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Anatomical localisation of the marginal mandibular branch of the facial nerve

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The marginal mandibular nerve was studied post mortem in 50 human subjects. The nerve was found to be presented by one branch (32%), two branches (40%) and three branches (28%). The relationship of the nerve to the lower border of the mandible was variable: it was either totally above the lower border of the mandible (28%), below the mandible (44%) or in 28% of cases lying above and below it. The branch which lay below the lower border of the mandible crossed it opposite the masseter muscle or opposite the facial artery or else anterior to the facial artery.

The branches which lay above the lower border of the mandible were always deep into the superficial layer of the parotid fascia, while below the mandible all the branches ran intrafascially. The termination of the nerve was always deep to the muscles of the lower lip.

The results of the present study were discussed and correlated with the results of other authors from the anatomical and surgical points of view. It is concluded that the lower border of the mandible can serve as an important landmark to help avoid injury to the nerve; above it a subplatysmal flap is satisfactory but below it a subfascial flap is much safer.

Key words: subfascial flap, subplatysmal flap, mandibular nerve

INTRODUCTION

Of the branches of the facial nerve the marginal mandibular is the branch most frequently injured in surgical procedures. Injury to it results in a deforming paralysis of the muscles which depress the angle of the mouth. It may be injured in parotidectomy [3, 13], submandibular gland excision [12], carotid endarterectomy [1, 2], rhytidectomy and liposuction surgery [10] or during the deep dissection of the neck [15]. The high incidence of marginal mandibular branch injury is due to lack of an accurate description of the course of this nerve in most of the known textbooks of anatomy [19, 20]. Anatomy textbooks by British, French, German and Italian authors describe the extra parotid branches of the facial nerve in a consistent way, usually distinguishing five branches.

However, opinions diverge concerning the marginal mandibular nerve [18]. Intraoperatively, many methods have been established that do not rely on knowledge of the location of the nerve but upon strategies that isolate the structure in a layer of fat or fascia [19]. This work was therefore undertaken with attention focused on the precise localisation of the marginal mandibular nerve in relation to the adjacent structures and with the aim of suggesting, if possible, the best way of exposing it and avoiding injury to it.

MATERIAL AND METHODS

The current study was carried out in the mortuary of the Faculty of Medicine, King Abdulaziz University. Experiments were performed with the

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Table 1. The marginal mandibular nerve

Number of branches	Number and percentage of cases	Branches	Relation to the lower border of the mandible		Relation to the facial artery			Site of crossing on the lower border of the mandible		
			Above	Below	Superficial	Deep	Unrelated	On masseter--muscle	On facial artery	Anterior to facial artery
One	16 (32%)	One	12%	20%	32%	–	–	–	20%	–
Two	20 (40%)	Upper	16%	24%	32%	8%	–	8%	16%	–
		Lower	16%	24%	30%	–	6%	–	18%	6%
Three	14 (28%)	Upper	28%	–	20%	8%	–	–	–	–
		Middle	14%	14%	26%	–	2%	4%	12%	2%
		Lower	–	28%	22%	–	6%	–	22%	6%

understanding and consent of the subjects' relatives. The study was ethically approved by the Bioethics Committee of the Faculty of Medicine, King Abdulaziz University. A total of 50 human subjects, both male and female and ranging in age from 19 to 68 years, were used post mortem in the current study. In each case a skin incision was made about 5 cm below and parallel to the lower border of the mandible from the anterior border of one sternomastoid muscle to the anterior border of the other one. A subplatysmal skin flap was made and was reflected upwards, in a degloving manner, to the level of the lower lip. The marginal mandibular branch was identified and traced precisely from its emergence from the parotid gland until its termination in the muscles of the lower lip. The relationship of the nerve to the lower lip was determined on both sides.

RESULTS

The results of the current study can best be presented under the following headings.

