# CASE REPORT & REVIEW OF LITERATURE

## Surgical management of standard Type-A chronic dissecting aneurysm of the ascending aorta, arch and descending aorta

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## ABSTRACT

Acute aortic dissection is a morbid condition with surgical mortality as high as 25%. The surgical managment of aortic dissection is one of the most challenging areas of cardiac surgery. We report a case of chronic type A dissection and its surgical management done at Tabba Heart Institute (THI). The surgery was conducted with the help of right axillary artery cannulation, deep hypothermia, lower body circulatory arrest for the anstomoses of descending aorta and construction of elephant trunk. The arch vessels were anstomosed using the technique of Carrol Patch. Chest was left open for a day due to bleeding. The patient improved slowly and was discharged on 9th post operative day.

Keywords: Aortic Aneurysm, Elephant Trunk, Type A Dissection, Chronic Dissection.

## INTRODUCTION

Acute aortic dissection is a morbid condition with surgical mortality as high as 25% [1,2]. Acute type A or Debakey I dissection has the propensity to involve the arch and descending thoracic aorta in 10-30% of cases. Based on current understanding of aortic dissection, replacement of the aortic arch is considered in patients with pre-existing arch aneurysm or when the primary intimal tear (PIT) is identified on the preoperative CT in the distal arch and proximal descending thoracic aorta [3]. We describe a case of chronic type A dissection presenting more than two weeks after the primary event with aneurysm of the distal ascending aorta, arch and descending thoracic aorta.

## CASE REPORT

A 48-year-old hypertensive male was admitted in Tabba Heart Institute (THI) with history of increasing dyspnea on lying down. There was no history of antecedent chest pain and on examination the only positive finding was increased blood pressure readings. There was no ECG change but chest x-ray showed significant mediastinal widening [Fig 1-a]. Echocardiography showed that the ascending aorta was dilated and contained intimal flap. The aortic root was spared and the aortic valve was normal looking with no signs of regurgitation. The CT-scan confirme the echo findings [Fig 1-b]. It showed type A dissection starting well above the aortic root and involving the arch and descending thoracic aorta (DTA) extending up the aortic bifurcation. The intimal flap was extending down to the iliac arteries. The true lumen of the DTA and abdominal aorta was compressed by large false lumen containing thrombus. The DTA was >8cm just beyond the left subclavian artery and the mid thoracic aorta. There was minimal pleural effusion of the left side. Echocardiogram and TEE showed normal aortic valve with normal LVEF. The dissection process started above the STJ and ascending aorta was aneurysmal with intimal flap. The intimal tear was identified in the distal aortic arch and proximal descending aorta on color flow doppler. Repair of the ascending aorta, replacement of the aortic arch and elephant trunk procedure was planned and undertaken.

At operation, ascending aorta was adherent to the pericardium. The ascending aorta and arch were livid in color and were aneurysmal [Fig 1-c]. The descending thoracic aorta was hugely dilated and aneurysmal. The ascending aorta was densely adherent to the main and right pulmonary artery and the superior vena cava. The MPA and right pulmonary artery (RPA) were partially torn during dissection and had to be repaired with autologous pericardial patch. The superior vena cava also had longitudinal tear, which was closed primarily. The intimal tear was located in the ascending aorta well above the STJ and the false lumen was aneurysmal and filled with organized clot. The wall of the aorta was thickened, severely fibrotic and partially calcified. The false lumen was extending along the convexity of the arch (involving the area of head and arm vessels) into the descending aorta. Descending aorta was significantly dilated and filled with thrombus. The area of dilatation was extending down beyond view. No malperfusion was detected at any time during the course of operation. Aortic root and valve were not involved in the dissection process.

