DOI: 10.7860/JCDR/2024/68207.19016

Original Article

Oncology Section

Assessment of Oncosurgical and Functional Outcomes in Patients undergoing Glossectomy for Advanced Carcinoma Tongue: A Cross-sectional Study at a Tertiary Cancer Care Centre in Northern India

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ABSTRACT

Introduction: Tongue carcinoma presents a global oncological challenge due to its aggressive nature and late-stage diagnosis. Glossectomy, a key surgical procedure for advanced cases, significantly affects both cancer control and essential functions such as speech and swallowing.

Aim: To analyse the impact of different glossectomy types on oncological and functional outcomes in patients with advanced carcinoma of the tongue.

Materials and Methods: A cross-sectional study was conducted in the Department of Surgical Oncology, Cancer Research Institute, Himalayan Institute of Medical Sciences, Swami Rama Himalayan University, Uttarakhand, India over a one-year period from September 1, 2022, to August 31, 2023. The study included 47 patients with squamous cell carcinoma of the oral and posterior tongue who underwent glossectomy. Oncological outcomes (mortality and hospital stay) and functional outcomes (swallowing, speech, dysphagia, and Quality of Life (QoL)) were assessed. The questionnaires used were the EORTC Core Quality of Life questionnaire (EORTC QLQ-C30), EORTC questionnaire for the assessment of QoL in head and neck cancer patients (EORTC QLQ-H&N35), M.D. Anderson Dysphagia Inventory (MDADI), and Speech Handicap Index (SHI). Follow-up was conducted at the 6th week to assess changes in the functional aspects compared to the baseline scores. Data were entered into Microsoft Excel, and the analysis was performed using Statistical Packages for Social Sciences (SPSS) software version 25.0. The data were analysed using the Wilcoxon Signed Rank test. A p-value of <0.05 was considered statistically significant.

Results: The study comprised 37 (78.72%) males and 10 (21.28%) females, with a mean age of 47.77±12.6 years. Preoperative staging indicated that 22 (46.81%) patients had T2N0 stage, 16 (34.04%) patients had T3, and 9 (19.15%) patients had T4a disease. Among the patients, 14 (29.79%) underwent partial glossectomy, 27 (57.45%) underwent hemiglossectomy, and 3 (6.38%) underwent subtotal glossectomy, and 3 (6.38%) underwent total glossectomy. The mean duration of hospital stay was 10.09±2.87 days. There were no instances of mortality or tumour recurrence at the 6th week. Regarding the functional outcomes, compared to baseline, at the 6th week, there was a significant decrease in EORTC QLQ-H&N35 median scores from 6.94 to 1.73 (p=0.005), but no significant change in the mean EORTC QLQ-C30 (90±8.22 versus (vs) 89.72±8.52, p=0.368), mean MDADI (4.51±1.2 vs 4.43±1.19, p=0.585), and mean SHI (15.81±25.76 vs 13.43±26.19, p=0.052).

Conclusion: It can be inferred that glossectomy for advanced carcinoma of the tongue leads to a significant improvement in symptoms; however, the overall Quality of Life (QoL) and functions of the tongue such as swallowing and speech remain comparable to pre-surgery levels.

Keywords: Dysphagia, Hemiglossectomy, Quality of life, Surgery, Tongue cancer

INTRODUCTION

Carcinoma of the tongue, primarily represented by squamous cell carcinoma, poses a significant oncological challenge worldwide. It is notorious for its aggressive nature, late-stage diagnosis, and detrimental impact on patients' quality of life [1]. Its incidence is reported to increase, with an average annual percentage change of 1.8%, as reported in a recent study [2].

The symptoms of carcinoma of the tongue primarily include an ulcer, and the location is most commonly on the lateral side of the tongue. For diagnosis, biopsy remains the gold standard method-but accurate results require great precision and accuracy for sampling and reporting [3]. The late-stage diagnosis, frequently seen in these cases, has led to an increase in the rates of advanced stages of cancer, necessitating complex surgical procedures, including major glossectomy, which substantially affects the functional aspect of the tongue and quality of life of the patients [4].

Oncological surgical approaches for tongue cancer management have evolved significantly over the years. Major glossectomy, a cornerstone of treatment, involves the resection of varying portions of the tongue, depending on tumour size and location. Chang JW et al., proposed a classification system for glossectomy types, further refining the understanding of the surgical extent and its implications [5]. These classifications range from partial glossectomy, hemiglossectomy, subtotal glossectomy, to total glossectomy as tongue resections involving 25-50%, 50-75%, >75%, and 100% of the tongue volume, respectively [6]. Major glossectomy significantly affects not only oncological outcomes but also essential functions such as speech, swallowing, and overall quality of life. The necessity for reconstructive procedures arises from the functional deficits resulting from extensive tongue resection. In recent years, surgical techniques for tongue reconstruction have advanced, offering various options such as local tissue flaps and microvascular free tissue transfer. These techniques have distinct advantages and limitations that can influence postoperative function and patient-reported outcomes [7].

