

A rare Presentation of Aberrant Right Subclavian Artery: A Case Report

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Case Report

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Abstract

The aorta, a vital artery originating from the left ventricle, typically divides into three branches in most individuals: the brachiocephalic trunk, the left common carotid artery, and the left subclavian artery. However, some individuals may present with variations in the branching pattern of the aortic arch. This case report discusses the unusual presentation of an Aberrant Right Subclavian Artery (ARSA) in a 50-year-old woman from Iran who sought medical attention due to dyspnea. Upon admission to the emergency department, the patient's blood pressure measurements in both arms showed a significant difference. This led to further investigation, including a CT angiography, which revealed an unusual course of the right subclavian artery. Instead of following the typical anatomical route, the aberrant artery passed through the second and third ribs, entered the right breast tissue, and then spiraled into the right upper limb. This case not only adds to the body of medical knowledge but also emphasizes the significance of clinical awareness and thorough diagnostic evaluation when encountering unusual and unexpected patient presentations.

Introduction

The aorta is an artery that originates from the left ventricle. In normal people, this artery divides into three branches, brachiocephalic trunk (bifurcating into the right subclavian and right common carotid artery), left common carotid artery, and left subclavian artery (1). To observe the Aberrant Right Subclavian Artery, it is useful to review briefly the embryonic development of the aortic artery (2). beginning during the fifth week of development The ascending aorta develops as a part of the primitive heart tube. The truncus arteriosus (first dilation of primitive heart tube) forms the basis for developing the ascending aorta and pulmonary trunk. The truncus is eventually divided by the aorticopulmonary septum into separate vascular outflow channels (3). The normal definitive aortic arch develops from multiple sources. The portion of the arch proximal to the brachiocephalic trunk derived directly from the aortic sac. The medial area of the arch, between the brachiocephalic trunk and the left common carotid artery, arises from the left fourth aortic arch (4). The portion of the arch distal to the left common carotid artery arises from the dorsal aorta. pharyngeal arch arteries derive from the aortic sac, with a pair of branches traveling within each pharyngeal arch and ending in the dorsal aorta. All six pairs are not present together; they develop and regress at different stages. Third, fourth and sixth pair arches are related to definitive aortic arch and its branches (5).

- Third aortic arch - contributes to the formation of the common carotid arteries bilaterally and the proximal internal carotid arteries bilaterally.
- Fourth aortic arch - The right arch contributes to the R proximal subclavian artery. The left arch gives rise to the medial portion of the aortic arch.
- Sixth aortic arch - The right and left arches separate into ventral and dorsal segments. The ventral segments are responsible for the formation of the pulmonary arteries bilaterally. The left ventral arch also contributes to the formation of the pulmonary trunk.

The fourth aortic arch, On the right, it forms the most proximal segment of the right subclavian artery, the distal part of which is formed by a portion of the right dorsal aorta and the seventh intersegmental artery. We can detect some aberrancy related to right subclavian artery (6).

Between 23,882 arches, seven of the most common variants were analyzed. The most common variants is brachiocephalic trunk bifurcating into a left common carotid, and a left subclavian artery (80.9%); the bovine arch variant (13.6%); and the left vertebral artery variant (2.8%). The other four remaining most common variants were identified as the type 4 (bovine and LV), type 5 (common carotid), type 6 (aberrant Right Subclavian), and type 7 (right arch), each of which had an incidence of <1% (7).

Case presentation

A 50-year-old woman originated from Iran was admitted to the emergency department mid-august 2022 for dyspnea. Past medical history revealed hypertension for over 16 years, hyperlipidemia and drug consumption of metoral 25 mg, propranolol 10 mg atorvastatin 20, and ASA 80. The patient reported symptoms of weakness, exhaustion, headache, fever, and chills two weeks prior to visiting the ER. The patient also reports one instance of bloody sputum discharge (about 10 cc in volume), which did not recur in the previous two weeks. However, he did not report experiencing symptoms like dyspnea, nausea, vomiting, anorexia, or weight loss. However, he admits having trouble breathing when moving. He visits his physician for this reason, and after receiving more testing, he is admitted to the hospital's emergency department on the grounds that he may have a cardiovascular condition. The patient's left hand's blood pressure (BP=110/85) and right hand's blood pressure (BP=210/90) were tested upon admission to the emergency department, and they differed considerably from each other, and by sensing the pulses on both hands, the difference might be calculated. The patient reports experiencing periodic spasms in the distal lower limb muscles, namely in the gastrocnemius muscles of both legs, and a general sense of exhaustion in these muscles. In addition, he reports experiencing discomfort in the joints of both legs, although there is no sign of erythema or soreness. The patient's vital signs (Puls Rate = 81 beat per minute, Respiratory Rate = 20 breaths per minute, Temperature =36.9 °C) and other organ evaluations were normal. The patient's arms had different pressures. Thus, after injecting 100 mL of iodinated contrast medium via the left antecubital vein at a rate of 3.0 mL/s beginning at the D10 level and continuing till the base of the skull, we performed CT arch aortography on the patient, which might be explained by anomalies in the cardiovascular system seen on the CT angiography. such that the abdominal aorta's constriction and the lack of the right subclavian artery may be seen (Figure 1). According to echocardiography, Ejection Fraction (EF) = 55% - 50% with mild to moderate Aortic Insufficiency (AI).

