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Original Article

Oncological Safety and Feasibility of Posterior Marginal Mandibulectomy vis-à-vis Anterior Marginal Mandibulectomy in Oral Cancers

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Abstract

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The surgical management of retromolar trigone cancer (RTC) is an area of contention regarding the extent of bony resection. We aim to evaluate the oncological safety and feasibility of posterior marginal mandibulectomy (PMM) for RTC. We analyzed the clinical records of 98 patients with squamous cell carcinoma managed surgically using marginal mandibulectomy during 2014 to 2017, in which anterior segment mandibulectomy (AMM) and PMM were done in 56 and 42 patients, respectively. The median follow-up time was 44.4 months (95% confidence interval [CI] 42.3, 49.5) and the overall survival rate was 93.9% (95% CI 89.4–98.8%). The local recurrence rate was 19.6 and 18.3 % in PMM and AMM ($p = 0.854$). In the PMM group, osteoradionecrosis (ORN) was detected in two patients (4.3%) and fractures in one (2.1%) patient, while the AMM group neither had fracture nor ORN till the latest follow-up. The study results suggest that PMM is an oncological safe and adequate procedure for RTC.

Keywords

- local recurrence rate
- osteoradionecrosis
- posterior marginal mandibulectomy
- retromolar trigone cancer
- survival rate

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Introduction

The squamous cell carcinoma (SCC) located in the posteriormost part of the oral cavity, including retromolar trigone (RMT), presents unique challenges in surgical practice. The complexities and peculiarities of this region warrant treatment approaches that are distinct from other subsites of the oral cavity.[1] While many lesions in the RMT area remain undetected for some time before presenting in advanced stages, due to the proximity to the posterior mandible and inherent difficulty in accessing that area, even low-volume lesions are often categorized in advanced stages. Moreover, these lesions can quickly spread to the masticator space and the infratemporal fossa, making surgical clearance challenging. Due to the firmly draped mucosa over bone in the RMT region, early bone involvement is always a possibility.[2] Therefore, appropriate management of the mandible is paramount in the SCC of the posterior part of the oral cavity, especially in the early-stage lesion. Radical surgeries like hemimandibulectomies have often been considered the treatment of choice for oncological adequacy. However, these procedures are functionally debilitating, require complex reconstructions, and can easily be superfluous if the bone is not involved. Despite the tremendous advancements in reconstructing mandibular defects by employing microvascular free tissue transfers over the last two decades, segmental defects still cause significant functional and cosmetic deficiencies. Microvascular reconstruction is a labor-intensive skilled procedure that is costly and may not be available to all patients and in all hospitals providing oral cancer treatment. Marginal mandibulectomy has been an established oncologically safe procedure and used in achieving adequate margins in oral SCC (OSCC), which are close but not infiltrating the mandible. Over the years, it has been used successfully to manage anteriorly and posteriorly based oral cancers.

Several authors in the past have described the use of marginal resection of the mandible in the posterior segment as posterior marginal mandibulectomy (PMM). Even though this procedure is technically challenging, it can prove invaluable in preserving the continuity of the mandibular arch in appropriately selected cases.[3] The extent of PMM can vary depending on the extent of the lesion and it can often be combined with upper alveolectomy.

However, controversies exist regarding the use of PMM due to concerns regarding its oncological safety and many surgeons advocate segmental mandibulectomy with appropriate bony reconstruction by free tissue transfer. The present study aims to evaluate the oncological safety and adequacy of PMM for SCC of RMT compared to anterior marginal mandibulectomy (AMM) performed for similarly staged disease in the anterior oral cavity. The safety and adequacy of this procedure are being compared with marginal mandibulectomies performed for similarly staged oral cancers located in the anterior segment of the mandible (anterior to the molars).

