

# Pattern of Cervical Lymph Node Metastasis in Tongue Cancer

\*Dr. Masroor Rahman<sup>1</sup>, Dr. Arif Mahmud Jewel<sup>2</sup>, Dr. Abdullah-Al-Mamun<sup>3</sup>

<sup>1</sup>Associate Professor, Department of Otolaryngology–Head & Neck Surgery, Bangladesh Medical University, Dhaka, Bangladesh

<sup>2</sup>Associate Professor, Department of Otolaryngology–Head & Neck Surgery, Bangladesh Medical University, Dhaka, Bangladesh

<sup>3</sup>Assistant Professor, Department of Otolaryngology–Head & Neck Surgery, Bangladesh Medical University, Dhaka, Bangladesh

## Abstract

**Background:** Squamous cell carcinoma of the tongue is a common malignancy with a high tendency for cervical lymph node metastasis due to its rich lymphovascular supply. Given the prognostic importance of nodal spread and variability in its reported patterns, this study was undertaken to evaluate the pattern of cervical lymph node metastasis in patients with tongue cancer.

**Methods:** This prospective observational study was conducted at the Department of Otolaryngology–Head & Neck Surgery, Bangladesh Medical University (BMU), Dhaka, Bangladesh, from March 2025 to February 2026. A total of 80 patients with histopathologically confirmed tongue carcinoma were enrolled to evaluate cervical lymph node metastasis patterns. Tumor and nodal status were assessed clinically, radiologically, and histopathologically, and patients were categorized as node-positive or node-negative. In node-positive cases, nodal level distribution, tumor stage association, skip metastasis, and laterality were analyzed. Data were analyzed using SPSS version 26.0, with  $p < 0.05$  considered statistically significant.

**Results:** Among 80 tongue cancer patients, most were aged 40–60 years (57.5%) and male (72.5%). T3 was the most common stage (37.5%). Cervical lymph node metastasis occurred in 65.0%, most commonly in Level II (57.7%). Nodal involvement increased significantly with tumor stage (25.0% in T1 to 88.9% in T4;  $p = 0.004$ ). Skip metastasis was 7.7%, and ipsilateral spread predominated (76.9%).

**Conclusion:** Tongue cancer shows a strong tendency for progressive and predominantly ipsilateral cervical lymph node metastasis, increasing with advancing tumor stage.

**Key words:** Tongue Cancer, Cervical Lymph Node Metastasis, Tumor Staging.

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**Corresponding Author:** Dr. Masroor Rahman, Associate Professor, Department of Otolaryngology–Head & Neck Surgery, Bangladesh Medical University, Dhaka, Bangladesh

## Introduction

Squamous cell carcinoma of the tongue is a common malignancy treated by surgeons. Tongue is a complex anatomical site and its form and function are crucial for efficient swallowing, speech and appreciation of taste. The survival in carcinoma of the tongue is poor compared to other subsites in oral cavity. Tongue squamous cell carcinoma (TSCC) is the most common

oral cancer and is characterized by an extensive and well-developed vascular and lymphatic system and a high rate of metastasis to cervical lymph nodes [1,2]. Oral squamous cell carcinoma (OSCC) frequently metastasizes to cervical lymph nodes. The regional spread of the disease is present in over 40% of patients with oral cancers at the time of clinical presentation.

The presence of lymph node metastasis diminishes locoregional control rates, and is the most important factor for prognosis in head and neck cancer [3,4]. Cervical lymph node involvement is crucial for prognostic factor for oral squamous cell carcinomas, and understanding nodal metastasis pattern is essential for optimal neck dissection, oncological control, and minimizing morbidity. The nodal staging of the tumour determines the treatment strategy and survival outcomes. It has been reported that the chance of survival for five years is reduced by 50% in the presence of a positive metastatic lymph node.

Tongue squamous cell carcinoma (TSCC) is characterized by an extensive and well-developed vascular and lymphatic system and a high rate of metastasis to cervical lymph nodes [5]. Dissection of the lower jugular lymph nodes (level IV) has been advocated because of the possibility of ‘skip metastases’ to level IV [6,7]. Skip metastasis is defined as metastasis to level IV without involvement of levels I–III. Patients with early TSCC generally achieve good outcomes by undergoing the surgical resection of primary sites. However, tongue squamous cell carcinoma shows potential for early and unpredictable lymphatic spread, making nodal assessment critical in disease management.