Discussion

The major vein leading from the left side of the heart to the head, neck, and upper limbs is called the aortic arch (AA). Its pattern of branching out to supply these structures can change as it passes through the thorax (8). According to previous studies, right subclavian formation is an uncommon congenital

variation that often presents with no symptoms and is detected at random (9, 10). Congenital aortic arch malformations include a wide range of variations and defects that resulted from previously known disrupted branchial arch development. The aberrant persistence or involution of embryonic vascular segments is the cause of these abnormalities (11). There are more prevalent forms of aortic branch variants in different geographic locations, and recognizing typical patterns enables medical professionals to be aware of these variations in order to avert difficulties during surgery and other cardiovascular disorders (8). Knowing the anatomic diversity of the AA in great detail is vital given the rising incidence of neck and chest surgeries (12, 13). The majority of AA anatomic abnormalities can raise the risk of problems during surgical treatments, even when they have no physiological effects (14, 15).

Imaging investigations of the chest and neck often reveal these irregularities. Although they are typically incidental radiological findings in individuals who are asymptomatic, they can sometimes manifest as nebulous symptoms including dysphagia and chest discomfort (11). However, according to the literature review, the absence of subclavian artery is a rare phenomenon. In fact, in the patient under discussion, the aortic trunk's branched arterial branches have been described in such a way that, rather than forming the subclavian artery in its anatomical location, aberrant artery have gone through the second and third ribs, entered the right breast tissue, and then, following a spiral path, entered the right upper limb, representing the patient's clinical symptoms (Figure 2 and 3). This phenomena has also been used to explain (the difference in pressure between the two upper limbs, numbness of the right hand, and shortness of breath).

Vascular anomalies can be found using a variety of diagnostic techniques, including endoscopy, CT scanning, ultrasound, and echocardiography. Many of these congenital anomalies can also be identified during pregnancy screenings (16). However, the prompt application of diagnostic instruments will be greatly aided by the physician's clinical suspicion.

Conclusion

In conclusion, the case of a 50-year-old woman with an Aberrant Right Subclavian Artery highlights the significance of understanding vascular anomalies, especially within the aortic arch. This rare congenital variation in the aortic arch's branching pattern can lead to clinical symptoms, such as differences in blood pressure between the upper limbs and associated discomfort. The study underscores the importance of thorough diagnostic imaging and clinical evaluation in identifying such anomalies, which may often present as incidental radiological findings in asymptomatic individuals. Understanding these variations is crucial for medical professionals, particularly in the context of rising incidences of neck and chest surgeries, as they can impact surgical planning and outcomes. In summary, this case report emphasizes the clinical significance of identifying and understanding vascular anomalies, contributing to improved patient care and management in the field of cardiovascular medicine.

Declarations

The authors state that there are no conflicts of interest in the present study

Competing interests: The authors declare no competing interests.

