Subclavian Aneurysm Presenting with Massive Hemoptysis: A Case Report and Review of the Literature

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Abstract

We present a case of a 70-year-old male with a past medical history of coronary artery bypass grafting and end stage renal disease who presented with massive hemoptysis. He had a history of methicillin-resistant *Staphylococcus aureus* endocarditis, with infection and removal of endocardial pacing leads. His work-up revealed a 2.9-cm proximal left subclavian artery aneurysm. Bronchoscopy confirmed bright red blood in the left upper lobe bronchus and coronary angiography confirmed a patent left internal mammary artery (LIMA) to left anterior descending bypass. Because of the consideration of maintaining coronary perfusion via the LIMA while excluding the subclavian aneurysm, he underwent a left carotid to left axillary artery bypass graft followed by deployment of an Amplatzer II vascular plug just distal to the aneurysm. A thoracic endograft was then deployed to exclude the origin of the subclavian. A review of the literature reveals hemoptysis as a rare presentation of a subclavian aneurysm. We discuss approaches to this challenging clinical problem, ranging from open repair to hybrid approaches.

Keywords

- ▶ subclavian
- ▶ aneurysm
- ▶ hemoptysis
- ▶ hybrid
- ▶ endovascular repair

Aneurysms of the proximal subclavian artery are rare. Reported etiologies of this unusual clinical problem include arteriosclerosis, trauma, fibrodysplastic disease, degenerative connective tissue disorders, cervical ribs in association with thoracic outlet syndrome, congenital lesions, and infection. We present a case of a 70-year-old male with an extensive medical history who presented to an outside hospital with massive hemoptysis. His past medical history was significant for coronary artery disease and he had undergone coronary revascularization several years prior with a left internal mammary artery (LIMA) to left anterior descending (LAD) coronary artery bypass graft as well as a saphenous vein graft to the obtuse marginal branch (OMB) of the left circumflex coronary artery. His medical history was also notable for end stage renal disease, diabetes, hypertension, paroxysmal atrial fibrillation, and cardiomyopathy with

left ventricular ejection fraction of 40%. Notably, he had complete heart block with pacemaker implantation two years before, then requiring explantation due to methicillin-resistant *Staphylococcus aureus* (MRSA) infection and subsequent replacement with epicardial nonintravascular leads.

Chest CT scan revealed a pseudoaneurysm originating from the proximal left subclavian artery measuring 2.2 × 2.9 cm with adjacent ground-glass opacity and consolidation of the lung (–Figs. 1 and 2). He had persistent hemoptysis but remained hemodynamically stable and was transferred to our facility for further management. An angiogram confirmed the subclavian artery aneurysm (–Fig. 3). Coronary angiography was pursued to delineate coronary artery anatomy. There was no significant left main coronary disease. There was an occluded vein graft with the OMB filling by right to left collaterals and a widely patent LIMA to LAD

Fig. 1 CT scan showing ground glass opacity at left lung base (arrow).

bypass. The distal LAD showed diffuse critical disease. He was thought to be dependent on his LIMA to LAD bypass for adequate cardiac perfusion.

Bronchoscopy confirmed bright red blood in the left upper lobe bronchus and the aneurysm was thought to be the likely source of his hemoptysis.

Given the dependence on his LIMA to LAD bypass for coronary perfusion and his high operative risk for a direct approach to the subclavian aneurysm because of his previous coronary surgery, he was taken to the operating room for hybrid management and exclusion of the left subclavian aneurysm.

A left carotid artery to left axillary artery bypass was performed. A 16-mm Amplatzer II vascular plug (AGA Medical Corp., Plymouth, MN) was deployed beyond the aneurysm but proximal to the takeoff of the vertebral artery and LIMA. This allowed retrograde left subclavian artery perfusion of the left vertebral artery and LIMA via the carotid to axillary bypass. A 152-mm-long Zenith TX2 (Cook Inc., Bloomington, IN) thoracic endograft measuring 38 mm diameter and tapering distally to 36 mm diameter was then placed in the arch

Fig. 2 CT scan showing subclavian aneurysm (arrow).

