissue of the ascending aorta can then be resected and the aortic root can be repaired according to the pathology. The proximal anastomosis is done during the cooling period. At the desired temperature, circulatory arrest is initiated, the arterial cannula removed and the aortic arch inspected. Depending on the extent of the dissection, an open distal anastomosis (with a proximal, partial or total arch repair) is performed. Before physiological blood flow is re-established, retrograde perfusion via the venous drainage is started to wash out thrombotic material and for de-airing. The aortic cannula is inserted into the tube graft, secured with string...
Even in patients whose aortic dissection displays a 360-degree circumferential separation of the lumina [9], DTLC facilitates safe and fast cannulation. Accordingly, DTLC should not only be considered as a ‘bail-out’ strategy when peripheral cannulation fails. Its major advantage is the correct identification of the true lumen and thus an antegrade organ perfusion.

SUPPLEMENTARY MATERIAL

Supplementary material is available at ICVTS online.

Conflict of interest: none declared.

REFERENCES


eComment. Acute aortic dissection type A: which strategy of the arterial perfusion to choose?

Authors: Leo A. Bockeria, Anatoliy I. Malashenkov and Sergey V. Rychin
Bakoulev Scientific Center for Cardiovascular Surgery, Moscow, Russia
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We read with great interest the report of Conzelmann and colleagues [1], describing the original method of direct aortic cannulation and we congratulate the authors for their excellent results. However, the separation between the adventitial layers of the ascending aorta and the pulmonary artery can lead to rupture of the aorta in this area. In addition, direct cannulation of the true aortic can be complicated by thromboembolism in the case of the false lumen thrombosis. Inadequate organ perfusion is one of the major problems in patients with acute type A aortic dissection (AADA). Until recently, the retrograde perfusion via the femoral artery was the perfusion mode of choice in thoracic aortic surgery [2]. But in some cases, this was marked by a high risk of potential malperfusion and atheroembolic complications associated with retrograde perfusion, especially in dissections.

In recent years, subclavian artery cannulation for AADA has become a widely accepted arterial access for antegrade aortic and cerebral perfusion [3,4]. Surgical

COMMENT

Inadequate organ perfusion is one of the major problems in patients presenting with AADA. Prompt establishment of antegrade systemic perfusion may prevent further dissection, organ malperfusion and cerebral embolization [2]. Instant antegrade perfusion can be achieved by DTLC of the ascending aorta. Normothermic circulatory arrest of up to 5 min can be tolerated [8], which should enable identifying the true lumen and placing the arterial cannula—usually, this part required <2 min [4, 6]. Preliminary aortic arch inspection for further entries of the dissection allows for precise definition of the consecutive surgical procedure with respect to temperature management and cerebral protection regime. When the presumed diagnostic findings are restricted to the ascending aorta, the arterial cannula can be moved to the aortic arch. This cannulation site has been applied as a quick, safe and easy approach in patients with AADA [4, 6, 7].

We consider the Overholt clamp placement behind the dissected aorta as the riskiest part of DTLC. Most important is the careful dissection between the adventitial layer of the ascending aorta and the pulmonary artery: the adventitial layer of the aorta must remain intact when placing the tape.