

Giant Ascending Aorta and Aortic Arch Aneurysm Extending to the Brachiocephalic Trunk with Sternal and Clavicular Erosion: A Case Report

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Abstract

Background: Giant thoracic aortic aneurysms involving the supra-aortic branches are rare and may present with unusual compressive, thromboembolic, and erosive complications. Extensive osseous erosion of the anterior chest wall is particularly uncommon and may mimic an aggressive cervicothoracic mass.

Case Presentation: A 79-year-old man with a history of arterial hypertension presented with a progressively enlarging painless right supraclavicular mass. Computed tomography angiography (CTA) demonstrated a complex multisegmental aneurysmal disease involving the ascending aorta (57 mm), aortic arch (75 mm), and brachiocephalic trunk, with a giant saccular cervicothoracic aneurysmal component measuring 127 × 89 × 73 mm and extending to the C5 level. The aneurysm caused marked erosion and scalloping of the posterior manubrium and medial right clavicle, together with leftward tracheal deviation and compression of adjacent cervicomediastinal structures. A large mural thrombus within the brachiocephalic component was associated with complete occlusion of the right subclavian artery, while the right common carotid artery remained patent.

Conclusion: This case illustrates an unusual presentation of a giant multisegmental thoracic aortic aneurysm as a cervicothoracic mass with sternoclavicular bone erosion and thromboembolic complications. CTA is essential for establishing the vascular origin of such lesions, identifying potentially misleading osseous changes, assessing associated complications, and providing the detailed anatomical mapping required for therapeutic planning.

Keywords: Thoracic Aortic Aneurysm; Brachiocephalic Trunk; Bone Erosion; Computed Tomography Angiography; Cervicothoracic Mass; Subclavian Artery Occlusion

Introduction

Brachiocephalic trunk aneurysms are rare vascular lesions that may occur in isolation or in association with aneurysmal disease of the thoracic aorta [1]. Although frequently asymptomatic, they are clinically relevant because of the risk of thromboembolism, thrombosis, rupture, and compression of adjacent structures [1,2]. Their clinical presentation is therefore variable and may include neurologic or upper-limb ischemic manifestations, pain, or a pulsatile cervical or supraclavicular mass [1,2].

Giant thoracic aortic aneurysms may cause substantial displacement and compression of adjacent cervicomediastinal structures. Osseous erosion of the anterior thoracic skeleton is uncommon but has been previously described, including involvement of the manubrium

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and medial end of the clavicle in aneurysms arising near the brachiocephalic trunk [3]. Such an appearance may represent a diagnostic pitfall when an aneurysmal lesion presents as an apparently aggressive cervicothoracic mass. We report a giant multisegmental thoracic aortic aneurysm involving the brachiocephalic trunk, presenting as a right supraclavicular mass with sternal and clavicular erosion. This case highlights the role of computed tomography angiography in establishing the vascular origin of the lesion and comprehensively depicting its osseous, compressive, and thromboembolic complications.

Case Presentation

A 79-year-old man with a history of long-standing arterial hypertension presented with a progressively enlarging, painless mass in the right supraclavicular and lower cervical region. Physical examination revealed a firm, expansile, pulsatile mass in the right supraclavicular fossa, with a palpable thrill. The right radial pulse was markedly diminished compared with the contralateral side, without associated motor or sensory deficit of the right upper limb. Vital signs were stable, and routine laboratory tests, including inflammatory markers, showed no significant abnormalities.

Contrast-enhanced computed tomography angiography (CTA) of the thoracic aorta and supra-aortic branches demonstrated complex multisegmental aneurysmal disease. The ascending aorta showed fusiform aneurysmal dilatation measuring up to 57 mm in maximum diameter, extending into the aortic arch, which measured up to 75 mm. A giant saccular cervicothoracic aneurysmal component measuring $127 \times 89 \times 73$ mm extended superiorly through the thoracic inlet to the C5 level. Peripheral mural calcifications were present along the aneurysmal wall (Figure 1 and 2).

