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CASE REPORT

Common carotid artery kinking associated with bovine arch: a case report and review of literature

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Introduction

Kinking, tortuosity, and coils of the common carotid artery (CCA) are far less common than tortuosity of the internal carotid artery (ICA), and less reported in the literature as well.

For more precision, different types of tortuosity have been defined. Although there are no reported definitions of this issue in the CCA, these definitions were inspired by articles about the ICA. Tortuosity is elongation or redundancy creating a C or S-shaped loop without an acute angle. Kinking is a sharp angle formation, while coiling is elongation in a narrow space resulting in a circular shape.¹

Brown and Rowntree were the first to illustrate the link between hypertension and the development of tortuosity.² Other studies started to point to other risk factors as female gender, atherosclerosis, aging, and Takayasu arteritis.³

Clinical presentations include pulsatile neck masses, dysphagia,^{4,5} and transient ischemic attacks (TIAs).⁶ Diagnostic investigations include duplex ultrasound scan and CT or MRI angiography.⁷

Highlighting this pathology is important because it can be mistaken as a carotid artery aneurysm,⁸ an enlarged thyroid,⁹ or a submandibular swelling.¹⁰ Moreover, this anomaly can cause unexpected troubles during neck surgery, particularly neck dissection surgery,¹¹ and tracheostomy.¹²

Bovine arch is the most common congenital variant of aortic arch branching, named type 2 aortic arch pattern. It is reported to occur in 13% to 27% of the population. This variant anatomy has no clinical consequences. However, without preoperative knowledge, it can increase the difficulty of surgical and endovascular procedures involving the aortic arch.¹³

In this article, we will present a case of bilateral kinking of common and internal carotid arteries associated with bovine aortic arch, with a review of previously reported cases.

Case report

A female patient aged 62 years old, hypertensive, presented with a two-month history of a pulsatile swelling in the lower part of the front of the neck. The patient denied any history of trauma.

At the time of examination, the swelling was pulsating, soft, non-tender, occupying the thyroid region, but more prominent on the right side (Fig. 1). Carotid artery pulsations were felt equally bilaterally. Blood pressure was 145/90.

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Figure 1 The pulsatile mass in the lower part of the neck, an arrow is referring to the most prominent part of the mass.

A duplex ultrasound scan was performed, showing bilateral kinking of the CCAs with no atherosclerotic plaques. CT angiography was arranged, revealing the left CCA originating from the brachiocephalic artery (Bovine arch), with a kink of the CCA on both sides near their origins. Additionally, there was a kink in both ICAs and the left subclavian artery (Figs. 2 and 3). No cardiomegaly was detected on the ECHO cardiography.

The patient was asymptomatic except for the pulsatile neck mass, and the kinks were extensively distributed. Therefore, the patient was advised to control hypertension and follow up regularly. After 1 year of follow up, there was no change in the shape or the size of the swelling; the patient did not develop any neurological manifestations or TIAs.

Literature review

Data from the last 25 years were collected (Table 1).

In addition to the previous summary, Iwanaga J et al. noticed the presence of tortuous CCA during dissection of four cadavers.¹² In a recent study, Iwai-Takano M et al. concluded that the CCA kinking is an independent risk factor for the development of major cardiovascular events.¹⁷

Overall, female predominance is a consistent finding in the previous cases. The right CCA is much more commonly affected than the left. Nevertheless, the two reported coils in the CCA occurred on the left side. Whereas the ICA tortuosity, coiling, and kinking were reported to exist in infants and children, the CCA was never detected in this age, and all the cases were above 50 years of age.¹

Along with hypertension and atherosclerosis, other risk factors included bent posture, Takayasu arteritis, and bovine arch.^{3,14,15} Symptoms varied greatly: some of the cases were asymptomatic and accidentally discovered, while other patients experienced major cerebrovascular or cardiovascular events. Generally, surgical correction was offered to only two cases who suffered from marked symptoms, refractory dysphagia, and TIAs.^{5,6}

Discussion

The basic criteria of our patient are consistent with the previous reports, being a female in the seventh decade of her life and hypertensive.^{5,10}

To our knowledge, only one published case has the same anatomical pattern of our patient, which was reported by