*Operative Procedure*

After putting the arterial line through the left radial, right radial and left femoral, patient was induced with fentanyl based anesthesia. The induction was smooth, without hemodynamic or ST changes. This was followed by insertion of CVP line, foley and swan ganz. The patient was then prepared and draped in the routine manner. Median sternotomy was done followed by pericardiotomy. Right axillary artery was then exposed by a transverse subclavicular incision, 8 mm Dacron graft was attached to the artery with 6/0 prolene sutures and it was then used as arterial

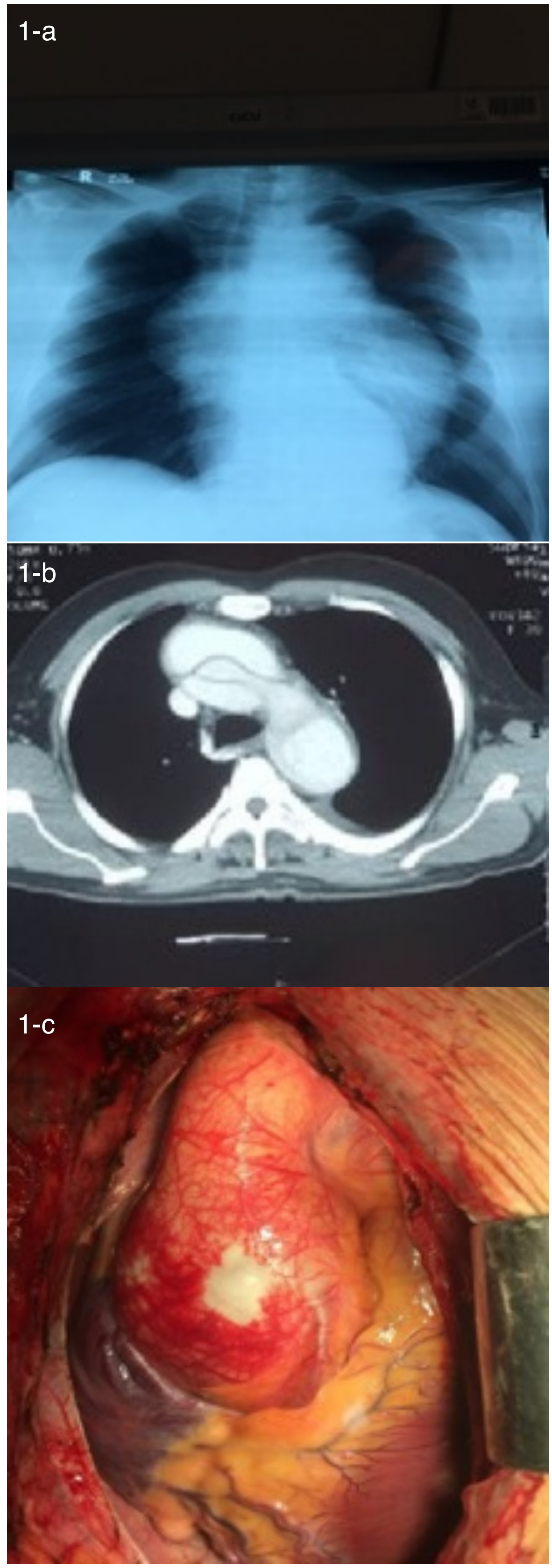


Figure 1

inflow channel. Right atrial appendage was then cannulated and CPB was established. Temperature was initially lowered to 26 C and later on to 21 C during lower body circulatroy arrest for descending thoracic anastomosis. During lower body circulatory arrest, axillary artery perfusion to the brain (ACP) was continued. The left subclavian and left common carotid arteries were back flowing well and were kept clamped during distal anastomosis and arch reconstruction. The arch and the ascending aorta were opened (as shown in images below) by a longitudinal incision after circumferential dissection around it and the DTA protecting the left recurrent laryngeal nerve (RLN). A carrel patch was created for the head and arm vessels. The patch was in two layers but the intima was intact. The DTA was divided beyond the left subclavian artery and the false lumen was cleared of organized clot. The layers of false and true lumen were first joined by 3/0 prolene interrupted sutures buttressed on the outside by Teflon felt. 24 sized dacron conduit was invaginated and 8-10 cm elephant trunk was hung down into the DTA and circumferential anastomosis of the invaginated graft was made to the cut descending thoracic aorta with 3/0 prolene. The convexity of the conduit was then opened longitudinally and island of the head and arm vessels was the anastomosed to the said opening with 3/0 continuous prolene sutures in such a way that the dissected layer of the island and Teflon felt were included in the sutures line. After completion of the distal anastomosis an 8 mm Dacron graft was anastomosed to the most distal part of the conduit and lower body perfusion was started. The area proximal to the side arm was clamped during reconstruction of the arch. After attaching the island of head and arm vessels the graft was clamped more proximally and the whole body perfusion was reestablished through the axillary artery while the side arm was clamped. The graft was then brought down to the STJ and cut after sizing. It was then anastomosed to the ascending aorta with continuous 3/0 prolene buttressed on the outside with Teflon felt. Rewarming was started and the aortic cross clamp was removed after thorough de-airing. The heart came back into normal sinus rhythm. The graft was then found kinked in the mid ascending neo-aorta. Aorta was clamped again and the graft was refashioned after excising the kinked part. The two cut ends were joined together with 4/0 prolene followed by de-clamping. Heart was perfused and the bleeding

