

Transesophageal Echocardiography-guided Left Ventricular Transapical Cannulation of Aorta in Acute Stanford Type: An Aortic Dissection: A Case Report

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ABSTRACT

We present a safe technique of transapical left ventricular (LV) cannulation under the guidance of a transesophageal echocardiogram (TEE) in a case of acute aortic dissection. This technique ensures the perfusion of the true lumen avoiding malperfusion syndromes.

Case description: A 44-year-old male presented to the hospital with a history of acute chest pain. This gentleman was a chronic smoker, alcoholic, and known to suffer from hypertension to diabetes mellitus. Transthoracic echocardiography and computerized tomography of the chest revealed acute Stanford type A aortic dissection. He underwent emergent hemiarch and ascending aorta replacement under cardiopulmonary bypass (CPB). TEE-guided LV transapical cannulation was done with a 24 Fr size straight arterial cannula, which was directed to the aorta through the aortic valve for arterial return from CPB. The patient was cooled to 26°C with a total CPB time being 285 minutes and a total aortic cross-clamp time of 156 minutes. With the aid of retrograde cerebral perfusion (RCP) through superior vena cava cannulation and later antegrade cerebral perfusion (ACP) through innominate and left common carotid artery, hemiarch of the aorta was replaced and circulation restarted. Following this, the ascending aorta replacement was completed. Surgery was successful and the patient was discharged home on the 10th postoperative day.

Conclusion: Left ventricular (LV) transapical cannulation can be performed safely with TEE guidance to ensure a safe perfusion strategy. Acute aortic dissection is a serious life-threatening condition; therefore, a safe strategic plan is very crucial for a successful outcome of surgery. TEE helps to guide the accurate placement of the aortic cannula through the LV apex into the true lumen of the aorta and ensures adequate perfusion.

Keywords: Case report, Stanford type A acute aortic dissection, Transapical aortic cannulation, Transesophageal echocardiography.

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INTRODUCTION

Acute aortic dissection is the most commonly diagnosed potentially lethal disease of the aorta where prompt diagnosis and surgical treatment are necessary. The mortality increases by 1–2% every hour without surgery. The optimal site of arterial cannulation for initiation of cardiopulmonary bypass (CPB) is a matter of debate. Femoral artery cannulation with a retrograde perfusion is routinely followed but this may be associated with the risk of atheroembolism and malperfusion of the vital organs. Herein, we present the simple approach to this complex problem where the body may be perfused with single left ventricular (LV) transapical cannulation which is transesophageal echocardiography (TEE) guided.

CASE DESCRIPTION

A 44-year-old hypertensive, diabetic, smoker, and alcoholic gentleman presented to the hospital with a history of acute chest pain for 2 days. On examination, pulse was 90 bpm sinus rhythm, blood pressure 170/130 mm Hg, and SpO₂ 98% at room air. Computerized tomography showed a dilated aortic root (42 mm) and ascending aorta (58 mm) with limited acute type A aortic dissection involving the ascending thoracic aorta. Transthoracic echocardiography showed normal biventricular function with mild aortic regurgitation dissection flap seen in the aortic root.

Intraoperative management was as follows—two intravenous 16G cannulas were inserted, intravenous labetalol infusion was started at the rate of 20 mg/hour, and the right radial artery and, the right internal jugular vein were cannulated under local

