

## SHORT REPORT

# Lateral External Carotid Artery: Implications for the Vascular Surgeon

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*The internal carotid artery (ICA) usually lies posterolaterally to the external carotid artery (ECA) beyond the carotid bifurcation. Unusual conformations of these arteries have received little attention in the literature. Two cases of lateral ECA (LECA) were identified during cadaveric dissection which would have limited access to the ICA during carotid endarterectomy (CEA). ICA exposure during CEA in cases of LECA is challenging requiring care to avoid hypoglossal or internal laryngeal nerve injury. Circumferential dissection and medial mobilisation of the ECA provides suitable exposure for CEA.*

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## Introduction

Although the carotid bifurcation is usually located between C3 and C4 inter-individual variation is well documented. Similarly, aberrant branching patterns are common and may cause difficulty in accurate ICA identification during CEA.<sup>1</sup> Further, if the relative positions of the ICA and ECA beyond the bifurcation are transposed this may have profound surgical implications.

Most contemporary anatomy texts state that the ICA lies posterior or posterolateral to the ECA although earlier publications, such as the 1918 edition of Gray's Anatomy concede that the ICA "has been found to be placed nearer the middle line of the neck than the external carotid."<sup>2</sup> This report describes two cases of a lateral external carotid artery (LECA) and discusses appropriate surgical management of this anomaly during CEA.

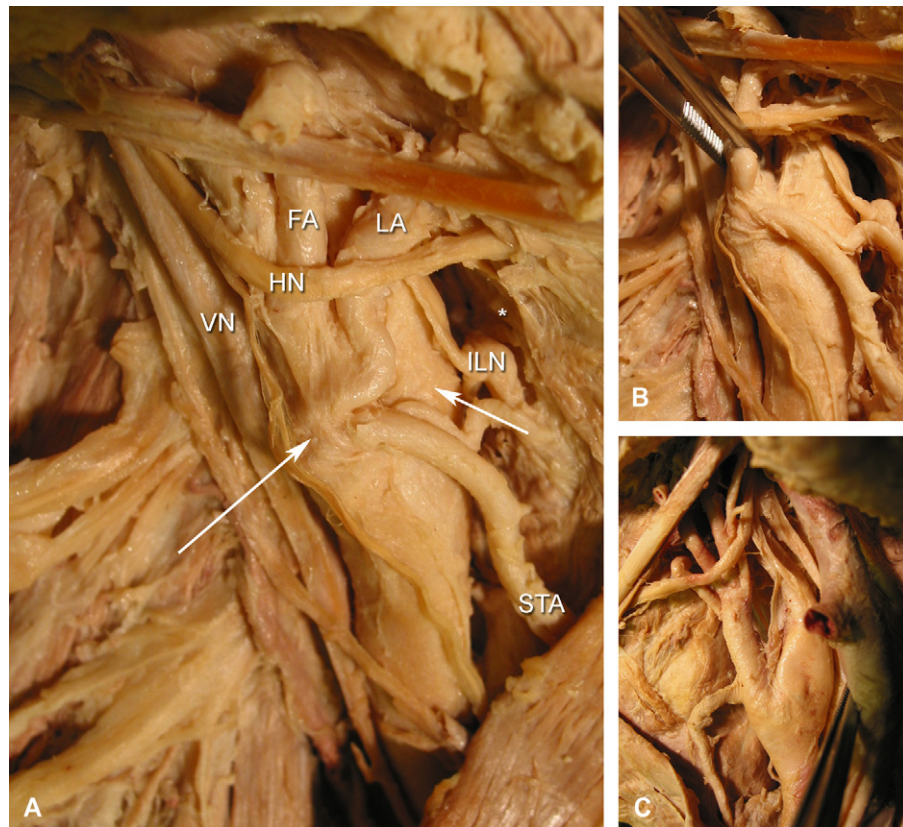
## Report

Neck dissection of four formaldehyde fixed human cadavers was performed as part of a BSc project. In 2 cadavers (aged 82 and 83) a LECA was identified on the right. In this conformation, the superior thyroid, lingual and facial branches of the ECA coursed medially, crossing and partially obscuring the ICA thus potentially limiting surgical access to the vessel (Fig. 1A). The hypoglossal nerve (HN) passed lateral to the ECA before passing deep to the digastric tendon. Lateral retraction of the ECA and its branches to improve ICA exposure placed the nerve under tension. Further, the internal laryngeal nerve (ILN) was at risk of injury since it lay directly over the ICA (Fig. 1B). In both cadavers configuration of the contra-lateral carotid arteries was normal (Fig. 1C).

