

# Modified Port-Access Technique

for the Treatment of Aortic  
Dissection after Previous Cardiac Surgery

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*One of the most challenging conditions to manage after previous cardiac surgery is chronic dissection of the ascending aorta. We operated on a 54-year-old man who had aortic dissection in addition to large aortic dimensions very close to the sternum, severe aortic regurgitation, and a false lumen in the descending aorta. We used a combination of perfusion and myocardial protection techniques, arising from port-access technology, that enabled antegrade flow into the aorta, endoclamping of the ascending aorta, the administration of cardioplegic solution before opening the sternum, and left ventricular venting to prevent ventricular distention. Our technique resulted in minimal blood loss, shorter circulatory-arrest and operative times, the ability to operate on a decompressed heart and descending aorta, good myocardial protection, and easier and safer access to the heart. Three years postoperatively, our patient was doing well.*

*Other patients might benefit from this approach; however, the surgeon must ensure that an aortic segment is suitable for endoclamping. (Tex Heart Inst J 2017;44(3):202-4)*

**Key words:** Aortic aneurysm, thoracic/surgery; balloon occlusion/methods; cardiac surgical procedures/methods; reoperation/instrumentation/methods; treatment outcome

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**S**urgical treatment of acute ascending aortic dissection is challenging in patients who have a history of cardiac surgery.<sup>1</sup> In such cases, a repeat sternotomy might cause catastrophic bleeding because of existing injury to the ascending aorta. The objective is to achieve profound hypothermia and circulatory arrest before opening the chest under cardiopulmonary bypass (CPB) via femofemoral cannulation. If aortic valve insufficiency is present, ventricular fibrillation might develop as the temperature decreases, leading to ventricular distention and myocardial damage. This phenomenon is not resolved by femofemoral bypass.

The aim of this brief report is to describe a technique that uses the port-access approach in treating chronic ascending aortic dissection after previous cardiac surgery.

## Case Report

In November 2009, a 52-year-old man underwent mitral valve repair because of severe regurgitation. Two years later, he was readmitted to our hospital with severe dyspnea. Echocardiograms revealed severe aortic valve regurgitation and an intimal flap in the ascending aorta. A contrast-enhanced computed tomographic angiogram showed a 6.5-cm segment of the ascending aorta very close to the sternum; an aortic dissection started above the coronary sinuses and extended to the descending aorta. The true lumen of the aorta was 3.8 to 4.2 cm in diameter, and the false lumen was partly filled with thrombus. The patient had reported an episode of severe chest pain 3 months earlier. We thereupon made a diagnosis of chronic aortic dissection and scheduled the patient for surgery.

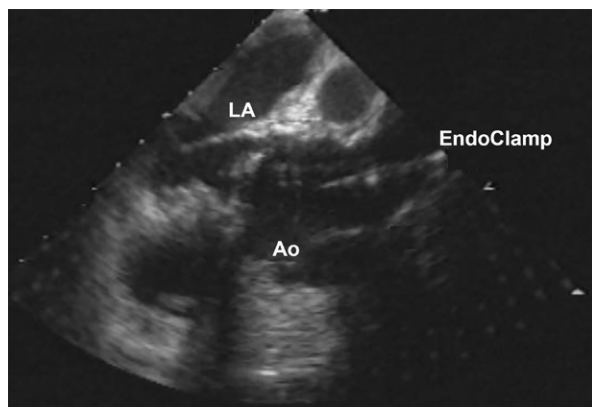
**Modified Technique.** An EndoPlege<sup>®</sup> catheter (Edwards Lifesciences LLC; Irvine, Calif) was advanced into the coronary sinus with transesophageal echocardiographic (TEE) assistance. The patient was draped, with the right clavicle and right shoulder exposed. After heparin administration, a 22F QuickDraw<sup>®</sup> venous cannula (Edwards Lifesciences) was percutaneously inserted into the right femoral vein and advanced into the right atrium under TEE guidance. The right axillary artery was approached by blunt dissection through the deltopectoral groove. A 10-mm Dacron graft, trimmed at a 45° angle, was anastomosed to the anterior aspect of the axillary artery (Fig. 1). Then, a 21F EndoReturn<sup>®</sup> arterial cannula (Edwards Lifesciences) was inserted into the Dacron graft, secured with 3 ties, and connected to the arterial

