Triangle of Marginal Mandibular Branch (MMB): Anatomical Zone, Constant Reference of the MMB in Cervical Surgical Position

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ABSTRACT

Summary: The purpose of this study is to reduce the search area of the marginal mandibular branch, this scarecrow nerve of the upper cervical surgery. Materials and methods: MMB dissection was applied to 25 anatomical subjects, who described an ABC Triangle where the MMB is still inside the cervical surgical position: A mandibular angle, B intersection of the MMB with the lower border of the mandible (LBM), C the position of the furthest MMB below the LBM. Results: This nerve is still depth of the superficial cervical fascia, and its division is constantly after the intersection with the facial vein (FV). The position of the MMB furthest from the LBM is found between 2 and 2.2 cm below the LBM and at 2/3 of the distance AX from the angle of the mandible angle to the intersection of the FV with the LBM. This distance AX represents the 2/3 of the distance AB from the angle of the mandible to the intersection of the MMB with the LBM and whose measurement is between 4 and 4.5 cm. Conclusion: This triangle ABC landmark of MMB provides reliable and constant anatomical markers allowing the surgeon locating or avoidance of MMB.

Keywords: Triangle landmark of the marginal branch of the mandible

1. INTRODUCTION

The MMB is a branch with superficial localization and rare anastomoses with the other branches of the facial nerve which makes it very vulnerable, and its injury is responsible for an asymmetry of the lower part of the face, in particular, a smile very unsightly And its recovery is often difficult or impossible.

The risks of paralysis of the MMB increase in multiple approaches cervico-faciales since this area is frequently approached by many surgeons. In these situations, we find in the management of tumoral and lithiastic pathologies of the submaxillary glands, during the retrograde surgery of the parotid gland and in the context of neoplastic pathologies (functional cervical recess of the territory Ib) , But also during aesthetic surgeries such as liposuction and facial lifting and during local dermatological and plastic procedures in the super-lateral region of the neck.

If we exclude the trunk of VII, the MMB is the branch of the facial nerve more constant, hence the need to find a concept of locating this nerve when it is touched the top and side by the neck. While some studies have investigated the MMB, the tracking data has not been clearly identified, and the authors are more inclined towards avoidance behavior.
The objectives:
1. Minimize the research area of the MMB.
2. Show that the location of this nerve is reliable and therefore the avoidance behavior is riskier.

2. METHODS

This is an anatomical study made in 25 anatomical subjects, fresh and in operative position: dorsal decubitus, in a fixed position, neck extended and head turned to the contralateral side. On each of the anatomical subjects, we made a unilateral incision type Redon extended to a Sibéleau to avoid the potential symmetry of the MMB.

We chose four anatomical landmarks:
1. The angle of the mandible
2. The lower border of the mandible
3. The facial vein
4. The superficial cervical fascia

The angle of the mandible and the lower border of the mandible: 2 fixed bone landmarks are precisely situating the MMB, unlike the soft tissue. It's palpable under the skin, reliable and easy to evaluate clinically and surgically.

Facial vein: vascular landmark easy to identify and constantly deep compared to the MMB.

The superficial cervical fascia: Plan constantly superficial to the MMB.

Measures: Taken on each of the 25 cadavers, coupled with a review of the literature has allowed us to identify a concept of ABC whose surface is reduced and the nerve is constant at its surgical cervical position we have named the “triangle landmark of MMB”:

- AB = The distance between the angle of the mandible and the intersection of MMB with LBM.
- AX = The distance between the angle of the mandible and the intersection of the facial vein with LBM.
- AY = The distance between the angle of the mandible and the projection of point C which is the position of the MMB farthest from LBM.
- CY = The distance where the MMB is farthest down LBM.

3. RESULTS

A number of branches: single branch in 70% of cases and two branches in 30% of cases. The division of the MMB is always done after its intersection with the vein (Table 1).
MMB relationship with the lower border of the mandible, MMB is still below the LBM.
The relationship between MMB and facial vessels, the MMB is 100% surface compared to the artery and facial vein.
The relationship between MMB and superficial cervical fascia, MMB is still deep over the fascia.

