

Appendix I. Barium swallow test. (B) Plump cricopharyngeal muscle. (C) Impression of struma. Severe impression dorsal of esophagus by right-sided aortic arch. (D) = fig 4 Small hiatus hernia esophagus

The surgeon ordered a thyroid uptake single-photon emission computed tomography (SPECT-CT) to see if the patient could qualify for radioactive iodine therapy. The following findings were made: right-sided thyroid (estimated 55 g), extension dorsal of the esophagus with slight impression on the esophagus, in this dorsal part of the right thyroid no iodine uptake, almost no impression on the trachea, and known vascular anomaly of the right-sided aorta with compression on the esophagus (Appendix II).

With the suggestion of a vascular ring, the patient was referred to a cardiothoracic surgeon for treatment options. See timeline (appendix IV). (See timeline (appendix IV)).

Discussion

The differential diagnosis of dysphagia is extensive, and although sometimes the diagnosis is obvious, in some cases it is difficult to pinpoint the cause, especially, when it is an anatomic cause in an elder patient and if there are multiple anatomical explanations for the dysphagia. Normal work-up of dysphagia include a thorough anamnesis (and elicit symptoms in patient history), physical examination, barium swallow, manometry, and endoscopy. Several questionnaires have been made to aid the interpretation of dysphagia [1].

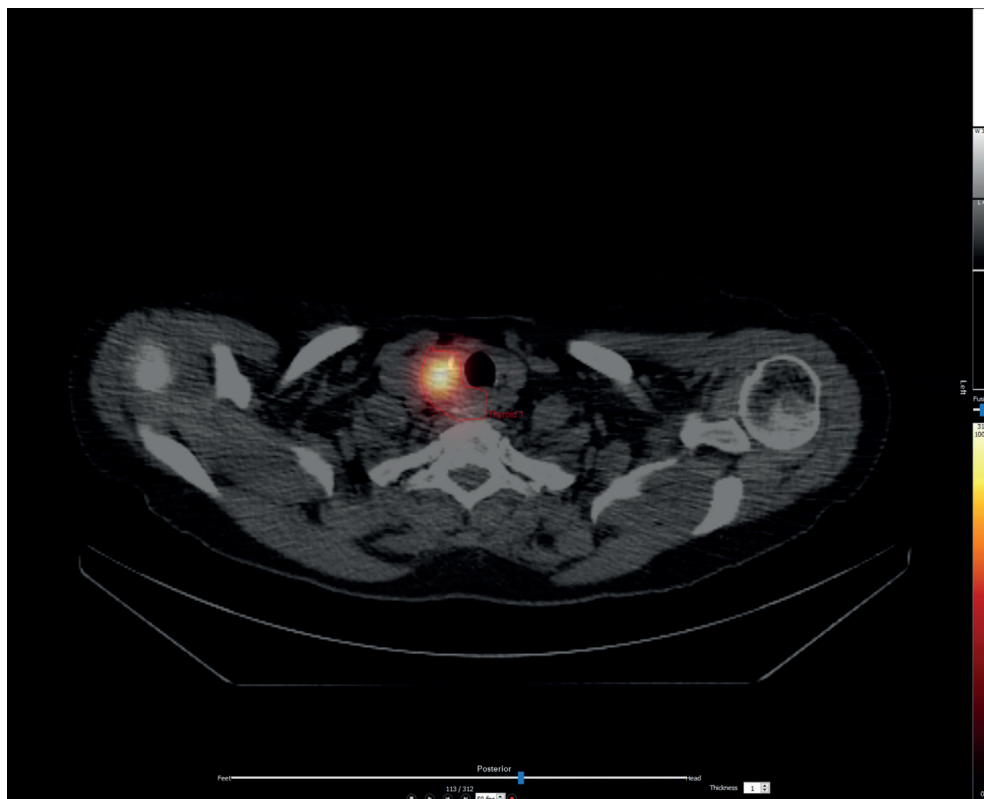
This case presents an uncommon cause not always thought of during work-up. Our patient had a right-sided aortic arch with a left ligament arteriosum (Appendix III).

Symptoms of vascular rings in children are: noisy breathing and barky cough (seal-bark cough), recurrent upper respiratory tract infections, wheezing, dyspnea on exertion, and dysphagia. Some infants can have apnea or even an apparent life-threatening event. Dysphagia is usually a symptom until solid foods are given to the child [2]. Most of the time, a vascular ring is diagnosed in children since it is symptomatic. In adults, it is considered rare and may be misdiagnosed as asthma. This case represented a medical history of asthma, and her reflux did not respond to omeprazole. It is possible that in this case the reflux complaints and asthma are symptoms of vascular ring.