However, there are very few studies from Bangladesh, where the incidence of tongue cancer is high [8,9]. The distribution of metastases suggests skip lesions and peppering. However, in patients with clinically staged N0 oral tongue cancer, there is controversy regarding whether supraomohyoid neck dissection or extended supraomohyoid neck dissection should be performed. The lack of a universally accepted classification of the anatomical levels (groups) of cervical nodes has led to confusion over which nodal groups are at highest risk of metastasis. The distribution of cervical lymph node metastases from squamous cell carcinomas has been described before; however, the introduction and increasing popularity of modified and selective neck dissections has led to a renewed interest in the routes and mechanisms of tumour spread within the cervical lymphatic system. It is the topic of debate on the extent of an elective neck dissection considering the T stage, subsite and nodal metastasis.

Given the high incidence of cervical lymph node metastasis in tongue cancer, its significant impact on prognosis, and the variability in reported patterns of nodal spread, a clear understanding of metastatic distribution is essential for accurate staging and optimal treatment planning. Despite existing studies, uncertainty remains regarding the involvement of different cervical neck levels, patterns of spread, and their association with tumor stage. Therefore, this study was undertaken to evaluate the pattern of cervical lymph node metastasis in patients with tongue cancer.

### **Objective**

- To evaluate the pattern of cervical lymph node metastasis in patients with tongue cancer.

### **Methodology & Materials**

This prospective observational study was conducted at the Department of Otolaryngology–Head & Neck Surgery, Bangladesh Medical University (BMU), Dhaka, Bangladesh, between March 2025 and February 2026. A total of 80 patients with histopathologically confirmed carcinoma of the tongue were included in the study, selected consecutively based on predefined inclusion and exclusion criteria for the evaluation of the pattern of cervical lymph node metastasis in tongue cancer.

### **Inclusion Criteria**

- i. Patients of any sex with histopathologically confirmed tongue cancer
- ii. Patients who provided informed consent for participation in the study

### **Exclusion Criteria**

- i. Patients with recurrent or previously treated tongue carcinoma
- ii. Patients with metastatic head and neck malignancies from other primary sites
- iii. Patients with incomplete clinical, radiological, or histopathological data
- iv. Patients who received prior neck dissection or radiotherapy before initial assessment
- v. Patients who refused to give consent for inclusion in the study

### **Clinical Evaluation and Data Collection**

## Pattern of Cervical Lymph Node Metastasis in Tongue Cancer

All enrolled patients underwent detailed clinical evaluation, including demographic profiling (age and sex), assessment of primary tumor characteristics, and staging according to the TNM classification system. Cervical lymph node status was assessed through clinical examination and relevant radiological investigations and confirmed histopathologically following surgical intervention where applicable. Based on these findings, patients were categorized into node-positive and node-negative groups according to the presence or absence of cervical lymph node metastasis.

### Assessment of Cervical Lymph Node Metastasis

In node-positive patients, the distribution of metastatic cervical lymph nodes was analyzed according to neck levels (Level I–V). The association between primary tumor stage and cervical lymph node metastasis was evaluated to determine the relationship between tumor progression and regional spread. Additional patterns of nodal dissemination, including skip metastasis and laterality of involvement (ipsilateral, bilateral, and contralateral), were also assessed to characterize the metastatic pattern of tongue carcinoma.

### Statistical Analysis

All collected data were recorded in a structured proforma and analyzed using Statistical Package for the Social Sciences (SPSS) software (version 26.0). Categorical variables were expressed as frequencies and percentages. The association between tumor stage and cervical lymph node metastasis was assessed using appropriate statistical tests, and a p-value of less than 0.05 was considered statistically significant.

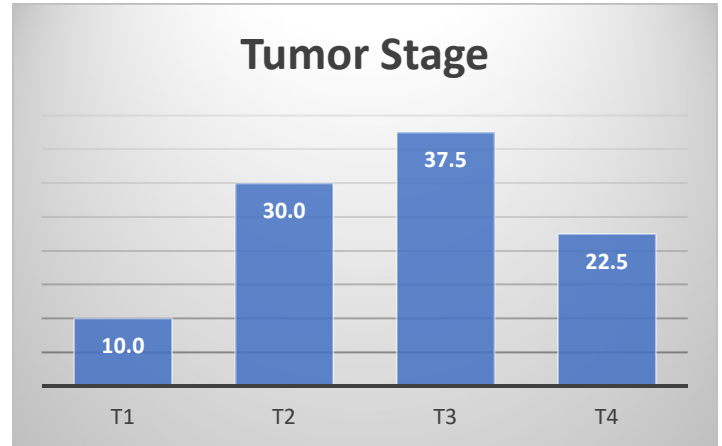
### Results

**Table 1: Demographic Characteristics of the Study Population (n = 80)**

Variables	Frequency (n)	Percentage (%)	
Age (years)	<40	12	15.0
	40–60	46	57.5
	>60	22	27.5
Sex	Male	58	72.5

	Female	22	27.5
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The majority of patients were aged 40–60 years (46 patients, 57.5%), followed by those older than 60 years (22 patients, 27.5%) and those younger than 40 years (12 patients, 15.0%). Male patients predominated in the study population (58 patients, 72.5%), while females accounted for 22 patients (27.5%).



