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Assessment of Dysphagia after Hemiglossectomy and Radiotherapy: A Prospective Study

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Abstract

Background Malignancy of the tongue is a common condition affecting patients and their day-to-day activities. The tongue plays an important role in deglutition. The combination treatment modality involving surgical resection with or without reconstruction and radiation is the most commonly used modality for such lesions. This in turn has a profound impact on the quality of life of the patients owing to the nature of the treatment.

Aim of the study This study aimed to assess swallowing in patients with carcinoma tongue following hemiglossectomy and radiotherapy (RT).

Methodology A prospective study carried out in 20 patients who underwent hemiglossectomy with primary closure for carcinoma of the tongue followed by RT. All patients were evaluated for swallowing using the Dysphagia Handicap Index before surgery; after surgery on the 10th and 30th days; during RT after 15 fractions of radiation; and after 1, 2, and 3 months postcompletion of RT.

Results The Dysphagia Handicap Index has significantly increased from the preoperative value following both surgery and RT on all follow-up visits ($p < 0.001$). The most severe self-reported dysphagia was noted during and after RT($p < 0.001$).

Conclusion This study shows that hemiglossectomy followed by primary closure with adjuvant RT has a severe negative impact on swallowing, thereby affecting the quality of life.

Keywords
- dysphagia
- hemiglossectomy
- mouth neoplasms
- radiotherapy

Introduction

In the human face region, tumors of a cancerous nature take a toll on patients' lives. Regardless of addressing the disease surgically or otherwise, the palpable drop in the well-being of those who suffer from oral squamous cell carcinoma is a significant source of daily distress, with the potential to worsen with every passing week.

In the mouth, the tongue is seen to be targeted in among 30% of patients with Oral Squamous Cell Carcinoma (OSCC), with the lateral border being the primary site for most lesions. There exist different modalities of treatment for this disease. Encouraging responses to surgical excision followed by primary closure/reconstruction or a combination of surgery with chemo/radiotherapy (RT) have often

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been employed to tackle the challenge that is oral cancer.[1,2]

Nevertheless, the aggressive nature of such therapy leads to a sharp decline in patient's quality of life. When a normal bodily function becomes impeded in some way following surgical intervention, the patient is highly aware of the change, and this awareness can precipitate alarm.[3]

The act of swallowing is aided in no small part by the presence and active functioning of the human tongue. Deglutition is vital to the maintenance of one's physical health, the process being our most natural method of ingesting nutritive substances. Depending on the severity of the lesion, resection of diseased tissue with standard healthy margins could be an extensive procedure, leading to marked impairment in function. The strength and mobility of the tongue will decline proportional to the volume of tissue removed or the volume of tissue used for reconstruction.[4] Apart from surgical resection and tissue loss, dysphagia may also be secondary to xerostomia, mucositis, odynophagia, muscular fibrosis, or trismus following RT or chemotherapy, all of which together contribute to a significant decrease in patients' assessments of their quality of life.[4]

Concerning the available literature regarding the assessment of swallowing function following resection of the tongue, earlier studies have been limited to patients who underwent total glossectomy. At the same time, most studies also determined their research into outcomes following either surgical intervention or management with RT.

This study aims to assess the swallowing function of patients with carcinoma of the tongue before and after surgical excision, that is, hemiglossectomy, with primary closure and RT.

The study's primary objectives were to assess and compare swallowing in these patients before and after the surgical intervention and determine the associated changes in swallowing after the patients received RT.

Materials and Methods

In this prospective study, 20 patients reported tongue carcinoma to the Leela Narayan Shetty Memorial Cancer Institute, Justice K.S. Hegde Charitable Hospital, Mangaluru, Karnataka, and A.B. Shetty Memorial Institute of Dental Sciences, Mangaluru, Karnataka, were included. Sample size was calculated using the following formula:

$$n = \{(Z\alpha + Z\beta)^2 \,/\, C^2\} + 3 \text{ where } C = 0.5 \text{ x } \ln(1 + r \,/\, 1 - r)$$

Where, r = correlation coefficient – 0.616. With 95% confidence level and 90% power, sample size comes to be minimum of 20.

Inclusion Criteria

Inclusion criteria include the following:

- Patients with tongue carcinoma indicated for surgical excision, not more than hemiglossectomy.
- A lesion with following Tumor, Nodes and Metastases (TNM) grading, such as T1 and T2, and any N.
- Tongue lesions require primary closure.

Exclusion Criteria

Exclusion criteria include the following:

- Patients have neoplasm in other areas of the body.
- Any lesion was other than tongue lesion.
- Any tongue lesion requires more extensive excision than hemiglossectomy.
- A lesion with TNM grading T3.
- Edentulous patients.