Fig. 3 Preoperative angiogram showing left subclavian pseudoaneurysm (arrow).

covering the origin of the left subclavian artery to complete the exclusion of the aneurysm (► **Figs. 4–6**).

Antibiotics were continued perioperatively. At the time of previous MRSA infection of his pacemaker, he had undergone explantation and prolonged antibiotic therapy. At 3-month follow-up, an ultrasound evaluation demonstrated that the carotid to axillary bypass graft was patent and there was no flow in the proximal left subclavian aneurysm. The patient was free of chest pain or cardiac complications and he had no further episodes of hemoptysis.

He continues to remain well at this time, 18 months postprocedure, without evidence of infection or persistent or recurrent subclavian aneurysm. Follow-up CT scan at 7 months did not reveal any evidence of persistent subclavian aneurysm (► **Fig. 7**).

Discussion

Aneurysms of the subclavian artery are uncommon. The true incidence is unknown, but Paiolero et al reported all cases of subclavian-axillary artery aneurysms seen at the Mayo Clinic

Fig. 4 Intraoperative imaging demonstrating patent left carotid axillary bypass graft (long arrow) with patent left internal mammary bypass graft (short arrow).

Fig. 5 Patent carotid axillary bypass graft with subclavian aneurysm still filling before placement of the TX2 device. An Amplatz plug has been deployed in the identified location (arrow).

Fig. 7 Postoperative CT scan reconstruction showing patent carotid axillary bypass graft (short white arrow) with TEVAR in place (long white arrow). An Amplatz plug (black arrow) prevents backfilling of the aneurysm.

between 1960 and 1980. Thirty-two aneurysms are described. Fourteen of the aneurysms were located primarily in the subclavian artery, with 20 of the lesions being right sided, and a mean size of 3 cm. Operative approaches described by Paiolero included rib and/or clavicular resection with aneurysm resection, aneurysmorrhaphy, or ligation.¹ Subclavian aneurysms are rare when compared with other peripheral aneurysms and have been described in ~3.5% of arterial aneurysms.² The incidence of mycotic subclavian pseudoaneurysms is even less well defined. The patient described may have had this aneurysm develop in the context of a previous MRSA infection of his endocardial pacemaker and endocarditis.

Patients with subclavian aneurysms may be asymptomatic but may present with chest pain, Horner syndrome, paresthesias, hoarseness, upper limb ischemia, or a pulsatile mass.

Fig. 6 Patent carotid axillary bypass graft (long arrow) with TEVAR in place and patent left internal mammary bypass graft (short arrow). An Amplatz plug prevents backfilling of the aneurysm from the carotid axillary bypass graft.

There have, however, been few reports of subclavian artery aneurysm presenting with hemoptysis.

A review of the English literature reveals this as one of the few cases of a subclavian artery aneurysm presenting with massive hemoptysis. Of the 12 cases of subclavian aneurysm presenting with hemoptysis in the English literature, 3 cases involved the right subclavian and 9 involved the left subclavian artery^{3–13} (see ►Table 1). At least three cases were fatal before receiving intervention. Seven cases were managed with open repair and interposition grafting or aneurysm ligation. One case was managed in a hybrid fashion by carotid to carotid to axillary bypass followed by deployment of two iliac endovascular occluders proximal and distal to the aneurysm.³ Another patient was managed by an endovascular approach utilizing a homemade stent-graft to the subclavian.⁴ One case was managed by proximal and distal embolization with metallic Guglielmi coils to embolize the vertebral artery to prevent retrograde blood flow.⁵ The majority of the cases we reviewed were associated with documented infection, lung abscess, or immunosuppression due to chemotherapy and/or malignancy.