Material and Methods

This is a retrospective study analyzing the impact of marginal mandibulectomy performed on treatment-naive OSCC from 2014 to 2017 at our institute. We initiated this study after receiving approval from our Institutional Human Ethics Committee (IEC No: 900821). Patients with a histological diagnosis other than SCC and those with prior treatment history of chemotherapy or radiotherapy were excluded from the study to avoid heterogeneity. The demographic, clinical, and surgical details were obtained from electronic medical records of the hospital. For this study, we grouped the marginal resections of the mandible involving the molar, retromolar, or the ascending ramus as PMM and marginal resections done anterior to the molars for anteriorly placed oral cancers as AMM.[3,4] Study was conducted taking into consideration the Helsinki's Declaration.

Statistical analyses were performed using IBM SPSS 21 Statistics and R Studio. Association between posterior segment marginal mandibulectomy and categorical clinical parameters was analyzed using the chi-square test or Fisher's exact test. Comparison between posterior segment marginal mandibulectomy with continuous clinical parameters was performed using the independent *t*-test or Mann–Whitney *U* test. Overall survival was defined as the duration between the date of surgery to the date of death due to any cause or date of last follow-up (censored). The Kaplan–Meier method was used to estimate the probability of overall survival. Survival analysis was performed by comparing groups with the log-rank test. A p-value of ≤ 0.05 in a two-tailed test was considered statistically significant.

Results

Ninety-eight patients were eligible for the study during the selected study period and the pertinent data collected was evaluated statistically. The demographic and basic clinicpathological details are provided in ►**Table 1**. Of these 98 patients, 42 (41.9%) underwent PMM and 56 (57.1%) underwent AMM and both groups have similar demographic profiles. The median follow-up time for the entire cohort was 44.4 months (95% confidence interval [CI] 42.3, 49.5) and reported a 3-year overall survival rate of 93.9% (95% CI 89.4–98.8%. Both groups did not show any statistically significant ($p = 0.59$) difference in overall survival for the entire cohort. However, the overall survival in the group with recurrence was significantly different from the group with no recurrences ($p = 0.012$) (►**Fig. 1**). The comparison between PMM and AMM is given in ►**Table 2**.

Out of the total 15 recurrences recorded in the study, 6 (40%) were in the PMM group and 9 (60%) were in the AMM group and were not statistically significant. The risk of recurrence was not significantly related to differentiation, lymphovascular invasion, perineural invasion, pT stage, and pN stage but was significant for extracapsular spread ($p = 0.01$). There was no significant relation between recurrence rate and size of primary, nodal positivity, depth of invasion (DOI), and margin status or bone involvement. However, most of the (9/15) recurrences occurred in early-stage (pT1), node-negative cases with clear margins and in 86.7% of cases with recurrences, there was no bone involvement. There was no statistically significant difference

Table 1 Demographical, clinical, and tumor-related characteristics of the patients ($N = 98$)

Age in years, mean (SD)	51.6 (12.3)
Sex	
Male	89 (90.8)
Female	9 (9.2)
Mean (SD) T size in cm	2.1 (1.2)
Pathological T classification (%)	
T1	43 (43.9)
T2	29 (29.6)
T3	13 (13.3)
T4	13 (13.3)
Pathological nodal metastasis (%)	
N+	22 (22.4)
Extracapsular spread (ECS)	
Present (%)	9 (9.2)
Mean (SD) depth of invasion (DOI) in cm	0.7 (0.6)
Margins (%)	
Adequate	86 (87.8)
Inadequate	12 (12.2)
Mean (SD) margin distance in cm	0.7 (0.2)
Bone involvement (%), yes	9 (9.2)
Lymphovascular invasion present (%)	1 (1.0)
Perineural invasion present (%)	5 (5.1)
Differentiation (%)	
Well-differentiated	18 (18.4)
Moderately differentiated	71 (72.4)
Poorly differentiated	9 (9.2)
Adjuvant treatment (%)	
Chemoradiotherapy	17(17.3)
Radiotherapy	35 (35.7)
No adjuvant therapy	46 (46.9)
Patient received RT (%)	52 (53.1)
Follow-up status (%)	
Alive	81 (87.1)
Not alive	12 (12.9)
Lost to follow-up	5 (5.1)

