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Research Article

SUCCESSFUL SURGICAL MANAGEMENT OF RIGHT SUBCLAVIAN ARTERY ANEURYSM IN GHANA

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ABSTRACT

Aneurysms of the subclavian artery are extremely rare in the clinical setting. They can occur secondary to atherosclerosis, cystic necrosis of the tunica media, trauma or infections. Open surgical repair is one of the main treatment *choices* especially of the extrathoracic subclavian artery aneurysm which can be repaired via a supraclavicular incision without sternotomy or thoracotomy. Herein, we present a case of a 63-year-old male with an expanding pulsatile mass of the right neck. A duplex ultrasound scan reported of a right common *carotid* artery aneurysm but the CT angiogram reported of mild intimal wall thickening and focal calcified plaques in proximal segment of right subclavian artery and site of branching of right common carotid artery. Open surgical repair via a right supraclavicular incision was successful. Pathological report of the aneurysmal sac was consistent with cystic medial degeneration.

INTRODUCTION

A 63-year-old male presented with a 10-year history of progressively increasing, pulsatile and painful right anterior neck swelling associated with pain in the right upper limb but no weakness, paraesthesia or numbness. The patient described several syncopal episodes with exertion and right upper limb fatigue with prolonged use. He had no history of trauma to the chest, neck or previous surgery of the neck or right upper limb. There were no other risk factors for vascular disease. He is a known hypertensive for 25 years with a controlled blood pressure on Amlodipine, Lisinopril and Carvedilol along with Aspirin. He is a commercial driver. Significant examination findings revealed a BP of 140/90mmHg with a heart rate of 90beats/min, regular and normal in volume.

Avisible, pulsatile neck mass approximately 6cm x 3cm in greatest diameter in the right supraclavicular region with a palpable thrill. Neuromuscular examination of the right upper extremity was normal. However, the right radial pulse disappeared on pressing the mass. All other organ systems were clinically normal. The patient was investigated with a chest x-ray, duplex ultrasound scan, and a CT angiogram of the right upper extremity and chest. The chest x-ray showed cardiomegaly with a cardiothoracic ratio of 0.63. The duplex scan reported of features suggestive of a right carotid artery aneurysm but the CT angiogram reported of mild intimal thickening and focal calcified plaques seen in proximal segment of right subclavian artery and the site of branching of right common carotid artery. ECG showed normal sinus rhythm with non-specific T waves changes and the echocardiography showed a mild concentric hypertrophy with dilated left atrium and left ventricular diastolic dysfunction. The blood investigations including liver and renal functions were in normal *ranges*. Patient was subsequently advised and he consented for surgery. Under *general anesthesia* with endotracheal intubation and aseptic conditions, a right subclavian approach was used with a single incision in a curvilinear fashion along Langer's lines of the neck. The right

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subclavian artery proximal and distal to the aneurysm was dissected and isolated on slings or vascular tapes. After systemic heparinization of 5000IU, the vessel was clamped proximally and distally. The aneurysm sac was opened. The aneurysm was resected with the atherosclerotic contents as shown in the figure 3 and an end-to-end anastomosis with Prolene 5/0 in a continuous single layer fashion was done. Postoperatively, he developed power deficit in the right upper *arm* with a power of 2 and therefore was started on graded physiotherapy. After 2 months, he had fully regained power after having been discharged on the 5th postoperative day on aspirin. Histopathology done reported of medial cystic degeneration.

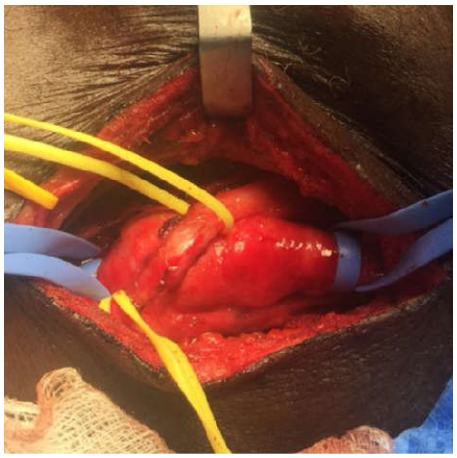

Figure 1 Aneurysm isolated on blue vascular tapes and the brachial plexus on yellow tape

