Journal of Heart and Stroke

Case Report
Published: 05 Apr, 2019

Management of Large Fusiform Aneurysm of Distal Aortic Arch with Contained Rupture Using Midline Sternotomy: A Case Report

Devvrat Desai, Jignesh Kothari and Bhavin Bhrambhatt*

Department of Cardiovascular and Thoracic Surgery, U N Mehta Institute of Cardiology and Research Center, India

Abstract

Aneurysm of distal aortic arch is routinely repaired using left thoracotomy. Very large aneurysm can present as contained rupture making this approach highly unsafe. Here, we are reporting an unusual case of large fusiform aneurysm of distal aortic arch with contained rupture managed successfully using mid-line sternotomy. A 54 year gentleman presented with progressive dyspnoea and chest pain in NYHA class 4 over a period of two to three years. He was diagnosed to have large (11 cm × 11.5 cm × 12 cm) fusiform aneurysm of distal aortic arch extending up to proximal descending thoracic aorta with contained rupture resulting in displacement of trachea towards right & left main bronchus inferiorly with underlying lung collapsed. The patient underwent distal arch replacement via mid-line sternotomy under Deep Hypothermic Circulatory Arrest with continuous Selective Antegrade Cerebral Perfusion using right axillary artery and right femoral artery cannulation. The arch was replaced using 28 mm collagen impregnated, woven polyester graft. He remained stable in post-operative period & was discharged on tenth post-operative day.

Keywords: Distal aortic arch; Aortic aneurysm; Contained aupture; Saccular aneurysm; Fusiform aneurysm; Aortic arch replacement

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Correspondence:

Devvrat Desai, Department of Cardio Vascular and Thoracic Surgery, U N Mehta Institute of Cardiology and Research Center, (Affiliated to B. J. Medical College), New Civil Hospital Campus, Asarwa, Ahmedabad-380016, Gujarat, India, Tel: +91 98258-45972; E-mail: drdevvratcvts@gmail.com

Received Date: *12 Mar 2019*

Accepted Date: *02 Apr 2019*

Published Date: *05 Apr 2019*

Citation:

Desai D, Kothari J, Bhrambhatt B. Management of Large Fusiform Aneurysm of Distal Aortic Arch with Contained Rupture Using Midline Sternotomy: A Case Report. J Heart Stroke. 2019; 4(1): 1054.

ISSN: 2475-5702

Introduction

Aneurysm of distal aortic arch is relatively rare entity in the spectrum of cardiovascular diseases. Saccular aneurysms of distal aortic arch or proximal descending aorta are reported in literature. As reported in literature, the saccular aneurysm of distal aortic arch has very ominous natural history as compared to the typical fusiform aneurysm [1]. Very large fusiform aneurysm of proximal descending aorta involving the distal arch can present with contained rupture & have a very poor prognosis [2]. Such a large saccular aneurysm with contained rupture has not been reported in literature. Aneurysm of distal aortic arch is routinely repaired using left thoracotomy. However, with contained rupture this approach appears rather unsafe [3]. Here we are reporting an unusual case of large fusiform aneurysm of distal aortic arch with contained rupture managed successfully using mid-line sternotomy & deep hypothermic circulatory arrest with selective antegrade cerebral perfusion.

Case Presentation

A 54 year gentleman presented with progressive dyspnoea and chest pain in New York Heart Association class 4 over a period of two to three years. On clinical examination, patient had regular heart rate of 70 beats per minute with blood pressure of 130/90 mmHg. Cardiac auscultation was normal.

Electrocardiogram confirmed normal sinus rhythm. Echocardiography showed normal left ventricle size with ejection fraction of 55%. Chest radiography showed soft tissue homogenous opacity in left upper zone with widening of superior mediastinum (Figure 1). On further work up, computed tomography of thorax with contrast showed large (11 cm × 11.5 cm × 12 cm^3) fusiform aneurysm of aortic arch distal to origin of left subclavian artery extending up to proximal part of descending thoracic aorta with contained rupture resulting in displacement of trachea towards right & left main bronchus inferiorly with underlying lung collapse (Figure 2). Conventional coronary angiogram was not performed due to unstable hemodynamics. He was advised urgent surgical repair.

