MARGINAL MANDIBULAR NERVE AND ITS RELATION WITH LOWER BORDER OF MANDIBLE AND FACIAL ARTERY

1SAIRA ATIF, BSc, BDS, M.Phil
2NAJEEB ULLAH GUMMAN, BDS, FDS RCS
3FAIQUA YASSER, BDS, M.Phil
4RIAZ AHMAD WARRAICH, MCPS, FCPS, MDS

ABSTRACT

Marginal mandibular nerve is a motor branch of facial nerve which supplies the muscles of the peri oral region. Surgical and cosmetic procedures might cause injury to this nerve resulting in functional loss and cosmetic imperfection.

This study on the anatomical relation of marginal mandibular nerve, with respect to the lower border of mandible and facial artery, will benefit maxillofacial and plastic surgeons in its safe identification, hence preserving the functional integrity of this significant branch of facial nerve.

Careful dissection was done on one hundred (100) hemi-faces of adult cadavers in Forensic and Anatomy departments of King Edward Medical University, Lahore from September 2009 to March 2010. Cadavers with scar, disfigurement or putrefaction in face and/or neck region were excluded.

In 100 hemi faces, Marginal mandibular nerve present singly above the lower border of mandible was seen in 74% of cases. Marginal mandibular nerve having two rami, both located above the lower border was seen in 14% of cases. Two rami of marginal mandibular nerve, one present above and one below the lower border of mandible was seen in 6% of cases. Three rami of marginal mandibular nerve, two rami above and one below lower border of mandible were present in 6% of cases.

In our population marginal mandibular nerve normally exits from anterior border of parotid gland above the lower border of mandible. When two or more rami of nerve are present; chances of lower most rami of nerve coursing below the inferior border of mandible increases. The nerve rami are present superficial to facial artery. It is at risk of iatrogenic injury overlying and anterior to masseter muscle where the nerve lies superficially underneath a thin layer of superficial musculoaponeurotic system.

Key Words: Marginal mandibular nerve, facial artery, rami, relation.

INTRODUCTION

“Break a vase, and the love that reassembles the fragments is stronger than that love which took its symmetry for granted when it was whole”.1 Marginal mandibular nerve is one of the five motor branches of facial nerve given in parotid gland and supplies muscles of lower lip and chin.2 In surgical/cosmetic procedures such as parotidectomy, excision of submandibular gland, mandibular advancement procedures, deep neck dissection, carotid endarterectomy, peri-oral rhytidectomy and liposuction procedures; the chances of injury to marginal mandibular branch of facial nerve are high.3-10 Permanent damage to marginal mandibular nerve causes paralysis of chin and lower lip muscles resulting in difficulty in eating, drooling of saliva, speech impairment, imbalance smile, and distorted facial expressions.2,3,11-13 Along with functional impairment, paralysis of lower lip may also have psychological consequences.14
One of the areas at risk on the face is overlying the masseter muscle and just anterior to it, where the marginal mandibular nerve crosses the body of mandible. Here the superficial musculoaponeurotic system (SMAS) is thin, buccal fat pad is minimum and nerve is located rather superficially.\textsuperscript{3,15,18}

Relation of marginal mandibular nerve with facial artery is important in accurate localization of the nerve because facial artery is an easily identifiable and palpable soft tissue landmark. Marginal mandibular nerve can be superficial or deep to the facial artery and in cases where more than one ramus is present, can run on both sides of the facial artery.\textsuperscript{17,22} Relation of the marginal mandibular nerve with the lower border of the mandible is also variable where it may present above or below it.\textsuperscript{17,22,24}

In surgical procedures involving the parotid gland it is easier to locate one of the terminal branches of facial nerve and following it proximally rather than locating the nerve trunk and mapping it distally. The easiest branch to locate is the marginal mandibular nerve because of its relatively lengthy and straighter course.\textsuperscript{25} Locating the marginal mandibular nerve will be easy if surgeons are familiar with exact location and anatomical variations of this nerve in our population.

Studies on anatomy of marginal mandibular nerve have been carried out in other countries but to our knowledge and understanding, in our population studies on the anatomical relations of marginal mandibular nerve have not been reported. This study will benefit the surgeons about the location and relations of this nerve in our population so that iatrogenic injury to this small yet functionally significant nerve can be avoided.

METHODOLOGY

This cross sectional study was done in the mortuary of Forensic Medicine department and dissection hall of Anatomy department of King Edward Medical University, Lahore from September 2009 to March 2010. One Hundred hemi-faces of adult unclaimed cadavers from both genders, chosen by non-probability convenience sampling, were included in this study. Cadavers with scar, disfigurement or putrefaction in face and/or neck region were excluded. Consent for dissection was taken from concerned Police Station. Approval from ethical committee of KEMU was taken before conducting the study.