The Study

After obtaining written, informed consent, all the patients included in this study were subjected to detailed documentation of their history and symptoms at presentation. The data collected had demographic details and medical, surgical, and personal accounts and meticulous documentation of the clinical examination. Computed tomography was performed to assess the extent of the tongue lesion to aid in planning the amount of resection. Swallowing was assessed in these patients before they underwent hemiglossectomy with primary closure. A single operator performed all surgical procedures.

Following the procedure, a swallowing assessment was done on postoperative days (PODs) 10 and 30. All patients were subjected to a course of RT as per our hospital protocol which was 60 Gy divided into 30 fractions over 6 weeks. During the RT period, after 15 bits, swallowing was assessed again. After the 1st, 2nd, and 3rd months, swallowing was reassessed after completion of RT. The primary author carried out all assessments.

The assessment was done using the "Dysphagia Handicap Index (DHI)"[5] (►**Fig. 1**). All patients included in the study were assessed at every appointment with a set of 25 questions as mentioned in the DHI. The patients were scored based on the three domains, namely, (1) physical (P) which has nine questions, (2) emotional (E) which has seven questions, and (3) functional (F) which again has nine questions. Each question has a response of never (scored 0), sometimes (scored 2), and always (scored 4). After questionaries, the patients were placed on a scale of 1 to 7, depending on their swallowing difficulty. The scores were documented as the Self-Reported Severity Scale for dysphagia.

Statistical Analysis

The qualitative data used in counts/percentages. Speech assessment scores were expressed as mean and standard deviation before and after the surgery and after RT. The changes in scores of pre- and postsurgery and after RT were analyzed by analysis of variance (ANOVA) followed by Bonferroni's correction.

Please circle appropriate responses to the questions about your swallowing

	Never	Sometimes	Always
1P I cough when swallowing liquids.			
2P I cough while eating solid food.			
3P My mouth feels dry.			
4P I cannot swallow food without washing it down with liquid.			
5P I have lost weight due to swallowing problems.			
1F I avoid certain kinds of food due to swallowing problems.			
2F I changed the way I swallow to make it easier to eat.			
1E I hesitate to eat in public.			
3F It takes longer to eat than before.			
4F I often eat smaller portions of food due to swallowing problem.			
6P It takes extra time to get the food down when swallowing.			
2E I get depressed because I cannot eat what I want.			
3E I do not enjoy eating as much as before.			
5F I don't socialize as much due to swallowing problems.			
6F I avoid eating due to swallowing problems.			
7F I eat less due to swallowing problems.			
4E I am nervous about swallowing problems.			
5E I feel impaired because I have difficulty in swallowing.			
6E I get annoyed with myself because of swallowing problems.			
7P I cough as I take my medicine.			
7E I have a fear that I may choke and suffocate with food in the throat because of my swallowing problems.			
8F I have to use an alternative method of eating (such as tube feeding) because of my swallowing problems.			
9F I changed the dietary composition due to swallowing problems.			
8P My throat feels tight when swallowing.			
9P I have coughing fits after swallowing.			

Self-reported Dysphagia Severity Scale.
Please circle the number that best describes the severity of your swallowing difficulty (1= no difficulty in swallowing, 4= somewhat of a problem, 7= the worst problem for me).

1 2 3 4 5 6 7
Normal Moderate problem Severe problem

Fig. 1 Back translation of the Japanese translation of the Dysphagia Handicap Index.

Results

Out of the 20 patients included in this study, 6 were below 50 years of age (30%) and 7 (35%) were above 60 years. It was found that 14 (70%) were males and the remaining 6 (30%) were females. There was a significant difference ($p < 0.001$) among the mean values of DHI total scores (►**Fig. 2**), P (►**Fig. 3**), F (►**Fig. 4**), E (►**Fig. 5**), and Dysphagia Severity Scale (DSS) (►**Fig. 6**). The study compared DHI scores individually at different time intervals. Bonferroni's *t*-test for repeated measures showed a significant difference in various follow-ups. When compared between preoperative and POD 10, there was an increase of 8.4 in mean DHI values, and this increase was found to be statistically significant ($p < 0.001$). And on POD 30, the increase was 5.9 which is less than in POD 10. But later, during RT after 15 fractions, there was an increase of up to 13.6. The increase was more in the other follow-up periods. This increase was maximum, having a mean of 19.9 at 3 months from preoperative. The values were compared from POD 10 with the remaining follow-ups. The

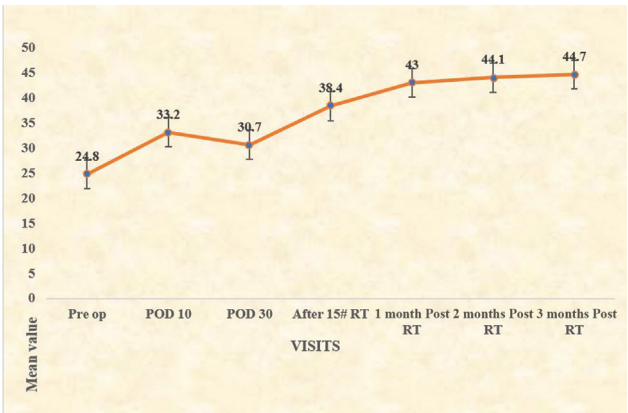

Fig. 2 Comparison of the Dysphagia Handicap Index (DHI) score. POD, postoperative day; RT, radiotherapy.