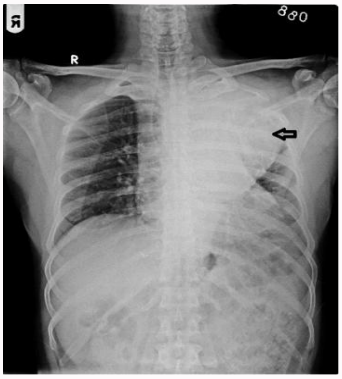

Figure 1: Pre-operative chest radiograph showing homogenous opacity in left upper zone with widening of superior mediastinum.

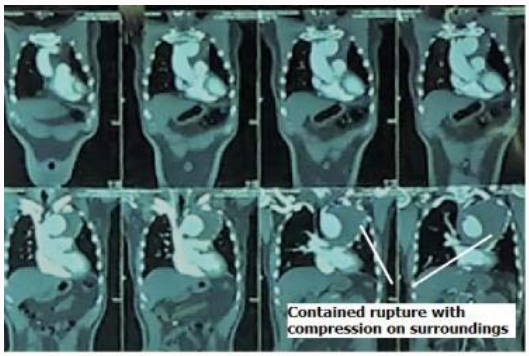

Figure 2: Large fusiform aortic arch aneurysm distal to origin of left subclavian artery with contained rupture resulting in displacement of trachea & left main bronchus.

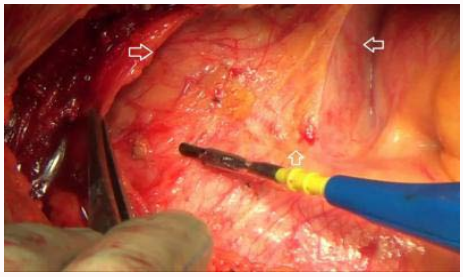

Figure 3: Large fusiform aneurysm with contained rupture at distal arch with relatively normal neck vessels & proximal arch.

Surgical technique

The decision to approach the lesion via mid-line sternotomy instead of left Thoracotomy was taken in order to get better proximal control and improve the ease of repairing the aortic arch with adequate cerebral protection, as lesion was large enough to compress the surrounding structures like left subclavian artery superiorly and left pulmonary artery and left main bronchus inferiorly (Figure 3).

Cardiopulmonary bypass was electively established using right axillary artery, right common femoral artery and bicaval cannulation. 8 mm polytetrafluoroethylene graft was anastomosed to right axillary artery in end to side fashion for cannulation (Figure 4).

Aneurysm was dissected free from the following surrounding structures - left subclavian artery, and left pulmonary artery; left main bronchus and underlying lung. In view of difficulty in getting distal control, decision was taken to achieve deep hypothermic (18°C)

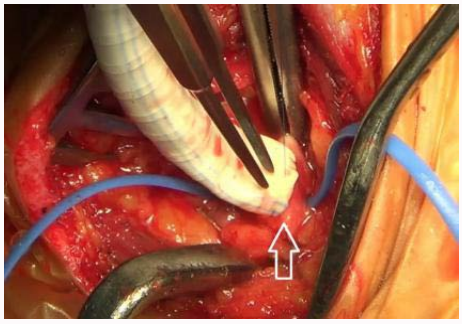

Figure 4: Right axillary artery side-graft cannulation technique.

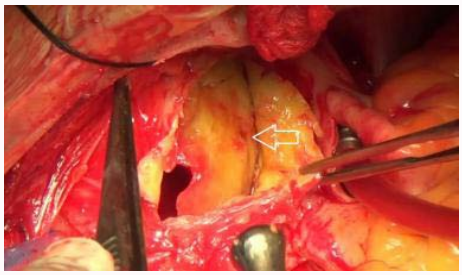

Figure 5: Contained rupture with massive clots.

