Main Article

Preservation of Marginal Mandibular Nerve by Direct Visualization during Neck Dissection

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ABSTRACT

Introduction

The marginal mandibular branch of the facial nerve is frequently at risk of injury during neck dissection surgery, causing visible cosmetic deformity and functional problems to the patient. The aim of the study was to assess whether there is any difference in incidence of marginal mandibular nerve palsy, level 1b lymph node yield and operating time between patients in whom the nerve is dissected by traditional methods (Hayes Martin) and where the nerve is directly visualised and dissected.

Materials and Methods

Retrospective review of 45 patients (56 neck dissections) of oral cancer undergoing neck dissection as part of their surgery.

Results

Patients in whom the marginal mandibular nerve is directly visualised and dissected have a statistically significant decreased incidence of post-operative marginal mandibular nerve palsy and higher level 1b lymph node yield than in patients where the nerve is protected by traditional methods, without any significant difference in operating time.

Conclusion

directly visualising the marginal mandibular nerve and dissecting it off the surgical field gives better cosmetic and functional results, as also nodal clearance, in patients undergoing neck dissection for oral cancer, without significantly increasing operating time.

Keywords

Neck Dissection; Oral Cancer; Marginal Mandibular Nerve; Hayes Martin Method; Sandwich Technique; Level 1b Lymph Nodes

The marginal mandibular nerve is an important branch of the facial nerve which supplies the muscles of the angle of the mouth and the lower lip- the depressor anguli oris, the depressor labii inferioris and the mentalis. The course of the nerve frequently exposes itself to injury during surgeries of the neck, especially the upper neck, like submandibular gland surgeries and neck dissections. Injury to this nerve causes significant cosmetic and functional deformities for the patient, manifested as an asymmetric smile and weakness of the angle of the mouth leading to inadequate lip closure and dribbling of saliva or liquids.

Neck dissection is an integral part of the surgical management of oral squamous cell carcinomas. The radical nature of these surgeries frequently leads the surgeon to pay little attention to preserving the marginal mandibular nerve diligently. This leads to frequent injury to the nerve with its attendant cosmetic and functional morbidities.

The marginal mandibular nerve is conventionally tried to be protected from injury by indirect methods of dissection like the Hayes Martin method or the sandwich technique, though these methods are less likely to be foolproof. In this study we aim to compare the conventional methods of marginal mandibular nerve dissection to direct visualization and dissection of the nerve and its effect on incidence of nerve injury and nodal yield. The specific objectives of the study are to compare the

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incidence of marginal mandibular nerve injury, the average nodal yield from the level 1b nodal level and the operating time between the two groups, between two groups–the conventional dissection method with and without direct visualization of the nerve.

Materials and Methods

The study adheres to the ethical guidelines as outlined in the declaration of Helsinki. This was a retrospective study of patients of oral cancer treated with surgery for the primary lesion combined with unilateral or bilateral neck dissection (levels I to IV/V) as the case may be. Data from our departmental registry for the preceding twelve (12) months (December 2023 through December 2024) was analyzed. We included Treatment naïve patients of oral cancer (buccal mucosa, tongue) and patients whose primary tumors were accessed either intra-orally or through a midline lip-split incision for our study.

Patients with cancer other than that of buccal mucosa or tongue, history of previous neck surgery, recurrent cancer, significant cheek skin involvement, those whose surgery involved an angle-split incision and patients undergoing mandibulectomy were excluded for the study.

Fifty-six (56) patients were included for the purpose of this study. We documented the age, sex, site of primary-buccal mucosa or tongue, neck dissection unilateral or bilateral, clinical N stage, method of marginal mandibular nerve dissection- conventional method or direct visualization and dissection method and operating time for neck dissection.

The marginal mandibular nerve was dissected via two techniques. In the conventional approach, the facial vein was ligated near the inferior border of the submandibular gland and was reflected off superiorly, with the idea that the nerve will be reflected off the field along with the vein. This is the Hayes Martin method. In some cases, the fascia over the submandibular gland was incised and dissection was carried on between the gland and the fascia, lifting the fascia off the gland - the so-called sandwich technique. The nerve which lies in the overlying fascia is thus believed to be protected from injury.

Fig. 1. The marginal mandibular nerve (pointed to by the forceps) demonstrated by the direct visualisation and dissection method at the gonion.