Before undertaking any reconstructive surgery, the assessment of oncosurgical and functional outcomes following major glossectomy surgery remains a pivotal area of research and clinical interest. The oncological outcomes remain of significance to decide how much tumour has been resected and what is the current status of the tumour, while the functional outcomes help to assess the specific functions of the tongue following the resection of the tumour (which includes a major portion of the tongue), such as speech and swallowing. Overall, the patient's quality of life needs to be assessed to determine the prognosis following surgery [8].

The evaluation of these outcomes is influenced by factors such as the extent of resection, reconstructive techniques employed, and the patient's preoperative functional status. Standardised instruments and questionnaires must be used to assess these critical aspects of patient well-being [9-16].

The EORTC QLQ-C30 is used to measure cancer patients' physical, psychological, and social functions. It includes a global score, with five functional scales and nine symptoms scales. Higher scores for symptomatic scales indicate severe symptoms, while higher scores for the global QoL and the functional scales suggest a better level of functioning [10]. The QLQ-H&N35 provides a valuable tool for the assessment of pain-related QoL in clinical studies of head and neck cancer patients before, during, and after treatment with radiotherapy, surgery, or chemotherapy [11]. A SHI questionnaire with 30 items on speech problems is a reliable and valid questionnaire for assessing speech problems. It includes 30 statements, with a total score ranging from 0 to 120; where higher scores indicate serious problems in speech [12,15]. The MDADI is the first validated and reliable self-administered questionnaire designed specifically for evaluating the impact of dysphagia on the QoL of patients with head and neck cancer [13,16].

The study was conducted with the objective of determining the oncological outcomes (mortality and hospital stay), functional outcomes of the patients, namely pain, swallowing, dysphagia, and overall QoL, and factors affecting them. The study is novel from the point of view that the management of carcinoma of the tongue and its oncological outcomes reporting is necessary to create more awareness among the patients and to allow them to consider surgery for themselves. Also, the overall data may give some confidence to the patients in terms of improvement in their functions after surgery for carcinoma of the tongue, thereby giving them the opportunity to make the decision of operation more judiciously.

MATERIALS AND METHODS

A cross-sectional study was conducted in the Department of Surgical Oncology, Cancer Research Institute, Himalayan Institute of Medical Sciences, Swami Rama Himalayan University, Dehradun, Uttarakhand, India over a period of one year from September 1, 2022, to August 31, 2023. The study was started after obtaining Institutional Ethical Clearance (Reference No.HIMS/RC/2022/314).

Inclusion and Exclusion criteria: The inclusion criteria were adult patients (age >18 years) with tongue cancer of stage T2N0, T2N1, any T3, any T4, and who underwent major glossectomy at present study Institute. Exclusion criteria were patients with distant metastasis, pregnant patients, and patients with simultaneous cancers of other organ systems.

Sample size calculation: The sample size for the present study was calculated based on the study of Agarwal SK et al., who observed that the mean QoL pre and post-treatment in patients with carcinoma of the tongue was 950.26±55.65 and 850.38±128.81, respectively [14].

Taking these values as a reference, the minimum required sample size with 95% power of the study and a 5% level of significance is 13 patients. Taking into account a 20% loss to follow-up, the total sample size to be taken is 17. To reduce the margin of error, the total sample size taken was 47. The formula used is:

For comparing mean of pre and post

$$n >= \frac{(\text{Standard deviation})^2 * (Za+Zb)^2}{(\text{Mean difference})^2}$$

Where Zα is the value of Z (normal variate) at a two-sided alpha error of 5% and Zβ is the value of Z (normal variate) at a power of 95%, and the mean difference is the difference in mean values of pre and post.

The eligible patients were explained about the study, and a written informed consent was obtained from them.

Study Procedure

The patient's age, gender, tumour stage, and nodal status were noted. Preoperative evaluation was conducted thorough history, clinical examination, imaging (X-ray, Computed Tomography (CT) and Magnetic Resonance Imaging (MRI), wherever necessary), and biopsies. Surgical procedures followed standard guidelines for glossectomy and neck dissection. It was categorised into different types of glossectomy. Following surgery, the resected tumour and the surgical specimen were sent to the histopathology Laboratory where grossing and microscopic examination was done. Histopathological reports were obtained, which comprised of the histopathological type of the tumour and the staging of the tumour.

Following surgery, the patients were monitored for any surgical complications and morbidities. The outcome measures were oncological outcomes (mortality and hospital stay) and functional outcomes (pain, speech, dysphagia, and QoL) using EORTC QLQ-H&N35, SHI, MDADI, and EORTC QLQ-C30, by comparing baseline and 6th-week postsurgery values [10,11,15,16]. Follow-up of the patients was done at the 6th week telephonically or by clinical visits.