Cadavers were placed on dissection table in supine position with head laterally turned. A skin incision with surgical blade no. 23 was made approximately 2 cm below and parallel to the mandible starting from midline of neck and extending up to the anterior border of sternocleidomastoid. Another relieving incision was made anterior to tragus up to zygomatic arch. Skin and attached subcutaneous tissue were relieved from underlying fascia by surgical blades no. 12 and 23. Platysma was incised and reflected. The site of emergence of marginal mandibular nerve from parotid gland was recorded (anterior border/ posterior border/ apex). At the site of emergence from parotid gland, the relation of marginal mandibular nerve with the lower border of mandible was noted as either being above or below. In case of marginal mandibular nerve having two or more rami, the relation of each ramus present above and below was recorded separately. Along the course of the marginal mandibular nerve its relation with the facial artery was noted as either being superficial to it or deep to it. Parotid gland was excised in bits and pieces to confirm the origin of the marginal mandibular nerve from cervicofacial division of facial nerve trunk. All dissections were done with magnifying loop (Neitz instruments co. ltd. BLS-3 magnification 2.5x to 3x working distance 350 to 550mm) in well lit mortuary rooms.

The data were analyzed with SPSS\textregistered version 15.0 (SPSS Inc., Chicago, IL, USA). Categorical variables (gender, side of face, relation with mandible and facial artery, site of exit of nerve from parotid gland) were expressed as frequency and percentages. Age being a quantitative variable was expressed as mean ± standard deviation. Chi-square test was applied to evaluate the association between categorical variables. Probability levels of p<0.05 were considered statistically significant.

RESULTS

The sample consisted of 95 (95%) male and 5 (5%) female cadavers. Mean age of the sample was 44.61 ± 15.024 years and range was 20-75 years. Side of the face dissected comprised of 58 left and 42 right halves.

Out of the 100 hemi faces dissected, 74 (74%) had single marginal mandibular nerve present above the inferior border of mandible. When two rami were present, both were above the mandible in 14 (14%) cases and in the remaining 6 (6%) cases, one ramus was above and the other was below the mandible. When three rami were present 2 (2%) rami were present above the mandible and one was present below the mandible. No case was reported where all three rami were present above or below the mandible.

Marginal mandibular nerve and its rami were classified into 5 different types on the basis of Site of exit from Parotid gland.

1. Single Ramus from Anterior border of Parotid gland
2. Two Rami all exiting from the anterior border of Parotid gland
3. Two Rami one exiting from the anterior border and the other exiting from the Apex of Parotid gland
4. Three Rami all exiting from the anterior border of Parotid gland
5. Three Rami two exiting from the anterior border and one from the apex of Parotid gland.
All 74 (100%) cases of single ramus of marginal mandibular nerve, exiting from the anterior border of parotid gland, were present above the lower border of mandible. When marginal mandibular nerve had two rami both exiting from anterior border of parotid gland, in 14 (73.7%) cases they were above the lower border of mandible and in 5 (26.3%) cases one ramus was above and one was below the mandible. Two rami, one exiting from anterior border and one from apex of parotid gland, 1 (100%) case had one ramus of marginal mandibular nerve coursing above and one below the lower border of mandible. When marginal mandibular nerve had three rami, all exiting from anterior border of parotid gland, 2 (100%) cases had two rami of marginal mandibular nerve coursing above and one below the lower border of mandible. When marginal mandibular nerve had three rami, two exiting from anterior border and one from apex of parotid gland, 4 (100%) cases had two rami of marginal mandibular nerve coursing above and one below the lower border of mandible. According to Chi square test there is a positive correlation between

### TABLE 1: MEAN AGE OF THE SAMPLE STUDIED

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of cases</td>
<td>95</td>
<td>5</td>
</tr>
<tr>
<td>Mean Age (years)</td>
<td>43.91 ± 14.83</td>
<td>58 ± 13.51</td>
</tr>
</tbody>
</table>

### TABLE 2: MARGINAL MANDIBULAR NERVE AND ITS RAMI FROM THEIR SITE OF EXIT FROM PAROTID GLAND

<table>
<thead>
<tr>
<th>Site of Exit of nerve from Parotid gland</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anterior border, one ramus</td>
<td>74</td>
<td>74</td>
</tr>
<tr>
<td>Anterior border, two rami</td>
<td>19</td>
<td>19</td>
</tr>
<tr>
<td>One ramus from anterior border, one from apex</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Anterior border, three rami</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Two rami from anterior border, one from apex</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

### TABLE 3: SITE OF EXIT OF RAMI FROM PAROTID GLAND AND RELATION OF THOSE RAMI FROM INFERIOR BORDER OF MANDIBLE

#### Relation with inferior border of mandible

<table>
<thead>
<tr>
<th>Number of Rami</th>
<th>Site of Exit from Parotid Gland</th>
<th>1 ramus: above</th>
<th>2 rami: both above</th>
<th>2 rami: 1 above, 1 below</th>
<th>3 rami: 2 above, 1 below</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ant border</td>
<td>74</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>All from Ant border</td>
<td>0</td>
<td>14</td>
<td>5</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>1 from Ant border, 1 from Apex</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>All from Ant border</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>2 from Ant border, 1 from Apex</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

