



## Original Article

## Study of Anatomical Divergences in Facial Artery Endings

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## ABSTRACT

Facial artery supplies musculocutaneous tissue, visceral organs, and salivary glands at the upper cervical and facial level. This artery has wide range of anatomical variations in its course. **Objective:** To find the anatomical divergences in facial artery endings. **Methods:** It is a cross sectional study conducted at Jinnah international hospital, Abbottabad from January 2023 to July 2023 for duration of 6 months after taking approval from the ethical review committee. A group of 86 people were selected and anatomical course of facial artery was categorized in to four types. Angiographic images of each participant were evaluated by radiologist to categorize the course of facial artery. **Results:** The average Body Mass Index (BMI) of the participants was 28.3 ± 5.6. The study of angiographic images has concluded that 38.37% (n=33) has Type I course of facial artery, 47.67% (n=41) participants has Type II, 9.3% (n=8) participants has Type III and 4.65% (n=4) has Type IV category (p=0.01). Of the type I category of facial artery, 5 (15.2%) participants met the criteria of type IA, 7(21.2%) has Type IB and 21(63.6%) participants Type IC course of facial artery (p=0.01). **Conclusions:** This study has concluded that there exists vast variation in the anatomical course of facial artery in local population that streamlines with other studies conducted internationally. Facial artery with a nasal branch with or without alar endings is the most common anatomical variation.

## INTRODUCTION

The human face is a complex anatomical area with a vast network of blood vessels that are vital to the tissues' nutrient and oxygenation. Facial artery supplies musculocutaneous tissue, visceral organs, and salivary glands at the upper cervical and facial level [1]. Thomas Turner (1793-1873) laid the scientific foundation for accurate anatomical study of the facial artery, which plays a crucial role in facial anatomy and maxillofacial and vascular surgery [2]. It is crucial to know the details of the branching pattern and variations in termination of the facial artery not only for surgical procedures in cosmetic and reconstructive surgery, but also for understanding the underlying anatomical differences that may impact clinical results [3]. The high changeability in spreading patterns,

course, and profundity of facial artery, makes it difficult to ensure wellbeing during negligibly obtrusive injectable systems [4]. Additionally, huge varieties in orientation in fanning and conveyance of facial artery, interregional differences in distance across and thickness likewise exists that ought to likewise be considered [5]. Physical studies investigating the varieties in the endings of the facial artery have been reported in the clinical writing, but with differing accentuation and approaches. In the ordinary pattern, the facial artery ends by bifurcating into the unrivaled and sub-par labial corridors. The prevalent labial artery supplies the upper lip, while the sub-par labial artery gives blood to the lower lip. Nonetheless, in certain occurrences, the facial artery end can appear as an

unrivalled labial artery with a little parallel nasal artery branch, and a pre-masseteric branch with little branches starting from the infraorbital artery [6]. Varieties might happen in the fanning pattern of the facial artery as it moves toward the lips. Rather than bifurcating straightforwardly into predominant and mediocre labial veins, the facial artery might radiate extra branches or gap into numerous more modest vessels prior to arriving at its last objective. Studies have uncovered that Facial artery ends most often as the precise artery with a prevalence of 82%. Different variations of facial artery incorporate horizontal nasal artery that has a prevalence of 12%, unrivalled labial and alar artery with a prevalence of 3% of cases each, and pre masseteric in 18% of the cases [7]. These accessory arteries can contribute to the blood supply of adjacent structures in the facial region, such as the muscles, skin, or glands. Studies have found three pre-masseteric branches of the facial artery were observed in an elderly male cadaver [8]. There also exists unilateral variation in the anatomy and course of facial artery. A case report has revealed that the right facial artery can have an anomalous course through the submandibular salivary gland and form a redundant loop at the base of the mandible, potentially impacting upper neck and face surgeries [9]. In some cases, the facial artery may exhibit anomalous connections or communications with other arteries in the facial region. These anomalous connections can alter the normal distribution of blood flow and may have clinical implications in certain medical procedures or pathological conditions. A unique anastomosis exists between facial and inferior alveolar arteries, providing valuable information for oral and maxillofacial surgeons and dentists performing inferior alveolar nerve blocks [10]. While the facial artery primarily arises from the ECA, collateral connections between the branches of the ECA and ICA can occur. These connections, known as the "rete mirabile" or "wonderful network," may provide alternative pathways for blood flow to the facial region, particularly in cases of vascular pathology affecting the ECA or its branches [11].

## METHODS

It is a cross sectional study conducted at Jinnah international hospital, Abbottabad from January 2023 to July 2023 for duration of 6 months after taking approval from the ethical review committee of women medical and dental college Abbottabad Ref No: WMC Estb/19993 on date 24/10/2022. Patients with age 21 years or older, both male and female, with no known vascular abnormalities or facial deformities that could significantly alter the normal anatomy of the facial artery were included in this study. Patients with a history of vascular diseases such as arterial aneurysms, arteriovenous malformations, or arterial