STATISTICAL ANALYSIS

Descriptive statistics summarised demographics and clinical data. Categorical variables were presented as numbers and percentages. Normally distributed quantitative data was shown as means±Standard Devaition (SD), while non normal data as median with interquartile range. Normality testing was done with the Shapiro-wilk test, and non parametric tests were used for non normal data. The data were analysed using the Wilcoxon Signed rank test. Linear regression was done to find the effect of the type of glossectomy on the oncological and functional outcomes. The data entry was done in an MS EXCEL spreadsheet, and analysis was done using SPSS software, IBM manufacturer, Chicago, USA, version 25.0. A p-value of <0.05 was considered statistically significant.

RESULTS

A total of 47 patients were included in the study. The mean (SD) age of the patients was 47.77±12.6 years. There were 37 males (78.72%) and 10 females (21.28%). Clinically, 22 (46.81%) patients had T2N0 stage, 16 (34.04%) patients had T3, and 9 (19.15%) patients had T4a disease. Partial glossectomy was done in 14 (29.79%) patients, 27 (57.45%) patients underwent hemiglossectomy, and 3 (6.38%) patients each underwent subtotal and total glossectomy. Unilateral neck dissection was done in 33 (72.34%) patients, and the rest 13 (27.66%) patients underwent bilateral neck dissection. Amongst patients who underwent B/L (bilateral) neck dissection, 1 (2.13%) patient (2.13%) underwent radical neck dissection, sacrificing all three structures including the internal jugular vein, spinal accessory nerve, and sternocleidomastoid muscle. Following surgery, 14 (29.79%) patients underwent reconstruction, with 11 patients (78.57%) undergoing Pectoralis Major Myocutaneous flap reconstruction and the remaining three patients (29.79%) undergoing free flap reconstruction in the form of radial artery forearm free flap reconstruction. Regarding the approach to glossectomy, 3 (6.38%) patients underwent mandibular swing and 2 (4.26%) patients underwent additional resection in the form of alveolectomy. The demographic and clinical characteristics of the patients are shown in [Table/Fig-1].

Baseline characteristics	n (%)	Mean±SD	Median (25th-75th percentile)	Range
Age (years)	-	47.77±12.6	47 (39.5-55.5)	28-82
Gender				
Female	10 (21.28%)	-	-	-
Male	37 (78.72%)	-	-	-
Histopathology				
Squamous cell carcinoma	47 (100%)			
T staging				
2	22 (46.81%)	-	-	-
3	16 (34.04%)	-	-	-
4A	9 (19.15%)	-	-	-
N staging				
0	22 (46.81%)	-	-	-
1	13 (27.66%)	-	-	-
2A	5 (10.64%)	-	-	-
2B	5 (10.64%)	-	-	-
3B	2 (4.26%)	-	-	-
Type of glossectomy				
Partial glossectomy	14 (29.79%)	-	-	-
Hemiglossectomy	27 (57.45%)	-	-	-
Subtotal glossectomy	3 (6.38%)	-	-	-
Total glossectomy	3 (6.38%)	-	-	-
Neck dissection				
Unilateral MRND	34 (72.34%)	-	-	-
Bilateral MRND	13 (27.66%)	-	-	-
Reconstruction				
No	33 (70.21%)	-	-	-
Yes	14 (29.79%)	-	-	-
Reconstruction type				
PMMC	11 (78.57%)	-	-	-
RAFFF	3 (21.43%)	-	-	-
SCM (Radical Neck Dissection)	1 (2.13%)	-	-	-
SAN (Radical Neck Dissection)	1 (2.13%)	-	-	-
IJV (Radical Neck Dissection)	1 (2.13%)	-	-	-
Mandibulectomy	11 (23.40%)	-	-	-
Mandibular swing	3 (6.38%)	-	-	-
Partial alveolectomy	2 (4.26%)	-	-	-

[Table/Fig-1]: Patient baseline demographic and clinical characteristics.
MRND: Modified radical neck dissection; PMMC: Pectoralis major myocutaneous flap reconstruction; RAFFF: Radial artery forearm free flap reconstruction

Neo-adjuvant chemotherapy was needed in 17 (36.17%) patients. Pathologically, 3 (6.38%) patients had a complete pathological response while 10 patients (21.28%) had close margins <5 mm. Postsurgical staging of the patients showed that 25 (53.19%) cases had pT2, 14 (29.79%) cases had pT3, 5 (10.64%) cases had pT4A, and 3 (6.38%) cases had stage 0. Regarding N staging, 8 (17.02%) cases had pN2B, 7 (14.89%) cases had pN3B, 5 (10.64%) cases had pN1, and 27 (57.45%) cases had stage 0. The median number of lymph nodes dissected was 52, and the median number of positive lymph nodes was two. Pathologically, positive nodal metastasis was present in 20 (42.55%) patients.

