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Original Article

A Correlative Study on Clinical, Pathological and Computed Tomography Scan Findings of Cervical Nodal Metastases in Head and Neck Malignancies

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Abstract

Background: Presence or absence of metastatic disease in the neck determines the prognosis and survival period of patients with malignant tumors of head and neck. The year survival rate is reduced to half if the palpable nodes are present at the time of diagnosis. Unfortunately, medical opinion is divided into various aspects of metastatic neck disease. Controversies remain in the assessment of neck disease, the prophylactic treatment of metastatic nodes, and place of radical neck dissection as opposed to modified radical neck dissection and the role of radiotherapy. Potential benefits of clinical examination far outweigh other investigative methods in the assessment of regional lymph nodes metastases.

Aim of the Study: The aim of the study was to study the pattern of cervical lymph node metastasis in various head and neck malignancies and to compare the accuracy between clinical examination, pathological study, and contrast enhanced computed tomography (CT) scans.

Materials and Methods: A total of 181 patients with head and neck malignancies attending the department of ear nose and throat were analyzed by clinical examination, pathological examination, and CT scan findings of the neck for the accuracy of their diagnosis. The sensitivity, specificity and positive and negative predicted values of the methods used in their diagnosis were calculated using crosscheck tables.

Observations and Results: A total of 181 patients with squamous cell carcinoma of the head and neck region were included; 33 patients underwent neck dissection. Maximum numbers of cases were carcinoma hypopharynx 26% followed by carcinoma of larynx 24.3%. Clinical examination had sensitivity, specificity, positive predictive value, and negative predictive value as 66.7%, 75%, 82.4%, and 56.3%, respectively (kappa significance 0.389, P = 0.021). The CT examination had sensitivity, specificity, positive predictive value, and negative predictive value as 85.7%, 41.7%, 72%, and 62.5%, respectively, κvalue 0.389; P = 0.021.

Conclusions: Higher incidence of head and neck squamous cell carcinoma was observed among the 61–70 years group. Males were more commonly affected. The most common head and neck malignancy with nodal metastasis were observed to be the hypopharyngeal malignancy, followed by carcinoma oropharynx. The occurrence of nodal metastasis was more common in carcinoma oropharynx. Bilateral nodal metastasis was observed to be high from carcinoma of base of tongue, followed by pyriform fossa malignancy and carcinoma supraglottis. Level I lymph node was observed to be the most common lymph node involved in the oral cavity and paranasal sinus malignancy.

Key words: Computed tomography scan, Head and neck tumors, Histopathology of malignant tumors, Malignancies, Undifferentiated carcinoma

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INTRODUCTION

Since its first description by George Washington Crile in 1906,[1] classical radical neck dissection has undergone an increasing number of modifications. It has now come to selective neck dissection in which only those lymph node groups are removed that are more likely to

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contain metastatic deposits from the concerned primary. Feinmesser *et al*.[2] found computerized tomography to have no advantage over physical examination in the detection of metastatic neck disease in their earlier study. Borges *et al*.[3] retrospectively analyzed various histological parameters in surgically treated patients with carcinoma of the anterior tongue and buccal mucosa to evaluate their role in prognosis and treatment. Their main findings were a strong correlation between high tumor grade, infiltrative tumor margins, perineural invasions, size >2 cm, and lymph node metastasis at presentation for both groups of patients. Shah[4] in a retrospective study to predict the pattern of cervical lymph node metastasis from squamous cell carcinoma of the oral cavity found the sensitivity, specificity, and overall accuracy of clinical examination for neck nodes to be 70%, 65%, and 68%, respectively. The false negative rate of clinical examination for neck metastasis in the study was 30%. Shah[5] in an attempt to predict the pattern of cervical lymph node metastasis from squamous cell carcinomas of the upper aerodigestive tract concluded that supraomohyoid dissection would have removed the majority of lymph nodes harboring occult metastasis in no patients. However, if Level I, II, and III were grossly positive at the time of surgery Level IV and V also should be dissected. Friedman[6] reported on the effectiveness of computerized tomography in staging head and neck cancer and advocated that the concept of elective dissection should be studied in the light of the improved ability to detect the nodal disease with computerized tomography. Van den Brekel *et al*.[7] performed a prospective study of the value of ultrasonography (US) and US-guided fine needle aspiration cytology (FNAC) for assessment of N_0 lesions in the neck and found it an unreliable method for detecting occult lymph node metastasis. Masahiro[8] found that computed tomography (CT) or magnetic resonance imaging (MRI) was not conclusive in detecting the extent of metastasis with 15 of the 60 patients exhibiting more extensive neck disease than what was evaluated preoperatively. Dhawan *et al*.[9] reviewed the histopathological findings in 57 surgical specimens of T_3 and T_4 buccal mucosa cancer, and clinical N+ group of patient's metastatic disease was histologically demonstrated in 17.5% at Level I and 14% at Level II. In clinically N_0 group it was only 11.7% and 9%, respectively. Borges *et al*.[3] reported 20% false negative rate of clinical examination of the neck in malignancies of oral cavity patients. They also found that CT scan and US can detect 60 to 70% of occult metastatic neck disease in clinically N_0 patients. The present study is a humble attempt to study the pattern of lymph node metastasis from various head and neck malignancies and to determine the sensitivity and specificity of clinical examination and contrast enhanced computed tomography in determining neck metastasis. An attempt has also been made to determine the role of selective neck dissection.

