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## Case Report

# Bilateral kinking of extracranial part of internal carotid artery with coiling and tortuosity of external carotid artery

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### ABSTRACT

**Background:** A rare anatomic anomaly known as the twisted carotid artery is characterized by vascular elongation that results in an altered path. It could be an unexpected finding or have symptoms that are clinically noteworthy. The internal carotid artery or, less frequently, the common carotid artery is the most typical site. Additionally, bilateral tortuous carotid arteries may develop, resulting in "kissing carotids," a condition in which the carotid arteries are opposed one another.

**Case Description:** This case report describes the bilateral presence of numerous loops in the exterior and internal carotid arteries of an adult 65 years old male cadaver.

**Discussion and Conclusion:** These loops may cause a reduction in blood flow to certain areas of the head and neck. It is essential for understanding these unusual loops for different surgical procedures. The aim of this paper is to enlighten physicians about the variations in these variants' etiology, anatomical characteristics, and associated clinical implications.

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## 1. Introduction

The principal bilateral arteries in the head and neck are the common carotid arteries (CCA). Furthermore, the primary sources of blood flow to the head and neck are the CCA and its terminal branches, the internal carotid artery (ICA) and the external carotid artery (ECA). The brachiocephalic trunk on the right and the aortic arch on the left are the sources of the common carotid artery. It splits into the ECA and ICA on either side at the level of the thyroid cartilage, situated between the third and fourth cervical vertebrae.<sup>1</sup> ICA is the larger terminal branch of the CCA, it enters the carotid canal near the base of the skull after ascending vertically within the carotid sheath. At the base of the brain, it splits into the anterior and middle cerebral arteries after passing through the cavernous sinus in the cranial cavity. ICA supplies blood

to the brain, eye, and internal ear. Its course in neck is straight but it may be angled, curved or straight.<sup>2,3</sup>

Tortuosity in the carotid artery system is less prevalent than variations in its branching and termination patterns. The tortuous CCA has been related to an increased risk of damage during neck-regional surgical operations, and these injuries typically arise during tracheotomy.<sup>4</sup> However, significant ECA tortuosity is also hazardous during procedures in the cervical region.<sup>5</sup>

Its documented variants include coiling, looping, kinking, or tortuosities, which may cause significant neurovascular issues due to alterations in blood flow dynamics.<sup>6</sup> The carotid arteries' variations may result from anomalies in the embryo i.e. lack of embryonic absorption of the upper intersegmental artery or the third aortic arch.<sup>7,8</sup> It may result in S or C-shaped elongations, kinkings, tortuosities and loops of the ICA.<sup>9</sup> ICA looping or tortuosity can also be seen with advancing age.<sup>10</sup>

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Kinking and looping of ICA leads to carotid occlusions.<sup>11</sup> Faries et al. attributed a high rate of carotid stenosis with a high incidence of stroke, the third leading cause of death in the US. Traditionally, these occlusions required surgical procedures using constantly evolving approaches that depend on the latest research in a variety of fields, such as the developmental biology of vascular abnormalities, both congenital and acquired.<sup>12</sup>

Coulson described ICA looping as pulsatile swelling in the neck.<sup>13</sup> Concerns with looping of ICA have been raised by otolaryngologists due to the possibility of lethal haemorrhage resulting from damage caused by tonsillectomy or adenoidectomy.<sup>14</sup>

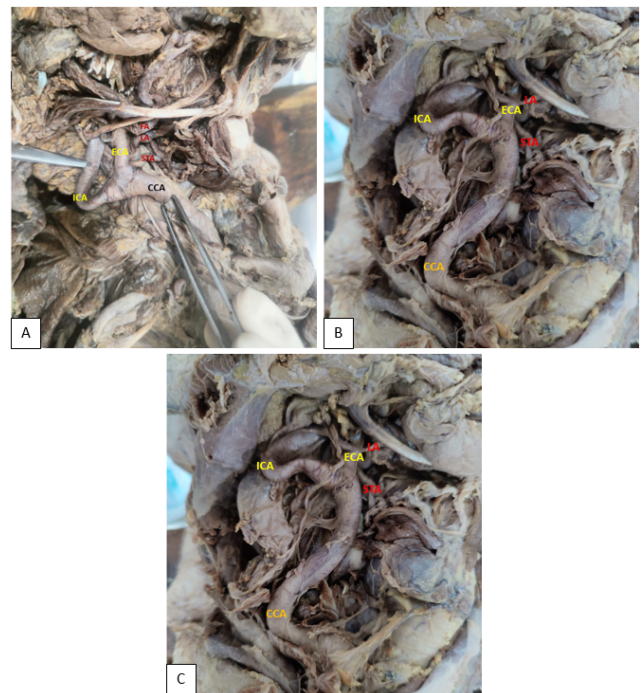
These variances are essential for clinical diagnosis, for neck operations, and for carotid angiography procedures.<sup>6</sup> We have discovered a noteworthy turn in the internal and external carotid artery's neck route that may have clinical significance.