As for postsurgery morbidities and complications, the mean feeding resumption time for the liquid diet was 2.47 days (range: 1-10 days) and semi-solid diet was 9.19 days. Tracheostomy was done in 18 (61.70%) patients, out of which 5 (27.78%) patients had long-term tube dependency. The median tracheostomy tube decannulation time was 18.61 days. Postoperative feeding tube was needed in 21 (44.68%) patients, the median decannulation time of which was 15.76 days.

As for the oncological outcomes, the mean duration of hospital stay was 10.09±2.87 days, and there was no mortality within six weeks of follow-up [Table/Fig-2]. At the 6th week, there was a significant reduction in the median EORTC QLQ-H&N35 scores compared to baseline scores (1.73 vs 6.94, p=0.005). However, there was no significant improvement in the EORTC QLQ-C30 (90±8.22 vs 89.72±8.52, p=0.368), MDADI (4.51±1.2 vs 4.43±1.19, p=0.585), and SHI (15.81±25.76 vs 13.43±26.19, p=0.052) [Table/Fig-3].

Variables	n (%)	Mean±SD	Median (25th-75th percentile)	Range
Duration of hospital stay (days)	-	10.09±2.87	10 (8-12)	6-18
Mortality	Nil			

[Table/Fig-2]: Oncological outcomes.

Functional outcomes	Median (25th-75th percentile)	Range	p-value
EORTC QLQ-H&N35			
At baseline	6.94 (0.926-14.877)	0-48.18	0.005†
At 6th week	1.73 (0-6.929)	-5.56-49.91	
EORTC QLQ-C30			
At baseline	93.33 (88.296-94.444)	62.44-100	0.368†
At 6th week	93.89 (88.389-94.444)	58.22-96.67	
MDADI			
At baseline	5 (5-5)	2-5	0.585†
At 6th week	5 (5-5)	1-5	
Speech handicap index			
At baseline	0 (0-11.5)	0-98	0.052†
At 6th week	6 (1-15)	0-103	

[Table/Fig-3]: Functional outcomes at baseline and at 6th week.
Wilcoxon's Singed -rank Test

Upon performing univariate regression, it was found that patients with T staging 3, 4A, N staging 1, 2B, type of glossectomy (hemiglossectomy, subtotal glossectomy, total glossectomy), reconstruction, and mandibular swing operation had a significantly longer duration of hospital stay (days), with beta coefficients ranging from 1.824 to 4.69. On multivariate regression, N staging 1 and type of glossectomy (hemiglossectomy) had a significantly higher duration of hospital stay, with adjusted beta coefficients of 2.096 and 2.483, respectively [Table/Fig-4].

In univariate regression, patients with T staging 3, N staging 1, 3B, type of glossectomy (subtotal glossectomy, total glossectomy), reconstruction, mandibulectomy, and partial alveolectomy had significantly higher EORTC QLQ-H&N35 scores at the 6th week, with beta coefficients ranging from 8.935 to 44.868. In multivariate regression, N staging 3B, type of glossectomy (subtotal glossectomy, total glossectomy), and the performance of partial alveolectomy had significantly high EORTC QLQ- H&N35 scores at the 6th week, with adjusted beta coefficients ranging from 13.882 to 30.192 [Table/Fig-5].

Univariate regression showed that patients with T staging 4A, N staging 3B, type of glossectomy (subtotal glossectomy, total glossectomy), and reconstruction had significantly lower EORTC QLQC30 scores at the 6th week, with beta coefficients ranging from -6.658 to -22.957. In multivariate regression, subtotal glossectomy and total glossectomy had significantly lower EORTC QLQ-C30 scores at the 6th week, with adjusted beta coefficients of -23.875 and -15.16, respectively [Table/Fig-6].

In the multivariate regression, patients with SCM (Radical Neck Dissection) exhibited a low SHI at the 6th week, with an adjusted beta