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References

1. BABu CR, ShARmA V. Two common trunks arising from arch of aorta: case report and literature review of a very rare variation. *Journal of Clinical and Diagnostic Research: JCDR*. 2015;9(7):AD05.
2. Oztas DM, Umutlu M, Ertan M, Beyaz MO, Badem S, Erdinc I, et al. Brief review of right aortic arch with aberrant left subclavian artery. *AORTA*. 2019;7(06):179-80.
3. Oka N. Surgical Treatment of the Transposition of the Great Arteries. *Kyobu geka The Japanese Journal of Thoracic Surgery*. 2022;75(10):802-6.
4. Niclauss L, Namasivayam J, Kirsch M, Prêtre R. Traumatic brachiocephalic trunk dissection of a bovine arch. *European Journal of Cardio-Thoracic Surgery*. 2020;57(4):801-2.
5. Gupta SK, Bamforth SD, Anderson RH. How frequent is the fifth arch artery? *Cardiology in the young*. 2015;25(4):628-46.
6. Zhang S, Wang J, Han J, Wang L, Wang L, Xiong X, et al. Prenatal ultrasound findings, genetic testing, and literature review of Isolated left subclavian artery. *Echocardiography*. 2023.
7. Popieluszko P, Henry BM, Sanna B, Hsieh WC, Saganiak K, Pękala PA, et al. A systematic review and meta-analysis of variations in branching patterns of the adult aortic arch. *Journal of vascular surgery*. 2018;68(1):298-306. e10.
8. Popieluszko P, Henry BM, Sanna B, Hsieh WC, Saganiak K, Pękala PA, et al. A systematic review and meta-analysis of variations in branching patterns of the adult aortic arch. *Journal of vascular surgery*. 2018;68(1):298-306.e10.
9. Bayford D. An account of a singular case of obstructed deglutition. *Mem Med Soc Lond*. 1794:275-86.
10. Irakleidis F, Kyriakides J, Baker D. Aberrant right subclavian artery—a rare congenital anatomical variation causing dysphagia Lusoria. *Vasa*. 2020.
11. Raimundo E, Guedes M, Pereira M, Farias L, Pedri A, Sales T, et al., editors. Anomalies and anatomical variants of the aortic arch and origin of the neck vessels 2019: European Congress of Radiology-ECR 2019.

12. Bhattacharyya N. The increasing workload in head and neck surgery: An epidemiologic analysis. *The Laryngoscope*. 2011;121(1):111-5.
13. Etzioni DA, Starnes VA. The epidemiology and economics of cardiothoracic surgery in the elderly. *Cardiothoracic Surgery in the Elderly: Evidence-Based Practice*. 2011:5-24.
14. Natsis KI, Tsitouridis IA, Didagelos MV, Fillipidis AA, Vlasis KG, Tsikaras PD. Anatomical variations in the branches of the human aortic arch in 633 angiographies: clinical significance and literature review. *Surgical and radiologic anatomy : SRA*. 2009;31(5):319-23.
15. Karacan A, Türkvatan A, Karacan K. Anatomical variations of aortic arch branching: evaluation with computed tomographic angiography. *Cardiology in the young*. 2014;24(3):485-93.
16. Song MJ, Han BH, Kim Y-H, Yoon SY, Lee YM, Jeon HS, et al. Prenatal diagnosis of aberrant right subclavian artery in an unselected population. *Ultrasonography*. 2017;36(3):278.

