

# Cannulating a Dissecting Aorta Using Ultrasound-Epiaortic and Transesophageal Guidance

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## ABSTRACT

Management of acute Stanford type A aortic dissection remains a major surgical challenge. Directly cannulating the ascending aorta provides a rapid establishment of cardiopulmonary bypass but consists of risks such as complete rupture of the aorta, false lumen cannulation, subsequent malperfusion and propagation of the dissection.

We describe a technique of cannulating the ascending aorta in patients with acute aortic dissection that can be performed rapidly in hemodynamically unstable patients under ultrasound-epiaortic and transesophageal (TEE) guidance.

## INTRODUCTION

The choice of cannulation site in acute Stanford type A aortic dissection remains controversial. A number of cannulation sites have been described including femoral, axillary and innominate arteries, trans-apical, and via the ascending aorta. However, no single technique has been proven to be the gold standard.

In femoral cannulation there is a risk of distal re-entry and perfusion of the false lumen, as well as dislodging atheromatous plaques [Noiseux 2003]. The axillary artery is rarely calcified or dissected, but the vessel may be small, limiting flow and prolonging time to cool, and the procedure is technically time consuming [Etz 2008]. Innominate artery cannulation provides the true antegrade cerebral flow. However, both extension of dissection and calcification of the innominate artery are considered to be contraindications [Di Eusanio 2007]. Additionally, a proportion of the population may have an incomplete circle of Willis, and therefore potentially only one hemisphere may be perfused [Khaladj 2008]. Cannulating trans-apically through the left ventricular apex is fast and assures perfusion of the true lumen but is not a suitable technique in stenotic aortic valves [Sosnowski 2008].

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In order to provide cardiopulmonary bypass (CPB) as rapidly and safely as possible, directly cannulating the ascending aorta is considered, but this may result in complete aortic rupture, false lumen cannulation, and propagation of the dissection. We describe a technique of cannulating the ascending aorta in acute aortic dissection that can be performed rapidly under ultrasound-epiaortic and transesophageal (TEE) guidance.

## TECHNIQUE

After general anesthesia and intubation, a TEE probe is inserted. A midline sternotomy is performed, the pericardium is opened, and after systemic heparinization, an ultrasound guided needle puncture is carried out on the ascending aorta and a guide wire from a standard central line insertion kit is inserted (Figure 1). The position of the guide wire in the true lumen is confirmed using a SonoSite MicroMaxx ultrasound epiaortic scan probe (SonoSite, Bothell, WA, USA) at the ascending aorta, and TEE in the distal arch and descending aorta (Figure 2A). A No. 77420 wire-wound arterial cannula (Medtronic, Minneapolis, MN, USA) 20-french gauge with tapered introducer is inserted over the guide wire using the Seldinger technique (Figure 2B). Patency of the cannula is established by identification of normal line pressure and flow back during initial checks conducted by the perfusionist prior to the initiation of CPB. The Doppler function on the TEE is also used to confirm presence of flow on the true lumen and absence of flow within the false lumen. A 2-stage venous cannula is then inserted, and CPB is instituted.

After reducing the patient's body temperature to 18°C, arterial inflow is stopped. The arterial cannula is then removed, the aorta is opened, and antegrade cardioplegia via the coronary ostia, if coming off the true lumen, and retrograde cardioplegia via the coronary sinus is administered. Then the dissected segment including the cannulation site is excised, and an appropriate size of Hemashield Dacron tube graft (Meadox Medicals Inc., Oakland, NJ, USA) is anastomosed distally to the aorta. The arterial cannula is then inserted into the side arm of the tube graft, and the tube graft is clamped proximally. Flow is then restored after careful de-airing, and the patient is re-warmed. The proximal end of the tube graft is anastomosed to the root after an indicated procedure on

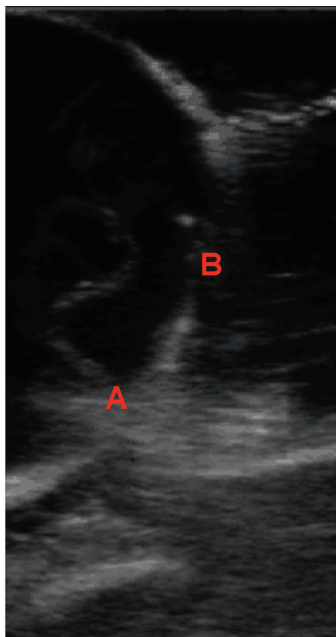


Figure 1. Epi-aortic scan demonstrating the dissecting flap (A) with the wire in the true lumen (B).

the aortic valve or the aortic root is carried out. The patient is weaned off CPB after decannulation and closed after careful hemostasis.