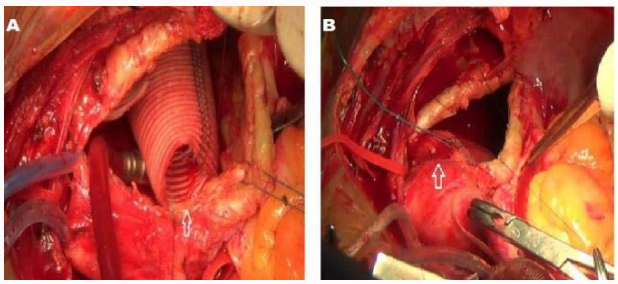

Figure 6: Interposition graft being anastomosed to descending thoracic aorta. (A) Distal anastomosis (B) proximal anastomosis.

Figure 7: Post-operative chest radiograph.

circulatory arrest with selective antegrade cerebral perfusion. All neck vessels were snared. After achieving total circulatory arrest, fusiform aneurysm was opened longitudinally and organized thrombus was evacuated (Figure 5).

28 mm collagen impregnated woven polyester interposition graft was used to reconstruct the distal arch & proximal part of descending aorta. Distal anastomosis was completed first in end to end fashion,

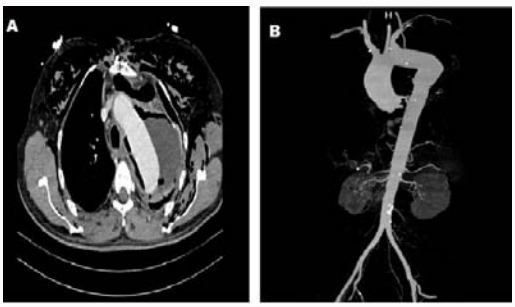

Figure 8: (A, B) Post-operative scan showing patent conduit in interposition graft.

and lower body circulation re-established using right femoral artery cannulation (Figure 6a).

Similarly, proximal end of the conduit anastomosed to aortic arch in extended end to end fashion to incorporate all three ostia of neck vessels (Figure 6b). Intermittent antegrade, cold snguinous root cardioplegia given to ensure adequate myocardial protection.

Post-operatively patient remained stable throughout his course in hospital and was discharged on tenth post-operative day (Figure 7). On first follow up, computed tomography of thorax with contrast showed patent interposition conduit without anastomotic leak (Figure 8a,8b).

Discussion

Saccular aneurysms have multiple etiologies including infectious causes like tuberculosis and syphilis, degenerative condition, progressive penetrating aortic ulcer, trauma or aortic surgery and Takayasu arteritis [4]. Saccular aneurysms of aortic arch have higher risk of rupture than fusiform aneurysms. Fusiform aortic aneurysms are mainly due to connective tissue disorders. Open surgical repair of an aortic aneurysm involving the distal arch is challenging. Distal aortic arch aneurysms can be considered a subset of aneurysms of the descending thoracic aorta; therefore, Left thoracotomy has been used as a standard approach. However, large fusiform aneurysm with contained rupture at distal arch can be approached safely through a mid-line sternotomy. In comparison to saccular aneurysm, fusiform aneurysm of distal arch is technically more demanding. The most important and tedious task being in terms of getting adequate proximal and distal control. Recent techniques have produced very promising results, particularly in high-volume centres of excellence in aortic surgery. Various cerebral protection strategies can be used like moderate hypothermia, deep hypothermia, antegrade cerebral perfusion, and retrograde cerebral perfusion [5].

Deep hypothermic total circulatory arrest with selective antegrade cerebral perfusion can be established easily using mid-line sternotomy approach.

Conclusion

Large contained ruptured fusiform distal aortic arch aneurysm remains very rare and lethal entity. Advanced cerebral and myocardial protection and a meticulous approach can reduce the rate of complications and mortality considerably. The operative approach we have described has not been priorly reported for ruptured fusiform aneurysm. We recommend this approach for similar large distal Aortic Arch aneurysms as it exhibits a low risk of peri-operative complication.

Financial Support

This work was supported by U N Mehta Institute of Cardiology and Research Center itself and received no specific grant from any funding agency, commercial or not-for-profit sectors.

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