Abbreviations: RT, radiation therapy; SD, standard deviation.

between median resection margins in patients with or without recurrences (0.7 vs. 0.6 cm, $p = 0.36$). The overall survival of patients who underwent PMM and AMM is depicted in ►**Fig. 1**. In the entire cohort, we noticed osteoradionecrosis (ORN) only in two cases in the PMM group and both had received adjuvant radiotherapy in the postoperative period. Since the number of ORN cases was so low ($n = 2$), we could not find any meaningful association with age, sex, pT stage, DOI, bone involvement, etc. However, we found a significant association between the presence of ORN

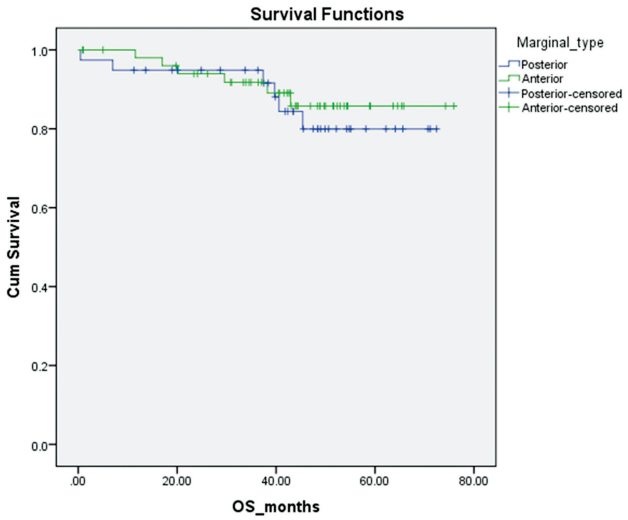

Fig. 1 Comparison of overall survival between posterior marginal mandibulectomy and anterior marginal mandibulectomy.

and node positivity ($p = 0.008$). One patient in the PMM group had a mandible fracture ipsilaterally at the angle.

Discussion

The unique properties and shape of the mandible are responsible for maintaining the form and function of the head and neck region. The tremendous forces exerted by muscles of mastication are countered by the mandibular bone's material property and geometric design.[5] Hence, a great emphasis is given to the preservation of mandible in head and neck SCC, wherever it is feasible. Mandible preservation is more easily attainable in anteriorly located tumors, with good surgical and oncological outcomes.[6] Anterior segment marginal mandibulectomy was initially described by Crile and has been established as an oncologically safe and technically feasible surgery.[8]

However, mandible preservation is challenging in the case of posteriorly located oral tumors like RMT tumors. Due to the difficulty in clinical evaluation and their proximity to bony structures (mandible and maxilla), they are more prone to cause bone erosion. Paradoxically, even smaller tumors may be classified in higher stages due to early masticator space involvement and suspected bone involvement. Preoperative clinical and radiological assessment is not infallible for detecting bone erosion.[6–8] Hence, decision to perform conservative surgery for mandible preservation in posteriorly located tumors requires diligent planning. When there is no evident bone erosion clinically, but due to the location of the tumor, many surgeons remove the posterior segment of the mandible. However, in such cases, proper bony reconstruction to restore the continuity of the mandible is essential and this is usually obtained by using microvascular free flaps. Marginal mandibulectomy is a well-established procedure for anterior oral cancers located close to or abutting the mandible. A similar concept can be applied to posteriorly located tumors as well. The idea of posterior segment marginal mandibulectomy introduced initially by Byers is still not being practiced in

