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ORIGINAL ARTICLE

Characterization of Cervical Lymph Node Metastasis in Oropharyngeal Squamous Cell Carcinoma — Patterns and Implications for Treatment Planning

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ABSTRACT

Background: *Oropharyngeal squamous cell carcinoma (OPSCC) is a common malignancy in the head and neck region, with cervical lymph node metastasis being a critical factor influencing prognosis and treatment planning. The aim of this study was to characterize the patterns of cervical lymph node metastasis in OPSCC patients and to evaluate its impact on management strategies.* ***Methods & Materials:*** *A cross-sectional study was conducted at the Department of Otolaryngology & Head-Neck Surgery, Sylhet M.A.G Osmani Medical College Hospital, from September 2018 to August 2020. A total of 100 patients with OPSCC and metastatic cervical lymphadenopathy were selected based on predefined inclusion and exclusion criteria. Data were collected using a structured questionnaire and clinical examination, including fibre-optic laryngoscopy (FOL), imaging (CT/MRI), punch biopsy of oropharyngeal lesions, and fine-needle aspiration cytology (FNAC) of enlarged lymph nodes. Histopathological analysis was performed by the same pathologist. Statistical analysis was carried out using SPSS version 26.* ***Results:*** *The study found that the palatine tonsil was the most common primary site of lymph node metastasis, with 75% of patients presenting with ipsilateral lymph node involvement. The most common carcinoma stage was T2, while the predominant lymph node stage was N3. Level II and Level III lymph nodes were most commonly involved. The findings suggested that the patterns of lymph node metastasis are crucial for treatment decisions, including the choice between primary surgery, chemoradiation, or surgery after chemoradiation.* ***Conclusion:*** *This study emphasizes the importance of cervical lymph node involvement in managing OPSCC. The findings offer valuable insights for treatment planning, especially regarding neck dissection and chemoradiation. Larger studies with extended follow-up are needed to confirm these patterns and refine treatment strategies for OPSCC patients with lymph node metastasis*

Keywords: *Oropharyngeal squamous cell carcinoma, cervical lymph node metastasis, treatment planning, neck dissection, chemoradiation.*

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INTRODUCTION

Oropharyngeal squamous cell carcinoma (OPSCC) is a subset of head and neck squamous cell carcinoma (HNSCC), affecting regions such as the base of the tongue, soft palate, palatine tonsil, and posterior pharyngeal wall.[1] OPSCC accounted for 0.5% of global cancer incidence in 2018, with 92,887 new cases.[2] While its incidence has decreased in developed countries, OPSCC remains highly prevalent in South-Central Asia and Central and Eastern Europe. In Bangladesh, OPSCC is one of the top five most common cancers, contributing to 2.4% of cancer incidence and 3% of cancer-related deaths in 2018.[3] Risk factors for Oropharyngeal squamous cell carcinoma (OPSCC) include smoking, alcohol consumption, and human papillomavirus (HPV) infection, with advanced

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stage and lymphadenopathy further worsening prognosis.[1,4] Cervical lymph node metastasis is a major prognostic factor, influencing treatment and survival outcomes.[5] The oropharynx's nonkeratinized stratified squamous epithelium is prone to lymphovascular invasion, contributing to early lymph node metastasis.[6] Lymphatic drainage in the head and neck follows a superficial to deep sequence, with various cervical lymph node levels involved in Oropharyngeal squamous cell carcinoma (OPSCC) metastasis. Notably, 10-20% of metastatic cervical lymph nodes have an unknown primary, often originating in the nasopharynx or oropharynx.[7] Fine needle aspiration cytology remains the gold standard for diagnosing metastatic lymph nodes.[8] This study aims to characterize the pattern of cervical lymph node metastasis in Oropharyngeal squamous cell carcinoma (OPSCC) to improve understanding of its metastatic behavior and inform better treatment strategies for affected patients.