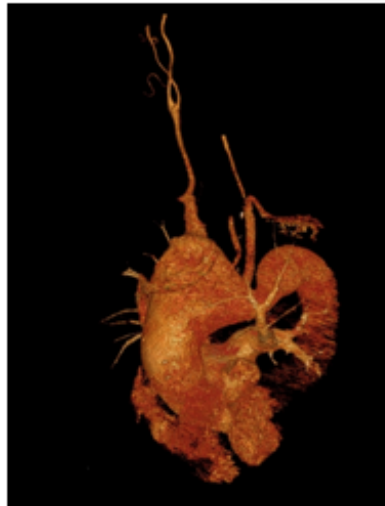


Figure 1: 3D volume rendering (VR) of the chest computed tomography angiography (CTA). Three-dimensional reconstruction displaying the giant aortic arch and brachiocephalic trunk (BCT) aneurysm. The right common carotid artery remains patent and courses superiorly, while the right subclavian artery is completely occluded at its origin.



Figure 2: Coronal contrast-enhanced CT reconstruction (mediastinal window). Demonstrating the fusiform aneurysmal dilatation of the S1 segment of the ascending aorta (57 mm) and the aortic arch (75 mm). The giant saccular cervicothoracic sac (127 x 89 x 73 mm) projects through the superior thoracic inlet up to the C5 level, causing marked leftward tracheal deviation.

The giant aneurysmal sac produced marked remodeling of the adjacent anterior thoracic skeleton, with scalloping and cortical erosion of the posterior aspect of the manubrium and the medial end of the right clavicle (Figure 3). Significant mass effect was also observed, including marked leftward deviation of the trachea, compression of the right thyroid lobe, and severe compression of the superior vena cava and right-sided cervicomediastinal venous structures. Multiple collateral venous channels were visible in the right lateral cervical region. The aneurysmal mass also extended inferiorly toward the cardiac structures, with mass effect on the right atrium.



Figure 3: Axial CTA image. Illustrating the chronic mass effect and pulsatility exerted by the giant aneurysmal sac, leading to significant bone remodeling and marked cortical erosion (scalloping) of the posterior surface of the manubrium sterni.

An extensive mural thrombus was present within the brachiocephalic component of the aneurysm and was associated with complete occlusion of the right subclavian artery at its origin. The right common carotid artery remained patent, with preserved contrast opacification throughout its visualized cervical and intracranial course (Figure 4). The coronary ostia were patent and located approximately 38 mm from the inferior margin of the ascending aortic aneurysmal component.



Figure 4: Coronal maximum intensity projection (MIP) CTA reconstruction. Highlighting the contrast-filled patent lumen and peripheral calcifications of the aneurysmal sac. The image demonstrates a 66% circumferential mural thrombosis of the brachiocephalic trunk (BCT) propagating to cause complete occlusion of the right subclavian artery at its origin.

Discussion

Brachiocephalic trunk aneurysms are uncommon vascular lesions with heterogeneous etiologies and clinical presentations. In the surgical series by Kieffer, *et al.* etiologies included degenerative disease, Takayasu arteritis, syphilis, chronic dissection, trauma, infection, postoperative complications, and Marfan syndrome; concomitant aortic aneurysmal disease was present in 17 of 27 patients [1]. More recent data also demonstrate a frequent association between aneurysmal aortic arch branch vessels and aortic aneurysms [4]. In our patient, the combination of ascending aortic, aortic arch, and brachiocephalic trunk involvement resulted in an unusually large multisegmental aneurysmal complex with extensive cervicothoracic extension.