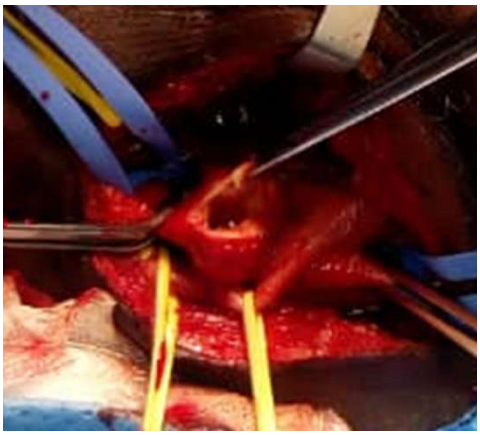

Figure 2 Arteriotomy showing the atherosclerosis and the intraluminal thrombus

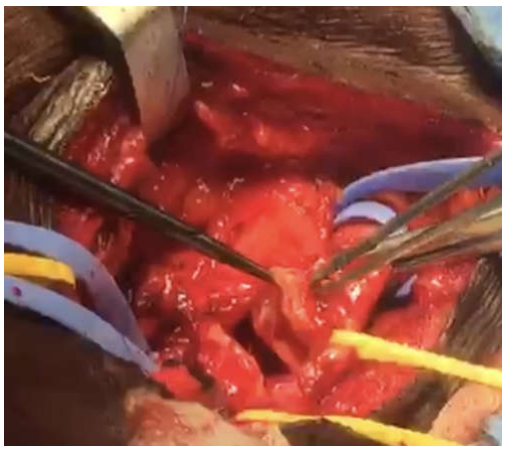

Figure 3 Post-aneurysmectomy showing the ends to be approximated

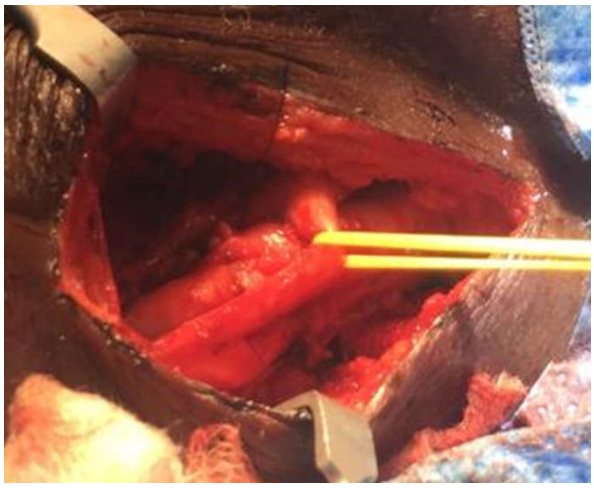

Figure 4 Post –repair

DISCUSSION

Subclavian artery aneurysm (SCAA) is a very rare type of peripheral artery aneurysms. Similar incidences of about 1% have been reported[1,2]. Report from a study done in 1972 identified 2 cases of subclavian aneurysms out of 1488 aneurysms[3]. However, incidence is reported to be increasing subsequently ,though less than 400 cases of subclavian aneurysms have been reported and published worldwide as of 2010[4].

Subclavian artery aneurysms are classified based on anatomical location into intra-thoracic and extra-thoracic SCAA [2]. They may also be classified as proximal, middle or distal segment SCAAs based on which segment of the artery the lesion is. The subclavian artery is divided surgically into segments in relation to the anterior scalene muscle. Vierhout *et al* found that majority of SCAAs tend to occur in the proximal segment (39%) with 25% and 24% occurring in the middle and distal segments respectively. Our case was an extrathoracic type involving the proximal segment extending to the middle segment of the right subclavian artery as shown in Figure 1.

Aetiology

In the early 20th century, syphilis and tuberculosis were the leading causes of SCAA accounting for 15% and 10% respectively. Atherosclerosis is the most common cause now, with about 60% of cases of SCAA being ascribed to it [5]. Atherosclerosis also accounts for majority of the causes of intra-thoracic SCAA, with other conditions such as medial calcific degeneration, infections, Marfans syndrome and Takayasu arteritis contributing to the aetiology of the disease [1,2]. Extra-thoracic SCAA, on the other hand, is most commonly the result of post-stenotic dilatation from thoracic outlet syndrome or an old trauma [6]. Intra-thoracic SCAAs caused by atherosclerosis is seen to have a predilection for males above 60 years while extra-thoracic SCAAs has a preponderance for females below 45 years [7]. Histopathology report showed the cause to be medial cystic degeneration in our patient. Moreover we also suggest that this may have been aggravated by the continuous and sustained trauma to the artery from his right upper extremity overuse from his occupation as a commercial driver. A review of 191 reports on SCAA in 2010 showed that

before 1980, atherosclerosis (24%) and thoracic outlet syndrome (24%) were the leading aetiological causes of SCAA. However, with a gradual increase in incidence from 1981, trauma became the leading cause (37%) with atherosclerosis and thoracic outlet syndrome still contributing a significant amount of 18% each. They also identified that proximal and distal segment SCAAs were mostly due to atherosclerosis (19%), collagen vascular diseases (18%), trauma (15%) and infections (13%). The distal segment SCAAs reported were due to thoracic outlet syndrome in about half (46%) of the cases [4]. On rare occasions, congenital subclavian aneurysm has been associated with Turner Syndrome [5]. Our right sided type is consistent with the reported increased incidence of the right subclavian artery aneurysm by Vierhout and his team suggesting that most cases were seen on the right (52%), then the left (37%),while bilateral SCAA were seen in 12% of cases [5].