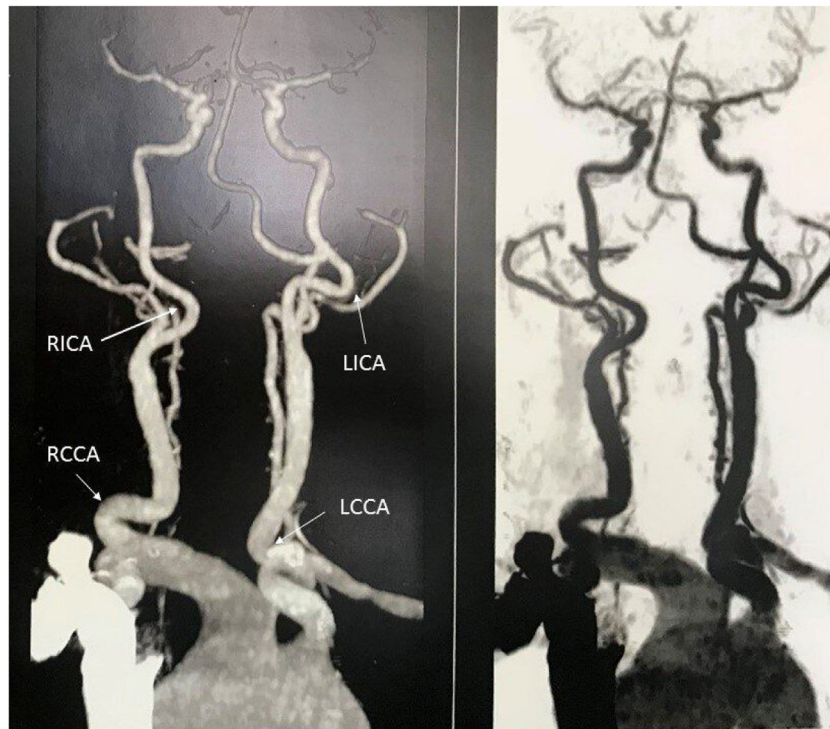


Figure 2 CT angiography showing bilateral common and internal carotid artery kinking along with a bovine aortic arch. The arrows are referring to the sites of kinking in different arteries.

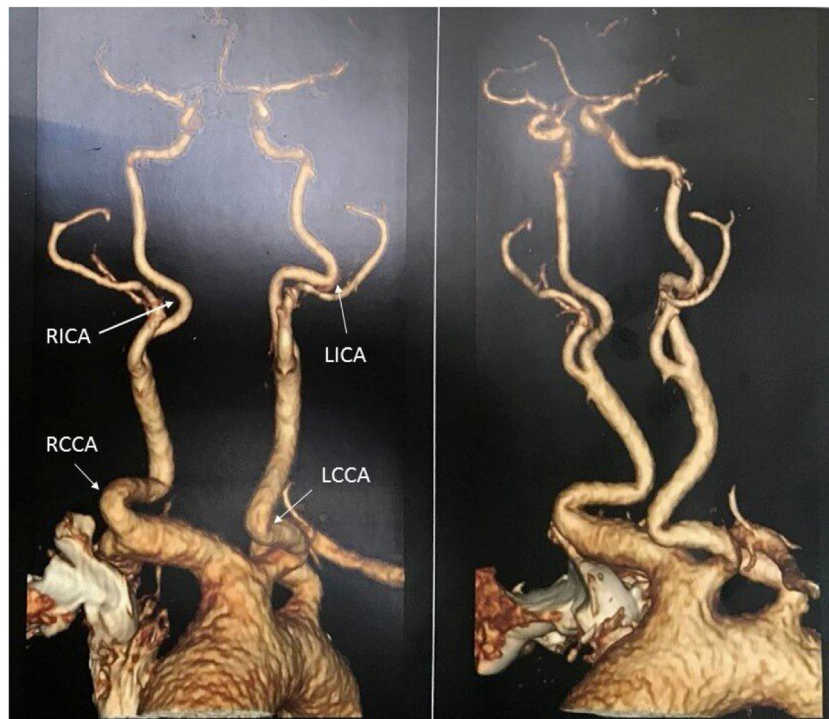


Figure 3 3D reconstruction of the aortic arch and its branches showing the same abnormalities. The arrows are referring to the sites of kinking in different arteries.

Table 1 Summary of previous articles describing cases with common carotid artery kinking, tortuosity, and coils.

| Author | Year | Age | Gender | Type | Side | Presentation | Related factors | Surgical correction |
|---------------------------------|------|-----|--------|------------|----------------------|-------------------------------------|---------------------------------|---------------------|
| G. Choi et al. ¹¹ | 1998 | 60 | Male | Tortuosity | RCCA | Asymptomatic | No | No |
| Peter H.L. et al. ⁵ | 2000 | 70 | Female | Coil | LCCA | Dysphagia | Hypertension | Yes |
| Gupta A et al. ⁴ | 2005 | 82 | Female | Tortuosity | RCCA | Neck mass Dysphagia | - | No |
| Tsunoda K et al. ¹⁴ | 2005 | 74 | Female | Tortuosity | RCCA | History of stroke | Atherosclerosis Bent posture | No |
| Milic DJ. et al. ⁶ | 2007 | 67 | Female | Coil | LCCA | TIAs | No | Yes |
| Kawano H et al. ³ | 2009 | 68 | Female | Tortuosity | RCCA | Asymptomatic | Takayasu arteritis | No |
| Yildiz, S et al. ¹⁵ | 2010 | 52 | Female | Tortuosity | RCCA LCCA LICA | Dysphagia Dyspnea | Hypertension Bovine arch | No |
| Katsanos S et al. ¹⁶ | 2017 | 70 | Female | Tortuosity | RCCA | Syncope Neck mass | No | No |
| Nakamoto T et al. ¹⁰ | 2019 | 86 | Female | Kinking | RCCA | Neck mass (right sub-mandibular) | Hypertension | No |
| Chen P-J et al. ⁹ | 2018 | 58 | Female | Kinking | RCCA | Neck mass | No | No |