The communication between MMB and the other branches of the facial nerve, 2 cases of MMB communications with the cervical branch of the facial nerve, 2 cases of oral communications with branch and 1 case of communication with the great auricular nerve.

**Fig. 2: Hemiface of a fresh anatomical subject showing the MMB located below the LBM and presenting a single branch even after its intersection with the facial vein**
Fig. 3: Hemiface of a fresh anatomical subject showing the division of the MMB into two branches after its intersection with the facial vein

Fig. 4: The photograph shows the location of the MMB below the LBM in front of the angle of the mandible and depth of the superficial cervical fascia

Triangle landmark of MMB: Our study showed that the distance AB is between (4 - 4.5 cm), the distance AX is found between (2.2 - 3.8 cm) and the distance AY is between (1.5 - 1.7 cm), so the point X is at 2/3 of the distance AB and the point Y is at 2/3 of the distance from the point AX. This allows us to deduce the position of the point C and thus the distance CY which varies between (1.7 - 2.2 cm).

Therefore, to have the triangle ABC, we draw a line AB at the LBM 4.5cm ahead of the angle of the mandible, then we will calculate the 2/3 of the distance AB, which is the distance AX and the 2/3 of the distance AX which is the distance AY and one will go down 2.5cm below the LBM to have the point C. This defines a reference triangle of the MMB ABC whose MMB is always at inside the cervical surgical position.
4. DISCUSSION

The marginal triangle of Percy Rossel Perry (2015)\(^{(19)}\)

It is an avoidance triangle made of anatomical landmarks which are the Lateral commissure of the mouth, Base of mastoid Apophysis and a point localized above the anterior border of the extracellular matrix muscle, thus limiting the MMB and The neighboring muscular and neurovascular, namely: SAMS, a portion of the parotid gland, facial artery, extracellular matrix muscle, masseter muscle, buccal and zygomatic branches of the facial nerve, lateral jugular vein And the external carotid artery as well as the MMB; Thus allowing the plastic surgeon to avoid the marginal branch of the mandible during a facelift or facial liposuction, and only during these extremely limited surgical situations. This avoidance triangle is almost the only concept of location of MMB described in any literature.

The marking triangle of the marginal branch of the mandible

It is a concept of tracking the MMB. Since the identification of a nerve requires a reduction to the maximum of the search area while being sure that the nerve is found in this zone. This reference triangle of the MMB (ABC) is constant for the location of this scarecrow nerve since the latter is always located inside the triangle in the surgical cervical position. Unlike the triangle of Percy Rossel Perry which is an avoidance triangle, this triangle will allow the ORL and maxillofacial surgeons, oncologists and also plastic surgeons, both a systematic tracking of the MMB or a precise avoidance behavior according to the surgical situation, and also during instrumental management.

The advantages of our MMB landmark triangle:

1. Locate the marginal mandibular branch using palpable reference points, reliable and easy to identify by clinical examination and surgical exploration.
2. Make precise measurements to facilitate the approach of the upper and lateral region of the neck.
3. Specify the position of the furthest MMB below the lower border of the mandible.
4. Guide the surgeon to avoid or locate the MMB.
5. Determine the location of the incision.