Marginal mandibular nerve represented by one branch

In 16 out of 50 cases (32%) of this study the marginal mandibular nerve was represented by one branch (Table 1). In 6 cases (12%), the nerve lay above the lower border of the mandible (Fig. 1–3). In these cases the nerve emerged from the anterior border of the parotid gland about 5–8 mm above the lower border of the mandible and usually ran in a straight manner parallel to the lower border of the mandible (Fig. 2, 3). In other cases, the nerve inclined downwards towards the lower border of the mandible and then upwards, resembling a gentle curve, to disappear deep into the depressor anguli oris muscle about 15–25 mm above the lower border of the mandible (Fig. 1). Above the lower border of the mandible the nerve ran deep into the superficial layer of the parotid fascia and superficial into the facial artery (Fig. 1–3). In 10 out of 50 cases (20%) the nerve emerged from the parotid gland about 10–15 mm below the mandible and ran intrafascially (in the general investing fascia of the neck) making a gentle curve upwards to cross the lower border of the mandible opposite the facial artery and then run upwards on the body of the mandible, disappearing deep to the depressor anguli oris muscle about 14—23 mm above its lower border (Fig. 4, 5).

Marginal mandibular nerve represented by two branches

In 20 out of the 50 cases (40%) the marginal mandibular nerve was represented by two branches (Table 1).

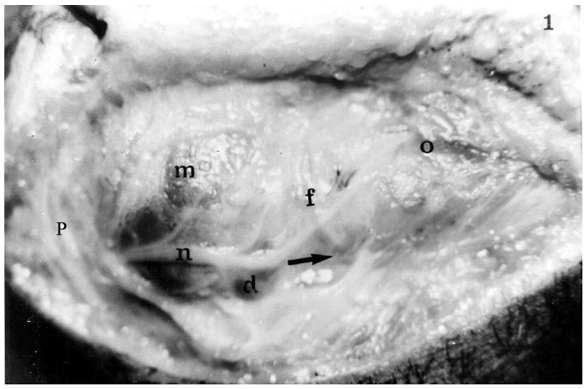

Figure 1. The right marginal mandibular nerve (n) emerging from the parotid gland (p). It runs on the masseter muscle (m), a lymph node (d), facial artery (f) and deep into the depressor anguli oris muscle (o). Notice that the whole course of the nerve is above the lower border of the mandible (arrow).

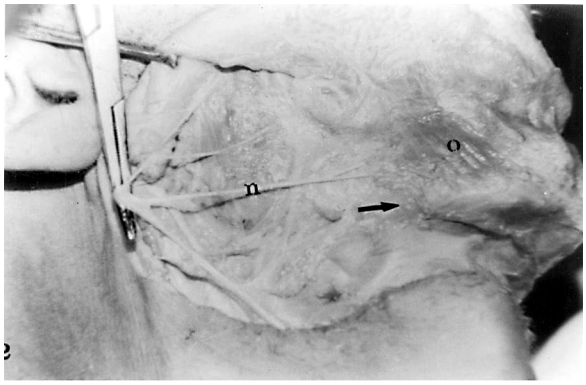

Figure 2. The right marginal mandibular nerve (n) running above and parallel to the lower border of the mandible (arrow) through its whole course to disappear deep to the depressor anguli oris muscle (o).

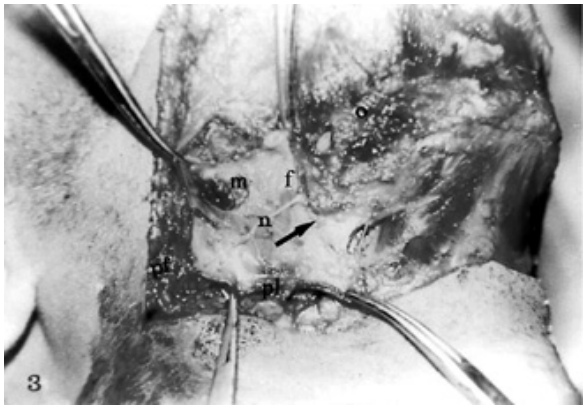

Figure 3. The superficial layer of the parotid fascia (pf) is incised and reflected by artery forceps to show the right marginal mandibular nerve (n), which runs deep into it and above the lower border of the mandible (arrow) up to the depressor anguli oris (o). Notice the masseter muscle (m), the facial artery (f) and the platysma muscle (pl).