**Figure 1: Distribution of Tumor Stage Among Study Patients (n = 80)**

Most patients presented with T3 tumors (30 patients, 37.5%), followed by T2 tumors (24 patients, 30.0%) and T4 tumors (18 patients, 22.5%). The least common presentation was T1 disease (8 patients, 10.0%).

**Table 2: Cervical Lymph Node Status in Patients with Tongue Cancer (n = 80)**

Nodal Status	Frequency (n)	Percentage (%)
Positive	52	65.0
Negative	28	35.0
<b>Total</b>	<b>80</b>	<b>100.0</b>

Cervical lymph node metastasis was present in 52 patients (65.0%), while 28 patients (35.0%) showed no evidence of nodal involvement.

**Table 3: Distribution of Cervical Lymph Node Metastasis by Neck Level in Node-Positive Patients (n = 52)**

Neck Level	Frequency (n)	Percentage (%)
Level I	6	11.5
Level II	30	57.7
Level III	12	23.1
Level IV	4	7.7
Level V	0	0.0
<b>Total</b>	<b>52</b>	<b>100.0</b>

Among patients with cervical lymph node metastasis, Level II was the most frequently involved nodal level (30 patients, 57.7%), followed by Level III (12 patients, 23.1%) and Level I (6 patients, 11.5%). Level IV involvement was observed in 4 patients (7.7%), while no involvement of Level V nodes was identified.

**Table 4: Association Between Tumor Stage and Cervical Lymph Node Metastasis (n = 80)**

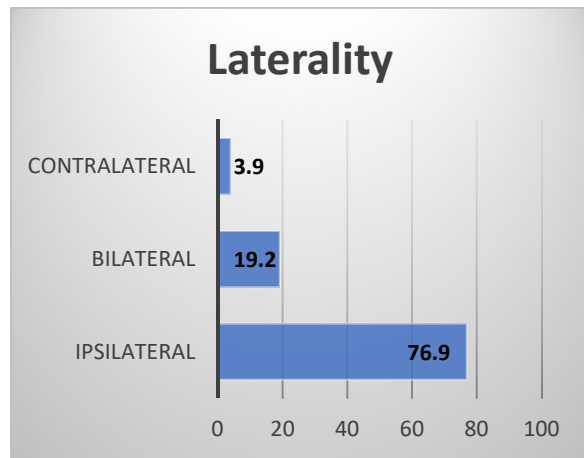
Tumor Stage	Metastasis Present n (%)	Metastasis Absent n (%)	P-value
T1 (n=8)	2 (25.0)	6 (75.0)	<b>0.004</b>
T2 (n=24)	12 (50.0)	12 (50.0)	
T3 (n=30)	22 (73.3)	8 (26.7)	
T4 (n=18)	16 (88.9)	2 (11.1)	
<b>Total</b>	<b>52 (65.0)</b>	<b>28 (35.0)</b>	

The frequency of cervical lymph node metastasis increased with advancing tumor stage. Metastasis was observed in 25.0% of T1 cases, 50.0% of T2 cases, 73.3% of T3 cases, and 88.9% of T4 cases, demonstrating a significant association between higher tumor stage and nodal involvement (p = 0.004).

**Table 5: Skip Metastasis Among Node-Positive Patients (n = 52)**

Skip Metastasis	Frequency (n)	Percentage (%)
Present	4	7.7
Absent	48	92.3
<b>Total</b>	<b>52</b>	<b>100.0</b>

Skip metastasis was identified in 4 patients (7.7%), while 48 patients (92.3%) did not demonstrate skip metastasis.



**Figure 2: Laterality of Cervical Lymph Node Metastasis in Node-Positive Patients (n = 52)**

Ipsilateral neck involvement was the most common pattern of cervical lymph node metastasis, observed in 40 patients (76.9%). Bilateral involvement was seen in 10 patients (19.2%), while contralateral neck involvement was rare, occurring in only 2 patients (3.9%).

