

Letter to the Editor

## Right Common Carotid Artery Crossing The Midline Of The Neck

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The carotid arterial system is the principal blood supply to the brain, head, and neck. The anatomy is very consistent, but variations have been described in the literature[1-3]. Variations may involve the tortuosity, course, and origin of the artery. Serious operative complications may arise if this is not anticipated prior to surgery. The common carotid arteries also serve as important landmarks during head and neck surgery. This case report describes an anatomical variation of the common carotid artery configuration.

A 35-year-old male with underlying cerebral palsy, kyphoscoliosis, and atrial septal defect was admitted to our center for severe pneumonia. He developed septic shock and respiratory distress. Subsequently he was transferred to the intensive care unit and required inotropic support. Multiple attempts to extubate the patient had failed. Due to prolonged intubation, he was referred to our department for tracheostomy.

The patient had no prior surgery to the neck. On examination, the neck was thin, and it was found that there was a pulsatile mass overlying the trachea just above the suprasternal notch. An ultrasound scan was arranged, and it was revealed that the right common carotid artery (CCA) crossed the midline anterior to the trachea and traversing to the left CCA.

The patient's condition deteriorated and then the family members withdrew consent. Tracheostomy was thus cancelled, and no further investigations were done. Patient then succumbed to his illness.

Congenital abnormalities of the carotid arterial systems are uncommon. As these abnormalities were usually asymptomatic in nature, they were very rare until angiography became commonplace. These abnormalities are becoming more recognized as the clinical implications can be fatal.

The embryology of the great vessels should be appreciated in order to understand these anomalies. The development of the aorta takes place during the 3<sup>rd</sup> week of gestation. The embryo develops 6 pairs of aortic arches along with a primitive ventral and dorsal segment. The primitive ventral and dorsal segments are continuous with the 1<sup>st</sup> aortic arch. As the embryo further develops, the 6 pairs of aortic arches undergo selective apoptosis, and the residual branch vessels forms the aortic arch and great vessels. The anatomic variants of vessels form during this process.

The 1<sup>st</sup> aortic arch forms the maxillary and external carotid arteries. The 2<sup>nd</sup> arch regresses. Failure of this will result in a persistent stapedal artery. The paired 3<sup>rd</sup> arches form the first part of the internal carotid arteries bilaterally. The right 4<sup>th</sup> arch persists as the proximal part of the right subclavian artery. The left 4<sup>th</sup> arch regresses and forms a small segment of the adult aortic arch, between the origin of the left common carotid and left subclavian artery. The 5<sup>th</sup> arch either regresses or is incompletely formed. The 6<sup>th</sup> arch forms the pulmonary arch, which develop into the right pulmonary artery and ductus arteriosus[4, 5].

Many variations of the common carotid artery have been described. These variations are closely related to the anomalies of branches of the aortic arch. Therefore, carotid artery anomalies may be associated with anomalies of other vessels. Most anomalies relate to the level of bifurcation, sequence of branches of the external carotid artery, or the degree of atresia or stenosis of the vessels. In a systematic review and meta-analysis by Popieluszko et al[6], seven types of aortic arch variations were identified. Type 1 is the normal arch which occurs in 80% of the population. Type 2 is



Figure 1- Ultrasound neck showing right common carotid crossing to the left

commonly called the bovine arch where the brachiocephalic trunk serves as the origin for both common carotid arteries. It occurs in 13.6% of the population. Type 3 is of normal configuration in addition to left vertebral artery arising from the arch and occurs in 2.9% of the population. Type 4 to 7 are other variations which occurs in 1% of the population.

Conoyer et al[2] described in a case report of a right common carotid crossing the midline of the trachea which was found during a cadaveric dissection. On further dissection, abnormality of the aortic arch branches was found. The right common carotid arose directly from the arch. Followed by the left common carotid and left subclavian artery. The right subclavian was the last branch and it coursed posteriorly, crossed the midline, and posterior to the oesophagus.

Another case by Shankar et al[7], found a brachiocephalic trunk arising from the arch of aorta along the left margin of trachea. It was also found that the brachiocephalic trunk gave rise to the subclavian and common carotid over the 4<sup>th</sup> and 6<sup>th</sup> tracheal rings. The right CCA then crossed the trachea over the 4<sup>th</sup> tracheal ring.

In these cases, the most likely explanation is congenital in origin. However there are also cases where the deviation of the normal course of the artery may be caused by previous radiotherapy[8]. However, it is more of an extreme form of tortuosity of the artery rather than an abnormality in the origin of the vessel.

In our case, the most likely cause is congenital origin. The patient did not have any previous radiotherapy but had multiple disabling comorbidities. The abnormal course of the common carotid is maybe due to severe tortuosity of the vessel. Unfortunately, due the deteriorating condition of the patient, further investigation such as CT angiography was not performed to further delineate this abnormality in further detail.

## Conclusion

It must be emphasized that clinical examination prior to any surgical procedure is very important. Anatomical anomalies must be borne in mind prior to any procedures especially to the neck. Other situations where this may be challenging are during thyroidectomies and neck dissections. Even in a straightforward procedure, a catastrophic outcome can be avoided.

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