Figures

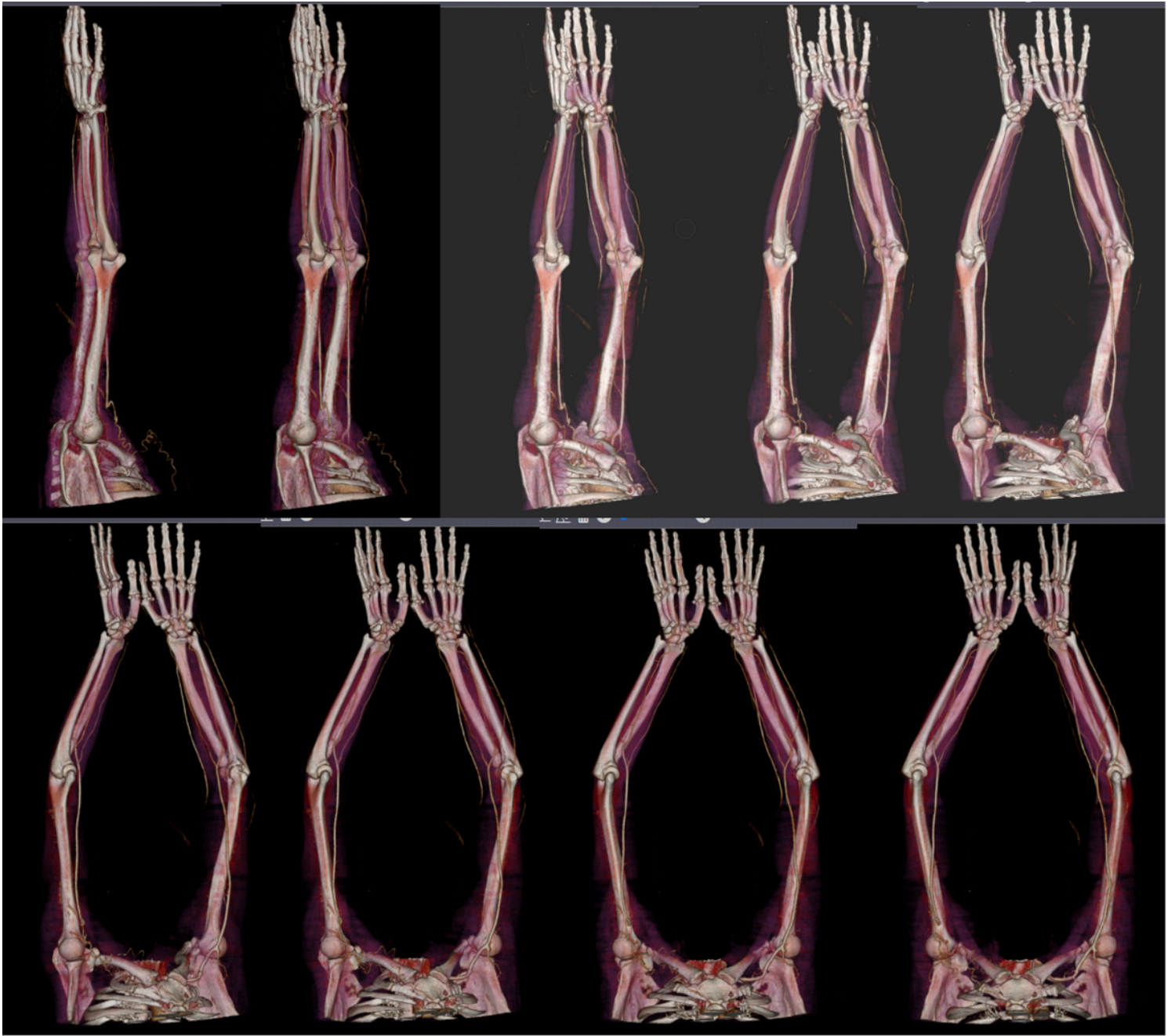


Figure 1

CT angiography of woman patient 50 years old with aberrant right subclavian artery.

