



**Human Biology Review (ISSN 22774424) www.HumanBiologyJournal.com
International Peer Reviewed Journal of Biological Anthropology
Volume 14, Number 2, April-June 2025 Issue**

Original scientific paper

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Human Biology Review, Volume 14 (2), pp. 79-87.

Revised and accepted on February 24, 2025

*Citation: Ajie, PC, Jacks, TW, Amadi-Ikpa, H, Victor, PD, Ordu, KS, Thompson BO, Emeka-Ogbugo, A and Jaja, NBR. 2025. A cadaveric study on the extracranial divisions of the facial nerve trunk in Nigeria. **Human Biology Review, 14 (2),79-87.***

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Extracranial divisions of the facial nerve trunk in Nigerian cadavers

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ABSTRACT

BACKGROUND: The facial nerve is the seventh cranial nerve. It is a mixed nerve that supplies motor and sensory innervation. Extracranially the facial nerve comes out from the facial canal in the cranium through the stylomastoid foramen. Facial paralysis is a common complication of parotidectomy because of injury to the facial nerve, therefore an understanding of its division and branching pattern in the parotid gland is essential to carry out this surgery effectively. **AIM:** To investigate the variation in the extracranial division of the facial nerve trunk in embalmed cadavers and to investigate the most frequent pattern of division. **MATERIALS AND METHODS:** 25 cadavers sourced from three gross laboratories including those of University of Port Harcourt, Choba, Rivers State University, and PAMO University of Medical Sciences. The dissection pattern used were both retrograde and antegrade dissection. **RESULTS:** In 6 cadavers (24%) the facial nerve divided before entering the parotid gland while in 19 cadavers (76%) divided within the parotid gland. The trunks in 23 cadavers (92%) bifurcated and in 2(8%) continued as a single trunks before dividing into 5 terminal branches. **CONCLUSION:** In this study, the most frequent pattern of division is bifurcation and usually within the parotid gland.

KEY WORDS: Extracranial, Bifurcation, Stylomastoid, Parotidectomy, Facial nerve, Nigerian, Cadavers

INTRODUCTION

The facial nerve (FN) is the seventh cranial Nerve. it contains the motor sensory and parasympathetic (secretomotor) nerve fibers, which provide innervation to many areas of the head and neck region including muscles of facial expressions. The extracranial course of the facial nerve and it's variable branching patterns have been subject of many of studies since the nineteenth century (Naidu and Rennie., 2020). The facial nerve trunk is the part of the facial nerve that comes

from the stylomastoid foramen to the point it bifurcated or trifurcates. The facial nerve trunk emerges from the facial canal in the cranium through the stylomastoid foramen and divides into two sub trunks (cervicofacial and temporofacial) and then divides further into five branches in the parotid gland (Sinnatamby., 2011; Moore et al.; 2014 and Naidu and Rennie., 2020). Injury to the facial nerve results in facial paralysis which is a very common complication of parotidectomy, therefore an understanding of it's division after coming out of the stylomastoid foramen and branching in the parotid gland is essential as iatrogenic injury to the facial nerve most often is seen after cervicofacialrhytidectomies, surgery of the parotid gland, acoustic neuroma resection, or tumor resection at any point along the passage of the facial nerve (Quadros et al., 2016).The facial nerve has also shown great variations with regards to number of trunks, number of divisions (viz bifurcation, trifurcation) and no branching and buccal branch origin being observed (Kawk et al., 2004; Khaliq et al., 2016; Rana et al., 2017and Pascaul et al., 2018).

There are so many works on the variations in the terminal branches of the facial nerve but there has been minimal focus on the facial nerve trunk and its point of division whether inside the parotid gland or before entering the parotid gland, therefore this study is being carried out to understand it's point of division in this region.

More so, in parotidectomy iatrogenic injuries are very common, therefore a need for cadaveric studies to understand the variations in the anatomy of the facial nerve trunk and understand it's position in the parotid gland is the next best thing. In Nigeria, there is no literature showing the variation of extracranial branches of the facial nerve trunk.