One of the most striking imaging findings was the marked erosion of the posterior manubrium and medial end of the right clavicle. Osseous erosion caused by large thoracic aortic aneurysms has been previously reported [3,5]. Bodhey, *et al.* described six patients with syphilitic ascending aortic aneurysms in whom erosion predominantly involved the right side of the manubrium and the medial end of the right clavicle; the aneurysms arose near the junction of the ascending aorta and transverse arch, close to the origin of the innominate artery [3]. Lorusso, *et al.* also reported sternal erosion associated with a giant chronic thoracic aortic aneurysm and severe tracheal compression [5]. These observations support chronic aneurysmal contact and mass effect as an explanation for the osseous remodeling identified in our patient, although the precise cellular mechanism of bone resorption cannot be established from imaging alone.

From a radiological perspective, this osseous involvement represents an important diagnostic pitfall. A cervicothoracic mass associated with cortical destruction may resemble a primary bone or chest-wall tumor, metastatic disease, or an infectious process such as osteomyelitis. In the present case, computed tomography angiography demonstrated direct continuity of the lesion with the thoracic arterial system and simultaneously depicted the relationship between the aneurysmal sac and the eroded sternoclavicular structures. Recognition of the vascular origin of such a mass before an invasive diagnostic procedure is essential, particularly because tissue sampling of an unsuspected vascular lesion would carry a major hemorrhagic risk.

Thrombotic and embolic complications constitute another clinically relevant feature of supra-aortic aneurysms. In the series by Kieffer, *et al.* thromboembolic complications occurred in 7 of 27 patients [1], while Cury, *et al.* identified embolization as a major mode of symptomatic presentation among supra-aortic vessel aneurysms [2]. In our patient, extensive mural thrombus within the brachiocephalic component was associated with complete occlusion of the right subclavian artery, consistent with the markedly diminished right radial pulse. In contrast, the right common carotid artery remained patent. This finding emphasizes the importance of evaluating the patency of each supra-aortic branch independently rather than inferring distal arterial compromise solely from the extent of mural thrombosis.

The exceptional volume of the aneurysm also resulted in substantial cervicomediastinal mass effect, with marked tracheal deviation, compression of the right thyroid lobe, and severe narrowing of major venous structures. Multiple right cervical collateral veins were present, suggesting chronic adaptation to venous compression. Giant thoracic aortic aneurysms causing severe airway compression have previously been described [5]. In our case, the coexistence of airway displacement, venous compression, osseous erosion, and arterial occlusion illustrates the broad spectrum of complications that should be systematically assessed on cross-sectional imaging.

Computed tomography angiography is particularly suited to the evaluation of such complex aortic disease. The 2022 American College of Cardiology/American Heart Association guideline identifies maximum aortic diameter, mural abnormalities or thrombus, luminal stenosis or occlusion, and branch-vessel involvement among the essential elements of computed tomography and magnetic resonance imaging assessment of aortic disease [6]. Expert recommendations for aortic arch pathology also describe computed tomography angiography as the first-line imaging modality and emphasize its ability to provide high-spatial-resolution three-dimensional evaluation of the aorta and surrounding structures; multiplanar reformations, maximum-intensity projections, and volume-rendered reconstructions further improve anatomical assessment [7]. In complex aneurysms involving the aortic arch and supra-aortic vessels, imaging also contributes to treatment planning by defining branch-vessel anatomy and the feasibility of potential open, hybrid, or endovascular approaches [6,7]. Thus, the principal radiological contribution in this case extends beyond establishing the diagnosis to providing a comprehensive map of the vascular, thrombotic, osseous, and compressive complications relevant to multidisciplinary management.

Conclusion

Giant multisegmental thoracic aortic aneurysms involving the brachiocephalic trunk may present as unusual cervicothoracic masses with compressive, thromboembolic, and osseous complications. Recognition of associated sternal and clavicular erosion as a manifestation of chronic aneurysmal mass effect is important to avoid misinterpretation as an aggressive nonvascular lesion. Computed tomography angiography plays a central role in establishing the vascular diagnosis, assessing branch-vessel involvement and adjacent structural complications, and providing the anatomical information required for multidisciplinary therapeutic planning.

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