stenosis and congenital or acquired facial deformities, such as craniofacial syndromes or significant trauma, were excluded from this study. A total of 132 participants were screened and after evaluation 86 patients full filled the designed criteria and they were included in this study. Assuming the total participant as the population of the study, while using 95% confidence level, 5% margin of error and 80% prevalence the final sample size was 86. The selected sample was provided detailed information about the steps and procedure involved in this study including potential risk and benefits and informed consent was taken. Complete bio data and clinical information of the patients including age, gender, ethnicity, socioeconomic status, clinical presentation and duration of symptoms were noted. Vital signs including blood pressure, pulse and temperature of every participant were noted. Functionality and calibration of the equipment was verified before the procedure. The angiographic images were acquired using fluoroscopy and Digital Subtraction Angiography (DSA) techniques. Multiple images from various angles were collected to visualize the course and branching patterns of the facial artery. The angiographic images were systematically analyzed by two radiologists to identify the divergences in facial artery endings. The anatomy of the facial artery among patients undergoing unilateral carotid angiography was assessed including effective assessment for congenital anomalies, cerebral vascular related malformations, and intra-arterial procedures, including brain cerebral artery aneurysm coil embolization, and tumor embolization, carotid artery stent graft, and cerebral artery thrombolysis. Data were entered and analyzed to identify patterns, variations, and correlations in facial artery anatomy among participants using SPSS version 24.0. It was presented as mean, standard deviation, and percentages. p-values of  $\leq 0.05$  will be considered statistically significant.

## RESULTS

Data were collected from 86 patients and the mean age was  $49.2 \pm 5.4$  years. The majority of participants were male (58.14%) while females constituted the remaining 41.86%. The average Body Mass Index (BMI) of the participants was  $28.3 \pm 5.6$ . Diabetes was present in 38.37% of individuals and 36.04% of participants reported a diagnosis of hypertension.

**Table 1:** Demographic Characteristics of Study Sample (n=86)

Variable	N (%)
<b>Age (years)</b>	
Mean $\pm$ SD	49.2 $\pm$ 5.4
<b>Gender N (%)</b>	
Male	50 (58.14 %)
Female	36 (41.86 %)
BMI (mean $\pm$ SD)	28.3 $\pm$ 5.6
Diabetes	33 (38.37%)
Hypertension	31 (36.04%)
History of Smoking	37 (43.02%)

In table 2 the study of angiographic images has concluded that 38.37% (n=33) has Type I course of facial artery which is characterized by a facial artery that has an angular branch. This angular branch terminates in the midline taking different course around the orbit. The results have also shown that 47.67% (n=41) participants has Type II course of facial artery. In this cohort, facial artery gives its branch called lateral nasal artery which terminated with or without alar branch. This was followed by third category of facial artery which was found in 9.3% (n=8) participants ( $p=0.01$ ). The fourth category of facial artery was found in 4.65% (n=4) participants with inferior labial artery as the final arterial ending.

**Table 2:** Outcomes of the Study

Variables	Type I N (%)			Type II	Type III	Type IV
	33 (38.37%)					
	Type IA	Type IB	Type IC			
<b>Results</b>	5 (15.2%)	7 (21.2%)	21 (63.6%)	41 (47.67%)	8 (9.3%)	4 (4.65%)

## DISCUSSION

The rise in aesthetic operations in recent years has resulted in an alarming rise in complications related to arterial artery and branch damage. With more people turning to cosmetic modifications to get desired aesthetic results, procedures like botulinum toxin injections, dermal fillers, and other face rejuvenation methods have become standard [12]. A case that highlights the potential dangers of blood vessel injury during corrective treatments is the facial artery, which is a huge vein that provisions the facial elements. Keeping up with blood flow to the nose, lips, and cheeks, among other face areas, is significantly subject to this artery and its branches [13]. Serious results might happen assuming the facial artery is harmed. An infusion into the facial artery or in nearness to it, for instance, may bring about vascular impediment, which compromises blood flow to the encompassing tissues [14]. Vascular trade off can impact a patient's quality of life and need costly healing measures on the off chance that it brings about tissue misfortune, scarring, and practical disability [15]. Moreover, issues like tissue putrefaction might carve out opportunity to show up, making harm to artery

structures after superficial tasks more subtle from the beginning. Hence, to limit negative results and stay away from long haul outcomes, early location and timely treatment of vascular issues are fundamental [16]. To address these worries, healthcare providers carrying out superficial methodology should have a complete comprehension of facial anatomy, particularly the vascular designs, and exercise intense watchfulness to limit the risk of blood vessel injury [17]. Despite the large number of prior studies on the morphology, locations, and courses of the facial arteries, the findings have been quite inconsistent, and there hasn't been any agreement among researchers. Moreover, some past studies have been constrained since they concentrated on cadaveric research [18, 19]. There are also vast inconsistencies present in the outcomes of the present literature further stressing the exhaustive inquiry on the deviations in the course of facial artery. An American study examining the deviations in facial artery by using facial computed tomographic angiography has revealed that in 34% of cases facial artery terminates as Type I, 40% participants has Type II categorization while 24% has shown Type III categorization. Type IV was found in only 2% of the cases [20]. The findings of the above study are consistent with the outcome of this study which increases its credibility.

## CONCLUSIONS

This study has concluded that there exists vast variation in the anatomical course of facial artery in local population that streamlines with other studies conducted internationally. Facial artery with a nasal branch with our without alar endings is the most common anatomical variation. Facial artery with inferior labial artery as the terminal branch is the least common anatomical variation in the study population

## Authors Contribution

Conceptualization: AH

Methodology: SJ<sup>1</sup>, SJ<sup>2</sup>

Formal analysis: MSK

Writing, review and editing: HI, RS

All authors have read and agreed to the published version of the manuscript.

## Conflicts of Interest

The authors declare no conflict of interest.

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