Variables	Univariate		Multivariate	
	p-value	Beta coefficient (95% CI)	p-value	Beta coefficient (95% CI)
Age (years)	0.872	-0.005 (-0.074 to 0.063)	-	-
Gender				
Female				
Male	0.260	-1.162 (-3.212 to 0.888)	-	-
T staging				
2				
3	0.041	1.824 (0.078 to 3.57)	0.293	-0.98 (-2.841 to 0.882)
4A	0.004	3.136 (1.033 to 5.239)	0.343	1.331 (-1.478 to 4.14)
N staging				
0				
1	0.0002	3.577 (1.827 to 5.327)	0.026	2.096 (0.265 to 3.927)
2A	0.229	1.5 (-0.979 to 3.979)	0.775	-0.352 (-2.834 to 2.13)
2B	0.023	2.9 (0.421 to 5.379)	0.385	-1.52 (-5.027 to 1.988)
3B	0.109	3 (-0.695 to 6.695)	0.973	-0.068 (-4.193 to 4.057)
Type of glossectomy				
Partial glossectomy				
Hemiglossectomy	0.0002	3.246 (1.643 to 4.849)	0.012	2.483 (0.585 to 4.38)
Subtotal glossectomy	0.007	4.357 (1.26 to 7.454)	0.359	1.756 (-2.083 to 5.596)
Total glossectomy	0.004	4.69 (1.593 to 7.788)	0.736	0.728 (-3.617 to 5.072)
Neck dissection				
Unilateral MRND				
Bilateral MRND	0.375	0.839 (-1.047 to 2.725)	-	-
Reconstruction	<0.0001	3.338 (1.769 to 4.906)	0.056	2.351 (-0.066 to 4.769)
Reconstruction type				
PMMC				
RAFFF	0.388	1.576 (-2.258 to 5.410)	-	-
SCM (Radical Neck Dissection)	0.751	0.935 (-4.956 to 6.826)	-	-
SAN (Radical Neck Dissection)	0.751	0.935 (-4.956 to 6.826)	-	-
IJV (Radical Neck Dissection)	0.751	0.935 (-4.956 to 6.826)	-	-
Mandibulectomy	0.052	1.907 (-0.02 to 3.833)	-	-
Mandibular swing	0.041	3.47 (0.148 to 6.792)	0.389	1.368 (-1.816 to 4.552)
Partial alveolectomy	0.085	3.567 (-0.512 to 7.645)	-	-

[Table/Fig-4]: Univariate and multivariate linear regression to find significant factors affecting duration of hospital stay (days).

Variables	Univariate		Multivariate	
	p-value	Beta coefficient (95% CI)	p-value	Beta coefficient (95% CI)
Age (years)	0.933	0.012 (-0.285 to 0.31)	-	-
Gender				
Female				
Male	0.112	-7.079 (-15.868 to 1.711)	-	-
T staging				
2				
3	0.028	8.935 (0.998 to 16.873)	0.882	0.401 (-5.04 to 5.841)
4A	0.143	7.078 (-2.481 to 16.636)	0.846	0.793 (-7.442 to 9.028)
N staging				
0				
1	0.021	9.535 (1.494 to 17.575)	0.614	1.376 (-4.112 to 6.863)
2A	0.580	-3.147 (-14.535 to 8.24)	0.038	-7.623 (-14.794 to -0.451)
2B	0.456	4.248 (-7.14 to 15.635)	0.263	5.87 (-4.614 to 16.353)
3B	0.010	22.584 (5.608 to 39.56)	0.018	13.882 (2.531 to 25.232)
Type of glossectomy				
Partial glossectomy				
Hemiglossectomy	0.273	3.113 (-2.537 to 8.763)	0.220	3.367 (-2.106 to 8.839)
Subtotal glossectomy	<0.0001	32.496 (21.582 to 43.41)	0.001	21.792 (9.629 to 33.955)
Total glossectomy	<0.0001	26.045 (15.131 to 36.959)	0.002	21.655 (8.267 to 35.044)

Neck dissection				
Unilateral MRND				
Bilateral MRND	0.219	5.038 (-3.096 to 13.172)	-	-
Reconstruction	0.001	12.468 (5.293 to 19.643)	0.280	-3.603 (-10.272 to 3.067)
Reconstruction type				
PMMC				
RAFFF	0.125	-19.200 (-44.555 to 6.154)	-	-
SCM (Radical Neck Dissection)	0.057	23.899 (-0.724 to 48.522)	-	-
SAN (Radical Neck Dissection)	0.057	23.899 (-0.724 to 48.522)	-	-
IJV (Radical Neck Dissection)	0.057	23.899 (-0.724 to 48.522)	-	-
Mandibulectomy	0.006	11.511 (3.482 to 19.54)	0.576	-1.488 (-6.846 to 3.871)
Mandibular swing	0.240	8.809 (-6.099 to 23.716)	-	-
Partial alveolectomy	<0.0001	44.868 (32.429 to 57.306)	<0.0001	30.192 (17.565 to 42.82)

[Table/Fig-5]: Univariate and multivariate linear regression to find significant factors affecting EORTC QLQ-L&N35 at 6th week.