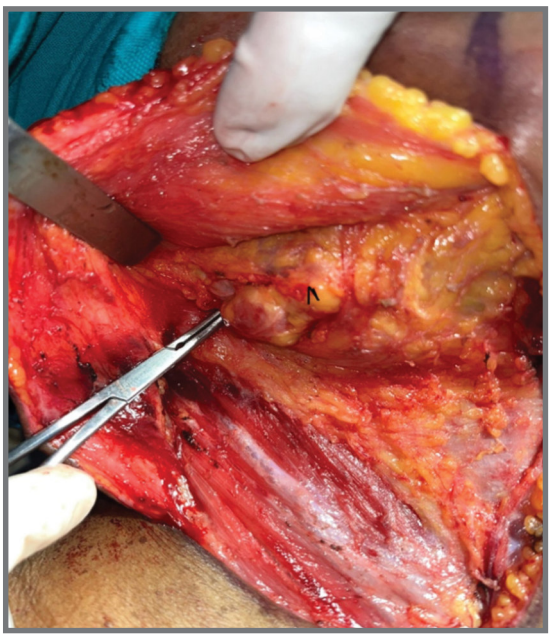

Fig. 2. A perifacial node (black arrowhead) in the vicinity of the marginal mandibular nerve. Only direct visualisation and dissection of the nerve can effectively clear these nodes.

From May 2024 onwards, we abandoned the aforementioned techniques and tried to directly look for the mandibular nerve and dissect it off the operating field. We call it the direct visualization and dissection method (figures1 and 2).

In this method, first the inferior border of the submandibular gland is identified and pulled inferiorly by a Babcock's forceps, thereby stretching the fascia over the gland near the inferior border of the mandible. We locate the gonion as an anatomical landmark and carefully look for the nerve which usually lies within 1 cm superior or inferior to the gonion. Once the nerve is identified, careful dissection of the nerve is carried out from the gonion posteriorly to above the inferior border of the mandible anteriorly and the nerve is mobilized superiorly to keep it off the operating field. We avoid the use of monopolar diathermy in the vicinity of the nerve. Minute bleeding is controlled with the judicious use of bipolar diathermy under copious irrigation.

We assessed for marginal mandibular nerve palsy on the first post-operative office visit. Marginal mandibular nerve palsy was said to be present if the patient had a facial asymmetry, particularly on smiling or showing teeth.

We measured outcomes on the basis of presence or absence of clinical evidence of marginal mandibular nerve palsy at first post-operative office visit, level 1b nodal yield in the final histopathology and operating time for neck dissection.

Statistical analyses: All statistical tests were carried out using IBM SPSS Statistics, version 26. D escriptive statistics were employed for the demographic parameters. Independent samples T-Test was used for comparing means between groups. Chi square test for independence was used for comparing frequencies between groups of categorical variables. Level of significance was set to less than 0.05.

Results

45 patients, undergoing 56 neck dissections, were included in the study. There were 30 males and 15 females in the study population (male=66.6%, females 33.3%). Age of the patients ranged from 37 years to 67 years (mean age=50.714 years, SD 8.184). 34 patients underwent unilateral neck dissections, and 11 patients underwent bilateral neck dissections. Table 1 represents the demographic characteristics of the patients along with other findings. 34 patients (75.55%) had cancer of the buccal mucosa and 11 patients (24.44%) had cancer of the oral tongue (table 2). The nodal status of the included patients is presented in table 3.

Table I: Patient demographics and operative findings

MEAN AGE IN YEARS (RANGE)	50.714 (37-67)
Sex, n (%)	
male	**30 (66.6%)**
female	**15 (33.3%)**
Neck dissection, n (%)	
unilateral	**34 (75.5%)**
bilateral	**11 (24.4%)**
Site of primary, n (%)	
Buccal mucosa	**34 (75.5%)**
Tongue	**11(24.4.%)**
Operating time	
Group 1, mean (SD)	**72.41 (11.164)**
Group 2, mean (SD)	**77.41 (9.866)**
Level 1b Nodal yield	
Group 1, mean (SD)	**2.409 (0.959)**
Group 2, mean (SD)	**3.265 (1.421)**

Table II: Site of primary distributed by sex

	BUCCAL MUCOSA PRIMARY	TONGUE PRIMARY	TOTAL
male	**22**	**12**	**34**
female	**08**	**03**	**11**
total	**30**	**15**	**45**

Table III: Nodal status of patients

NODAL STATUS	NUMBER	PERCENTAGE
N0	23	41%
N1	16	28.5%
N2a	02	3.5%
N2b	07	12.5%
N2c	08	14.3%
Total	56	100%

The marginal mandibular nerve was addressed conventionally in 22 necks, while in the rest 34 necks, direct visualization and dissection of the nerve was performed. In the conventional dissection group, 14 of 22 patients had post-operative marginal mandibular nerve palsy (63.63%). In the direct visualization group, 10 of 34 patients had marginal mandibular nerve palsy in the post-operative period (29.41%). There was a statistically significant difference in incidence of nerve palsy between the two groups (S«^{2} = 6.389, df=1, p= 0.011).

The mean level 1b nodal yield per neck in the conventional group was 2.409 +/- 0.959 (range 1-4), while that in the direct visualization and dissection group was 3.265 +/- 1.421(range 1-6) (table 1). There was a statistically significant difference in the level 1b nodal yield between the two groups (t= -2.479, df=54, p=0.016).