Table 2 Distribution of tumor characteristics of PMM and AMM

	Posterior marginal mandibulectomy (PMM)	Anterior marginal mandibulectomy (AMM)	*p*-Value
Total numbers (%)	42	56	–
Median tumor size	1.9 (1.3, 2.5)	22 (1.1, 3.0)	0.95
Pathological T stage (%) T1 T2 T3 T4	17 (40.5) 13 (31.0) 8 (19.0) 4 (9.5)	26 (46.4) 16 (28.6) 5 (8.9) 9 (16.1)	0.41
Lymph node metastasis (%) Negative Positive	32 (76.2) 10 (23.8)	44 (78.6) 12 (21.4)	0.78
Extracapsular spread present (%)	5 (11.9)	4 (7.1)	0.41
Median (IQR) depth of invasion	0.6 (0.4, 0.9)	0.6 (0.3, 0.9)	0.31
Margins (%) Clear Close Positive	37 (88.1) 5 (11.9) 0	49 (87.5) 6 (10.7) 1 (1.8)	0.67
Median (IQR) margin in cm	0.7 (0.5, 0.8)	0.6 (0.5, 0.8)	0.45
Bone involvement present (%)	4 (9.5)	5 (8.9)	0.92
Adjuvant treatment received (%)	22 (52.4)	30 (53.6)	0.9
Recurrence (%)	6 (14.3)	9 (16.1)	0.80
Osteoradionecrosis	2 (4.8)	0 (0.0)	0.101

Abbreviation: IQR, interquartile range.

adequate numbers.[3] There is a dearth of literature to firmly establish adequacy, oncological safety, and functional attribute outcome of PMM. The concern of causation of ORN and pathological fractures in the maximum stress-bearing area of the mandible also precludes the preference of PMM by many. However, in our center, the PMM is still practiced wherever indicated, and the current study is an audit of our experience with PMM. In the present study, the results of the PMM group are compared with the AMM group to understand the oncological safety and adequacy of PMM. We could not find any significant difference in the adequacy for tumor excision measured in terms of margin status and rate of recurrence or postoperative complications like ORN and fracture of the residual mandible.

The median size of the primary tumor was marginally smaller in the PMM group compared to the AMM group. However, the PMM group had greater lymph node positivity (23.8% vs. 21.4%), nodal extracapsular spread (11.9% vs. 7.1%), DOI (0.6 vs. 0.5 mm), and bone involvement (8.7% vs. 7.6%). Even though the above results are not statistically significant, they indicate an aggressive nature of tumors in the RMT area.[9]

The rate of ORN detected in the study (2.0%) is well within the range described in recent literature.[10] In this study, both cases of ORN were found in the PMM group. The PMM reduces the cross-sectional area around the angle of mandible, thus making the mandible more susceptible to stress forces at this location. The frequent stress may have a casual association with ORN in PMM. However, both these patients had nodal metastasis and have received adjuvant radiotherapy. A fracture of the residual mandible was also detected in the PMM group, which could be attributable to the previously discussed phenomenon. However, in the absence of any statistically significant association and a small number of ORNs (two cases) detected, such inference is assumptive and cannot be interpreted as valid.

The present study also showed that the recurrence rate in the PMM group (40%, 6 out of 15) though not statistically significant was slightly lower than the AMM group (60%, 9 out of 15). The overall recurrence rate detected was 15.3%, comparable to other studies.[11] The factor significantly related to local recurrence was extracapsular spread, which can be a surrogate marker for aggressive disease. The overall 3-year survival was 93.3% and the survival was not significantly different in the two groups ($p = 0.59$).

The relatively smaller sample size with the study's retrospective nature is a significant drawback. Also, a longer follow-up period may be required for better inferences from the study. Despite these, the present study can demonstrate the PMM and AMM's comparability in oncological safety. Even though all cases of ORN and fracture were detected in the PMM group, a causal association is difficult to establish. Nonetheless, precautions must be taken while performing marginal mandibulectomy, as advised in prevalent literature on the issue.[3,12–14]

The present retrospective, comparative analysis of AMM and PMM shows that the PMM is the oncologically safe and adequate procedure for appropriately selected lesions arising near the posterior part of the mandible. Both procedures were sufficient for resection of the primary tumors in

indicated cases. When performed with due diligence, we noticed a similar recurrence rate and overall survival without a significant increase in the rate of complications.

Conclusion

We conclude that posterior marginal mandibulectomy when performed in select group of lesion is both oncologically safe with similar recurrence rate and with no added complication rates.

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Conflict of Interest
None declared.

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