METHODS & MATERIALS

This cross-sectional study was conducted at the Department of Otolaryngology & Head-Neck Surgery, Sylhet M.A.G Osmani Medical College Hospital, from 1st September 2018 to 31st August 2020. The study population consisted of adult patients diagnosed with metastatic cervical lymphadenopathy from oropharyngeal squamous cell carcinoma, who met the inclusion criteria. Purposive sampling was employed to select participants, and the sample size was calculated using Guilford's and Frucher's formula. Based on a 95% confidence interval and an allowable error of 10%, the calculated sample size was 96.04, and 100 patients were ultimately included in the study. Inclusion criteria were: patients aged over 18 years with confirmed primary oropharyngeal squamous cell carcinoma and neck node metastasis by FNAC and histopathology. Exclusion criteria included patients with a history of chemoradiation or neck surgery, as well as those with advanced-stage disease.

Study Procedure

This study was conducted at the Department of Otolaryngology & Head-Neck Surgery, Sylhet M.A.G Osmani Medical College Hospital, with ethical approval. A total of 100 patients who met the inclusion and exclusion criteria were selected during the study period. Data were collected using a pre-tested, structured questionnaire. Each patient underwent a comprehensive history and clinical examination, focusing on the ear, nose, throat, and neck. Fibre-optic laryngoscopy (FOL) was performed, and general investigations, including CT and MRI of the neck, were conducted. Punch biopsy of oropharyngeal lesions and FNAC from enlarged lymph nodes were performed, with histopathological analysis conducted by the same pathologist. Peroperative findings were recorded for patients who underwent surgery, and post-operative follow-up was provided. All data were documented in case record forms and analyzed using SPSS version 26.

Data Processing and Analysis

Data were processed and analyzed manually and using SPSS version 26. Quantitative data were expressed as means and standard deviations, while qualitative data were presented as frequencies and percentages. A p-value of <0.05 was considered statistically significant, while a p-value >0.05 was considered insignificant.

Ethical Considerations

Ethical clearance for the study was obtained from the Ethical Review Committee of Sylhet M.A.G Osmani Medical College. Permission to conduct the study was granted by the concerned department. All participants were assured of appropriate treatment for any complications arising from the study. Confidentiality was guaranteed, and participants were informed that they could withdraw from the study at any time without consequence.

RESULT

The study found that the palatine tonsil was the most common primary site of lymph node metastasis, with 75% of patients presenting with ipsilateral lymph node involvement. The most common carcinoma stage was T2, while the predominant lymph node stage was N3. Level II and Level III lymph nodes were most commonly involved. The findings suggested that the patterns of lymph node metastasis are crucial for treatment decisions, including the choice between primary surgery, chemoradiation, or surgery after chemoradiation.

Table – I: Demographic Distribution of Patients by Age Group and Sex (*n*=100)

Age group in year	No. of patient	Percentage
mean±SD (yrs)	53.09±9.35	
20 to 30 years	1	1
31 to 40 years	14	14
41 to 50 years	20	20
51 to 60 years	40	40
> 60 years	25	25
Sex		
Male	65	65
Female	35	35
Total	100	100

1 shows that 40% of the patients were aged between 51 and 60 years, and Table 25% were older than 60 years. Additionally, 20% of the patients were aged between 41 and 50 years, 14% were between 31 and 40 years, and only 1% were aged between 20 and 30 years. The mean age of the patients was 53.09±9.35 years. In our study, the majority of squamous cell carcinoma (SCC) cases occurred in individuals over 50 years of age. Regarding gender distribution, 65% of the patients were male, and 35% were female, with males being predominant in this study.