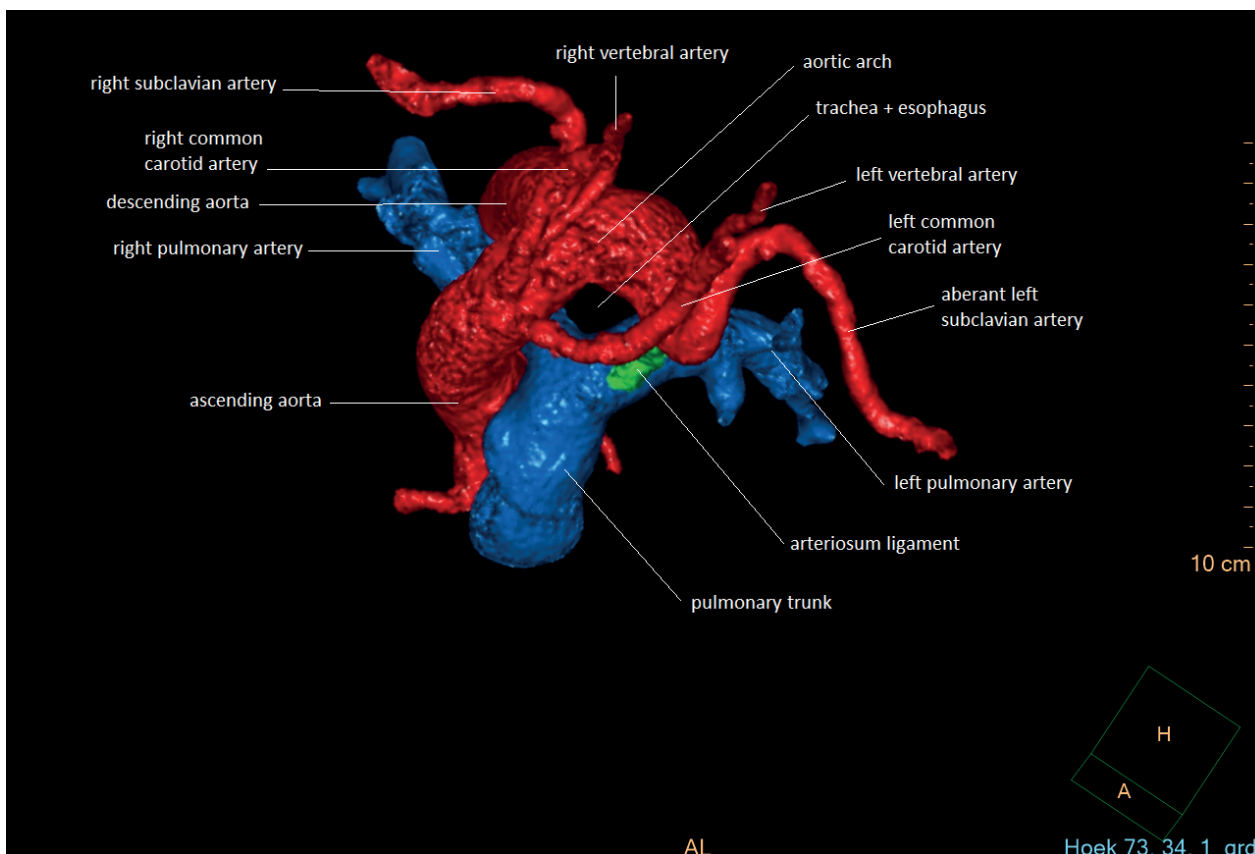
Understanding the embryology of the aorta helps to understand vascular rings. A right-sided aorta is formed when the fourth left branchial arch involutes, resulting in a right-sided arch. Of the right-sided aorta (approximately 0.1% in adults) there are three types of the right-sided aortic arch:

- Type 1: right-sided aortic arch with mirror image branching (59% of all right-sided arches).
- Type 2: right-sided aortic arch with the aberrant left subclavian artery (39.5%).
- Type 3: right-sided aortic arch with isolation of the left subclavian artery (rarest type, 0.8%) [3,4].