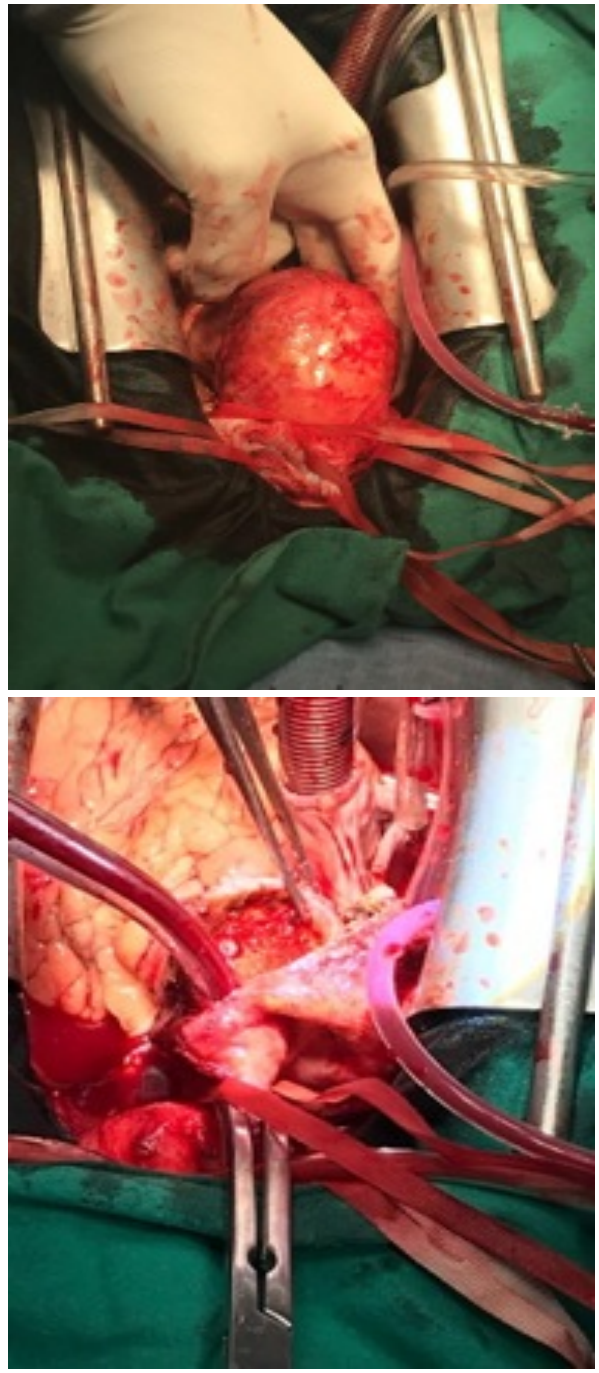

Figure 2
2-a Ascending Aorta and Arch. The arch vessel encircled with tapes.
2-b The aortotomy showing aneurysm with the clot inside.

