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ORIGINAL ARTICLE

IDENTIFYING PATTERNS OF FACIAL NERVE BRANCHES WITH REVIEW OF LITERATURE

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ABSTRACT: The facial nerve is highly variable and complex in its extra cranial course. Past studies have described patterns of branching in the face and anastomoses between branches. The studies have also thrown light on the significance of the patterns for the surgeon. With more and more development of surgical and aesthetic procedures evolving, an attempt has been made to identify all previously described named patterns with review of past literature and recognize any newer patterns to be noted and recorded. Adult human cadavers (24) which were allotted to first year medical students in the department of Anatomy, P.E.S Medical College, for routine dissection as per schedule were used for the study. One full term fetus was also included in the study. Dissection was done on either side of the faces and therefore the total sample size was considered to be 50 cervicofacial halves. The age of the cadavers was unknown at the time of dissection. The conventional method of dissection was used to identify and trace the facial nerve and its branches. The variability of branching pattern of facial nerve was observed. The patterns observed in this study were compared to patterns described by Davis et al in 1956.Twelve specimens(24/48) cervicofacial halves, showed straight branching pattern(type-1).Three specimens(6/48), cervico-facial halves showed anastomosis in temporo-facial division(type-II), Three (6/48), specimens showed loop formation between divisions(type-III). The type-VI which is a complex pattern of intricate anastomosis of all the branches was seen in four specimens (8/48).In two (4/48) specimens there was loop formation in the cervicofacial division. A larger cervicofacial division was seen in one of the specimens (2/48).The fetal halves did not show any anastomosis between the branches. An attempt has been made to identify the different patterns described with review of literature, to find out any new patterns and to correlate surgical significance of the patterns.

KEYWORDS: Facial nerve, cervicofacial branch, temporofacial branch.

INTRODUCTION: The surgical anatomy of the facial nerve is very important in reconstructive and aesthetic surgery and also in surgeries of parotid gland. Branching pattern of facial nerve has been described in the past. Surgeons who undertake surgery of the parotid gland have to be aware of the anatomy of the facial nerve. The facial nerve enters the postero-medial surface of the parotid gland. Within the gland it divides into temporofacial and cervicofacial trunks. The temporofacial trunk divides into temporal and zygomatic branches.

The cervicofacial trunk divides into buccal, marginal mandibular and cervical branches. The nerve supplies muscles of facial expression. The facial nerve has a large variability of configurations. We cannot rely on rigid models to describe the nerve. The clinical significance of the branches forming the communications has been well explained by Alfred D. Katz et al[1] after 100 parotidectomies. They have described 5 main anatomic types. McCormack et al in 1945[2] have studied 100 facial nerves from human cadavers and described the surgical anatomy with special reference to

the parotid gland. They described 8 different patterns of facial nerve branching and anastomosis. The present study was aimed at studying the different patterns and compared the same with 6 patterns described by Davis et al in 1956[3] based on a study of 350 cervicofacial halves.

MATERIALS AND METHODS: 48 cervicofacial halves from 24 adult human cadavers, 2 facial halves from 1 full term fetus were dissected in the department of anatomy, P.E.S. Medical College.

The skin and superficial fascia on the face were carefully reflected along conventional anatomical lines from posterior to anterior part of face. The anterior border of parotid gland was identified. Buccal branches of facial nerve were first identified and then followed backwards towards the main trunk near the stylomastoid foramen.

OBSERVATION:

Trunk of Facial Nerve: All the specimens showed only a single trunk. There was no duplication or multiple trunks of the facial nerve.

Divisions of the Facial Nerve: The trunks in all the specimens divided into main divisions: the temporofacial and the cervicofacial. There was no occurrence of more than two divisions

PATTERN OF BRANCHING AND COMMUNICATION BETWEEN BRANCHES: All the patterns of branching and the communications between the branches that were previously identified were also identified in this study. A large cervicofacial division and communication between branches of the CF division were observed which was not previously reported. In the fetus there were no anastomoses between the branches.

DISCUSSION WITH REVIEW OF LITERATURE: One of the earliest studies that placed emphasis on the topographic anatomy of the parotid area and the manner in which the facial nerve was thought to run through the substance of the parotid gland was by Luschka in 1862 & 1867[4] The intertwining and arciform character of the peripheral distribution of facial nerve was accounted for in a graphic fashion. A study reported from the Mayo clinic after reviewing 112 cases of surgery on parotid gland, the extremely complex pattern of the peripheral position of the nerve.

Piersol in 1930[5] referred to the innumerable branches from the two primary divisions of the facial nerve Claude C Coleman M.D in 1944[6] stated that they were much impressed with the complexity and variation of the facial nerve pattern. They described the branches as three main groups to supply the eye and forehead, the cheek, the lower lip and the neck. They also stated that an intricate anastomosis of the various branches resulted in such a kind of distribution that fibres destined for one group may find a distribution in a remote group.

The trunk of the facial nerve was the most consistent portion with bifurcation inside the parotid gland. Alfred D. Katz et al[1] in his study of 100 parotidectomies has reported five main anatomic types of branching. In what was described as type-V in 3 patients, he described two main trunks: a major and a minor trunk. The minor trunk joined the larger zygomaticofacial division. In the present study there was only a single trunk for all the specimens. All the facial nerves had divided into two divisions the temporofacial and cervicofacial.