Although there are limited outcome reports of treating mycotic subclavian aneurysms with Amplatz plug and TEVAR, there is precedent for treating infected thoracic aortic aneurysms or aortabronchial fistulas with TEVAR, albeit only a small number of cases have been reported.⁶ One report suggests a 9% recurrence rate of aortobronchial fistula at a mean of 21.5 months where a total of 67 outcomes are reported.⁷ Our patient is certainly at risk for delayed complications including aneurysm recurrence, hemoptysis, and infection. However, in the context of his prohibitive cardiovascular risk and multiple medical problems, the management described provides the most satisfactory treatment. Continued close surveillance is planned.

We present the management of this patient as an innovative approach to maintaining perfusion to the heart of a patient with a proximal left subclavian artery aneurysm

Table 1 Reported cases, presenting symptoms, management, and outcomes

Authors	Age	Side	Sex	Presenting symptoms	Management	Outcome
Kopp et al ³	75	R	F	Hemoptysis, dyspnea, fever	Hybrid (carotid-carotid-axillary bypass, Iliac occluders)	Recovery up to 24 months
Sanada et al ⁴	17	L	F	Immunosuppressed (leukemia), fever, hemoptysis	Homemade stent graft	Recovery, death from leukemia
Mori et al ⁵	52	L	M	Chemotherapy, pulmonary abscess, hemoptysis	Coil embolization (including vertebral artery)	Recovery, death from leukemia
Takagi et al ⁸	67	L	M	Hemoptysis, hoarseness, diplopia	Cardiopulmonary bypass	Successful surgery
Wu et al ⁹	50	L	F	Massive hemoptysis, left hemothorax	Sternothoracotomy, aneurysmorrhaphy, lobectomy	Recovery up to 3 years
Saliou et al ¹⁰	32	L	M	Immunosuppressed (leukemia), hemoptysis	Ligation and exclusion via thoracotomy, lung resection	Recovery, death from other disease
Mii et al ¹¹	62	L	M	Hemoptysis, lung mass	Interposition grafting	Recovery
Kulpati et al ¹²	60	L	M	Hemoptysis, fever, abnormal chest X-ray	Ligation and excision	Recovery
Miller et al ¹³	54	L	M	Hemoptysis, fever, tender neck mass, brachial plexus paralysis	Ligation and open packing	Discharge at 3 weeks, lost to follow-up
Miller et al ¹³	49	R	M	Hemoptysis, brachial plexus paralysis, Horner syndrome, pulsatile mass, sepsis	Ligation	Death from tracheoinnominate fistula
Cosmo et al ¹⁴	21	L	F	Mitral valve staphylococcal endocarditis, shoulder pain, hemoptysis	None	Death
Boundy and Bignold ¹⁵	40	R	F	Intermittent hemoptysis, syphilitic infection	Death before intervention	Death

Abbreviations: F, female; M, male; L, left; R, right.

and a patent LIMA to LAD bypass undergoing endovascular repair. As described above, the patient was managed with a hybrid procedure including carotid to axillary bypass graft, Amplatzer II vascular plug in the subclavian artery beyond the aneurysm and a TX2 thoracic endograft for coverage of the left subclavian artery origin. The patient was thought to be unsuitable for a subclavian artery covered stent alone because of the proximity of the aneurysm to the aorta that would not permit adequate length to ensure a hemostatic seal.

The patient had undergone previous median sternotomy for coronary artery bypass grafting and was documented to have coronary perfusion dependent on his LIMA to LAD bypass graft. Reoperative sternotomy would have been technically challenging, as coronary perfusion was dependent upon the LIMA, and proximal and distal control of the subclavian would have led to interruption of flow in his LIMA graft with cardiac ischemia. We protected his LIMA to LAD bypass by maintaining LIMA perfusion via a carotid to axillary bypass graft. The aneurysm was then excluded with the distal Amplatzer II vascular plug and the proximal TX2 thoracic endograft. Completion angiography confirmed patency of his LIMA (—Fig. 6).

Conclusion

There are only scant reports in the literature of a subclavian aneurysm presenting with hemoptysis. This case also represented a management challenge due to patency of a LIMA to LAD bypass along with the subclavian aneurysm. This article reports an additional case and provides a report of management utilizing an innovative hybrid approach to an uncommon problem in a high-risk patient.

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