The number of branches

Dingman and Grabb et al. (1962)\(^{(1)}\) described a single branch in 80% of 100 hemifaces of cadavers studied, two branches in 67% of cases, three branches in 9% of cases and four branches in 4% of cases. These results Concord with the study of Touré et al. (2004)\(^{(6)}\) carried out on 54 MMB, which found a single branch in 43%
of cases, two branches in 44% of cases and three branches in 13% of cases. The study of Liu et al. (2007)\(^{(12)}\) joins the two previous studies and show that in 95% of 24 hemifaces studied the MMB had one or two branches. The results of our study were similar to most of these authors; We found that the MMB had only one branch in 70% of cases and two branches in 30% of the cases. However, we noted that the MMB is almost always a single trunk up to its intersection with the facial vein where it is potentially divided into two or more branches, results not reported by other authors. This involves searching for the MMB before its intersection with the facial vein, whether before point X, which further reduces the locating area. The study by Batra et al. (2010)\(^{(15)}\) made on 50 hemifaces human cadavers joins our study and describes the marginal branch of the mandible as a single branch to its origin in 88% of cases, 92% during the course, but It rarely single branch at termination (4% of cases). The MMB was divided into two branches in 12% of the cases at its origin, 8% of cases during the course and 12% of the cases at its termination. In almost all anatomical subjects (84% of cases) the MMB had more than two branches at its termination.

**Relation of the MMB with the angle of the mandible**

Our study finds that the MMB always progress forward and from the angle of the mandible, the distance between MMB and the angle of the mandible varies between 0.5 and 0.7 cm and the nearest position of MMB at the bottom of the LBM is below the angle of the mandible. This result is similar to that of Yang et al. (2016)\(^{(21)}\) carried out on 29 hemifaces who reported that in 82.8% of cases the MMB was less than 5 mm below the angle of the mandible and in 89.7% of the MMB was less than 10 mm below the angle of the mandible. However, the results of Batra et al. (2010)\(^{(15)}\) are different MMB 52% along the mandibular angle and 16% in the latter.

**Relation of the MMB with the lower border of the mandible**

It is the most constant anatomical landmark, and the most studied in the literature. According to our study, the MMB was still below the mandible. This result is close to that of Potgieter (2005)\(^{(6)}\) made on 36 hemifaces human cadavers of which 78% of cases, the MMB was below LBM Study of Karapinar et al. (2013)\(^{(17)}\) Also found that in the 44 hemifaces of anatomical subjects studied, the MMB was still under the LBM. Yet the results of Dingman (1962)\(^{(1)}\) Describe only 19% of cases below the LBM. The results of our study concerning the position of the furthest MMB below LBM varied between 1.7 and 2.2 cm. A 2.5 cm incision below the latter would be safe during cervical and lateral upper surgery. The study by Nason et al. (2007)\(^{(10)}\) carried out on 85 patients, showed that the situation of the MMB farthest LBM was 1.25 ± 0.7 cm with a maximum distance of 3 cm; Thus, they advise a ≥3 cm incision LBM. The study by Troué et al. (2004)\(^{(6)}\) carried out on 54 hemifaces fresh and formalin-fixed, noted that the position of the MMB more below the LBM was 1.715 ± 0.639 cm with a distance of 1.06 cm. From these results, they determined a ≥ 3 cm incision LBM. The study by Kim di et al. (2009)\(^{(13)}\) made on 85 hemifaces fresh and formalin-fixed, found that the maximum distance of MMB compared to LBM is environ1.06 cm. For this reason, they think that the incision should not be as far as 3-4 cm below LBM. The study by Batra et al. (2010)\(^{(15)}\) performed on 50 cadavers fixed in formalin, determined that the situation of the MMB farthest LBM was 1.5 cm with a maximum distance of 1.6 cm. Thus, they determine an incision ≥ 1.6 cm.

LBM allows specifying the extent of the incision by measuring the distance between the angle of the mandible and the intersection of the facial vein with the LBM. According to our study, this distance varied between 4 and 4.5 cm. A result identical to that of Yang et al. (2016)\(^{(21)}\) carried out on 29 cadavers of hemifacial, who noted a distance of 33.1 ± 5.2 mm with a maximum distance of 41.6 mm. From these results, we deduced that the MMB branches were mostly below the lower border of the mandible, which requires special attention during any dermatological and plastic procedure and during surgical procedures in This danger zone. In order to preserve this important anatomical structure to the expression of the face which is the MMB and to avoid a possible paralysis whose dramatic functional, psychological and aesthetic consequences. The inconsistency of the results between the authors relative to the situation of the MMB and the distance between the branch and the LBM is the consequence of the anatomical diversity between the individuals, but especially the surgical position of the neck, during the dissection And factors influencing the course of the study, since cadaveric tissue attached to formaldehyde is different from fresh anatomical subjects and living tissue.