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There was no trifurcation observed in this study. C. Baker etal[7] in 2000 parotidectomies in 1979 has not observed trifurcation. It may be explained with the addition of a buccal branch.

Of the two principal divisions the temporofacial division supplying the upper part of face has been reported to be far larger often two to three times the size of the cervicofacial division. (McCormack et al 1945[2], Davis et al 1956,[3] Alfred et al 1987[1]). The present study found the cervicofacial division larger than the temporofacial division in 2/24 specimens. (FIG-1).

The straight branching pattern (TYPE-1) was seen in 12 specimens. No unions occurred between the major 5 branches. Alfred D. Katz[1] stated that this type was clinically important as; if any branch is sacrificed in surgery on the face it can result in paralysis of the muscles supplied by it. The type-II with communication of zygomatic and buccal branches allows for possible sacrifice of buccal divisions. Type-III allows the surgeon greater safety margin in his dissection as there is extensive communication within buccal divisions.

Communication between branches of cervicofacial division was seen in 3/24 specimens. Davis et al[3] states that in the most complex pattern encountered least frequently does the mandibular branch join any member of the temperomandibular division. McCormack et al described the type-VIII pattern which had richly plexiform communications between the various branches. (FIG-2).

In the full term fetus the anastomoses were not seen and it appeared like a straight branching pattern (type-I). Ekinci N[8] concluded that incidence frequency of anastomoses increases with age. (FIG-3).

Myint K, Azian AL, Khairul FA[9]studied 79 formalin fixed Malaysian adult cadavers of various races and classified six types of branching patterns. They found the textbook pattern of type-I to be the least common patterns.

Henry Hollinshead[10] has described that the names given to the branches were more indicative of the region of distribution rather than individual branches. It has been also described that the upper temporofacial part of the nerve gave multiple branches and the lower part gave typically single branches.

Callander[11]in an investigation of 100 heads found eight variations of the disposition of the facial nerve Gerardo Schwember M.D., and Alberto Rodriguez M.D[12] in a study of 30 hemi-faces described 16 ramifications of the nerve in its extra-parotid course. No regular pattern of arborisation was found. The textbook pattern[13] of branches to the muscles of the face were all identified and traced to their respective destinations and it was concluded that the nomenclature used described the course of the branches.

CONCLUSION: The present study concluded that the facial nerve branching pattern was no doubt variable and highly complicated. The more the number of branches that united the better the chances of recovery from injury as the branches that join from another branch would compensate the damage that has occurred. Awareness of the highly variable pattern in facial nerve branching is important for the surgeon. Rigid models cannot be made regarding the patterns of the facial nerve as that is likely to mislead the surgeon to rely on previously described configurations and can result in inadvertent injury of the facial nerve branches to facial muscles.

The use of nerve integrity monitors has been advocated to reduce the incidence of facial nerve paralysis in parotidectomies. Pensak& associates reported that in 7% of otologic cases the nerve monitor failed to warn the surgeon of an exposed facial nerve before its identification using anatomic

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criteria. False positive alarms may frustrate the surgeon. Arthur B. Duel[14]has rightly stated that surgery of the facial nerve can only be learned by cadaver experience!

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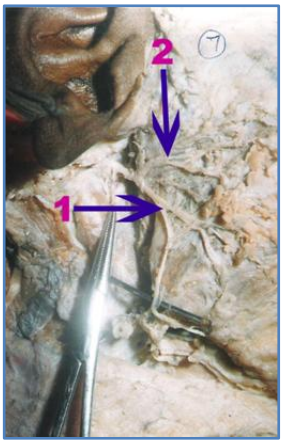

FIGURE 1:
1. **LARGER CERVICOFACIAL DIVISION**
2. **BUCCAL BRANCH**

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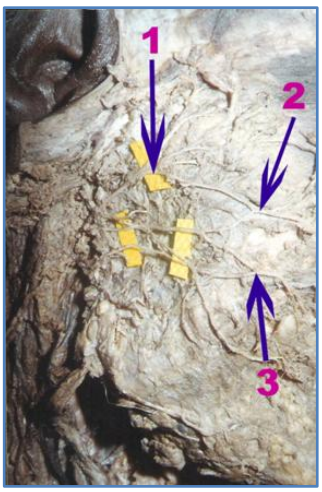

FIGURE 2: PLEXIFORM ANASTOMOSIS BETWEEN BRANCHES
1. TF division
2. Loop formed by TF & CF divisions
3. Loop formed in CF divisions

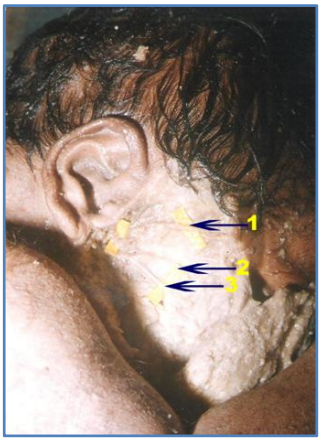

FIGURE 3: Straight branching pattern: type-I in foetus
1. Frontal branch
2. Zygomatic branch
3. Buccal branch

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