**DISCUSSION**

Acute Stanford type A aortic dissection requires prompt intervention and a careful choice of cannulation site. A number of techniques are employed. All have common goals of speed, and therefore lack of technical complexity, with the assurance of true lumen perfusion. As previously described, directly cannulating the dissected ascending aorta has advantages such as its technical simplicity, speed, and preservation of antegrade flow, reducing the risk of embolization and retrograde dissection.

Directly cannulating a dissecting aorta with only palpation will increase the risk of entry to the false lumen. Cannulation assisted with TEE has been reported previously; the Hannover group described using TEE and palpation as a method of assessing a suitable cannulation site [Di Eusano 2007]. Gobolos et al also described a Seldinger technique with TEE [Göbölös 2008]. Inoue and colleagues [Inoue 2007] used both TEE and epi-aortic scanning for cannulating ascending aortic aneurysm but avoided the use of this technique in

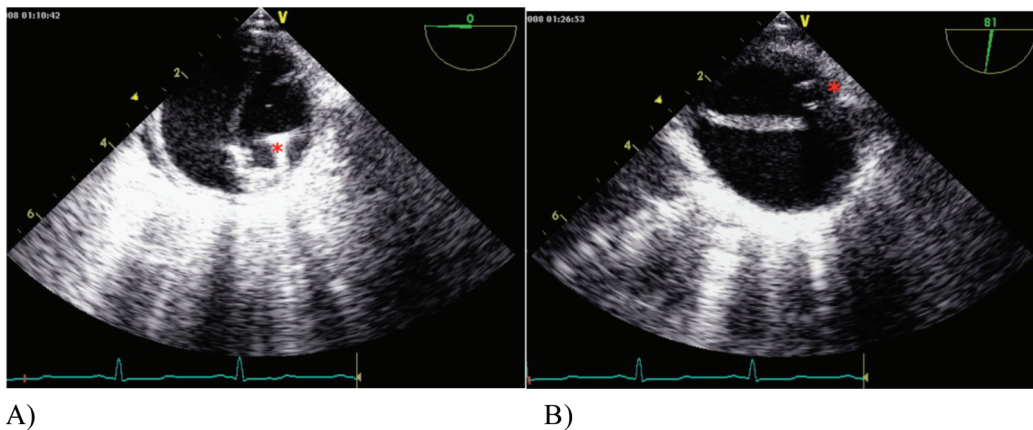


Figure 2. Transesophageal endocardiogram (TEE) of descending aorta. A) Dissection with wire positioned in true lumen (\*). B) Cannula in the correct position in the true lumen of the aorta (\*).

**Details/Outcome of Patients Who Were Cannulated with the Assistance of Epi-aortic Scan and Transesophageal Endocardiogram (TEE)**

Patients	EuroSCORE	Logistic EuroSCORE	Operation Status	Ventilation time, h	Postoperative Inotropic Use, h	Length of Stay in Intensive Care Unit, d	Complications/ Outcome	Length of Stay in Hospital, d
1	15	56.48	Emergency	12	24-48	2	None	11
2	11	23.59	Emergency	17	>48	5	Re-exploration for bleeding	9
3	8	12.15	Emergency	192	>48	9	Died	9
4	7	9.04	Emergency	10	0-12	2	Transient ischemic attack	11
5	10	19.74	Emergency	14	0-12	8	None	14
6	8	12.43	Emergency	7	0	2	None	8
7	4	3.8	Urgent	5	0	5	None	11

acute type A dissection [Lindblom 2000]. We used combined TEE and epiaortic scanning to assist in cannulating an acute type A aortic dissection. This combination minimizes the risk of false lumen cannulation; epiaortic scanning confirms the most suitable site, and the minimally invasive Seldinger technique reduces the initial incision size prior to the cannulation, decreasing the chance of sudden rupture of the aorta during the cannulation. TEE demonstrates that epiaortic scanning of the posterior wall of the aorta can identify the dissection flap and its extension.

With the assistance of epiaortic scanning, TEE, though unable to obviate the risks of rupture, does seem to reduce the probability of false lumen cannulation. It also has the obvious advantage of reduction in time to CPB in hemodynamically unstable patients. The technique is relatively safe, assures true lumen perfusion, and reduces the risk of aortic rupture and embolization but should be avoided if circumferential dissection of the aorta is suspected. We have adopted this method for cannulating a dissecting aorta in 7 consecutive patients (Table) and have experienced no complications related to cannulation.

#### ACKNOWLEDGMENTS

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