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Table – II: Distribution and Status of Cervical Lymph Nodes in Oropharyngeal Squamous

Carcinoma Patients (*n*=100)

	Number of Patients (n)	Percentage (%)
Distribution of nodes		
Ipsilateral	75	75
Contralateral	20	20
Bilateral	5	5
Nodal involvement		
Single	30	30
Multiple	70	70
Consistency		
Hard	52	52
Firm to hard	35	35
Firm	11	11
cystic	2	2
Mobility		
Mobile	70	70
Fixed	30	30
Size		
<3 cm	20	20
3 to 6 cm	35	35
>6 cm	45	45

Table II presents that lymph node involvement was ipsilateral in 75% of cases, contralateral in 20%, and bilateral in 5%. Multiple nodal involvement was observed in 70% of cases, while 30% had single nodal involvement. Regarding nodal consistency, 52% of cases showed hard consistency, 35% were firm to hard, 11% were firm, and 2% were cystic. In terms of nodal mobility, 70% of the nodes were mobile, and 30% were fixed. The size of the nodes was more than 6 cm in 45% of cases, between 3 to 6 cm in 35%, and less than 3 cm in 20%. The majority of patients had ipsilateral nodal involvement, with multiple nodal involvement being more common and hard consistency being the predominant finding.

Table – III: Distribution of Patients by Site of Involvement in Oropharyngeal Squamous Cell Carcinoma (*n*=100)

Site	Number of Patients (n)	Percentage (%)
Tonsil	55	55
Base of tongue	25	25
Soft palate	15	15
Posterior pharyngeal wall	5	5
Total	100	100

Table III demonstrated that 55% cases involved site was Tonsil, base of tongue was in 25% cases, 15% cases were soft palate and only 5% cases was posterior pharyngeal involvement. Tonsil is the most common site of involvement than another site of oropharynx.Table 3 demonstrated that 55% cases involved site was Tonsil, base of tongue was in 25% cases, 15% cases were soft palate and only 5% cases was posterior pharyngeal involvement. Tonsil is the most common site of involvement than another site of oropharynx.

Table – IV: Distribution of Patients by T Staging in Oropharyngeal Squamous Cell Carcinoma (*n*=100)

Staging of disease	Number of Patients (n)	Percentage (%)
T_1	24	24
T_2	54	54
T_3	13	13
T_4	9	9
Total	100	100

Table IV illustrates that 54% patients had Stage T2, 24% patients had Stage T1, 13% patients had Stage T3 and 9% patients had Stage T4. Most common patients had T2 stage.

Table – V: Staging of Cervical Lymph Node Metastasis in Oropharyngeal Squamous Cell Carcinoma (*n*=100)

Staging of lymph node	Number of Patients (n)	Percentage (%)
Stage N_1	20	20
Stage N_2	35	35
Stage N_3	45	45
Total	100	100

Table V shows that 45% of the patients were diagnosed with Stage N3 lymph node metastasis, 35% with Stage N2, and 20% with Stage N1. The most common lymph node stage observed in the study was N3.

Table – VI: Distribution of Nodal Metastasis in Cervical Lymph Node Levels in Oropharyngeal Squamous Cell Carcinoma (*n*=100)

	Cervical lymph node level	Number of Patients (n)	Percentage (%)
Ipsilateral	Level I	8	10.7
	Level II	39	52.0
	Level III	18	24.0
	Level IV	10	13.3
	Level V	-	-
Contralateral	Level I	5	25.0
	Level II	10	50.0
	Level III	5	25.0
Bilateral	Level I	2	40
	Level II	1	20
	Level III	2	40

Table VI indicates that in cases of ipsilateral nodal involvement, 39 patients had involvement at Level II, 18 at Level III, 8 at Level I, and 10 at Level IV. For contralateral nodal involvement, 10 patients had involvement at Level II, 5 at Level I, and 5 at Level III. In bilateral nodal involvement, 2 patients had involvement at Level I, 2 at Level III, and 1 at Level II. The most common level of involvement was Level II.