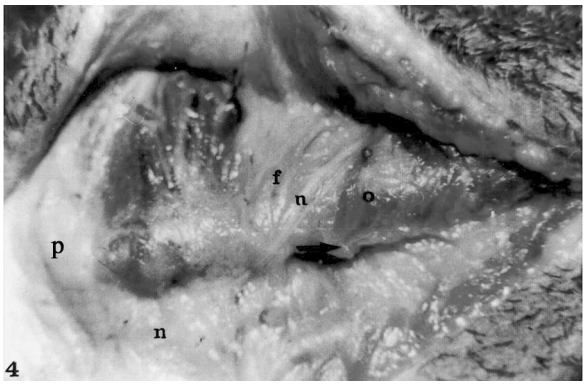

Figure 4. The right marginal mandibular nerve (n) emerging from the parotid gland (p). It runs intrafascially below the lower border of the mandible (arrow), which it crosses opposite the facial artery (f) and disappears deep into the depressor anguli oris (o). The masseter (m) and platysma muscles are seen.

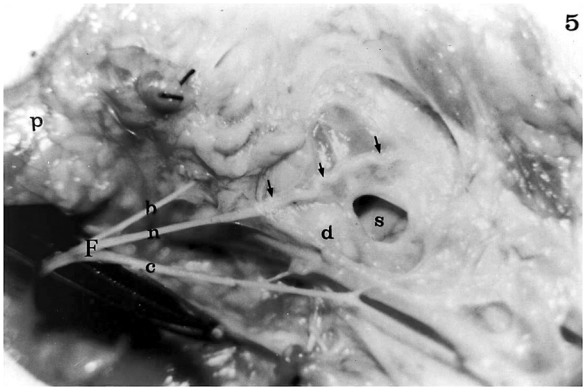

Figure 5. The lower part of the parotid gland (p) is completely dissected to show the right marginal mandibular nerve (n), which runs intrafascially (arrows) and superficially to the submandibular gland (s), which is seen through a hole in the general investing fascia (d), below the lower border of the mandible (arrow). The buccal (b) and cervical (c) branches are seen arising in common with the marginal mandibular from the lower division of the facial nerve (F).

In 8 cases (16%) the two branches lay above the lower border of the mandible. The upper one emerged from the parotid gland about 15–20 mm above the lower border of the mandible and ran nearly parallel to it crossing superficially (8%) or deep (8%) into the facial artery to disappear deep into the depressor anguli oris muscle (Fig. 6). The lower branch emerged from the parotid gland about 3–11 mm above the lower border of the mandible. It usually inclined downwards to the lower border of the mandible and then ascended and crossed superficially to the facial artery to then disappear deep to the depressor anguli oris muscle, either separately or after joining the upper branch (Fig. 6).

Figure 6. The right marginal mandibular nerve (n) is represented by two branches, which run on the masseter muscle (m) above the lower border of the mandible (arrow). The upper one crosses deep into the facial artery (f), while the lower one crosses superficially to it. The two nerves join and run deep into the muscles of the lower lip (L), which were incised to show them. The parotid gland (p) and the buccal branch (b) of the facial nerve are seen.

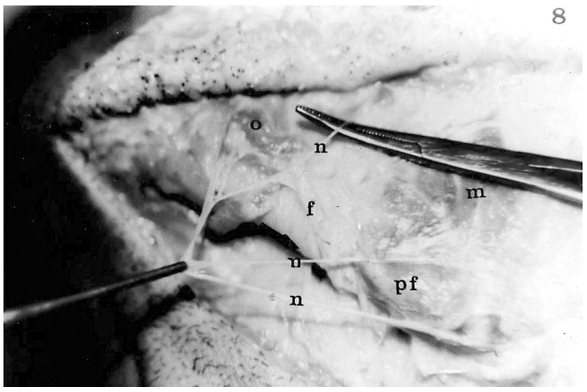

Figure 8. The left marginal mandibular nerve (n) emerging from the parotid gland (p) and represented by three branches: two above the lower border of the mandible (arrow) run on the masseter muscle (m) and are covered by the superficial layer of the parotid fascia (pf). The lower one runs below the mandible. Notice that the upper one crosses deep, the middle one superficially and the lower branch anteriorly in relation to the facial artery (f). The three branches join deep into the depressor anguli oris muscle (o), which was incised to show them.