RCCA, Right Common Carotid Artery; LCCA: Left Common Carotid Artery; LICA: Left Internal Carotid Artery.

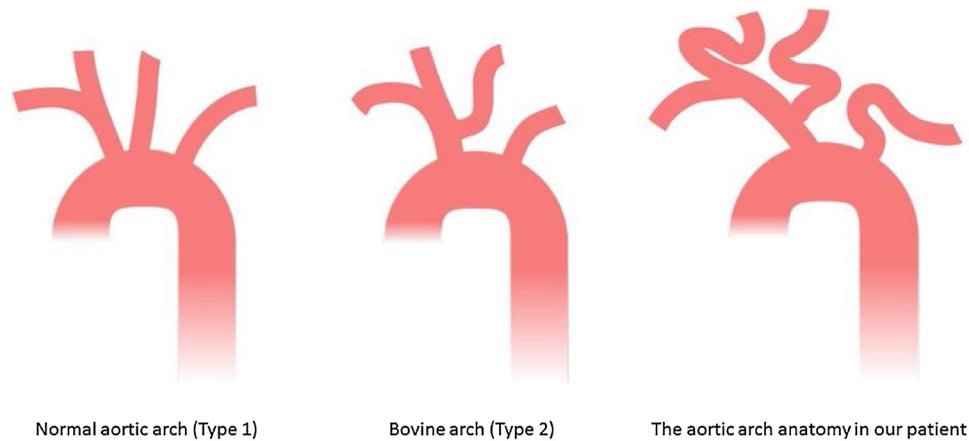


Figure 4 Model illustration of the variant anatomy in the studied case.

Yildiz S et al.: bilateral CCA tortuosity and bovine arch.¹⁵ However, the sharp angles formed by the CCA in our patient define its anomaly as kinking rather than tortuosity. Besides, the presenting complaint was a pulsatile neck swelling with no dysphagia. The two cases reported with kinking had similar neck masses.^{9,10}

The prevalence of RCCA affection was historically explained by the lower origin of the left CCA with a longer length and less liability to kinking.⁸ The bilateral distribution was encountered only in our case and the case reported by Yildiz S et al.,¹⁵ and both of them had an associated bovine arch pattern. This might be explained by the higher origin of the LCCA as it arises from the brachiocephalic trunk so that the length of the artery will occupy a shorter space, making it prone to kink (Fig. 4).

The studied patient did not receive a specific medical or surgical treatment, considering the benign nature of the condition and absence of any compression or neurological symptoms; this is consistent with Chen P-J et al.⁹ Still, she required followup by regular visits for the risk of development of cerebrovascular or cardiovascular complications.¹⁷

Recognition of these anomalies is vital, especially in surgical and endovascular interventions involving the arch of the aorta. Aboulhoda, B.E. et al. emphasized the importance of preoperative angiographic assessment of the aortic arch anatomy to avoid potential complications.¹⁸ Moreover, a mistaken diagnosis can lead to life-threatening consequences. Chen P-J et al. described an RCCA kinking, which was inaccurately diagnosed as thyroid mass and referred for biopsy.⁹ Finally, they might explain some confusing symptoms after the exclusion of common causes such as dysphagia, syncope, and TIAs.^{5,6}

Other positional variants have been reported to cause pulsatile neck mass, B.L. Wong et al. encountered a case of high-riding brachiocephalic trunk presenting with a pulsatile neck mass.¹⁹ A similar presentation was associated with a cervical aortic arch, as the case recorded by Rao D.P. et al.²⁰

Conclusion

Although rare, CCA kinking should be considered in the differential diagnosis of a pulsatile neck mass. The condition

might coexist with a bovine arch pattern, increasing the complexity of the aortic arch anatomy, which may represent an obstacle during certain surgical and endovascular interventions; therefore, adequate preoperative planning is mandatory. The condition is benign and requires no specific treatment as long as it does not produce complications.

Conflicts of interest

The author declares no conflicts of interest.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at <https://doi.org/10.1016/j.bjorl.2020.11.003>.

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