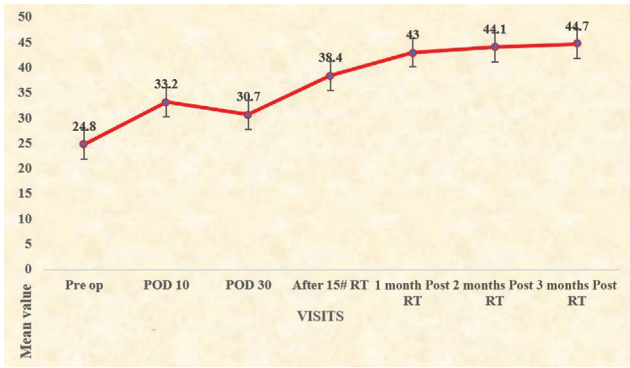

Fig. 3 Comparison of subscore physical (P).

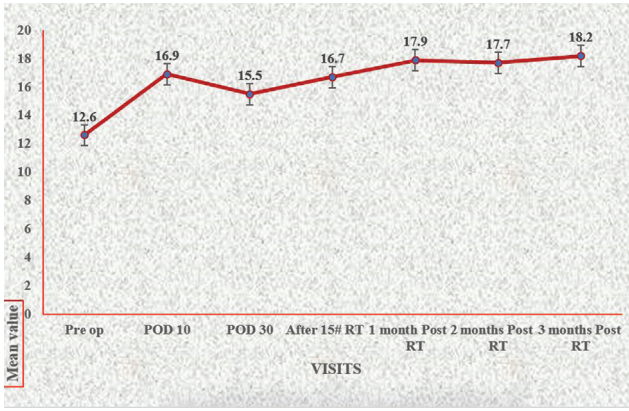

Fig. 4 Comparison of subscore functional (F).

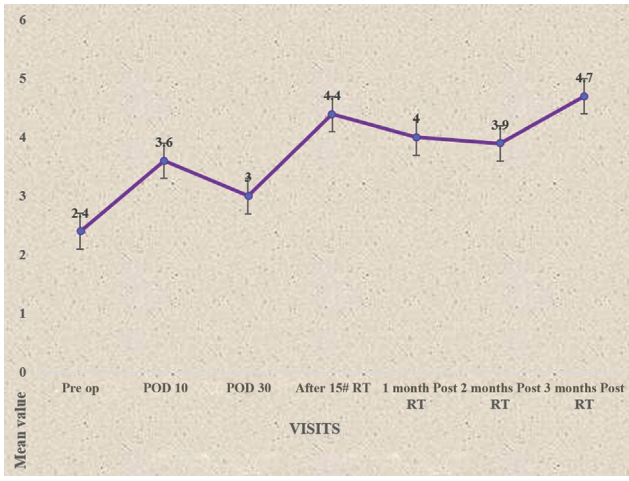

Fig. 5 Comparison of subscore emotional (E).

difference was insignificant between POD 10 and POD 30, with a mean decrease of 2.5.

Later follow-ups showed a significant ($p < 0.001$) increase in values. The subsequent follow-ups exhibited a significant difference compared to the POD 30 with an increase of up to 14 in mean difference. The contrast of DHI scores between RT 15 fractions and RTs of 1, 2, and 3 m were significantly different. However, the remaining comparisons were not significant (►**Table 1**).

The total DHI and P scores had a similar trend compared with follow-up visits. The F score was substantial ($p < 0.001$) in pre- and postoperative periods and E in the immediate postoperative period.

Discussion

Several pieces of evidence documented the profound impact of extensive respective surgery on the health and well-being of patients suffering from OSCC. Over the last 100 years, surgeons have slowly discovered the bare minimum amount of tissue that needs to be removed for the patient to have a chance at disease-free survival. Although developments in medicine and technology have helped refine the process, there is no escaping the fact that aggressive removal of tissue

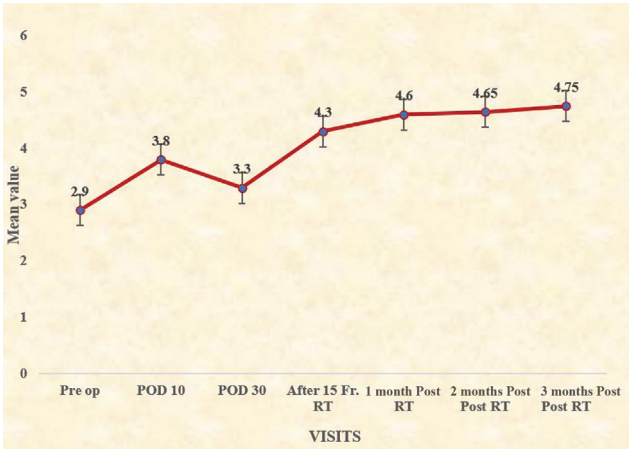

Fig. 6 Comparison of DSS.