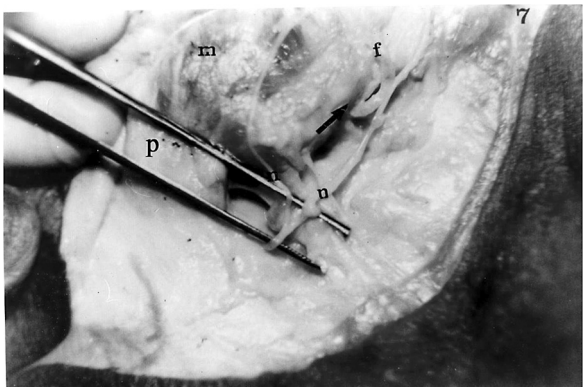

Figure 7. The right marginal mandibular nerve (n) is represented by two branches, which leave the parotid gland (p) and run below the lower border of the mandible (arrow). One branch crosses the lower border of the mandible opposite the masseter muscle (m) and the other crosses anteriorly into the facial artery (f).

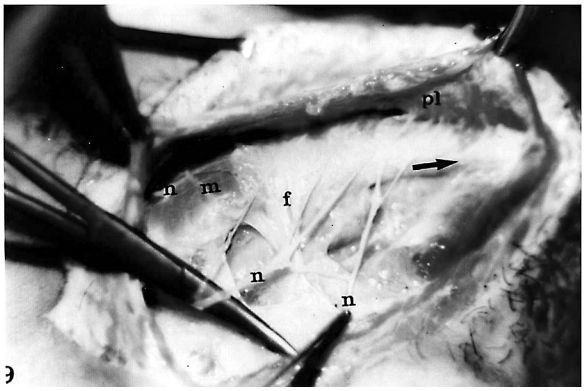

Figure 9. The right marginal mandibular nerve is represented by three branches: one above the lower border of the mandible (arrow) on the masseter muscle (m). The other branches run below the mandible and divide into many branches, which cross the lower border of the mandible opposite the facial artery (f) and anterior to it. Notice the reflected platysma muscle (pl) and the intrafascial course of the middle branch (arrows).

In 12 cases (24%) the 2 branches emerged from the parotid gland 10–23 mm below the mandible either as two separate branches or as one trunk which divided immediately into two branches (Fig. 7). These ran intrafascially (in the general investing fascia) until the point of crossing the lower border of the mandible. The upper one crossed the lower border of the mandible either opposite the masseter muscle (8%) or the facial artery (16%). The lower one crossed the lower border of the mandible opposite the facial artery (14%) or anterior to the facial artery (10%). They ran on the body of the mandible to disappear deep into the depressor anguli oris muscle (Fig. 7).

Marginal mandibular nerve represented by three branches

In 14 out of 50 cases (28%) the marginal mandibular nerve was represented by three branches (Table 1). The upper one emerged from the parotid gland about 10–40 mm above the lower border of the mandible. It ran either superficially (20%) or deep to (8%) into the facial artery covered by the superficial layer of the parotid fascia. It then passed deep into the depressor anguli oris muscle to join the other branches (Fig. 8). The middle one emerged from the parotid gland about 8–24 mm above the lower border of the mandible (Fig. 11) or 2–10 mm below the mandible (Fig. 9, 10).