## 2. Case Report

In this case, we report bilateral occurrence of multiple loops along the length of both the external and internal carotid arteries in an adult male cadaver's neck (Figure 1), aged about 65 years, donated to the department of anatomy for the purpose of education and research. At the level of the upper border of thyroid cartilage, the CCA split into two branches. The internal carotid traverses upward through the carotid sheath before entering the skull via the carotid canal. It begins very superficially in the carotid triangle of the neck, where it lies behind and lateral to the ECA. The sternocleidomastoid muscle overlaps it, and the deep fascia, platysma, and integument cover it. It then goes behind the parotid gland, where it is crossed by the hypoglossal nerve, digastric as well as stylohyoid muscles, and the occipital and posterior auricular arteries. Pharynx, ascending pharyngeal artery and superior laryngeal nerve are located medially. At its origin, the ECA is closer to the midline than the ICA, and it is also situated within the carotid triangle. Then it follows a slightly curved path. It first moves upwards and forward before sloping laterally and backwards to pass midway between the mastoid tip and the mandibular angle. Lastly, it splits into the superficial temporal and maxillary arteries within the parotid gland behind the mandible's neck. The ICA is located lateral to it, at the bottom part of its path. Superior thyroid, ascending pharyngeal, lingual, facial, occipital, posterior auricular, superficial temporal and maxillary arteries are the branches of ECA.

## 3. Discussion

The carotid arteries emerge embryologically from the third aortic arch and the dorsal aorta. Early ECA development first manifests as a sprout that emerges headfirst from the aortic sac around the ventral end of the third arch artery.



**Figure 1:** Bilateral looping of carotid arteries, (A) Kinking of internal carotid artery on right side, (B) Looping of common carotid, internal carotid and external carotid artery on right side, (C) Looping of common carotid, internal carotid and external carotid artery on left side. CCA: Common carotid artery, ICA: Internal carotid artery, ECA: External carotid artery, STA: Superficial temporal artery, LA: Lingual artery, FA: Facial artery

The third arch artery becomes the proximal portion of the ICA, while the CCA results from an expansion of the region around the aortic sac.<sup>15</sup> The dorsal aortae are extensions of the ICA that continue on the cranial side of the third aortic arches.<sup>1</sup> The path of ICA is typically straightened by the eighth week of development, when the dorsal aortic root descends thorax. It has been speculated that congenitally twisted or aberrant ICA results from inadequate carotid artery straightening, which allows the embryonic angulation to continue.<sup>16,17</sup> Prior to any neck surgery, consideration of the altered relationship between ICA and ECA at the site of origin is crucial in order to prevent challenges after the procedure.<sup>15</sup> The ECA was observed anterolateral to the ICA at the bifurcation of the CCA in a case reported by Manupati et al.<sup>18</sup> Another research found that 4.3% of instances had ECA positioned laterally.<sup>19</sup> Paulsen et al. (2000) characterised variations in the course of ICA as follows: a) an extension in the form of a "S" or "C" with a displacement to the medial, lateral, or ventrodorsal side, b) arterial coiling that give the appearance of two loops, c) an unwavering path to the skull's base, d) a twisting of one or more parts.<sup>20</sup> Agarwal and Agarwal described a rare instance of retropharyngeal tortuous right ICA at the level of the second cervical vertebrae.<sup>17</sup>

In the present case, unusual kinking of extracranial part of ICA with tortuosity of ECA was observed on Both sides. The diagnosis of such variations in people, especially youngsters, must always be anticipated in order to avoid disastrous effects following surgical procedures such as adenotonsillectomy.<sup>21</sup> Computed tomography, doppler ultrasonography, angiography, and magnetic resonance angiography imaging can be used to examine the course, calibre, contour to minimise the risk of inadvertent hemorrhagic consequences associated with carotid vessel alterations.<sup>22</sup> While ICA curvature has been linked to the natural ageing process and does not appear to be directly connected to a pathologic or congenital aetiology. Kinking of the ICA is associated with atherosclerotic change and fibromuscular dysplasia. The afflicted individuals are elderly people who are predisposed to cerebrovascular damage such as thrombosis and cephalic ischemic events.<sup>16,20</sup> Loop formation is a congenital abnormality of particular relevance in children. Because of the risk of harm during any surgical treatment, the loop is known as the "dangerous loop" when it is located near the pharyngeal wall.<sup>22</sup> It is essential for surgeons and radiologists to be aware of these variances before performing a surgical procedure in the neck area.

#### 4. Conclusion

Certain parts of the head and neck may have a decreased flow of blood as a result of these loops. Understanding these peculiar loops is crucial for procedures like radiographic, surgical, therapeutic, and diagnostic. The topographical architecture and specificity of the observed variation of the ICA and ECA may provide valuable guidance to radiologists and vascular surgeons. It can aid in the prevention of diagnostic errors, the influence of surgical and interventional techniques, and preventing the development of surgical complications during head and neck surgery. Because ICA variants can be asymptomatic, extra precautions must be taken even during common surgical procedures like as tonsillectomies, adenoid ectomy, and other head and neck surgeries.

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#### 6. Conflict of Interest

None.

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