The mean operating time in the conventional surgery group was 72.41min (SD 11.164), and in the direct dissection group was 77.41 min (SD 9.866), as shown in table 1. There was no statistically significant difference in neck dissection operating time between the two groups (t= -1.760, df 54, p= 0.084).

Discussion

Neck dissection is an integral part of surgery for oral squamous cell cancers (OSCC). Current evidence is strongly in favor of neck dissection even in cases of clinically node negative necks.[1] As defined by the American Academy for Otolaryngology- Head and Neck Surgery (AAO-HNS), neck dissections are classified according to nodal levels dissected, with selective neck dissection (levels I-III/IV) being the standard of care for clinically node negative OSCC.[2]

The marginal mandibular nerve (MMN) is a branch of facial nerve that exits from the antero-inferior border of the parotid gland. It courses deep to the investing layer of deep fascia running across the lower border of mandible and the facial vessels. Dingman and Grabb.[3] in their seminal paper of about 100 cadaveric dissections, are of the view that the relatively higher incidence of injury to this branch of the facial nerve is due to lack of an accurate description of its course, and due to lack of anastomosis with other facial nerve branches in its distribution. In their study, they found out that regarding the part of the nerve posterior to the facial artery, in 81% of cases, the nerve passed above the inferior border of the mandible, and in the rest 19%, it was found less than 1cm below the angle of the mandible. The part of the nerve anterior to the facial artery was above the inferior border of the mandible in 100% cases. They also found out that in 98% cases, the nerve crosses superficial to the facial vein and artery. Of note, a constant lymph node was found at the anterior angle of the facial artery where it crosses the inferior mandibular border. In 5% cases, there was an anastomosis between the marginal mandibular branch and the buccal branch.[3] Also, they reported that the nerve usually has two or more branches, most commonly two (67%), followed by a single branch (21%). Multiple branching of the nerve has also been reported by several other authors. Balagopal et al[4] reported 79.7% patients having a single division, 12.9% patients having two divisions and 6.9% patients having three or more divisions. According to Batra et al,[5] the branches are more at the terminal course of the nerve than at the origin.

In a study of 133 neck dissections, Nason et al[6] reported transient MMN palsy in 28% of patients and persistent palsy in 16%. Temporary dysfunction of the nerve was resolved in 3-6 months. Importantly, visualization of the nerve did not affect outcome, which was not the case in our study.[6] Moller et al[7] reported an incidence of 14% of nerve palsy in patients undergoing

neck dissection for oral cancer, 2 weeks after surgery, and a permanent palsy in 4-7% cases 1-2 years after the operation. Hsu et al [8] reported an incidence of 33.3% of MMN palsy in their series of minimally invasive neck dissection.

In 1951, Hayes Martin et al[9] described their classical technique of preservation of the MMN during operations on the neck. This eponymous technique entails ligation and division of the facial vein deep to the deep cervical fascia and lifting the vein along with the upper skin flap, with the idea that the nerve will lie between the vessel and the skin flap and will thus be protected from injury. Kudva et al[10] reported the so-called sandwich technique where the flap is raised off the surface of the submandibular gland taking the MMN along with it. Another technique is to ligate the facial vessels keeping a long suture end. A snap is attached to the cut end and flipped cranially, which forms a loop of the vessel around the nerve and protects it from injury.[11]

However, these traditional and indirect techniques have an obvious downside in that the surgeon may miss a number of prefacial or perifacial nodes in the vicinity of the MMN, if the MMN is not dissected off completely from the operating field. Lim et al[12,13] reported an incidence of 35% of perifacial lymph node positivity in oral cavity carcinoma. More importantly, the occult perifacial nodal positivity in their series of oral carcinoma was 27%. In this paper they defined the perifacial lymph nodes as the nodal pads that lie anterior or posterior to the anterior facial vein on top of the facial artery in the submandibular triangle. Riffat et al[14] reported that the Hayes Martin method of preservation of the MMN was oncologically safe, but this study consisted of patients of oropharyngeal carcinoma only and not oral cancers, which are known to behave differently as far as nodal metastasis is concerned. On the other hand, Tirelli et al,[15] in their prospective study on 62 patients undergoing neck dissection, perifacial nodes were identified in 84% cases, their numbers ranging from 0 to 5. Anterior perifacial nodes were found to be in direct contact with the MMN, and the Hayes Martin method failed to address all perifacial lymph nodes in 59% cases.

The main limitation of our study was the small sample size of 45 patients (56 neck dissections). This is a hindrance in drawing concrete conclusions from the study. Also, since it is a retrospective review, it lacks adequate power and level of evidence.

Conclusion

Traditional methods of marginal mandibular nerve preservation are inadequate in preventing nerve palsy and its attendant morbidities, as well as adequately clearing the perifacial nodes in the level 1B region of the neck during neck dissection surgery. Needless to say, more well designed and high powered studies are required to draw concrete conclusion about the functional and oncological results of direct nerve visualization and dissection in neck dissection.

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