Type of Study

A prospective cross-sectional hospital based open study.

Institute of Study

This study was conducted at the Department of Ear Nose and Throat (ENT), Government Medical College, Kozhikode, Kerala.

Study Period

This study was from December 2010 to October 2012.

MATERIALS AND METHODS

A total of 181 patients with head and neck.

Malignancies attending the department of ENT were included in the study. An Ethical Committee Clearance from the institute was obtained. An ethical committee cleared consent letter was used in the study. These patients were undergoing either therapeutic neck dissection or prophylactic neck dissection for the secondaries in cervical lymph nodes. Both the methods were considered for the comparison of accuracy between clinical examinations and reports of contrasts enhanced CT scans of the neck. The number of patients undergoing either therapeutic neck dissection or prophylactic neck dissection was 33 patients.

Inclusion Criteria

1. Patients with diagnosed newly cases of squamous cell carcinoma of head and neck region were included.
2. Patients undergoing either therapeutic or prophylactic neck dissection were included study group.

Exclusion Criteria

1. Patients with malignancies other than squamous cell carcinoma.
2. Patients with recurrence/post radiotherapy/post-chemotherapy.
3. Cervical lymph node metastasis with occult primary.

Experimental Methodology

All patients in the study population were evaluated by proper history, clinical examination of the primary lesion and detailed neck examination. CT with contrast was done in all cases. MRI was done in indicated cases. FNAC was done for palpable nodes. After neck dissection, the specimen was divided according to the level of lymph nodes. The specimens were fixed in 10% formalin and were sent for histopathological examination. Tissue sections were stained with H&E. Lymph nodes were studied for the presence or absence of metastasis. Results were tabulated and analyzed. The cases were divided

intocarcinoma of oral cavity, oropharnyx, hypopharynx, larynx, nasopharynx, and nose and paranasal sinus (PNS). Lymph nodes were assessed as Level I, II, III, IV, V, and VI. The incidence of lymph node metastasis in each group, the lymph node groups involved and the distribution of cases according to the subsite in node-positive cases were studied, and the results were expressed as a percentage.

Comparison between Clinical Examination and Contrast Enhanced CT

The cases undergoing neck dissection were evaluated in detail by clinical examination and contrast enhanced CT preoperatively for the level of the lymph nodes involved. This was compared with the histopathology report. The sensitivity and specificity of the clinical examination and the contrast enhanced CT was determined, and comparison between the two was done.

Analysis

The sensitivity, specificity, and the predictive values are calculated using the following formulae.

$$\text{Sensitivity} = \frac{\text{True positive}}{\text{True positive} + \text{false negative}} \times 100$$

$$\text{Specificity} = \frac{\text{True negative}}{\text{True negative} + \text{false positive}} \times 100$$

$$\text{Positive predictive value} = \frac{\text{True positive}}{\text{True positive} + \text{False positive}} \times 100$$

$$\text{Negative predictive value} = \frac{\text{True negative}}{\text{True negative} + \text{False negative}} \times 100$$

Measure of agreement used was kappa, $P < 0.05$ was considered as significant.