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Table – VII: Primary Tumor Site Distribution According to Lymph Node Staging in Oropharyngeal Squamous Cell Carcinoma (n=100)

		Lymph node stage			Total
		N_1	N_2	N_3	
Site	Palatine tonsil	5	25	25	55
	Base of the tongue	5	5	15	25
	Soft palate	10	5	0	15
	Post-pharyngeal wall	0	0	5	5
Total		**20**	**35**	**45**	**100**

Table VII presents the lymph node staging in head and neck cancer across different sites. In the palatine tonsil group, both N2 and N3 stages were observed in 25 patients from each group. In contrast, all 5 patients with post- involvement. The differences observed between these groups are statistically significant ($\chi^2 = 37.05$; $P < 0.005$).

Table – VIII: Primary Tumor Site Distribution According to Consistency of Metastatic Lymph Nodes in Oropharyngeal Squamous Cell Carcinoma (*n*=100)

		Consistency				Total
		Hard	Firm to hard	Firm	cystic	
Site	Palatine tonsil	30	15	8	2	55
	Base of the tongue	12	10	3	0	25
	Soft palate	10	5	0	0	15
	Post-pharyngeal wall	0	5	0	0	5
Total		**52**	**35**	**11**	**2**	**100**

Table VIII illustrates the consistency of metastatic lymph nodes based on the site of the primary oropharyngeal squamous cell carcinoma (OPSCC). A total of 52 patients showed hard lymph nodes, with 30 of these cases originating from the palatine tonsil group. Only 2 lymph nodes in the palatine tonsil group were soft in consistency. No cystic consistency lymph nodes were found in other sites. However, the differences observed between the sites were not statistically significant ($\chi^2 = 15.08$; $P < 0.09$).

Table IX: Tumor Site Distribution According to Staging in Oropharyngeal Squamous Cell Carcinoma (*n*=100)

		Stage of tumor				Total
		T_1	T_2	T_3	T_4	
Site	Palatine tonsil	5	38	6	6	55
	Base of the tongue	10	10	3	2	25
	Soft palate	9	1	4	1	15
	Post-pharyngeal wall	0	5	0	0	5
Total		**24**	**54**	**13**	**9**	**100**

Table IX shows the staging of the primary head and neck tumor based on the site of the tumor. A total of 54 patients were classified as Stage T2, with the highest frequency (38 patients) observed in the palatine tonsil group. Only 9 patients were categorized as Stage T4, with 6 of these patients coming from the palatine tonsil group. The differences between the groups were statistically significant ($\chi^2 = 32.27$; $P < 0.001$).

DISCUSSION

The present study aimed to characterize cervical lymph node metastasis in patients with oropharyngeal squamous cell carcinoma (OPSCC). Our findings align with previous studies on the clinical presentation, patterns of metastasis, and the impact of lymph node involvement on patient outcomes in OPSCC. Our study demonstrated that the majority of patients (40%) were aged between 51 and 60 years, with 65% of the sample being male. These findings are consistent with previous research indicating that OPSCC predominantly affects older individuals, particularly those over 50, with a clear male predominance.[1,2] The increasing prevalence of OPSCC in this age group is particularly relevant, as it may reflect the long-term effects of smoking and alcohol consumption, both of which are well-established risk factors for the disease.[9,10] The distribution of cervical lymph node metastasis in our cohort showed that 75% of patients had ipsilateral lymph node involvement, 20% contralateral, and 5% bilateral, with 70% of patients presenting with multiple node involvement. These findings are in line with studies by Patel et al. (2013) and Vartanian et al. (2003), who reported that ipsilateral nodal metastasis was most common in OPSCC, particularly in cases with multiple nodes affected[5,7]. Furthermore, we observed a predominance of hard