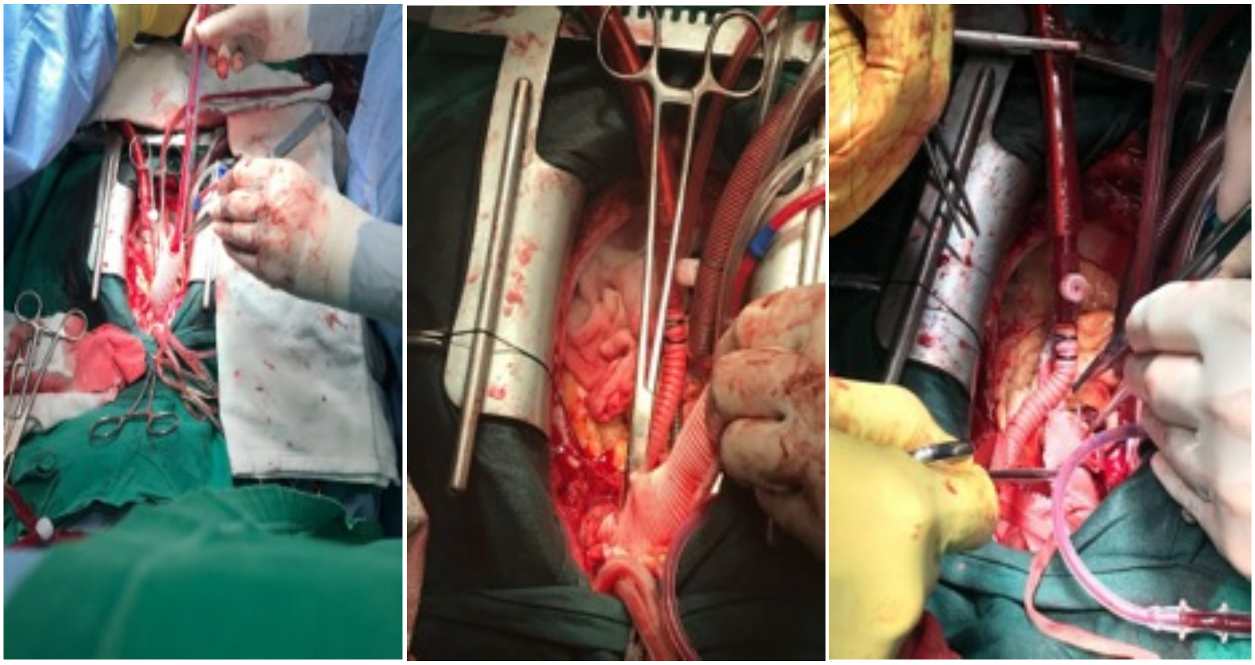

Figure 3

was checked. Rewarming was continued to normothermia. Heart resumed normal sinus rhythm. CPB was terminated with moderate inotropic support without difficulty. Total bypass time was 377 minutes and total cross clamp time was 242 minutes. Lower body ciculatory arrest time was 100 minutesand and axillary perfusion time was 186 minutes. Heparin was reversed. Decannulation and hemostasis were carried out. Pacing wires was attached to the RV. Wire was checked and found to be working on minimal thresholds. Three drains were placed in the mediastinum and the left pleural cavity. Due to severe coagulopathy the area was packed and the chest was left open. The wound was dressed and the patient was shifted to the ICU in a stable condition but with open chest. The coagulopathy was managed in the ICU by transfusing blood products and fresh whole blood. He remained hemodynamically stable and did not require re-packing in the ICU. He was kept sedated and relaxed and the chest was closed on the first postoperative day. Unfortunately he started to bleed after chest closure. He was reopened and the bleeding points were fixed. He woke up agitated on the second post op day. He was moving all four limbs. Sedation was re-started and he was finally extubated on the fourth day. By this he regained full GCS and it was noticed that he was showing paraparesis. He was moved to the HDU where he stayed for one day. He was finally discharged from the hospital on the 9$^{th}$ postoperative day. In the meanwhile, he required left pleurocentesis for left sided collection.

