

## Transposition of External and Internal Carotid Arteries: Clinical Significance

S. D. Jadhav\*, B. R. Zambare\*\*

### Abstract

The arteries of the human body show a large number of variations. In literature, many reports are available regarding variations of carotid arteries and their branches. Present paper describes a case of transposition of external and internal carotid arteries. Initially, the internal carotid artery was medial to external carotid artery at the bifurcation of the common carotid artery, while ascending upward the internal carotid artery passes behind the external carotid artery and ultimately entered the carotid canal. Such variations are important for surgeons and radiologist.

**Keywords:** External Carotid Artery; Internal carotid Artery; Transposition; Variation.

### Introduction

Anatomy texts describe that the internal carotid artery (ICA) lying behind or postero-lateral to the external carotid artery (ECA) in 88% of cases [1]. Many variations including high origin of ECA and ICA, aberrant branching patterns of ECA, absences of ECA or lateral position of ECA have been described in literature [2]. Few cases have been reported the transposition of external and internal carotid arteries in the medical literature. Angiographic and ultrasound examinations of these arteries revealed the incidence of transposition between 4% and 12% [3, 4, 5]. This is due to an absence of stringent criteria for defining the degree of rotation of the carotid bifurcation required to consider the ECA as lying lateral to the ICA. Definition of a laterally positioned ECA is that when the superior thyroid, lingual and facial branches of ECA should cross and cover the ICA, with the ECA lying posterior or postero-laterally to the ICA [6].

Vascular variations are common. Aging of arteries

**Author's Affiliation:** \*Associate Professor, \*\*Professor and HOD, Department of Anatomy, Padamashree Dr. VithalraoVikhePatil Foundations Medical College, Ahmednagar, Maharashtra, India.

**Corresponding Author:** Surekha Dilip Jadhav, Associate Professor, Department- Anatomy, PDVVPF Medical Collage, Vadgaon -Gupta (Viladghat) Post: M.I.D.C., Ahmednagar, Maharashtra, India, Pin: 414111.

E-mail: [drsurekhadjadhav@gmail.com](mailto:drsurekhadjadhav@gmail.com)

and earlier appearance of cerebrovascular diseases are more common when arteries show anomalies and variations [7]. Morphological variations of the external and internal carotid arteries are responsible for insufficiencies of cerebral vascularization in 10-15% of cases [8, 9]. Knowledge on the anatomical variations of the ECA and ICA is necessary for the correct interpretation of different radiological procedures, clinical examination and surgical procedures. Transposition of ICA and ECA may have important surgical and clinical implications, especially in terms of the incidence of cranial nerve damage.

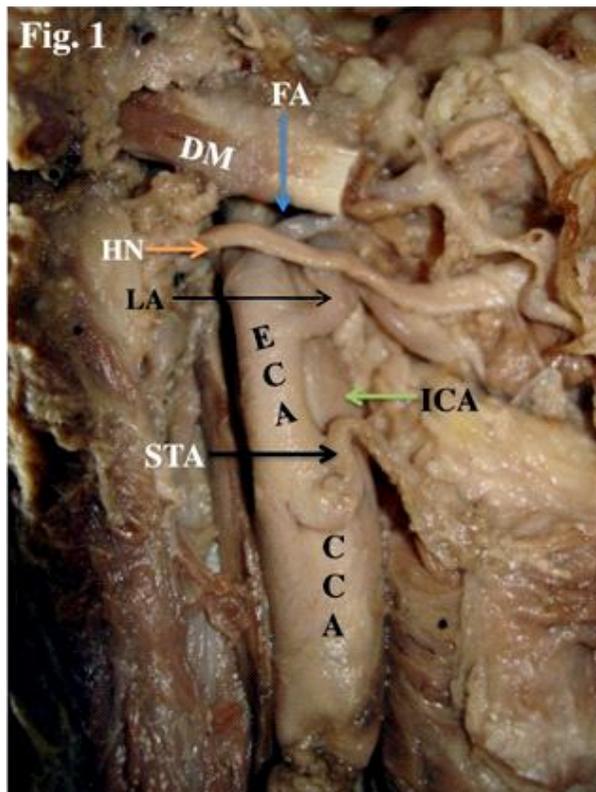
### Materials and Methods

In the Department of Anatomy, PDVVPF'S Medical College, We observed a transposition of internal carotid and external carotid arteries during dissection of neck of a 46 year old male cadaver. The right anterior triangle of neck was dissected carefully bilaterally and different structures were identified. Photographs were taken.