line. With the aid of TEE, a 260-cm, 0.038-in guidewire (3-mm J-tip, fixed-core, polytetrafluoroethylene-coated) was advanced through the side branch of the arterial cannula and the axillary artery, up to the ascending aorta and into the left ventricle (LV). Next, an EndoClamp® aortic catheter (Edwards Lifesciences) was advanced through the same route and positioned at the level of the last segment of the ascending aorta (Fig. 2). Positioning the balloon of the EndoClamp as superiorly as possible in the ascending aorta was important to ensure that the rest of the ascending aorta could decompress during cardiac arrest, thereby reducing the risk of aortic damage during sternotomy. Cardiopulmonary bypass was started by using a centrifugal pump-assisted venous return. The large lumen of the EndoClamp was used to vent the ascending aorta. Then, the aorta was endoclamped, blood cardioplegic solution was administered retrograde, and the heart was decompressed (Figs. 3 and 4). Transesophageal echocardiograms and radial artery pressure were continuously

monitored to discern the eventual displacement of the aortic balloon. The patient was cooled to a temperature of 22 °C. During the cooling procedure, we performed a longitudinal sternotomy. The ascending aorta was isolated and clamped. The EndoClamp was deflated and withdrawn almost 2 cm. The aortic root was replaced with a composite graft. The first step in this replacement procedure was to perform the proximal anastomosis and coronary preimplantation. When the patient's core temperature reached 22 °C, circulatory arrest was initiated. The aortic arch was inspected. No entry ports were observed up to the aortic isthmus, so the new graft was anastomosed to the ventral portion of the aortic arch. A short period of washout cerebral retroperfusion was achieved by perfusing the superior vena cava with

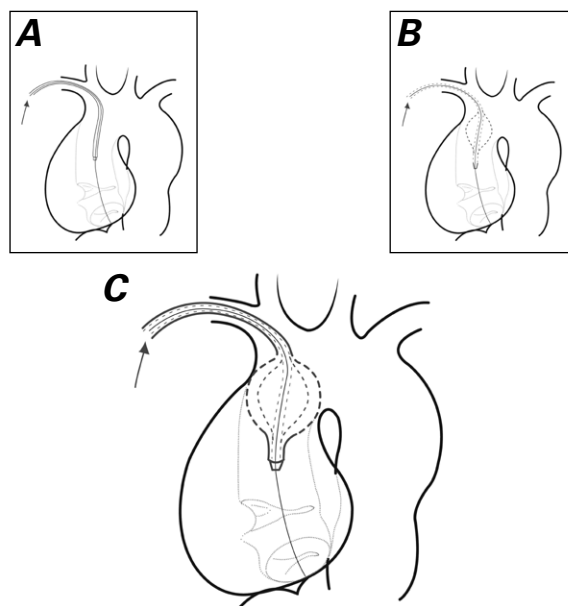


**Fig. 1** Intraoperative photograph shows the arterial cannula inserted into a 10-mm Dacron graft, which in turn is anastomosed to the axillary artery. An EndoClamp has been advanced into the axillary artery's side branch.