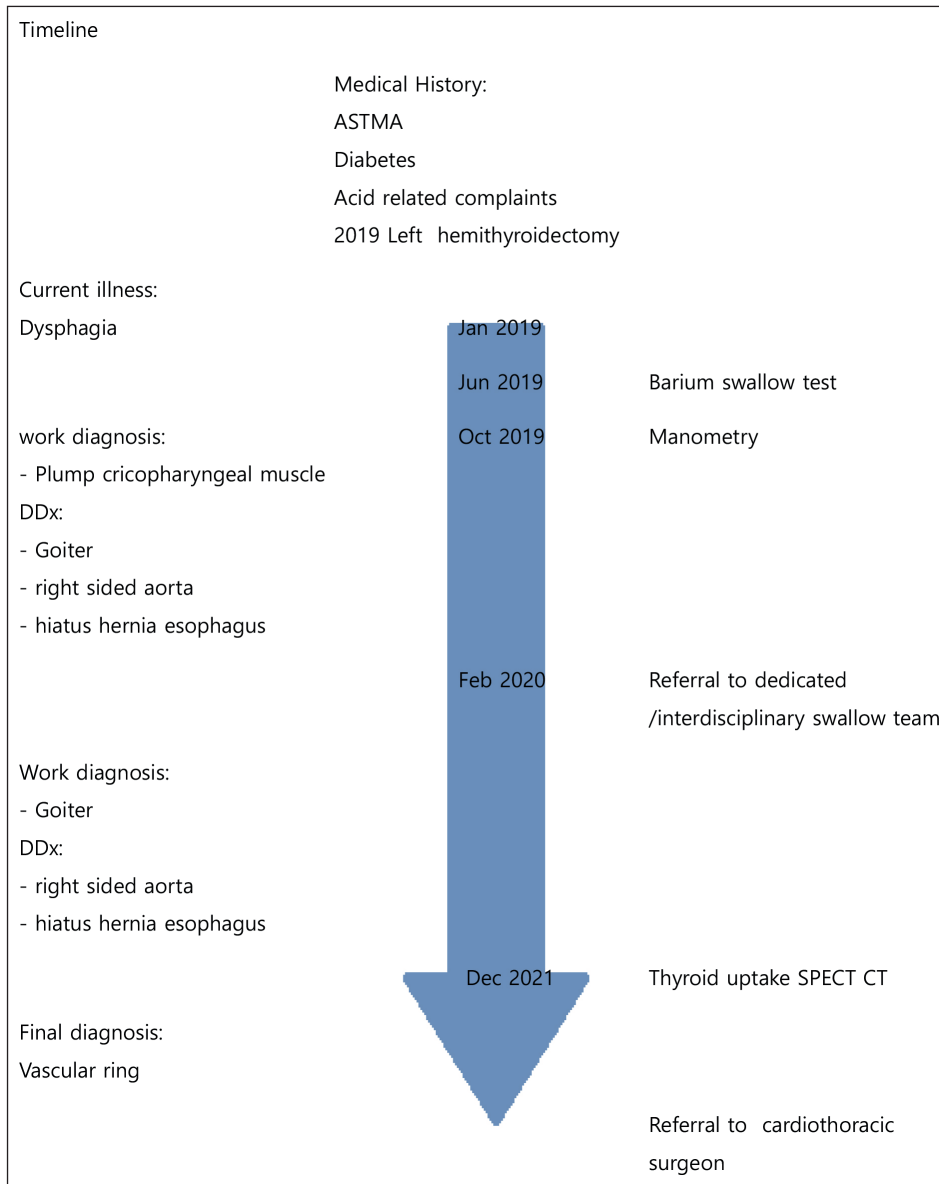
In the right aortic arch, a vascular ring is completed with a left-sided ligament arteriosum. It remains unclear why some patients become symptomatic or have slowly progressing symptoms in adulthood. It had been postulated that progressive aortic arch elongation and aortic atherosclerosis are contributing factors [5]. Or maybe the



Appendix II. I-123 SPECT-CT: status after left-sided hemithyroidectomy. Right thyroid 55 g, extension of right thyroid dorsal of esophagus. No uptake in thyroid tissue dorsal from the esophagus, and hardly any compression on the trachea.



Appendix III. (A) Right-sided aortic arch with left-sided ligament arteriosum and Kommerell's diverticulum with aberrant left subclavian artery. (B) The trachea and esophagus pass through the vascular ring.



Appendix IV. Timeline.

dilation of Kommerell’s diverticulum may be a contributing factor.

Conclusion

The purpose of this case report is to understand and identify relevant clinical anatomy. A right-sided aorta with a left-sided arteriosum ligament (and a ventral left common carotid artery) is a vascular ring and should be recognized as such. Although it is rare in adults, one should be triggered to think of a vascular ring in patients with dysphagia, especially with mild asthma and reflux complaints.

What is new?

Dysphagia in infants and young children based on anatomical variations (such as right-sided aorta variations) is well documented. Only a few reports are made of dysphagia in adults based on a right-sided aorta.

Conflict of interest

The author declares that there is no conflict of interest regarding the publication of this case report.

Funding

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Consent for publication

Obtained from the patient.

Ethical approval

Ethical approval is not required at our institution to publish an anonymous case report.

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Summary of the case

1	Patient (gender, age)	61yr, female
2	Final diagnosis	Vascular ring
3	Symptoms	Dysphagia (ASTMA and acid related complaints in medical history)
4	Medications	Omeprazole
5	Clinical procedure	Clinical work-up dysphagia complaint.
6	Specialty	Radiology, Surgery