Clinical Presentation

The location of the aneurysm determines the clinical picture produced. It usually ranges from an asymptomatic presentation to compressive symptoms as well as features of distal embolization. Extra-thoracic aneurysms commonly present as a pulsatile mass which may be associated with a thrill and this was the classical presentation of our patient. Other associated presentations include sensory and motor signs from brachial plexopathy or dysphonia (compression of recurrent laryngeal nerve). Our patient however had a normal neuromuscular examination finding. On rare occasions, there may be ischemia of the upper limb due to thromboembolism [5,8]. Intrathoracic aneurysms are often asymptomatic.

Symptomatic cases usually present as complications due to compression of surrounding structures such as dysphagia (oesophageal compression), dysphonia (recurrent laryngeal nerve compression) and rarely dyspnoea from tracheal compression. They may also cause hemoptysis from erosion into lung parenchyma or lung atelectasis [5,8,9]. Cases of Horner's syndrome due to stellate ganglion compression have also been reported [7]. The occurrence of aneurysmal rupture or embolization was found to be dependent on the anatomical location of the aneurysm. Proximal and middle segment aneurysms were more prone to rupture than distal segment aneurysms. Thromboembolic complications are most commonly associated with distal segment aneurysms, with 9% of cases arising from proximal lesions [4].

DIAGNOSTIC METHODS

In recent years, there has been an increase in reports of asymptomatic intra-thoracic cases of SCAA mainly due to routine chest x-rays. In case reports by Tigkiropoulos *et al* and Zhan, Zhang and Shao, chest x-rays initially done showed an upper mediastinal haziness[2,8]. In the past, angiography used to be the gold standard for diagnosis of subclavian aneurysm. However, recent advances in technology has seen the emergence of non-invasive procedures such as duplex ultrasonography. It is both useful for preoperative diagnosis as well as postoperative monitoring on follow-up [8].

With the emergence of computed tomography and magnetic resonance imaging, CTA and MRA use in diagnosis of subclavian aneurysms is gradually increasing. In the study by Vierhout *et al.*, angiography was employed in confirmation of diagnosis in half of the cases while CTA and MRA were utilized in 14% and 3% respectively[4].Our patient's anatomy was delineated with duplex scan and CT angiography.

Treatment Modalities

Due to the potential of rupture, thrombosis or embolization, surgical treatment of SCAA is the recommended treatment as stated in multiple literatures[1,4,7,8]. This may be done via open surgical repair or endovascular repair. History of surgical repair of subclavian aneurysms go all the way back to 1924 when proximal ligation of the subclavian aneurysm began. This subsequently progressed to resection and primary anastomosis in 1961. In 1965, the use of interposition grafting was invented and this has been the procedure of choice [5].

The choice of surgical access to the aneurysm is dependent on the location and laterality of the aneurysm. For intrathoracic left subclavian aneurysms, some literatures have recommended a high left lateral thoracotomy. However, right-sided aneurysms have been reported to require median sternotomies to allow for optimal control of the neck of the aneurysm[1,5,7]. For extrathoracic aneurysms, a supraclavicular approach is used and we approached our case by this method.

Currently, various surgical procedures for SCAA exclusion are simple ligation, aneurysmorrhaphy or aneurysmectomy with primary anastomosis or blood vessel grafting [1,4,5,8]. Pagni, Denatale and Ferneini found that simple ligation was the least favoured of the options due reports of continued growth and subsequent rupture of the aneurysms[5]. Aneurysmorrhaphy was documented to be employed mainly in small and false aneurysms according to Vierhout and his team [4].

Repair options after aneurysmectomy in multiple literatures have included primary anastomosis as was documented by Mechchat *et al* in 2002 and in some cases reported by Davidović *et al* in 2003[6,7]. Interposition with Dacron, polytetrafluoroethylene or saphenous vein are options in cases with extensive defects after aneurysmal resection as noted by Esteves[1]. Prior to 1980, about half of cases were repaired by aneurysmal resection with a vein or artificial graft as reported by Vierhout*et al*[4]. A survey comprising 12 cases also reported 7 of them having arterial reconstruction with PTFE or subclavian vein [7]. We did a primary resection of the aneurysm and end-to-end anastomosis with prolene 5/0 as shown above in figure 2, 3 and 4.

CONCLUSION

Open surgical repair technique of a right subclavian artery aneurysm using a single supraclavicular incision is possible in low resource centre. The ease of recognition, appropriate investigations and proper surgical technique ensure a good clinical outcome.

Acknowledgement

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

Conflict of interest

None declared

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