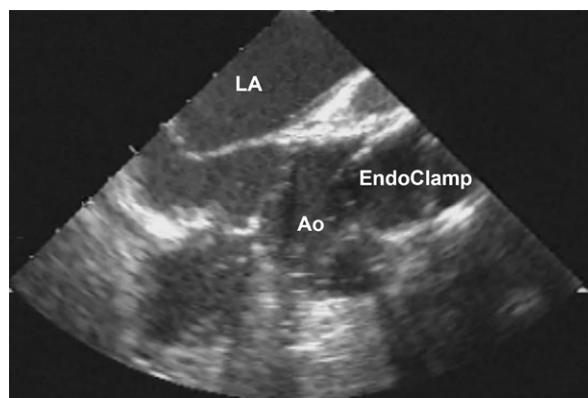


**Fig. 2** Transesophageal echocardiogram shows correct positioning of the EndoClamp in the ascending aorta, just above the coronary sinuses.

Ao = aorta; LA = left atrium



**Fig. 3** Drawings show **A)** EndoClamp insertion into the ascending aorta, **B)** partial balloon inflation, and **C)** full inflation.



**Fig. 4** Transesophageal echocardiogram shows the EndoClamp inflated inside the aorta.

Ao = aorta; LA = left atrium

a selective coronary perfusion cannula. De-airing was performed through the distal suture line, and after 21 minutes of circulatory arrest, the EndoClamp was positioned in the new ascending aortic conduit to enable venting. After de-airing and just before the patient was weaned from CPB, we removed the EndoClamp. The suture was tied, and the patient was rewarmed. He was extubated the next day, and his postoperative course was uneventful. Three years after surgery, he was doing well.

## Discussion

In patients with chronic aortic dissection after previous cardiac surgery (especially those in whom the aorta is very close to the sternum), CPB and circulatory arrest are established before re-sternotomy, to minimize the risk of catastrophic hemorrhage. The use of the right axillary artery as the inflow vessel for CPB has been described for pseudoaneurysms of the ascending aorta and arch.<sup>2</sup> When there is dissection of the descending aorta, axillary artery cannulation—which enables antegrade pump flow into the aorta—is associated with a lower risk of malperfusion and brain embolization. Circulatory arrest, however, can be very dangerous in the presence of severe aortic regurgitation, because overstretching myocardial fibers in the unvented and arrested heart can result in fatal myocardial damage. In addition, during repeat surgery, freeing aortic and pericardial adhesions can be cumbersome and time-consuming.

A technique of achieving circulatory arrest via the port-access system has been described in accounts of repeat aortic surgery through the femoral artery<sup>3,4</sup> and in treatment of aortic pseudoneurysm through the axillary artery<sup>2</sup>—but never in the context of aortic dissection and antegrade flow after previous cardiac surgery. Our technique enables antegrade flow, normal perfusion distal to the EndoClamp during CPB, closed-chest clamping of the ascending aorta, and avoidance of the deleterious effects (before repeat sternotomy) of aortic regurgitation, cardioplegic administration, and LV venting.

The flow from the aorta to the axillary artery should not be obstructed and must be confirmed before the operation. Before planning the procedure, the surgical team must document that the brachiocephalic trunk and axillary artery are not involved in the dissection. A distal segment of the ascending aorta must be available for endoclamping. Because the rest of the ascending aorta can be decompressed during cardiac arrest, clamping the superior aorta (as high as possible) is essential to avoid aortic damage during repeat sternotomy. Our technique should not be used when no segment is suitable for endoclamping. In patients with chronic dissection, the EndoClamp will occlude only the true lumen, and backflow into the ascending aorta through

the false lumen (fed by downstream reentry tears) might be present.

Good experience with port access, catheter positioning, and TEE monitoring of the EndoClamp position throughout the procedure is mandatory to prevent disastrous complications.<sup>5</sup> To achieve support when advancing the balloon, one must always position the guidewire inside the LV with use of TEE guidance; otherwise, the balloon will migrate from the targeted endoclampable segment of the aorta when the heart contracts. Positioning the percutaneous retrograde-cardioplegia catheter is difficult, time-consuming, and requires proper training. The EndoClamp should be monitored actively with use of TEE, and any displacement can be detected by continual analysis of the right radial artery pressure curve. All such adjunctive procedures take time, and this is one reason why such a technique is contraindicated in unstable patients.

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