	Univariate		Multivariate	
Variables	**p-value**	**Beta coefficient (95% CI)**	**p-value**	**Beta coefficient (95% CI)**
Age (years)	0.920	-0.01 (-0.206 to 0.186)	-	-
Gender				
Female				
Male	0.784	0.817 (-5.146 to 6.781)	-	-
T staging				
2				
3	0.120	-4.137 (-9.397 to 1.123)	0.770	0.726 (-4.266 to 5.718)
4A	0.040	-6.658 (-12.993 to -0.323)	0.340	-3.605 (-11.16 to 3.951)
N staging				
0				
1	0.052	-5.237 (-10.519 to 0.046)	0.406	-2.04 (-6.961 to 2.88)
2A	0.784	1.024 (-6.457 to 8.505)	0.084	5.84 (-0.822 to 12.502)
2B	0.448	-2.842 (-10.323 to 4.639)	0.921	-0.466 (-9.89 to 8.958)
3B	0.003	-17.705 (-28.857 to -6.553)	0.250	-6.028 (-16.48 to 4.423)
Type of glossectomy				
Partial glossectomy				
Hemiglossectomy	0.051	-3.972 (-7.959 to 0.015)	0.087	-4.405 (-9.488 to 0.677)
Subtotal glossectomy	<0.0001	-22.957 (-30.659 to -15.255)	<0.0001	-23.875 (-34.167 to -13.583)
Total glossectomy	0.001	-13.611 (-21.313 to -5.909)	0.011	-15.16 (-26.57 to -3.75)
Neck dissection				
Unilateral MRND				
Bilateral MRND	0.785	-0.742 (-6.198 to 4.714)	-	-
Reconstruction	0.004	-7.246 (-12.124 to -2.368)	0.346	2.884 (-3.242 to 9.01)
Reconstruction type				
PMMC				
RAFFF	0.189	9.860 (-5.572 to 25.291)	-	-
SCM (Radical Neck Dissection)	0.126	-12.748 (-29.237 to 3.741)	-	-
SAN (Radical Neck Dissection)	0.126	-12.748 (-29.237 to 3.741)	-	-
IJV (Radical Neck Dissection)	0.126	-12.748 (-29.237 to 3.741)	-	-
Mandibulectomy	0.138	-4.218 (-9.847 to 1.41)	-	-
Mandibular swing	0.163	-6.892 (-16.668 to 2.884)	-	-
Partial alveolectomy	0.057	-11.252 (-22.872 to 0.369)	-	-

[Table/Fig-6]: Univariate and multivariate linear regression to find significant factors affecting EORTC QLQ-C30 at 6th week.

coefficient of -35.53 (-66.204 to -4.856). Conversely, patients with N staging: 3B, and those undergoing types of glossectomy such as hemiglossectomy, subtotal glossectomy, and total glossectomy, as well as those with partial alveolectomy, showed high SHI at the 6th week, with adjusted beta coefficients of 49.203 (30.5 17 to 67.889), 7.39 (0.363 to 14.417), 51.801 (33.416 to 70.186), 51.47 (34.756 to 68.183), and 49.935 (31.682 to 68.188), respectively [Table/Fig-7].

In another multivariate regression, total glossectomy and partial alveolectomy were identified as significant independent factors affecting MDADI, with adjusted beta coefficients of -1.921 (-3.519 to -0.322) and -1.779 (-3.478 to -0.079), respectively [Table/Fig-8].

Variables	Univariate		Multivariate	
	p-value	Beta coefficient (95% CI)	p-value	Beta coefficient (95% CI)
Age (years)	0.917	0.032 (-0.582 to 0.647)	-	-
Gender				
Female				
Male	0.188	-12.184 (-30.522 to 6.154)	-	-
T staging				
2				
3	0.091	14.386 (-2.388 to 31.161)	-	-
4A	0.191	13.303 (-6.898 to 33.504)	-	-
N staging				
0				
1	0.018	19.93 (3.582 to 36.278)	0.805	0.903 (-6.45 to 8.256)
2A	0.759	3.545 (-19.607 to 26.698)	0.145	-7.237 (-17.103 to 2.629)
2B	0.921	1.145 (-22.007 to 24.298)	0.946	-0.394 (-12.136 to 11.348)
3B	0.002	55.045 (20.531 to 89.56)	<0.0001	49.203 (30.517 to 67.889)
Type of glossectomy				
Partial glossectomy				
Hemiglossectomy	0.085	8.159 (-1.188 to 17.505)	0.040	7.39 (0.363 to 14.417)
Subtotal glossectomy	<0.0001	72.714 (54.659 to 90.77)	<0.0001	51.801 (33.416 to 70.186)
Total glossectomy	<0.0001	65.714 (47.659 to 83.77)	<0.0001	51.47 (34.756 to 68.183)
Neck dissection				
Unilateral MRND				
Bilateral MRND	0.251	9.729 (-7.129 to 26.586)	-	-
Reconstruction	0.0001	29.47 (15.266 to 43.673)	0.723	1.626 (-7.618 to 10.87)
Reconstruction type				
PMMC				
RAFFF	0.250	-28.636 (-80.259 to 22.986)	-	-
SCM (Radical Neck Dissection)	0.048	51.283 (0.534 to 102.031)	0.024	-35.53 (-66.204 to -4.856)
SAN (Radical Neck Dissection)	0.048	51.283 (0.534 to 102.031)	-	-
IJV (Radical Neck Dissection)	0.048	51.283 (0.534 to 102.031)	-	-
Mandibulectomy	0.012	21.851 (5.009 to 38.693)	0.368	-3.507 (-11.309 to 4.295)
Mandibular swing	0.457	11.598 (-19.514 to 42.711)	-	-
Partial alveolectomy	<0.0001	91.067 (64.801 to 117.333)	<0.0001	49.935 (31.682 to 68.188)