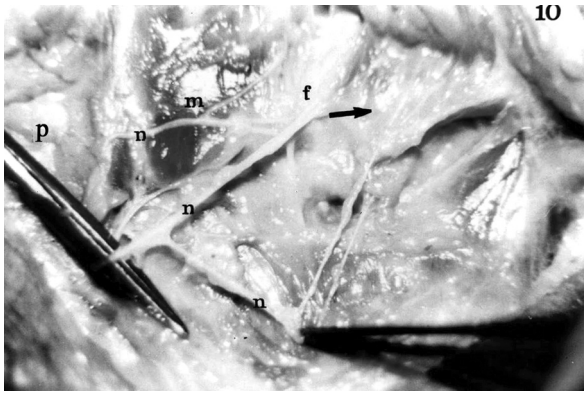

Figure 10. The right marginal mandibular nerve (n) emerges from the parotid gland (p) and is represented by three branches: one running on the masseter muscle (m) above the lower border of the mandible (arrow) and two branches below the mandible crossing its lower border, one opposite the facial artery (f) and the other anterior to it.

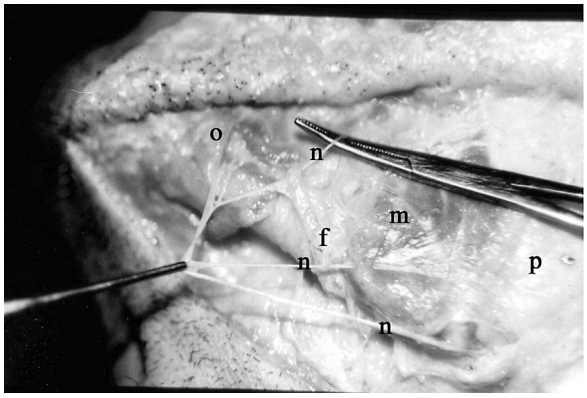

Figure 11. The right marginal mandibular nerve (n) is represented by three branches: the upper and middle branches arise in common with the buccal branch of the facial nerve. They run on the masseter muscle (m). The lower one leaves the parotid gland (p) at the angle of the mandible and runs downwards to a point about 13 mm below the mandible before dividing into two terminal branches which ascend to cross the lower border of the mandible, one opposite the facial artery (f) and the other anterior to it, to disappear deep into the depressor anguli oris muscle (o).

The latter branches crossed the lower border of the mandible either opposite the masseter muscle (4%) or the facial artery (12%) or anterior to the facial artery (2%) (Fig. 8–11). The lower branch appeared 2––15 mm below the mandible. It crossed the lower border of the mandible opposite the facial artery (22%) or anterior to the facial artery (16%). It ascended on the body of the mandible to disappear deep into the depressor anguli oris, where it usually joined the other branches (Fig. 8–11).

Relation of the marginal mandibular nerve to the deep fascia

All the branches that lay above the lower border of the mandible were always deep to the superficial layer of the parotid fascia (Fig. 3). However, all the branches of the nerve below the mandible ran intrafascially (in the general investing fascia of the neck) (Fig. 4, 5, 9).

Relation of the nerve to the muscles of the lower lip

In all cases of the present study (100%) the marginal mandibular nerve(s) ran deep into the muscles of the lower lip (Fig. 1, 6, 8).

DISCUSSION

Injury to the marginal mandibular branch of the facial nerve results in a significant cosmetic deformity due to a paralysis of the muscles of the lower lip that is difficult to correct. Precise knowledge of the anatomical relationship of the nerve will allow safe identification and preservation of this important structure. There are divergent reports in the literature concerning the anatomy of the marginal mandibular nerve. Most of the anatomy textbooks refer to the marginal mandibular branch as a single nerve. The results described here showed that it was a single trunk in 32% of cases, 2 branches in 40% of cases and three branches in 28% of cases. Similar results were reported by Dingman and Grabb [6], who found a single branch in 20%, 2 branches in 67%, 3 branches in 9% and 4 branches in 4% of their specimens. The results of the current study showed that the relationship of the marginal mandibular nerve to the lower border of the mandible is not the same in all cases.