MATERIALS AND METHOD

Materials used

The following materials were used for this study: Latex disposable gloves, Blade, Scalpel, Forceps, Laboratory Coat, Embalmed Cadaver.

Method

In dissection for the facial nerve, two methods were used: antegrade dissection and retrograde dissection

Anterograde dissection

In the antegrade method, an S-shaped incision was made antero-inferior to the ear lobe and anterior to the mastoid process. The incision was made continuously anteriorly to the face and below the mandible. Using blunt dissection the skin was flapped over the face and the superficial fascia was removed with a blunt dissection, then a cut was made at the upper border of the exposed sternocleidomastoid muscle and retracted to expose the posterior belly of digastric muscle, then the muscle was traced superiorly to its insertion on the mastoid process, medial to this point the facial nerve trunk was seen to emerge from the stylomastoid foramen and laid medial to the posterior belly of digastric muscle and then the facial nerve trunk was traced into the parotid gland. In the parotid gland the facial was seen under the superficial lobe, therefore blunt dissection was used to separate the superficial lobe of the parotid gland to expose the terminal branches of the facial nerve (Abd-Elwahab., 2014).

Retrograde dissection

In this pattern of dissection the parotid gland was open directly and one of its branches particularly the marginal mandibular branch because it is the most superficial was used to trace the main trunk, then from the trunk, the other branches were traced (Abd-Elwahab., 2014).

For identification of the facial nerve trunk, the antegrade method of dissection was the most suitable because exposing the facial nerve trunk from its emergence from the stylomastoid foramen prevents severance which may happen if dissecting using the retrograde method.

Study location

This study was carried out in Rivers State and used embalmed cadavers at medical colleges in Rivers State University, Nkpolu-ororukwo, University of Port Harcourt, Choba and PAMO University of Medical Sciences, Iribe all in Rivers State, Port Harcourt, Nigeria.

Twenty-five (25) embalmed adult cadavers (22 males and 3 females) were used for this study. The bodies were those kept in dissecting rooms of the Anatomy Department of the University of Port Harcourt (12), Faculty of Basic Medical Sciences Rivers State University (4), and PAMO (9) all in Rivers State, Nigeria.

Procedure



Figure showing the incision procedure

In order to identify the extracranial division and branching of the facial nerve, the following steps were followed:

A vertical incision was made on the lateral region of the neck, posterior to the lateral border of the sternocleidomastoid muscle. second incision was made horizontally interior to the mandible, laterally above and superior to the clavicle below. Anterior to the external ear, a vertical incision was made to meet the incision interior to the mandible and then on the lateral part of the face, a horizontal incision that continues with incision anterior to the ear was made and ended on zygomatic arch which was the third incision.

After all these incisions were made superficially, the skin was flapped over the face using blunt dissection. After the skin was flapped, the superficial fascia overlying the parotid gland was also removed using blunt dissection in order to expose the parotid gland

Then a cut was made at the upper border of sternocleidomastoid close to the mastoid process in order to flap it to expose the deeper structures. When the sternocleidomastoid muscle is flapped the posterior belly of digastric muscle is exposed and the facial nerve trunk can be seen lying medially as it emerges from the stylomastoid foramen below the tragus of the ear inferior to the external acoustic meatus. Then the facial nerve trunk is traced to the point where it pierces the parotid gland posteriomediaally.

When the facial nerve trunk emerged from the stylomastoid foramen it gave off its two muscular branches; the posterior auricular nerve and the nerve to the posterior belly of digastric and stylohyoid muscle. Using a forceps, the substance of the parotid gland was separated to expose the two subtrunks and/or the 5 terminal branches in the parotid gland.

Statistical analysis

Analysis of percentage was done using contingency table with SPSS version 28.0

Table 1: Percentage of the point of division of the facial nerve trunk

	Percentage of the Division Before and After Entering the Parotid Gland	
Cadaver	Before	After
	24.0%	76.0%

n=25

Table 2: Percentage of the point of division of the facial nerve trunk

	Percentage number of subtrunks	
Cadaver	With Major Trunks	Without Major Trunks
	92%	8%

In this study for the extracranial division of the facial nerve, 25 cadavers were dissected 22 males and 3 females.

