

Anatomical Variations in the Superficial Temporal Artery for the Neurosurgeon: A Review of the Literature

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Learning Objectives

The superficial temporal artery branches over the zygoma, with the frontal branch dominant over the parietal. Cadaveric studies consistently overestimate arterial diameter compared to radiographic studies.

Introduction

The superficial temporal artery (STA) is an important branch of the external carotid for the neurosurgeon: it lies directly over the pterional entry zone and is often damaged, intentionally or otherwise. Furthermore, the STA is a favored afferent for EC-IC bypasses, and it is prudent to preserve it when possible. In this review, our aim is to discuss the relevant morphological characteristics of the STA when considering its preservation and use for microsurgical anastomosis: the vessel's caliber and branching pattern.

Methods

We reviewed the English literature using the PUBMED database through January 2017 for anatomical studies of the STA through either cadaveric or radiological methods. Studies which recorded the branching location relative to the zygoma and the diameter of the STA and branches were included.

Results

A total of 15 studies met our criteria. Together, 161 cadavers were evaluated for patency and anatomical relations. All specimens had an intact STA with over 85% of samples having a frontal branch and 82% having a parietal branch with a diameter over 1mm (figure 1). The mean diameter of the STA and branches were larger in cadaveric specimens compared to radiologic samples (p = 0.012). Across all groups, the frontal branches had larger diameters than the parietal branches (p = 0.032). The STA consistently branched above the zygoma (40 - 90.4% of samples) independent of study method (p = 0.26) (figure 2).

Author	Study design	STA		Bifurcation		Frontal branch		Parietal branch	
		Atrophic	Patent	Atrophic	Patent	Atrophic	Patent	Atrophic	Patent
Stock et al 1980 (N = 50)	cadaveric	0%	100%	4%	96%	6%	84%	10%	90%
*Atamaz Pinar et al 2006 (N = 27)	cadaveric	0%	100%	•	•	11%	89%	22%	78%
Raducu et al 2006 (N = 52)	radiographic					14%	86%	23%	77%
Menovsky et al 2016 (N = 32) Atrophic ^{**} describes v escribes any vessel o	radiographic essel with diamete f diameter 1 mm o	0% er <1 mm at th r larger as me	100% at location a asured in the	- and includes 2 study. * - th	- vessel not p is study us	• resent for br 2d 1.5 mm as	anches, an the cutoff	- d "patent"	

Author	Study design	Sample size	STA	Frontal Branch	Parietal branch
Stock et al 1980	cadaveric	29	2.03 ± 0.33	1.74 ± 0.51	1.83 ± 0.34
Marano et al 1985	cadaveric	50	2.2 (1-5)		-
Chen et al 1999	cadaveric	52	2.14 ± 0.45	1.61 ± 0.19	1.68 ± 0.21
Atamaz Pinar et al 2006	cadaveric	27	2.73 ± 0.51	2.14 ± 0.54	1.81 ± 0.45
Tayfur et al 2010	cadaveric	26	2.5*	2.0 ^b	1.8 ^b
Stock et al 1980	radiographic	25	1.89 ± 0.68	1.38 ± 0.4	1.29 ± 0.5
Kim et al 2013	radiographic	70	1.9 ± 0.8	1.4±0.4	1.4±0.5
Medved et al 2014	radiographic	93	2.4 ± 0.6	1.3 ± 0.6	1.2 ± 0.4
Kuruoglu et al 2015	radiographic	53	2.6 ± 0.2	1.8 ± 0.3	1.5 ± 0.2
Raducu et al 2015	radiographic	52	1.9 ± 0.5	1.4 ± 0.5	1.3 ± 0.6

Author	Study Design	Below zygoma	At zygoma	Above zygoma	None		
Stock et al 1980 (N = 25)	cadaveric	8%	32%	60%			
Marano et al 1985 (N = 50)	cadaveric	-	8%	88%	8%		
4bul-Hassan et al 1986 (N = 30)	cadaveric	-	5%	90%	5%		
Chen et al 1999 (N = 52)	cadaveric	9.6%	3.8%	86.5%	-		
Atamaz Pinar et al 2006 (N = 27)	cadaveric		22.2%	74.1%	3.7%		
Mwachaka et al 2009 (N=30)	cadaveric	6.7%	13.3%	80%			
Tavfur et al 2010 (N - 26)	cadaveric	38%		62%			
Kuruoglu et al 2015 (N = 53)	radiographic	2%	58%	40%			
Kim et al 2013 (N=70)	radiographic	7.1%	10%	81.4%	1.4%		
Raducu et al 2015 (N =52)	radiographic	3.8%	5.8%	90.4%			
Medved et al 2014 (N = 93)	radiographic	3.3%	26.2%	60.3%	10.2%		



Among patients with an atrophic branch, the parietal branch is significantly more likely to be small compared to the frontal branch.



In the majority of instances, the STA branches above the zygoma (left), while a minority branch at or below the zygoma (right).

Conclusions

The morphological patterns of STA distribution are similar across the reviewed literature. Cadaveric studies consistently overestimate the caliber of the STA in comparison to radiological studies, likely due to post-fixation artifacts and differences in measurement methods. The frontal branch, when reported, is significantly dominant over the parietal branch of the STA, and both branches have diameters greater than 1mm, which is accepted as an appropriate caliber for arterial bypass.

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