## Discussion

The primary intimal tear location in the distal arch and proximal descending thoracic aorta (DTA) constitutes one of the indications of the replacement of the aortic arch [4-8]. The other reason for considering replacement of the arch and elephant trunk procedure for descending thoracic aorta is aneurysmal dilatation of the DTA. Tears in the proximal arch and along the concavity of the arch can be taken care of by Hemiarch type of procedure and Peninsula technique. In our case, we knew from the outset that replacement of arch along with standard elephant trunk procedure will be required. Historically arch procedures without adequate cerebral protection were fraught with danger of mortality as high as 42% [9,10]. The technique of Profound Circulatory Arrest (PHCA) with Open Distal Anastomosis (ODA) was first used by Griepp and later by Cooley [11,12,13]. The ODA provided bloodless field and allowed the opportunity to inspect the aortic arch for further intimal tears. The technique of PHCA with femoral artery cannulation was utilized to extend acute dissection surgeries to the arch. Femoral artery cannulation was the most commonly employed technique but its use has waned markedly. Its main advantage is the rapidity with which perfusion can be established in emergency situations but there is a possibility of false lumen pressurization especially if the ascending aorta is clamped during construction of root repairs. Moreover during rewarming and reperfusion after PHCA it is paramount to ensure that there is no malperfusion and the need to change from retrograde to antegrade flow [14,15,16,17]. The additional morbidity and mortality associated with this approach of PHCA with femoral artery cannulation, limited widespread adoption of the technique and spawned new methods of cerebral protection. Antegrade and retrograde cerebral protection were developed as competing methods to improve cerebral protection. Kazui et al used Selective Antegrade Cerebral Protection (SACP) at 10 mm/kg/minute during PHCA and demonstrated no excess neurologic morbidity and mortality among patients undergoing total arch replacement compared with PHCA alone and suggested that this technique allowed for longer periods of circulatory arrest [18]**.** This technique gained popularity with the development of axillary artery cannulation first described by Sabik and Baribeau [19,20]**.** In spite of additional time required to dissect the axillary artery and sew a perfusion graft to it this technique has been used successfully worldwide in the emergency setting of ATAAD. The big advantage of using axillary inflow is that brain can be perfused during the period of lower body circulatory arrest and the temperature drift to only 26C is possible avoiding coagulopathy associated with deep hypothermia. Single inflow is enough if tympanic membrane and bladder temperature are not drifting apart and the NIRS values in the contralateral hemisphere are not much different from the ipsilateral one. However, since we don't have NIRS, we relied on brisk backflow from the left carotid and left subclavian arteries as an indicator of integrity of circle of Willis and adequacy of perfusion of the opposite hemisphere. We chose to go down to 21 degree Celsius instead of 26 degree due to anticipated difficulty of the distal anastomosis [21]. Moreover, some form of cerebral protection was essential in our case because we needed to replace the arch and do conventional elephant trunk for descending thoracic aneurysm. The descending thoracic aneurysm had to be dealt with because of true lumen compromise with potential for distal malperfusion. In our case the distal anastomosis was particularly difficult because of two reasons viz. aneurysmal descending thoracic aorta and the need to do the anastomosis distal to left subclavian artery with the potential for recurrent laryngeal nerve injury. The distal anastomosis was done by first joining the two dissected layers by taking wider bites of the outer layer and narrower bites of the inner layer due to greatly compromised true lumen. Because the true lumen was small, we were only able to insert 24 size conduit inside the DTA. The reason for developing delayed paraparesis may the extended lower body ischemia time. The length of elephant trunk was kept as short a possible and this does not seem to be the reason for developing paraparesis. We think that use of lumbar drain could have prevented paraparesis. We were also lucky that the head vessel area although was dissected but intima was intact and we were able to reconstruct the island patch by joining the two layers thereby enduring true lumen flow. The above mentioned technique of arch replacement has an inherent problem of prolonged cardiac ischemia since it the first organ to be excluded from the systemic circulation and last to be reperfused. Newer techniques have been developed viz. 'Branch-First method' where a specially prepared **T**rifurcation **A**rch Graft with **P**erfusion side-arm **P**ort (TAPP) graft is used. [22]. This technique has many advantages the foremost of which is decrement in cardiac ischemia, early perfusion of the brain and the ease of distal anastomosis which is moved proximally due to debranching of the head vessels.

The other development which has allowed easier arch replacement is the Sun's procedure where a tetrafurcate graft with attached Frozen Elephant Trunk (FET) is used to replace the arch and address DTA at the same time [23]. Fourth option for patients who are not suitable candidates for the extensive open operations is Type II hybrid arch repair whereby ascending aorta and arch are replaced in addition to aortic debranching and endovascular stent graft placement in the same sitting or later on [24].

## Conclusion

Replacement of the aortic arch and the proximal descending aorta by elephant trunk (conventional or FET) is a major undertaking requiring additional measures for cerebral protection. Axillary artery perfusion as sole source of antegrade cerebral perfusion is usually sufficient for most patients' and provides better nutritive flow than retrograde cerebral protection. In patient where long period of lower body ischemia is anticipated for construction of distal anastomosis and conventional elephant trunk, placement of lumbar drain may offer protection against paraplegia.

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