consistency in the affected nodes (52%), which is consistent with findings from previous studies[11]. This finding highlights the aggressive nature of the disease, as hard nodal consistency is often associated with advanced disease and poorer prognosis[8]. The mobility of the lymph nodes was also assessed, with 30% of nodes being fixed, which can serve as an indicator of extracapsular spread, a well-known poor prognostic factor in OPSCC.[5,12] In terms of primary tumor site distribution, our results showed that the palatine tonsil was the most common site of involvement (55%), followed by the base of the tongue (25%) and the soft palate (15%). This distribution aligns with the findings of Shah et al. (1986),[13] who also reported the palatine tonsil as the most common site of OPSCC, a trend which has been observed globally due to its lymphatic drainage patterns that predispose the tonsils to metastasis[14]. Moreover, our study identified that the majority of patients (54%) presented with T2 stage tumors, followed by T1 (24%), T3 (13%), and T4 (9%). This stage distribution is comparable to the findings of Kato et al. (2020), who found T2 to be the most common stage in OPSCC.[15] The early detection of tumors in lower stages, such as T1 and T2, has been associated with better survival outcomes, which emphasizes the importance of early diagnosis and appropriate management strategies[5]. The lymph node staging in our study revealed that 45% of patients had N3 stage metastasis, followed by N2 (35%) and N1 (20%), indicating that the majority of patients had advanced nodal disease. This finding is consistent with the study by Bluemel et al. (2015), who reported a similar distribution of nodal stages in OPSCC, with N3 being the most prevalent in cases with advanced disease.[11] The involvement of multiple cervical lymph node levels, particularly Level II, was the most common in our study, which is consistent with findings from Dogan et al. (2014), who also reported Level II as the most frequently affected in OPSCC.[16] Furthermore, Vartanian et al. (2003) and Kato et al. (2018) have emphasized that understanding the pattern of lymph node involvement at different cervical levels is crucial for determining the appropriate treatment plan, including neck dissection and radiotherapy.[7,15] Regarding the consistency of metastatic lymph nodes, our study found that 52% of patients exhibited hard lymph nodes, with the majority of these originating from the palatine tonsil group. This finding is supported by the work of Fossum et al. (2017), who noted that hard consistency is often associated with more advanced metastatic disease.[17] Additionally, the lack of cystic nodes in other sites, as seen in our study, has been previously reported in similar studies, where cystic consistency is relatively rare in metastatic nodes.[11] The staging of the primary tumor according to its site revealed that the palatine tonsil group had the highest frequency of Stage T2 tumors, with 38 patients. This is consistent with the findings of Vartanian et al. (2003), who observed that the palatine tonsil is the most common site for T2 stage tumors, reflecting its anatomical and lymphatic characteristics.[7] The statistically significant differences observed between tumor site and staging in our study further reinforce the need for personalized treatment strategies based on tumor location and stage.In summary, our findings are consistent with global trends in OPSCC, with palatine tonsil involvement being the most common, advanced lymph node metastasis at higher N stages, and the predominance of hard, fixed lymph nodes indicating more aggressive disease. These patterns highlight the importance of early detection, accurate staging, and a multidisciplinary approach in managing OPSCC, as outlined in the literature.[8,11] Moreover, further studies with larger cohorts and long-term follow-up are needed to better understand the prognostic significance of these findings and optimize treatment protocols for OPSCC patients.

LIMITATIONS OF THE STUDY

This study had several limitations. Firstly, due to its cross-sectional design, no causal associations could be established. The sample size was not representative as the study was conducted during training, and data were collected from a single center using non-probability purposive sampling, without randomization. As a result, the sample may not reflect the broader population. Additionally, long-term follow-up was not possible in this study.

CONCLUSION AND RECOMMENDATIONS

In this study, the tonsil was the most common primary site of lymph node metastasis in oropharyngeal squamous cell carcinoma (OPSCC). Approximately 75% of patients had ipsilateral lymph node involvement, 20% had contralateral involvement, and 5% had bilateral involvement. The most frequent carcinoma stage was T2, while N3 was the predominant lymph node stage. Level II and III neck nodes were most commonly affected. These findings offer valuable insights for OPSCC management, particularly in determining the appropriate treatment approach. Further studies with larger sample sizes and extended follow-up are needed to better understand the patterns of cervical lymph node metastasis in OPSCC.

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