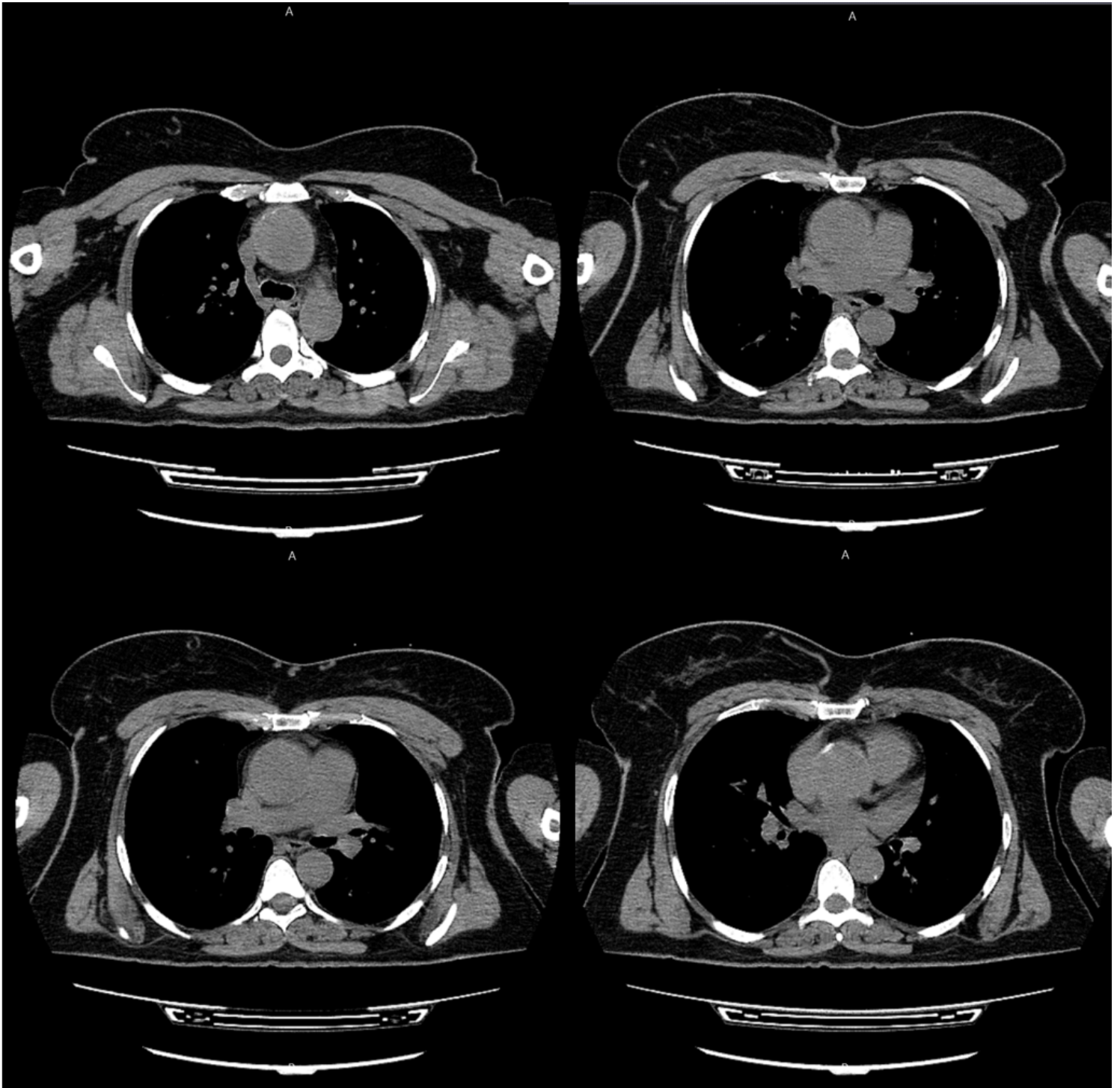


Figure 2

The aberrant artery branched from the aortic arch and entered the right breast tissue after passing through the second and third ribs.

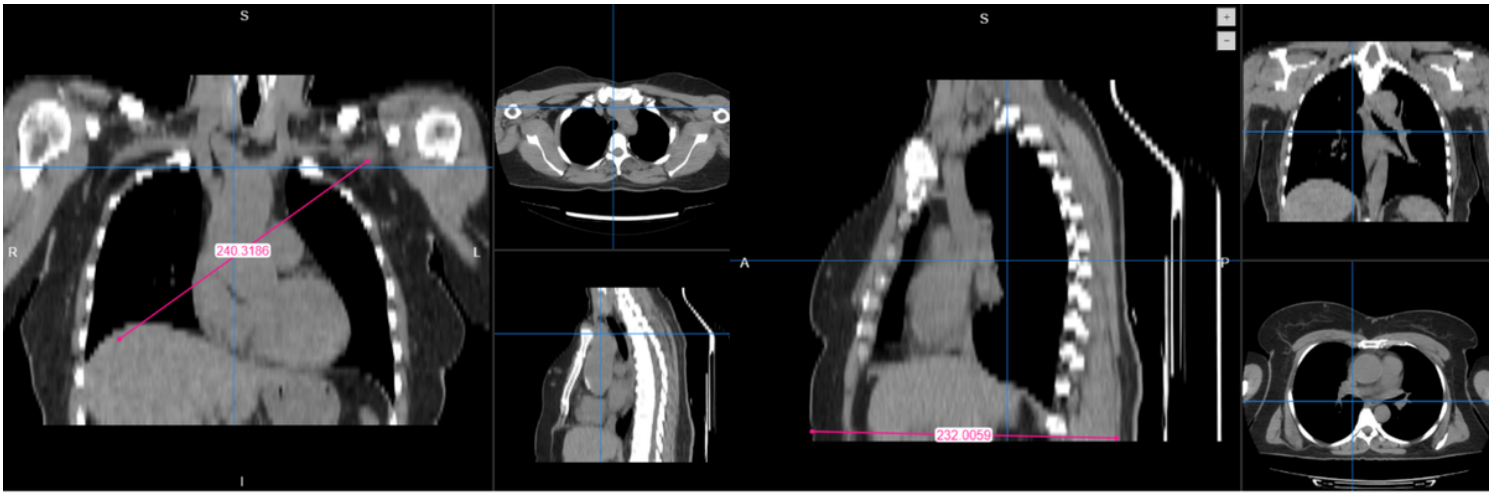


Figure 3

Sagittal, coronal, and transverse view of the passage of the misplaced artery and its entry into the breast tissue.