**Relationship of MMB with superficial cervical fascia (ACS)**

The ACS is a structure for locating and locating the MMB. This relationship between MMB and ACS was rarely studied in the literature. According to our study, the MMB was always in depth of the superficial aponeurosis of the neck, so a surgical detachment below the platysma muscle without crossing the ACS during an approach of the territory Ib poses no danger for the MMB, even if the detachment reaches the LBM. Thus, surgery in the region of the MMB’s triangle requires a detachment that does not cross the ACS.

The study by Ziarah et al. (1981)\(^2\) conducted on 120 cadavers reports that the MMB was in a plane between the platysma muscle and fascia. Nelson and Gingrass\(^22\) noted that the MMB was walking in the ACS. The study by Al-Hayani et al. (2007)\(^11\) made on 50 cadavers mentioned that above the LBM, the MMB left parotid gland and crossed the masseter muscle covered by the superficial fascia of the neck until its demise in muscle depth. Lowering the angle of the mouth; While below the LBM, the MMB was traveling through Lakes to its point of intersection with the LBM.

**MMB communication with other branches of the facial nerve** [Table 2]

<table>
<thead>
<tr>
<th>Authors, Date &amp; Location</th>
<th>HF</th>
<th>Number of branches</th>
<th>Below LBM%</th>
<th>Superf to FV</th>
<th>Distance Max below LBM (cm)</th>
<th>Communication</th>
<th>Surgical incision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dingman &amp; Grabb et al. 1962 USA(^1)</td>
<td>100c</td>
<td>1b: 20% 2b 67% 3b: 9% 4b: 4%</td>
<td>Post FA: 19%</td>
<td>100%</td>
<td>1cm</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td>Ziarah &amp; Atkinson al. 1981 England(^2)</td>
<td>110c</td>
<td>1 b: 35.7% 2b: 52.9% 3b: 11.4%</td>
<td>53%</td>
<td>100%</td>
<td>1.2 cm</td>
<td>BB 8% BC 12%</td>
<td>≥ 2 cm in LBM</td>
</tr>
<tr>
<td>Wang et al. 1991 China(^3)</td>
<td>120c</td>
<td>1 b: 32% 2b: 50% 3b: 13% 4b: 3%</td>
<td>Ant FA: 10% Post FA: 33%</td>
<td>95%</td>
<td>3cm</td>
<td>BB 22% BC 12% CBB+ 4%</td>
<td>≥ 3 cm in LBM</td>
</tr>
<tr>
<td>Basar et al. 1997 Turkey(^4)</td>
<td>40c</td>
<td>1 b: 35% 2b: 60%</td>
<td>15%</td>
<td>----</td>
<td>1.06 cm</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td>Savary et al. 1997 France(^5)</td>
<td>22c</td>
<td>2 b: 27% 3b: 73%</td>
<td>Ant FA: 27% Post FA: 63%</td>
<td>100%</td>
<td>1cm</td>
<td>BB 50% BC 27%</td>
<td>≥ 3-4 cm below LBM</td>
</tr>
<tr>
<td>Touré et al. 2004 France(^6)</td>
<td>54c</td>
<td>1 b: 43% 2b: 44% 3b: 13%</td>
<td>----</td>
<td>94%</td>
<td>1.06 cm</td>
<td>----</td>
<td>≥ 3 cm below LBM</td>
</tr>
<tr>
<td>Potgieter et al 2005 South Africa(^7)</td>
<td>36c</td>
<td>----</td>
<td>77.8%</td>
<td>----</td>
<td>0.69 cm</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td>Woltmann et al. Brazilin 2006(^8)</td>
<td>45c</td>
<td>1 b: 31% 2b: 60% 3b: 9%</td>
<td>43.3%</td>
<td>----</td>
<td>1.3 cm</td>
<td>BB 42% BC 22%</td>
<td>≥ 2 cm below LBM</td>
</tr>
<tr>
<td>Saylam et al. 2007 Turkey(^9)</td>
<td>50c</td>
<td>2 b: 62% 3b: 34%</td>
<td>Post FA: 26%</td>
<td>----</td>
<td>1.004 cm</td>
<td>----</td>
<td>≥ 2 cm below LBM</td>
</tr>
<tr>
<td>Nason et al. 2007 Saudi Arabia &amp; Canada(^10)</td>
<td>85p.</td>
<td>----</td>
<td>64%</td>
<td>----</td>
<td>3 cm</td>
<td>----</td>
<td>≥ 2 cm below LBM</td>
</tr>
<tr>
<td>Al-Hayani 2007 Saudi Arabia(^11)</td>
<td>50c</td>
<td>1 b: 32% 2b: 40% 3b: 21%</td>
<td>44%</td>
<td>----</td>
<td>2.3cm</td>
<td>----</td>
<td>≥ 1 inch in LBM</td>
</tr>
<tr>
<td>Liu et al. China July 20y(^12)</td>
<td>24c</td>
<td>1+2 =95.9%</td>
<td>----</td>
<td>----</td>
<td>0.97cm</td>
<td>----</td>
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</tr>
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</table>