A single branch was found above the lower border of the mandible in 12% and below the mandible in 20% of the cases. When the nerve was represented by two branches they were found either above (16%) or below (24%) the lower border of the mandible. In the cases where the nerve was represented by 3 branches the upper one was always above (28%), the lower one was always below (28%) and the middle one was either above (14%) or below (14%) the lower border of the mandible.

The emergence of the marginal mandibular nerve above the lower border of the mandible has been reported by many authors. Conley et al. [4] confirmed that the nerve extended 1–2 cm below the lower border of the mandible in all cases. Williams et al. [20] and Romanes [16] mentioned that the marginal mandibular leaves the parotid gland and runs be-

low the lower border of the mandible, which it crosses to supply the muscles of the lower lip, without referring to the site of this crossing. However, McMinn [11] mentioned that the nerve crosses the lower border of the mandible at the anterior border of the masseter superficially to the facial artery. Freilinger et al. [7] and Corriea and Zani [5] mentioned that the nerve crosses the lower border of the mandible halfway between its angle and its mental protuberance.

Indeed, the site of crossing of the nerve on the lower border of the mandible is variable. The present study showed that the nerve may cross the lower border of the mandible opposite the masseter muscle or opposite the facial artery or anterior to the facial artery (Table 1). Stern [19] as well as Dingman and Grabb [6] indicated that anterior to the facial artery the nerve is above the lower border of the mandible in all cases.

To avoid injury to the marginal mandibular nerve Kennedy and Poole [9] suggested exposure, ligation and section of the facial artery below the lower border of the mandible. The distal stump of the artery is reflected upwards to form a loop that retracts the nerve with it. The current study showed that the nerve may be unrelated to the facial artery; in 12% of cases it crossed at the level of the masseter muscle and in 14% of cases it was anterior to the artery, so that this technique would be of no value in ensuring safety of the nerve. Moreover, the results presented here, as well as those of Dingman and Grabb [6], show that the nerve may be presented by 2 branches which cross, one superficial and the other deep to the artery; the manipulation of the facial artery in this case severely endangers the nerve.

The distal part of the marginal mandibular branch(es) was found by most authors, including the current study, to be deep to the muscles of the lower lip. At the same time Stern [19] mentioned that the nerve ran through the platysma muscle anterior to the facial artery. Liebman et al. [10], in addition to Greyling and Meiring [8], showed that the nerve runs superficially as it travels to supply the effector muscles.

The relationship of the marginal mandibular nerve to the deep fascia of the neck is rarely mentioned by textbooks of anatomy and surgery in spite of its great importance from the surgical point of view. The current study showed that above the lower border of the mandible the nerve leaves the parotid gland and runs over the masseter muscle covered by the superficial layer of the parotid fascia until it disappears deep into the depressor anguli oris muscle. On the other hand, below the mandible the nerve(s) runs intrafascially (in the general investing fascia) until the point of crossing on the lower border of the mandible. Similar results were described by Stern [19] and Rudolph [17], who reported that on the body of the mandible the nerve runs covered by the masseteric fascia up to the muscles of the lower lip. Nelson and Gingrass [14] mentioned that superficial to the submandibular gland the marginal mandibular nerve runs in the investing fascia of the neck. Stern [19] mentioned that regardless of the type of skin incision employed the first step in neck dissection is usually the development of a subplatysmal flap. The intrafascial course (in the general investing fascia) of the marginal mandibular nerve in the upper part of the neck presented here raises a question over the validity of making a subplatysmal flap routinely in upper neck dissections. In fact a subfascial flap, thus including the general investing fascia, would be much more reasonable and safer. The reflection of a subfascial flap will allow the surgeon to work in a field free from the marginal mandibular nerve.

CONCLUSION

In conclusion, the current study showed that the lower border of the mandible can be used as an important landmark for avoiding injury to the nerve. In operations above the lower border of the mandible a subplatysmal flap would be satisfactory, while below the mandible's subfascial flap (including the general investing fascia) would be much safer, provided that the incision lies at least one inch below the mandible.

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