Embolization in the External Carotid Artery

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The technical skill set of peripheral interventional radiologists is well-suited to the performance of most transcatheter embolization procedures in the external carotid artery (ECA). These procedures center in large part on hypervascular tumors, epistaxis, and trauma. ECA embolization in the trauma patient is well-defined, albeit in small patient series. The transcatheter treatment of epistaxis is still mostly reserved for cases that are intractable to conservative therapy. Preoperative embolotherapy for vascular tumors remains popular, although it is somewhat controversial in terms of its risk–benefit ratio. The purpose of this review is to highlight pertinent anatomy, selected technical procedural aspects, and the available literature to better characterize the role of ECA embolization in the hands of the practicing peripheral interventionist.

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Abbreviations: ECA = external carotid artery, ICA = internal carotid artery, IMA = internal maxillary artery, JNA = juvenile nasopharyngeal angiofibroma, MMA = middle meningeal artery, PVA = polyvinyl alcohol

THE external carotid artery (ECA) is anatomically complex, providing the blood supply to the extracranial head and neck and most of the meninges intracranially. Despite this significant arterial network, angiography is presently reserved almost completely as a precursor to highly anticipated transcatheter intervention. ECA intervention is almost exclusively performed in the form of embolotherapy except in unusual situations such as revascularization for atherosclerosis and transcatheter chemotherapeutic instillation, with the latter showing promising results but still limited to experimental protocols at this stage (1). Transcatheter embolization is likewise limited to relatively few situations. However, because many of these situations are emergent/urgent or preoperative situations in which the surgery is widely performed, intervention in the ECA should be a skill set for not only neurointerventionists, but also peripheral interventionists. The purpose of this review is to provide an outline of ECA embolization procedures, including technical aspects, results, and possible complications. This review is limited to urgent and preoperative situations and does not include the vast array of arteriovenous malformations and, in particular, intracranial malformations involving the dural and cavernous sinuses. Extracranial arteriovenous malformations of the ECA are treated much like those in the peripheral circulation, which also takes a special skill set, and is beyond the scope of this review. The review will begin with a discussion of the pertinent arterial anatomy, followed by a focused description of the technical aspects of these procedures, and then by a discussion of intervention in the particular disease entities.

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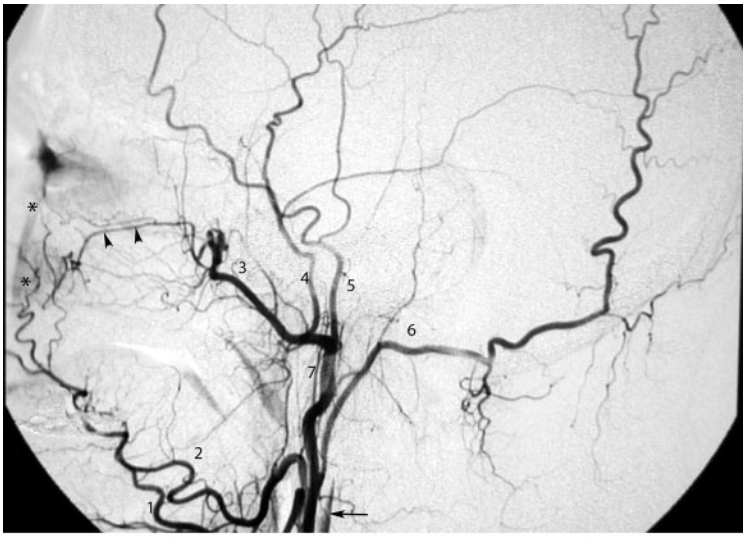
ECA Anatomy

An understanding of the anatomy of the ECA is essential for safe and effective endovascular therapy and is the subject of extensive reviews in several excellent texts. The ECA originates from the bifurcation of the common carotid artery and lies anterior to the internal carotid artery (ICA) in 94% of patients (2). The short trunk of the common ECA progressively decreases in size as it gives rise to eight branches, terminating in the largest of those, the internal maxillary artery (IMA) (**Fig 1**). The anatomy of the ECA is quite variable and is best considered on a functional basis. In particular, when one artery is small, that area is then supplied by an enlarged neighboring branch. Such variations are important when endovascular therapy is considered.

The first branch of the ECA is traditionally the superior thyroidal artery, which arises anteriorly and courses inferiorly to supply the larynx and thyroid gland. It is rarely involved in interventional procedures. The second branch of the ECA is the lingual artery, which arises anteriorly and consists of two portions: a posterior carotid segment and an anterior lingual segment. The former supplies the hypoglossal region, which is important in endovascular terms for tumors



a.

b.

Figure 1. Anteroposterior and lateral angiograms of the ECA. **(a)** Lateral view of ECA shows occlusion of ICA (arrow). This lateral view nicely demonstrates the infraorbital artery (arrowheads) from the IMA (*3*). Branches of the distal facial artery (asterisk) demonstrate how this vessel contributes supply to the nasal cavity participating in epistaxis (*1*, lingual artery; *2*, facial artery; *3*, IMA; *4*, MMA; *5*, superficial temporal artery; *6*, occipital artery; *7*, ascending pharyngeal artery). **(b)** Frontal view of ECA in the same patient demonstrates that most vessels are overlapped in this view except for the distal IMA, particularly the sphenopalatine artery (arrow). Arrowhead shows distal branches of the facial artery (*1*, MMA; *2*, occipital artery).