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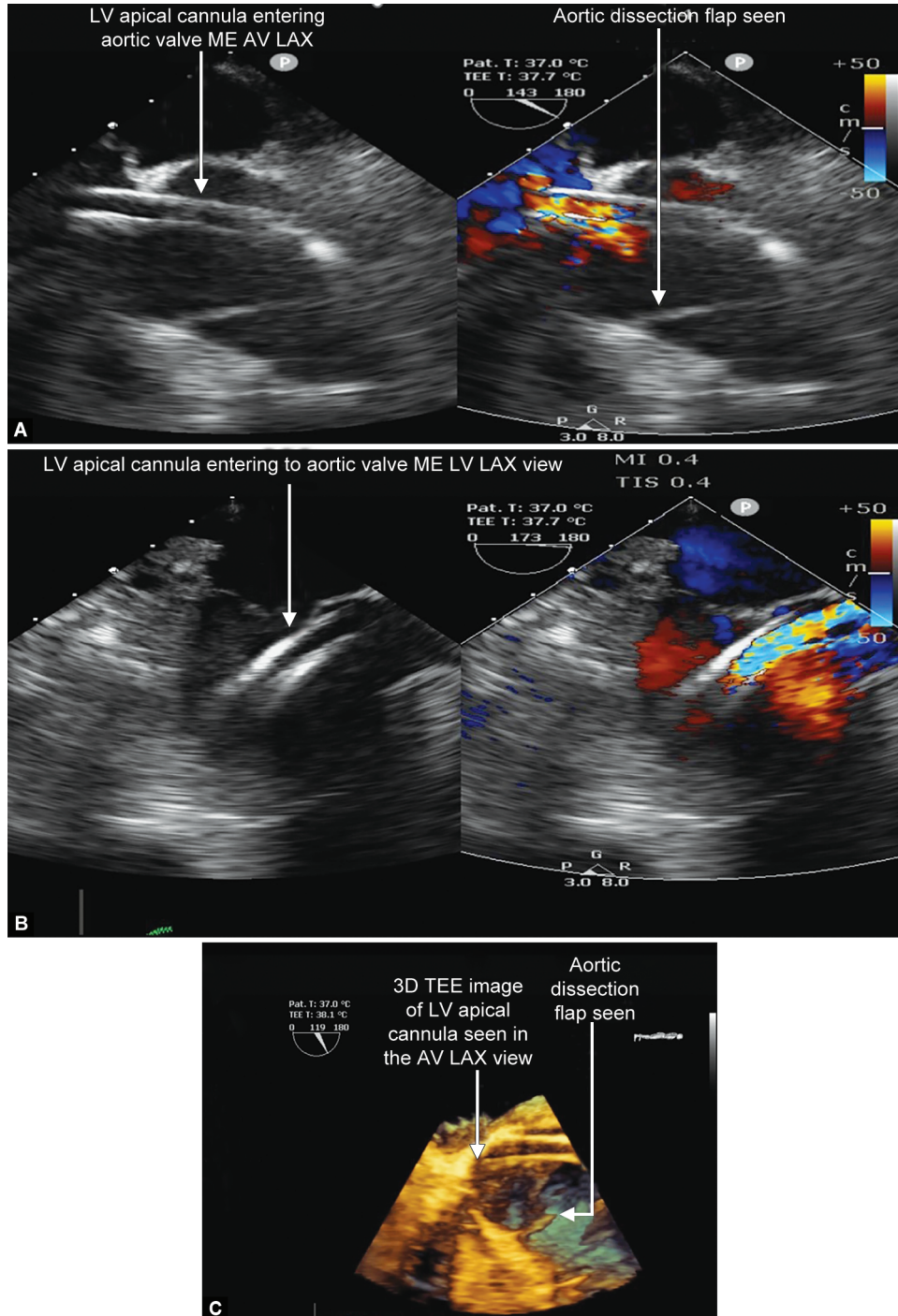
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Patient consent statement: The author(s) have obtained written informed consent from the patient for publication of the case report details and related images.

analgesia before the induction of anesthesia. Regional cerebral oxygen saturation was monitored throughout surgery. TEE showed a dissection flap localized to the junction of the sinus of Valsalva

and sinotubular junction, sparing the coronary ostia, extending to the proximal arch, with moderate aortic regurgitation and good biventricular function. After heparinization, the right atrial cannula was inserted for venous drainage. TEE was used for guiding LV transapical cannulation with the midesophageal LV and aortic valve long-axis view (Fig. 1 and Video 1). Once the cannulation was performed, the CPB was initiated and systemic cooling to 26°C was commenced (Fig. 2). Inferior vena cava cannula and vents were inserted on bypass. The total circulatory arrest was

established and cerebral preservation was provided by retrograde cerebral perfusion (RCP) at a pressure of 25 mm Hg. Once the arch was evaluated, the RCP was stopped and selective antegrade cerebral perfusion (SACP) at a pressure of 40–60 mm Hg was provided through innominate and left carotid arteries. Hemiarth replacement was performed and circulation was reestablished after deairing of the aorta. Proximal anastomosis was performed while rewarming and the aortic clamp was released after de-airing the heart. After satisfying the criteria for separation, CPB was



Figs 1A to C: (A) Arterial cannula entering the aortic valve in midesophageal LV long-axis view through the LV apex; (B) Midesophageal aortic valve long-axis view showing tip of cannula beyond the sinus of Valsalva in the true lumen of the aorta; (C) Three-dimensional image of arterial cannula seen in midesophageal aortic valve long-axis view in true lumen of aorta with dissection flap