[Table/Fig-7]: Univariate and multivariate linear regression to find significant factors affecting Speech Handicap Index (SHI) at 6th week.

Variables	Univariate		Multivariate	
	p-value	Beta coefficient (95% CI)	p-value	Beta coefficient (95% CI)
Age (years)	0.573	-0.008 (-0.036 to 0.02)	-	-
Gender				
Female				
Male	0.033	0.903 (0.078 to 1.727)	0.237	0.407 (-0.279 to 1.093)
T staging				
2				
3	0.118	-0.614 (-1.39 to 0.163)	-	-
4A	0.112	-0.753 (-1.687 to 0.182)	-	-
N staging				
0				
1	0.019	-0.972 (-1.774 to -0.17)	0.817	-0.081 (-0.789 to 0.626)
2A	0.748	0.182 (-0.955 to 1.318)	0.137	0.712 (-0.238 to 1.662)
2B	0.974	-0.018 (-1.155 to 1.118)	0.485	0.379 (-0.71 to 1.467)
3B	0.124	-1.318 (-3.012 to 0.376)	0.320	-0.699 (-2.104 to 0.707)
Type of glossectomy				
Partial glossectomy				
Hemiglossectomy	0.337	-0.296 (-0.912 to 0.319)	0.287	-0.357 (-1.026 to 0.312)
Subtotal glossectomy	0.0003	-2.333 (-3.523 to -1.144)	0.164	-1.144 (-2.779 to 0.49)
Total glossectomy	<0.0001	-2.667 (-3.856 to -1.477)	0.020	-1.921(-3.519 to -0.322)

Neck dissection				
Unilateral MRND				
Bilateral MRND	0.660	-0.174 (-0.966 to 0.618)	-	-
Reconstruction	0.001	-1.236 (-1.918 to -0.554)	0.497	-0.299 (-1.184 to 0.586)
Reconstruction type				
PMMC				
RAFFF	0.142	1.727 (-0.668 to 4.122)	-	-
SCM (Radical Neck Dissection)	0.684	0.5 (-1.956 to 2.956)	-	-
SAN (Radical Neck Dissection)	0.684	0.5 (-1.956 to 2.956)	-	-
IJV (Radical Neck Dissection)	0.684	0.5 (-1.956 to 2.956)	-	-
Mandibulectomy	0.056	-0.785 (-1.59 to 0.02)	-	-
Mandibular swing	0.451	-0.545 (-1.989 to 0.898)	-	-
Partial alveolectomy	<0.0001	-3.667 (-5.039 to -2.294)	0.041	-1.779 (-3.478 to -0.079)

[Table/Fig-8]: Univariate and multivariate linear regression to find significant factors affecting MDADI.

DISCUSSION

Authors enrolled 47 patients with advanced carcinoma of the tongue who underwent surgical procedures, and their oncological outcomes were assessed. No deaths were reported within the first 6 weeks following the surgery. In comparison to other studies, the mortality rates for advanced carcinoma of the tongue were 30.76% (1-year) by Agarwal SK et al., 30% (3-year) in the study by Katna R et al., 81% (5-year) in Quinsan ICM et al., and 32% (1-year) by Shockley et al., [14, 17-19]. It's worth noting that these rates were observed after longer follow-up durations compared to present study.

The mean hospital stay for the patients in present study was 10.09±2.87 days. The duration of hospital stay was found to be influenced by the higher Tumour Node Metastasis (TNM) staging of the tumour. Moreover, the performance of hemiglossectomy, subtotal glossectomy, or total glossectomy, the use of reconstruction procedures, and mandibular swing operations were associated with significantly longer hospital stays after surgery. Similarly, in the study by de Melo GM et al., hospital stays were significantly longer in relation to the clinical severity of the carcinoma and postoperative complications [20]. In the study by Quinsan ICM et al., the mean duration of hospital stay was 9.9 days [18]. Overall, the duration of hospital stays typically ranged from 7-10 days following glossectomy, but the type of glossectomy may lead to an increased hospital stay due to associated surgical complications/morbidities and higher preoperative stage, which may necessitate a major glossectomy. Notably, no prior study has evaluated the risk factors for hospital stays as comprehensively as in the present study.