### Cases Report

We observed a variation in the position and course of the external and internal carotid arteries on the right side of the neck. The internal carotid artery was medial and posterior to the external carotid artery

(Fig. 1). Initially, the ICA was medial to ECA, while ascending upward the internal carotid artery passes behind the ECA and ultimately entered the carotid canal. The superior thyroid artery, lingual artery and facial arteries were found to branch out from the anterior aspect of the ECA and to cross the internal carotid artery superficially. The internal jugular vein was removed for better exposure which was present lateral to ECA. The hypoglossal nerve was crossing the loop of lingual artery and origin of facial artery (Fig. 1). On the left side, the internal and external carotid arteries and internal jugular vein followed their usual relation and course.



**Fig. 1:** Showing Transposition of External and Internal Carotid Arteries

FA- Facial artery; DM- Digastric muscle; HN- Hypoglossal nerve; LA- Lingual artery, ECA- External carotid artery; STA- Superior thyroid artery; CCA- Common carotid artery; ICA- Internal carotid artery.

## Discussion

Handa et al mentioned that the first description of the lateral position of the ECA was reported by an anatomist Hyrtl in 1841 [10]. According to Zumre et al. that excessive mediolateral migration of the ECA during embryogenesis is the cause of the lateral ECA. Also, he stated that a secondary cause may be age-related elongation and tortuosity of the carotid arteries due to atherosclerosis [11]. Jasmindelæ et al. studied

the positional variations of the external and the internal carotid artery by using MRI angiography and found 4 different types [12]:

Type-1 ECA in its initial part is placed medially and goes to the front side of the ICA in 90% of cases.

Type-2 In 7% of cases, the right ECA is placed laterally from the ICA. Symmetric (bilateral) lateral position of the ECA in relation to the ICA was found in 2% of cases.

Type-3, The ICA (medially) and ECA (laterally) go away from each other, without crossing, (Divergent position) was found in 1% of cases.

Type-4, In 1% of cases the right ECA and the right ICA cross two times.

Incidence of lateral position of ECA was studied by few researchers and they reported its incidence in 4.9% cases and its occurrence is more on right side [4]. Agarwal and Agarwal reported a rare case of retropharyngeal tortuous right ICA [13]. In literature, there are few reports about peripheral hypoglossal nerve palsy which were due to laterally placed ECA [4]

In the present case, the ECA was placed lateral to the ICA at origin and in their subsequent course the ICA pass behind the ECA which is dangerous situation. Transposition of ECA and ICA is a dangerous variation. Such variations are recognized accidentally or during cadaveric dissection because most affected people are asymptomatic and no treatment is necessary [14]. During bleeding from terminal branches of ECA occasionally it is necessary to consider ligation of the artery. It is very important to ensure that the artery being ligated must be the ECA rather than internal carotid as ligation of latter causes a high risk of hemiparesis.

Precise knowledge of the position of the ECA and ICA is essential for surgeons and radiologists to undertake a various surgical and radiological procedure in the neck region. Correct diagnosis of these cases can be made by intravenous digital subtraction angiography (IVDSA) and Doppler scanning, ultrasound scanning or magnetic resonance imaging scan [15].

## Conclusion

The ECA and ICA are the main arteries of the head, neck and brain region. Therefore, it is essential to understand the precise knowledge of surgical anatomy and variations of these arteries to carry out various surgical and interventional radiological procedures and to minimize intra and post-operative

complication. This case report describes the transposition of ECA and ICA which will provide knowledge to surgeons for clinical examination and surgical procedures and radiologist for the correct interpretation of different radiological procedures.

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