Ant = Anterior

### TABLE 4: RELATION WITH INFERIOR BORDER OF MANDIBLE AS REPORTED IN VARIOUS STUDIES

<table>
<thead>
<tr>
<th>Reference to facial artery</th>
<th>Above</th>
<th>Below</th>
<th>Along</th>
<th>Both</th>
</tr>
</thead>
<tbody>
<tr>
<td>This Study</td>
<td>74%</td>
<td></td>
<td></td>
<td>26%</td>
</tr>
<tr>
<td>Batra et al.</td>
<td>100%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Al-Hayani et al.</td>
<td>16%</td>
<td>32%</td>
<td>52%</td>
<td></td>
</tr>
<tr>
<td>Saylam et al.</td>
<td>74%</td>
<td>26%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Woltmann et al.</td>
<td>57.5%</td>
<td>43.3%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### TABLE 5: RELATION WITH FACIAL ARTERY AS REPORTED IN VARIOUS STUDIES

<table>
<thead>
<tr>
<th>Sample Size</th>
<th>Superficial</th>
<th>Deep</th>
<th>Both</th>
</tr>
</thead>
<tbody>
<tr>
<td>This Study</td>
<td>100%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Batra et al.</td>
<td>100%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kim et al.</td>
<td>85%</td>
<td>42%</td>
<td>4%</td>
</tr>
<tr>
<td>Liu et al.</td>
<td>100%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Touré et al.</td>
<td>94%</td>
<td>6%</td>
<td></td>
</tr>
<tr>
<td>Karapinar et al.</td>
<td>97.7%</td>
<td>2.3%</td>
<td></td>
</tr>
</tbody>
</table>
Relations of Marginal Mandibular Nerve

DISCUSSION

Marginal mandibular nerve injury is one of the most commonly reported iatrogenic injury in surgical procedures performed around the mandibular region. In the present study the relation of the nerve with the lower border of mandible was noted at the site of exit from parotid gland. The rami were categorized according to their location with respect to the inferior border of mandible. It was observed that when nerve was present singly without any ramifications at the point of exit from parotid gland, it was present above the mandible. Out of the 100 cases, in 74 cases single ramus was present and all these single rami coursed above the inferior border of mandible. When two rami were there, both coursed above the mandible in 14 cases and in the remaining 6 cases, one ramus was above and the other was below the mandible. When three rami were present 2 rami were present above the mandible and one was present below the mandible. No case was reported where all three rami were present above or below the mandible.

Higher incidence, of nerve being present above the inferior border of mandible than below, has also been reported in other studies. Saylam et al. reported that the nerve was above the mandible in 74% and below in 26% of cases. Woltmann et al. also reported high incidence of marginal mandibular nerve coursing above the inferior border of mandible (57.7%) than below the mandible (43.3%).

Study conducted in India showed different results where the nerve coursing along and below was the commonly seen pattern. Batra et al. reported that the nerve present along and below the inferior border of mandible was more common than the nerve coursing above the mandible. He found marginal mandibular nerve coursing above the inferior border of mandible in only 16% of the cases (Table 4).

In the present study marginal mandibular nerve rami were present above the lower border of mandible in majority of the cases. This was observed at the site of exit from parotid gland where the nerve is somewhat present superficially overlying the masseter muscle. Here SMAS is thin and nerve is at risk of iatrogenic injury which is the main complication during surgeries performed in submandibular and parotid gland region.

Marginal mandibular nerve and its rami were found to be superficial to facial artery in all cases in this study. Batra et al. and Liu et al. have also reported similar relation of the nerve with facial artery.

Results were different in study by Kim et al. on 85 facial halves of Koreans in which marginal mandibular nerve was reported to be superficial to the facial artery in 42% of cases. In 54% of the cases, some rami were superficial and some were deep to the artery. Marginal mandibular nerve was deep to the facial artery in only 4% of the cases (Table 5).

Relation with facial artery was found to be constant in all cases. In the light of this, it is safe to say that facial artery can be used as a useful guide to locate marginal mandibular nerve during surgical procedures to safe guard the nerve. Facial artery can be easily palpated and pulsations felt by the surgeons. This also means that the facial vessel bundle should be handled carefully during electrosurgery because thermal energy from electrodesiccation of facial artery can injure close lying marginal mandibular nerve.

CONCLUSION

In our population marginal mandibular nerve normally lies above the level of lower border of mandible and remains superficial to facial artery. Facial artery and lower border of mandible are useful anatomical
landmarks to identify the nerve. Measures must be taken to prevent irretrievable injury to marginal mandibular nerve in all surgical/cosmetic procedures. Moreover, care must also be taken during electro surgery of facial artery or vein because thermal energy from electrodestruction can injure marginal mandibular nerve lying in the vicinity.

Surgical exploration done, without the anatomical knowledge, increases the risk of iatrogenic injury to marginal mandibular nerve. This study identified the relation of the nerve at the exit site from the parotid gland and with the lower border of mandible. It is recommended to carry out further studies to map out the entire course of marginal mandibular nerves at different anatomical landmarks.

REFERENCES


13 Moffit DA, Ramsden RT. The deformity produced by palsy of the marginal mandibular branch of the facial nerve. J Laryngol Otol 1977; 41: 401-16.