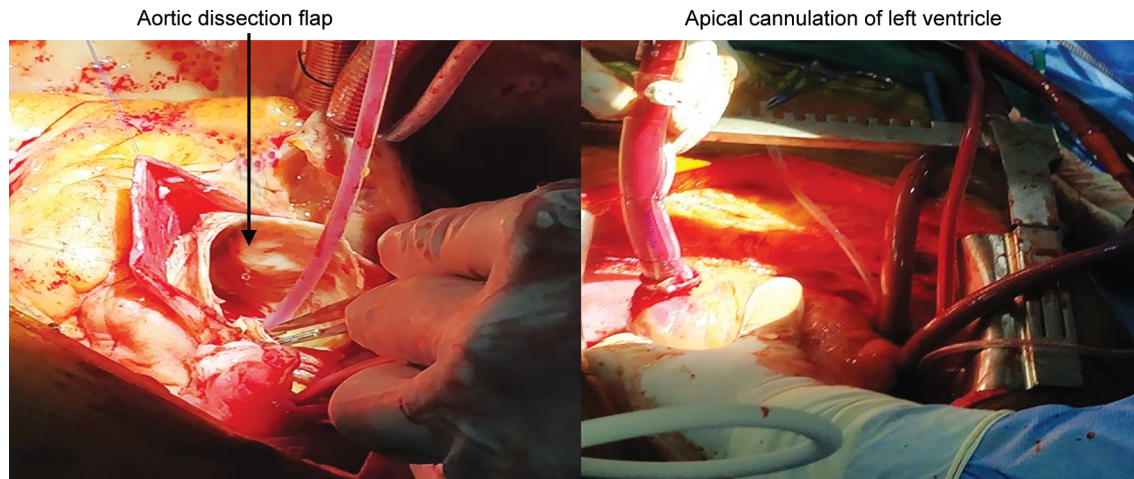


Fig. 2: The left image demonstrates the dissection flap in the root of the aorta and the right image shows LV apex arterial cannulation

weaned and hemostasis was achieved. The total bypass time was 285 minutes and the total aortic cross-clamp time was 156 minutes. Single donor platelets, fresh frozen plasma, and cryoprecipitate were administered to achieve hemostasis based on viscoelastic measurements with rotational thromboelastometry. The patient was cared for in the intensive care unit for elective postoperative ventilation, and postoperative recovery was uneventful.

DISCUSSION

Acute dissection is one of the most lethal aortic diseases, with mortality reaching up to 50% if untreated in the first 48 hours. The principal aim of the surgery is to prevent rupture of the aorta and further dissection of the aorta causing malperfusion. The most common approach to CPB in these cases is femoral artery cannulation, since the 1950s. However, this has a potential risk of further extension of the dissection flap, cerebral embolization of atheromatous debris, and malperfusion of arch vessels.¹ Herein we present a simple and quick approach for arterial cannulation through the LV transapical route. In 1969, it was Zwart et al., who proposed this approach, as a part of a LV support system.² Subsequently, in 1985, Golding elaborated the successful application of this technique, in patients with severe atherosclerotic disease of the ascending aorta for coronary bypass operation.³ In 1991 Robicsek reported that a similar technique could be used in acute aortic dissection.⁴ Wada et al. also contributed and published their large series with tremendous improvement in the clinical results. Out of 138 patients, the mortality rate was <20%, with no malperfusion events, intraoperatively.⁵

The aortic cannula can be inserted by the surgeon without difficulty, especially with the guidance of TEE, which facilitates the tip of the cannula to be positioned exactly beyond the sinus of Valsalva, without the hazard of entering the false lumen and left atrium. There is a reduced probability of aortic regurgitation with this technique but, this technique is not feasible for use in patients with severe aortic stenosis, in whom the cannula might not pass through the aortic valve.

CONCLUSION

This technique is considered to be advantageous over other methods of cannulation due to its simplicity and faster approach during emergency cannulation, adequate antegrade aortic flow, and the reliability of true lumen perfusion with a significantly decreased risk of stroke and malperfusion.

Clinical Significance

The TEE-guided LV transapical cannulation technique in acute type A aortic dissection surgeries is a safe and proven technique to ensure true lumen cannulation of the aorta and systemic perfusion.

SUPPLEMENTARY MATERIAL

The supplementary [Video 1](https://www.jacutecare.com/journalDetails/JAC) is available online on the website of <https://www.jacutecare.com/journalDetails/JAC>

Video 1: Showing arterial cannula entering the aortic valve in midesophageal LV long-axis view through the LV apex

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