Following surgery, the quality of life and improvement in tongue function are crucial concerns for the patient. Therefore, authors assessed various scoring systems for dysphagia, swallowing, speech, and quality of life individually. While quality of life improved in some aspects, speech and swallowing were impaired, particularly in cases involving extensive glossectomy.

This underscores the balance between cancer control and function. Enhancing postoperative rehabilitation and speech therapy is vital for patients' overall well-being [21].

In present study, authors observed that only the EORTC QLQ-H&N35 pain scores decreased from 6.94 to 1.73, p=0.005 at the 6th week of follow-up. However, the overall quality of life (EORTC QLQ-C30) (90±8.22 at the 6th week vs 89.72±8.52 at baseline, p=0.368) and functional aspects remained statistically unchanged (p>0.05), including the dysphagia score (MDADI) (4.51±1.2 at the 6th week vs 4.43±1.19 at baseline, p=0.585) and speech score (SHI) (15.81±25.76 at the 6th week vs 13.43±26.19 at baseline, p=0.052). This highlights the challenges in regaining normal swallowing and speech function post-glossectomy, indicating that early intervention and rehabilitation are crucial for improving long-term swallowing and speech outcomes.

In comparison, long-term follow-up studies, such as Balbinot J et al., also support ongoing improvements in quality of life, particularly in dysphagia severity score (3.2 vs. 2.3, p<0.001) [22]. Similarly, Tamer R et al., found that patients undergoing total or subtotal glossectomy often faced significant swallowing difficulties, with the mean MDADI score being significantly highest at one month (47.77±19.08) and lowest at three months (7.05±2.11) postoperatively (p<0.05), as compared to preoperative values (27.36±14.67) [23,24]. This was also in line with the study by Agarwal SK et al., where swallowing scores showed nonsignificant improvement after surgery [14]. Studies by Yanai C et al., and Pyne JM et al., also reported statistically comparable speech functions [25,26]. In the study by Yanai C et al., after surgery and speech therapy, speech quality was good, acceptable, and poor in 5 (29.4%), 9 (52.9%), and 3 (17.7%) patients, respectively [25]. Pyne JM et al., found that SHI did not change significantly after total glossectomy postoperatively (59.9 vs 55.7, p=0.285) [26].

Agarwal SK et al., used the UW-QoL 12 scale to assess the quality of life in tongue carcinoma patients after glossectomy and found that out of 12 domains, significant improvement occurred in 5 domains, i.e., pain (mean difference -17.94), overall activity (-13.46), recreational activities (-8.33), and mental status including mood (-13.71) and anxiety (-11.53) [14]. The scores were significantly worse in seven domains including the patient's appearance (32.05), chewing (24.35), shoulder pain and discomfort (6.92), swallowing (16.41), taste (35.12), speech (29.48), and saliva production (20.51) [14].

Limitation(s)

The study results must be interpreted in view of limitations of a small sample size and single-centre data collection. Secondly, relying solely on patient-reported questionnaires for functional outcomes introduces potential response bias. To address these limitations in future research, larger and more diverse patient cohorts from multiple centre should be considered to enhance external validity.

CONCLUSION(S)

In present prospective cohort study of patients undergoing glossectomy for advanced carcinoma of the tongue, the findings underscore the formidable challenges posed by the aggressive nature and late-stage diagnosis of this malignancy. While the surgical procedures, including various types of glossectomy, are essential for improving the oncological outcomes, the study highlights that major glossectomy, in comparison to partial glossectomy, leads to an increase in hospital stay and decreases functional improvement. Overall, despite improvements in pain-related quality of life, the overall functional outcomes showed limited enhancement, emphasising the need for comprehensive postoperative rehabilitation. The study provides valuable insights into the delicate balance required in managing advanced tongue

carcinoma, addressing both oncological control and preservation of crucial functions. However, acknowledging its limitations, further research with larger, multicentre cohorts is warranted to deepen our understanding and refine the approach to surgical interventions for improved patient outcomes.

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PLAGIARISM CHECKING METHODS: [Jain H et al.]

- Plagiarism X-checker: Oct 27, 2023
- Manual Googling: Dec 20, 2023
- iThenticate Software: Jan 05, 2024 (8%)

ETYMOLOGY: Author Origin

EMENDATIONS: 6

AUTHOR DECLARATION:

- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: **Oct 21, 2023**
Date of Peer Review: **Nov 16, 2023**
Date of Acceptance: **Jan 07, 2024**
Date of Publishing: **Feb 01, 2024**