Table 1 Intercomparison of total DHI

		Mean difference	*P*
Preoperative	POD 10	−8.4	<0.001
	POD 30	−5.9	<0.001
	After 15 Fr. RT	−13.6	<0.001
	1-month post-RT	−18.2	<0.001
	2-month post-RT	−19.3	<0.001
	3-month post-RT	−19.9	<0.001
POD 10	POD 30	2.5	1.000
	After 15 Fr. RT	−5.2	0.008
	1-month post-RT	−9.8	<0.001
	2-month post-RT	−10.9	<0.00
	3-month post-RT	−11.5	<0.001
POD 30	After 15 Fr. RT	−7.7	<0.001
	1-month post-RT	−12.3	<0.001
	2-month post-RT	−13.4	<0.001
	3-month post-RT	−14.0	<0.001
After 15 Fr. RT	1-month post-RT	−4.6	0.033
	2-month post-RT	−5.7	0.002
	3-month post-RT	−6.3	<0.001
1-month post-RT	2-months post-RT	−1.1	1.000
	3-month post-RT	−1.7	1.000
2-month post-RT	3-month post-RT	−0.6	1.000

Abbreviations: DHI, Dysphagia Handicap Index; POD, postoperative day; RT, radiotherapy.

is still indicated for all operable lesions. For carcinoma of the tongue, the employment of surgical and reconstructive techniques along with RT has proven a beneficial combination in the long fight against oral cancer. Being extensive, the surgical address of the tumor leaves the patients with impairments in their daily functioning. In light of this, our

study was designed to evaluate how swallowing gets affected in patients with carcinoma of the tongue following hemiglossectomy with primary closure and RT.[1,2]

In this study, 20 patients with carcinoma of the tongue were included. The mean age of patients was 58.4 ± 12.701 and male patients were more in number than females. Following the inclusion and exclusion criteria of the study, 20 patients were clinically and radiologically assessed and selected for this study who underwent hemiresection of tongue lesion with primary closure and then underwent RT. The patients were assessed before surgery and in six follow-up periods, one on POD 10, one on POD 30, then during RT after 15 fractions of radiation, and finally one at 2 and 3 months after the completion of RT. Swallowing was assessed by the DHI questionnaire as described earlier. The results show that the mean DHI score was highly significant ($p < 0.001$) and it progressively worsened over the follow-up visits. Similar trends were seen in the P subscore of the DHI. The F and E subscores also were found to be very highly significant. The functional aspect was more significant in the pre- and postoperative periods. The E subscore significantly peaked immediately after surgery. Patients reported significantly severe dysphagia in the immediate postoperative period, with scores levelling in the subsequent visits. However, when swallowing is considered, reconstruction with a free flap gives more volume and bulk modifications to the tongue after resection of the tumor. The results of our study are comparable to previously published literature.[6,7] The other objective of this study was to assess the effects of RT on swallowing. When patients were subjected to RT, the P component was affected most in the radiation and postradiation period. The E impact of dysphagia was highly significant during RT, with the highest peak during the third month after RT. Patients, when asked to subjectively report on how severe they felt their dysphagia was, they reported significantly higher levels of severity during the RT and even in the visits following RT, indicating a definite worsening of swallowing after exposure to radiation. These results are similar to the other literature. Earlier studies documented that swallowing function is severely affected by adjuvant RT,[7–9] mostly because radiation causes atrophy of salivary glands, dry mouth, fibrosis, and mucosal edema and impairs the tongue's mobility or oral tongue structures involved in the mechanism of swallowing.[9] Some studies suggest radiation over surgery as a treatment modality for malignancies of the tongue base in both early and late stages of the disease.[10] Our study results are not directly comparable to this study.

Limitations

Following the use of the DHI in all patients included in this study, the limitations of the index became apparent. It is worth noting that the index is not easy to understand or intuitive, and this highlights the need for a more standardized, user friendly index that is accessible to a more varied patient population.

Conclusion

The treatment modality employed in this study to treat carcinoma of the tongue had definitive effects on the ability of patients to swallow. Changes in deglutition were most prominent in the immediate postoperative period, and after undergoing RT. This study reveals that the loss of bulk following primary closure significantly alters tongue mobility, thus proving to be a roadblock to effective deglutition.

Conflict of Interest
None declared.

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