**Discussion**

In this prospective observational study conducted at Bangladesh Medical University (BMU), Dhaka, a total of 80 patients with carcinoma of the tongue were evaluated to determine the pattern of cervical lymph node metastasis. A substantial proportion of patients presented at advanced tumor stages with a high rate of nodal involvement, predominantly affecting Level II cervical lymph nodes. Cervical metastasis showed a significant association with increasing tumor stage, while skip metastasis was relatively uncommon and ipsilateral neck involvement was the predominant

pattern, highlighting the characteristic and progressive nature of lymphatic spread in tongue cancer.

The demographic findings of the present study demonstrated that the majority of patients were aged 40–60 years (57.5%), with a further 27.5% being older than 60 years, indicating that tongue cancer predominantly affects middle-aged and elderly individuals. A marked male predominance was also observed, with males accounting for 72.5% of cases. These findings are consistent with those reported by Chakravarthy et al.[10], who found that 75% of patients were male and that the majority of cases occurred in individuals older than 50 years, with a mean age of approximately 58 years. Similarly, Aittiwaraopoj et al.[11] reported a slight male predominance and observed the highest incidence of tongue squamous cell carcinoma in the sixth and seventh decades of life. The proportion of younger patients (<40 years) in the present study was 15.0%, which is comparable to the 17.9% reported by Aittiwaraopoj et al.[11], although slightly higher than the 9.5% reported by Chakravarthy et al.[10]. Overall, the age and sex distribution observed in this study aligns well with previous reports, reinforcing the established epidemiological pattern that tongue cancer predominantly affects middle-aged to older males.

The distribution of tumor stage in the present study demonstrated that T3 tumors were the most common presentation (37.5%), followed by T2 (30.0%) and T4 tumors (22.5%), while T1 tumors accounted for only 10.0% of cases. These findings indicate that a substantial proportion of patients presented with advanced primary disease at the time of diagnosis. Similar observations were reported by Ghorbanpour et al.[12], who found that many patients with oral tongue squamous cell carcinoma were classified in higher T categories following staging assessment, reflecting the tendency of tongue cancer to be diagnosed at relatively advanced stages. Likewise, Stawarz et al.[13] reported that advanced tumors constituted a considerable proportion of oral cancer cases, with T3 and T4 lesions together accounting for more than half of the study population. The predominance of advanced-stage tumors in both previous studies and the present series may be attributed to delayed healthcare seeking, lack of early symptom recognition, and the aggressive biological behavior of tongue carcinoma. Therefore,

the tumor stage distribution observed in this study is consistent with existing literature and underscores the continuing challenge of achieving early diagnosis in patients with tongue cancer.

In the present study, cervical lymph node metastasis was observed in 52 patients (65.0%), while 28 patients (35.0%) had no evidence of nodal involvement. This high rate of nodal positivity highlights the strong tendency of tongue carcinoma to metastasize to regional cervical lymph nodes. Similar findings were reported by Dogan et al.[14], who evaluated patients with oral tongue squamous cell carcinoma undergoing glossectomy and neck dissection and demonstrated a substantial burden of cervical nodal disease, including both clinically apparent and occult metastases, emphasizing the aggressive metastatic potential of tongue cancer. Likewise, Nithya et al.[15] reported a high frequency of cervical lymph node metastasis in patients with carcinoma of the oral tongue, with nodal involvement observed in 35.6% of T1–T2 tumors and 62.35% of T3–T4 tumors, and identified nodal status as an important prognostic factor. The nodal positivity rate observed in the present study is comparable to these reports and further supports the well-established role of cervical lymph node metastasis as a key determinant of disease progression, treatment planning, and prognosis in patients with tongue cancer.

In the present study, Level II was the most frequently involved cervical lymph node level, accounting for 57.7% of metastatic cases, followed by Level III (23.1%), Level I (11.5%), and Level IV (7.7%), while no metastasis was observed in Level V nodes. This pattern indicates a predominance of upper cervical nodal involvement in tongue cancer and is consistent with previous reports in the literature. Jin et al.[16] demonstrated that ipsilateral Level II was the most common site of occult nodal metastasis in tongue carcinoma, followed by Levels I and III, with approximately half of all occult metastases occurring in Level II nodes, highlighting its role as the principal nodal basin for lymphatic spread from the tongue. Similarly, Cariati et al.[17] reported that Level IIA was the most frequently involved nodal station, followed by Level III, and observed a preferential pattern of metastasis involving the upper cervical lymph node levels. The predominance of Level II

metastasis and the relatively low frequency of lower neck involvement observed in the present study closely mirror these findings, reflecting the predictable lymphatic drainage pathways of the oral tongue. These observations support the importance of careful evaluation and management of upper cervical lymph node levels, particularly Level II, during the staging and treatment of patients with tongue cancer.