Two pattern of division was observed as the facial nerve trunk emerged from the stylomastoid foramen. The facial nerve trunk emerged from the stylomastoid foramen gave off two muscular branches (the posterior auricular branch and the nerve to the posterior belly of digastric and stylohyoid muscle) then enters the parotid gland and bifurcates into two major sub trunks, upper trunk (temporofacial) and lower trunk (cervicofacial) before giving out the five terminal branches. As it emerges, it gives off the two muscular branching and divides immediately into two subtrunks before entering the parotid gland and then giving off the five terminal branches.

For the type 1 pattern of division - 19 cadavers showed this pattern i.e. 76%

For the type 2 pattern of division - 6 cadavers showed this pattern i.e. 24%

In the cadavers that shows the pattern of division in which the facial nerve trunk enters the parotid gland before dividing:

89.5% divided into 2 major subtrunks before giving off the 5 terminal branches i.e. 17, while 10.5% gives of the 5 terminal branches without dividing into 2 major subtrunks.

Table 3: Comparison of studies showing the division of facial nerve trunk
Write year with the names of the authors in the table

Studies	Single trunk	Bifurcation	Trifurcation
Kwak et al	-	26(86.7%)	4(13.3%)
Devi and Toleti	12%	88%	-
Stankevicius and Suchomlinoy	-	18	2
Kalaycioglu et al	-	81.25%	18.75%
Rana et al	2(2%)	95(95%)	3(3%)
Thuku et al	-	16(80%)	4(20%)
Naidu & Rennie	-	18(90%)	2(10%)
Present study	2	23	-

DISCUSSION

During parotidectomy the aim of the surgeon is to identify and preserve the branches of the facial nerve in addition to removal of the parotid gland, therefore understanding how the facial nerve trunk divides and the point of its division is important. The facial nerve after coming out of the stylomastoid foramen gives off its two muscular branches then divides into upper(temporofacial) and lower(cervicofacial) and in very rare cases straight into five terminal branches without dividing into two subtrunks.

Point of division

In the course of carrying out this study it was discovered that the facial nerve trunk either enters the parotid gland and then divides this was seen in 19 cases (76%) or it divides before entering the parotid gland this was seen in 6 cases (24%). This discovery is in agreement with Salame et al., (2002) in which 15% of the cases divided before entering the parotid gland and 85% divided within the parotid gland.

Number of subtrunks

The number of subtrunks that was prevalent in this study was 2 subtrunksie bifurcation which was seen in 23 cases (92%), this pattern of division is in agreement with the study carried out by Kwak et al., 2004 on 30 cadavers in which 26(86.7%) bifurcated, and also with Thuku et al., 2018 and Naidu and Rennie., 2020 which had an incidence of 16(20%) and 18(90%) respectively.

A single trunk dividing straight into the 5 terminal branches without dividing into subtrunks was also seen in this study, it was seen in 2 cases(8%), this is in agreement with Devi and Toleti., 2015

in a study carried out on 25 fetus cadavers and 5 adult cadavers in which the facial nerve trunk 12% of the fetus cadavers divided straight into 5 terminal branches.

During the course of this study there were no cases of trifurcations as was seen by Stankevicius and Suchomlinov(2019) and Kwak et al., (2004).

There were also no cases of double trunks seen emerging from the stylomastoid foramen as was seen in Stankevicius and Suchomlinov., (2019)

Conclusion

In conclusion the most frequent point at which the facial nerve divides is within the parotid gland and the most frequent pattern of division is the bifurcation.

The extracranial course of the facial nerve is variable in different individuals and even in the same individual therefore if clinicians and surgeons understand it's variations, injury to the facial nerve during parotidectomies or other types of surgeries that will affect the facial nerve extracranially will be reduced.

Recommendation

I recommend that more studies should be carried out in the African continent most especially in Nigeria. And studies should be carried out to compare between the right and left side of the face and also between genders to determine sexual dimorphism.

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