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Dartevelle Approach for Intra-Thoracic Subclavian Artery Aneurysm Repair

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Abstract

Subclavian artery aneurysm is a rare phenomenon in the West, but its prevalence is increasingly proportionate to incidence of atherosclerotic disease in the population. It is generally accepted that gold standard care is surgical resection but with limited experience opportunity remains to optimise this. We report on a 66-year-old female arteriopath with an 8 cm intra-thoracic aneurysm of the right subclavian artery, just distal to the brachiocephalic trunk. Lack of a proximal landing zone prohibited endovascular repair thus we utilised the anterior transcervical approach described by Dartevelle. This approach provided excellent visualisation of the aneurysm, along with right vagus and phrenic nerves, facilitating proximal and distal control and subsequent decompression. Post operative recovery was swift and not marred by substantial pain or inhibition of chest wall mechanics, associated with median sternotomy and thoracotomy incisions usually advocated for such aneurysms. As such we purport this approach to offer excellent operative exposure for this increasing disease burden, with less morbidity associated than the currently accepted approach, representing an advance in the management of this condition.

Keywords

Aneurysm, Subclavian Artery, Dartevelle Approach

1. Introduction

Subclavian Artery Aneurysm (ScAAn) is a rare phenomenon with incidence in Western populations ~1/100,000 per annum, comprising only 0.5% of diagnosed aneurysmal disease. Mean age of incidence is 49 years, twice as common in males. ScAAn is classified based upon anatomical location which generally reflects aetiology. Ex-

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tra-thoracic ScAAn commonly results from trauma or thoracic outlet syndrome, occurring in females typically <45 years. Intra-thoracic ScAAn is most often due to atherosclerosis, and consequently it is most frequent in males > 60 years. Remaining aetiologies include inflammatory processes, Marfan's disease, cystic medial necrosis and of course congenital abnormality, and these have no preponderance for either anatomical location [1].

Presentation of ScAAn is via three modalities: direct symptoms such as upper limb pain, distal emboli or rupture resulting in profound hypotension, and in some cases, death. Secondly by mass effect, within the thorax this may produce dysphagia or haemoptysis, in the axilla and it may present as a palpable pulsatile mass or brachial plexopathy. Finally, ScAAn is often an incidental finding.

The paucity of experience with ScAAn leaves its natural history uncertain. Growth rates of 5 - 15 mm/year have been observed but rupture risk at a given diameter is undetermined [2]. Consequently the consensus that operative management is gold standard therapy is based upon extrapolation from other aneurysmal disease. Furthermore, the optimal approach to operative management is not established.

2. The Case Figures 1-7

We report a 66-year-old known arteriopath who presented with a 2 month history of right upper limb pain following a minor fall. After conservative measures failed to alleviate symptoms the General Practitioner ordered a shoulder radiograph which identified part of a large opacification in the apex of the right hemithorax. Chest radiograph ensued confirming the mass and highlighting a calcified rim suggestive of aneurysmal disease. Referral to Thoracic Surgery was made.

A Commuted Tomography (CT) angiogram of the aorta was obtained. This delineated an 8 cm aneurysm just distal to the common trunk of the brachiocephalic artery, compressing the trachea. Significant vessel calcification was noted implying atherosclerotic aetiology. Aneurysmal diameter and mass effect exerted on the trachea prompted a decision to offer surgical repair. An endovascular repair was considered but prohibited by the vessel's tortuosity and lack of a proximal landing zone.

Open repair was performed using a cervico-thoracic transclavicular approach, as described by Dartevelle *et al.* [3]. An incision was made along the anterior boarder of sternocleidomastoid, curving laterally around the 2nd rib and extending to the mid clavicular line. The medial half of the clavicle was then excised providing excellent exposure of the subclavian artery and adjacent structures, including right phrenic and vagus nerves.

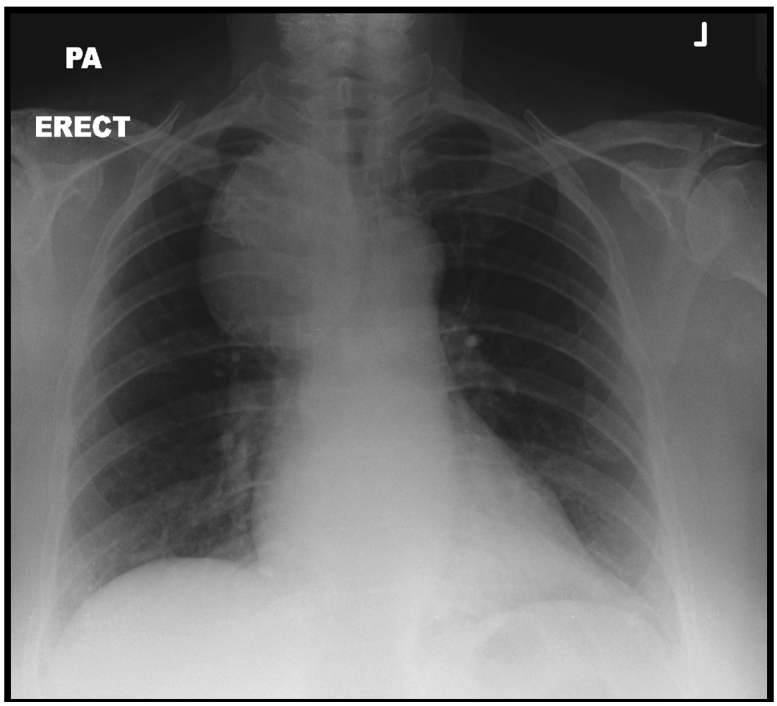

Figure 1. CXR demonstrating opacification in apex of right hemithorax.