The MMB rarely anastomoses with the other branches of the facial nerve, which makes it very vulnerable. This finding justifies the reason for definitive facial paralysis in subjects suffering direct lesion of the MMB.

According to our study, we found 5 cases of communication: 2 cases with the cervical branch of the facial nerve, two other cases with the buccal branch of the facial nerve and 1 case of communication with the large auricular nerve.

Ziarah et al. (1981) found that in the 110 hemifaces, MMB anastomosed to 12% with cervical branch and 8% with the buccal branch of the facial nerve.

Woltmann et al. (2006) reported that in 40 hemifaces, MMB anastomosed to 22% with cervical branch and 42% oral branch, but 36% showed no MMB anastomoses.

Batra et al. (2010) reported that in 50 hemifaces of cadavers, the MMB communicated with the cervical branch in 28% of cases and with the buccal branch in 12% of cases.

Balagopal et al. (2012) noted that in 202 hemifaces, MMB anastomosed to 24% with the cervical branch. Khanfour et al. (2013) found that in 30 hemifaces, MMB communicated with a buccal branch in 40% of cases and only 1 case of communication with the transverse cervical branch and one single case of communication with the great auricular nerve.

**Termination**

Our study found that in 100% of cases, the MMB terminated in the depth of the muscles of the lower lip. These results are similar to those of Al-Hayani et al. (2007) and the majority of authors.
5. CONCLUSION

This study reveals a great concept of the MMB’s Triangle landmark made of reliable anatomical landmarks and where the MMB is always located inside the cervical surgical position. This triangle significantly reduces the search area facilitating nerve identification, and given the superficial and palpable anatomical beacons of this triangle, the triangle can become a precise avoidance (which is not its primary vocation) When maneuvering external instruments. In addition, our study reveals two notions:

- The 1st notion: The potential division of MMB is uncommon after its intersection with the facial vein, which limits advantage of the search area.
- The 2nd notion: Rarely discussed in the literature insists that the MMB is still depth of the superficial cervical fascia, which gives a protection plan MMB during detachment of the flap in the already small area of the triangle mark Of the MMB.

Thus, this anatomical study, combined with a broad review of the literature, shows that there are reliable reference points for the identification of the nerve, but also variations in its situation and its path, which recommends its finding rather than its avoidance during The majority of surgical situations and keep the avoidance behavior to external instrumental maneuvers. Avoidance behavior that is very risky for the integrity of the nerve and often the cause of incomplete surgery should be avoided, giving way to potentially metastatic ganglionic tissue during carcinological surgery.

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