In the present study, cervical lymph node metastasis showed a clear increasing trend with advancing tumor stage, with 25.0% of T1, 50.0% of T2, 73.3% of T3, and 88.9% of T4 tumors demonstrating nodal involvement, indicating a statistically significant association between higher tumor stage and cervical metastasis ( $p = 0.004$ ). This progressive rise in nodal positivity reflects the increasing metastatic potential of more advanced primary tongue tumors. Similar observations have been reported by S V et al.[18], who demonstrated that even in early T1 oral tongue squamous cell carcinoma, lymph node metastasis occurred in a considerable proportion of patients (36.8%) and further emphasized that the likelihood of nodal spread increases with adverse tumor characteristics such as larger tumor size and greater tumor thickness, highlighting the close relationship between primary tumor extent and cervical lymphatic dissemination. Likewise, Mücke et al.[19] reported that cervical lymph node involvement significantly influenced patient outcomes and survival in oral tongue squamous cell carcinoma, reinforcing that more advanced primary tumors are associated with a higher risk of metastatic spread. The consistent findings between the present study and previous literature underline the strong biological behavior of tongue carcinoma, where increasing tumor stage is closely linked to progressive regional lymph node involvement, thereby emphasizing the importance of early detection and timely intervention.

In the present study, skip metastasis was observed in 4 patients (7.7%), while the majority of node-positive cases (92.3%) did not demonstrate any evidence of skip nodal spread. This low incidence suggests that lymphatic dissemination in tongue cancer generally follows a predictable sequential pattern rather than bypassing expected nodal levels. Similar findings have been reported in previous literature. David et al.[20] observed skip metastasis in 7 out of 58 patients

(12.1%), identifying the tongue as the most frequent primary site and emphasizing that, although uncommon, skip metastasis remains clinically significant when present. In contrast, large cohort data reviewed by Warshavsky et al.[21] demonstrated an even lower overall incidence of skip metastasis, ranging from approximately 0.5% to 3.6%, with tongue-specific subgroups also showing a similarly low frequency of less than 5%, thereby reinforcing its rarity in oral cavity malignancies. The findings of the present study are consistent with these reports and further support the concept that skip metastasis in tongue carcinoma is uncommon but clinically relevant, warranting careful neck evaluation despite its low incidence.

In the present study, ipsilateral cervical lymph node involvement was the predominant pattern of metastasis, observed in 40 patients (76.9%), followed by bilateral involvement in 10 patients (19.2%) and contralateral spread in only 2 patients (3.9%), indicating that cervical metastasis from tongue cancer predominantly occurs on the same side as the primary tumor with limited cross-neck dissemination. These findings are consistent with previous studies in the literature. González-García et al.[22] reported that ipsilateral nodal metastasis was the dominant pattern in oral tongue carcinoma, whereas contralateral spread was rare and observed only in a very small subset of patients, reinforcing the asymmetrical nature of lymphatic drainage in tongue cancer. Similarly, Klingelhöffer et al.[23] demonstrated that ipsilateral metastasis constituted the main pattern of spread, with contralateral involvement occurring in approximately 1.1% of cases and bilateral disease present only in a small fraction of patients, thereby highlighting the limited necessity for routine bilateral neck dissection in strictly unilateral disease. The findings of the present study closely mirror these reports and further support the concept that cervical lymph node metastasis in tongue cancer primarily follows an ipsilateral drainage pattern, with contralateral and bilateral involvement occurring infrequently but remaining clinically important for comprehensive neck assessment.

#### **Limitations of the study**

The study had a few limitations:

- Conducted at a single tertiary care tertiary care center, limiting external generalizability
- Relatively small sample size, which may reduce statistical power

### Conclusion

Tongue cancer is known for its aggressive behavior and tendency for early regional spread to cervical lymph nodes. This study demonstrated that patients predominantly presented at advanced tumor stages, with cervical lymph node metastasis being a frequent finding. Among node-positive cases, Level II was the most commonly involved nodal site. Nodal involvement increased with advancing tumor stage, while skip metastasis was uncommon. Ipsilateral neck spread was the predominant pattern, with relatively infrequent bilateral and contralateral involvement. Overall, the findings highlight a strong association between tumor progression and cervical lymphatic dissemination, emphasizing the importance of early detection and thorough neck evaluation in tongue cancer.

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