Figure 2. Coronal reconstruction of CT angiogram aorta demonstrating right ScAAn. Contrast within vessel lumen indicated by white arrow.

Figure 3. Transverse view of CT angiogram aorta. AA demarks Arch of Aorta. Note compression of trachea by aneurysmal sac.

Intra-operatively the ScAAn was noted to be adherent to both trachea and the right vagus nerve thus the decision made to leave it in situ. Proximal and distal control were obtained, the aneurysmal sac decompressed and then excluded via an 8 mm Dacron graft. Normal distal pulses were established and the incision closed. The patient was later discharged on the eighth day post operatively and at six month follow up found to be pain free with full range of movements throughout the entirety of the upper limb. Yearly follow up is planned to observe graft patency and for further aneurysmal disease.

Although adherence to the trachea obviated formal histology in this case, we believe that the patient's age, co-morbidities and aneurysmal location suggest atherosclerosis the likely aetiology.

3. Discussion

The incidence of ScAAn is rising, specifically secondary to atherosclerosis, as reflected in more recent case series eliciting higher mean age of incidence, five-fold higher in males [4]. The sequelae being the increasing disease burden is of intra-thoracic ScAAn in an older, frail demographic of co-morbid arteriopaths, often with

Figure 4. 3D reconstruction of pre-operative CT angiogram aorta demonstrating large aneurysmal sac (AS), with short proximal brachiocephalic trunk (BT) and tortuous distal course of Right subclavian artery (RSA). Ascending Aorta (AA) marked for clarity.

Figure 5. Red line denotes surface markings of Dartevelle approach. Clavicle and sternum outlined.

smoking related lung disease. Despite being poor candidates for surgery these patients require management of their disease to prevent compression of thoracic structures and threat to life from potential rupture. As our case demonstrates endovascular repair, although increasing in range and complexity, is only a viable non-invasive option where anatomy is favourable.

The current consensus within the literature is that resection of intra-thoracic ScAAn requires either median sternotomy for right sided disease or thoracotomy for left sided disease. Both of these approaches are associated with significant post operative pain and impaired chest wall dynamics, complications are reported in up to 47% [3]. The demographic of the population in which this disease burden predominates calls for alternate approaches to be explored. The Dartevelle approach was originally devised to facilitate access to cervical structures and the

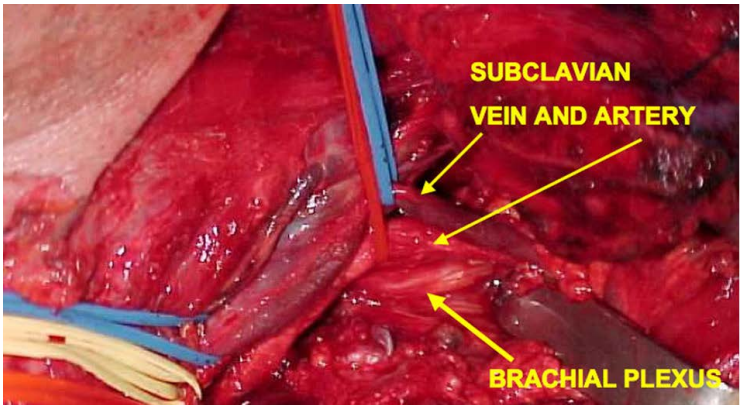

Figure 6. Subclavian vessels as visualised via Dartevelle approach.

Figure 7. Post-operative CT angiogram aorta demonstrating the Dacron Graft (DG) enhancing with contrast. Arrow indicates the calcified, shrunken remnants of the decompressed ScAAn. Note trachea is no longer deformed by mass effect.

thoracic inlet for resection of apical lung tumours. It is reputed to give excellent exposure of the subclavian vessels and adjacent structures. Our experience was consistent with this, the incision readily allowed identification of the extent of distal tortuosity of the subclavian artery and intimate adherence of the right vagus nerve. Literature review yields no other group has described this approach as a sole incision for repair of intra-thoracic ScAAn. Although one case report of a supraclavicular incision to augment endovascular repair is noted [5].

Post operatively adequate pain control was achieved simply with 24 h of patient controlled intravenous analgesia before oral agents alone could be relied upon. This is rare post median sternotomy or thoracotomy. Furthermore, adverse effects on chest wall mechanics well established after thoracotomy have not been observed with the Dartevelle approach. However, this statement must be tempered by the relative dearth of experience with this incision. With this in mind we note our patient's eight day length of stay to be shorter than those of case series using median sternotomy or lateral thoracotomy. Data following excision of the clavicle for malignancy suggests there should be no expectation of significant pain or limitation of upper limb function.

The technical demands of the approach are modest. It may be performed expediently and clarity of exposure granted makes it suitable regardless of aneurysm size or morphology, including in context of emergent surgery. However, alternate approach may be preferable with concomitant aneurysmal disease elsewhere in the thorax, or emergent cases where the primary operator is inexperienced with the Dartevelle incision.

4. Conclusion

The Dartevelle approach offers excellent visualisation of the anatomy relevant to intra-thoracic ScAAn repair. By obviating the need for more invasive incisions it may optimise patient outcomes and may permit resection in high risk patients encountered in the cohort experiencing the increase of this disease burden.

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rior approach for Pancoast tumour resection", MMCTS 2007 (1018): mmcts.2005.001776 doi: 10.1510/mmcts.2005. By permission of Oxford University Press.

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