## Discussion

Handa *et al.*<sup>3</sup> credit the first description of this anomaly to the anatomist Hyrtl in 1841. Whilst

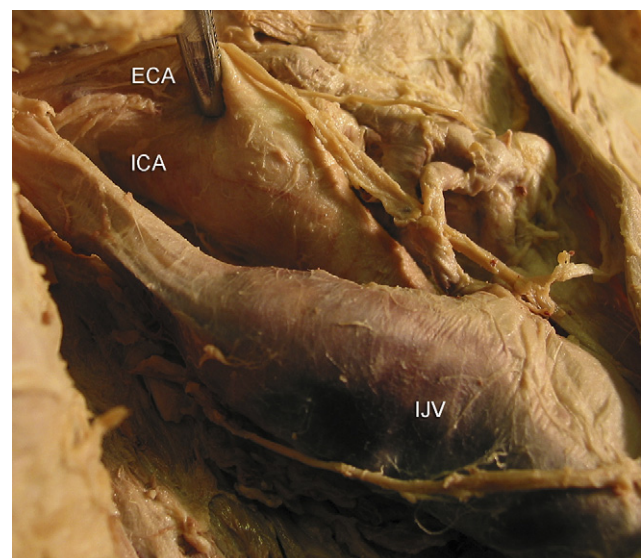
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**Fig. 1.** Anatomy of lateral external carotid artery. A) The external carotid artery (long arrow; ECA) is located lateral to the internal carotid artery (short arrow; ICA). The superior thyroid (STA), lingual (LA) and facial (FA) arteries pass antero-medial to the ICA. The hypoglossal nerve (HN) loops around the antero-lateral portion of the ECA and the internal laryngeal nerve (ILN) lies anteriorly on the ICA; the greater horn of hyoid is also in close proximity (\*). The vagus nerve (VN) is placed posteriorly. The internal jugular vein has been removed in this specimen. B) Retracting the ECA laterally reveals the ILN, which courses postero-medially beyond the hypoglossal loop, which itself placed under tension. C) The contralateral carotid arteries were orientated normally.

excessive medio-lateral ECA migration during embryogenesis may be responsible for this anatomical variation it may also be age related, secondary to elongation and tortuosity of atherosclerotic carotid arteries.<sup>4</sup>

Despite the prevalence of LECA in these cadavers, a literature search yielded only three case reports.<sup>3,5,6</sup> In contrast, angiographic and ultrasound studies have suggested an incidence of 4–12.3%, most often on the right.<sup>6</sup> This increases to 16.4% in patients aged >60 years. However, the degree of rotation necessary before the ECA can be considered 'lateral' is subject to author bias and in the absence of stringent criteria a definitive estimate of LECA incidence remains elusive. Regardless, rotation which distorts the carotid anatomy sufficiently to hamper accurate identification and subsequent access to the ICA is of relevance to surgeons performing CEA.



**Fig. 2.** Achieving adequate exposure for carotid endarterectomy in patients with LECA. Circumferential dissection of the ECA allows mobilisation and medial retraction of this artery allowing access to the lateral ICA.

When this anomaly is encountered during CEA recognition is crucial in order to preserve the hypoglossal and internal laryngeal nerves during ICA exposure. This is facilitated by circumferential ECA dissection and medial mobilisation to reveal the lateral surface of the ICA (Fig. 2). The vagus nerve, located deep to the ECA, must also be identified and preserved, when performing this dissection.

In summary the LECA may not be as uncommon as once thought, particularly in an elderly population with atherosclerotic disease. Vascular surgeons should be aware of this anomaly so that the surgical technique can be appropriately adjusted to allow safe CEA, avoiding unnecessary nerve injury.

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