OBSERVATIONS AND RESULTS

There were totally 181 newly diagnosed patients with squamous cell carcinoma of the head and neck region. Among the 181 patients, 33 patients underwent neck dissection. All these patients were considered for comparison between clinical assessment and radiological assessment of neck nodes. Maximum numbers of cases were carcinoma hypopharynx which contributed to 26% of the cases, followed by carcinoma of larynx (24.3%). The distribution of malignant tumors in different sites was tabulated [Table 1 and Figure 1].

The study of the age distribution of cases revealed that maximum incidence was in the age group of 61–70 (37%), followed by 51–60 age group (27%). The youngest patient was 15 years which were a case of nasopharyngeal carcinoma [Table 2 and Figure 2].

Analysis of the incidence of malignant tumors depending on the sex revealed a male preponderance and the male to female ratio was 6:1 [Table 3].

Nodal Metastasis

A total of 117 cases (64.64%) were found to have positive nodal metastasis, of which 20 cases presented with bilateral nodes (17.09%)

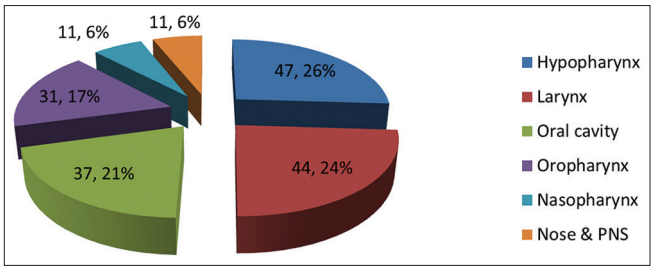

Figure 1: The pie chart of distribution of malignant tumors (*n* = 181)

Table 1: Site distribution (*n*=181)

Site	*n* (%)
Hypopharynx	47 (26)
Larynx	44 (24.3)
Oral cavity	37 (20.4)
Oropharynx	31 (17.1)
Nasopharynx	11 (6.1)
Nose and PNS	11 (6.1)

PNS: Paranasal sinus

Table 2: The age incidence in the study group (*n*=181)

Age	*n* (%)
0–10	0 (0)
11–20	1 (0.55)
21–30	0 (0)
31–40	8 (4)
41–50	21 (11.6)
51–60	49 (27)
61–70	67 (37)
71–80	29 (16)
81–90	6 (3)
91–100	0 (0)

Table 3: Sex distribution (*n*=181)

Sex	*n* (%)
Male	156 (86)
Female	25 (14)

Primary Tumor Site Distribution in Patients with Bilateral Nodal Metastasis

Total cases with bilateral nodal metastasis were 20, out of which most common was from carcinoma of the base of tongue 7/20 (35%), followed by pyriform fossa 6/20 (30%), [Table 4].

Site Distribution in Nodal Positive Cases

In this study population, the number of cases with nodal metastasis was 34/117 (29.05%), with the primary in hypopharynx 34/117 (29.05%), followed by 25/117 (21.36%) patients with primary in oropharyx [Table 5].

Analysis of each Site: Oral cavity (24/37)

Total cases of oral cavity malignancies were 37, of which 24 cases (64.86%) showed nodal metastasis. Tongue was the most common subsite with nodal metastasis in 11 patients (45.83%) [Table 6 and Figure 3].

The lymph node group most commonly involved in oral cavity malignancy was found to be Level I in 11 patients (45.83%), [Table 7 and Figure 4].

Oropharynx (25/31)

A total of 25 cases out of 31 (80.64%) showed lymph node metastasis in oropharyngeal malignancy, indicating high chances of nodal metastasis. Secondaries from oropharynx base of the tongue were found in 10 patients and were the most common subsite (40%) [Table 8 and Figure 5].

Oropharyngeal malignancies with Level II nodes were found in 23/25 of the malignancies (92%), Level III in 1 patient (4%) [Table 9 and Figure 6].

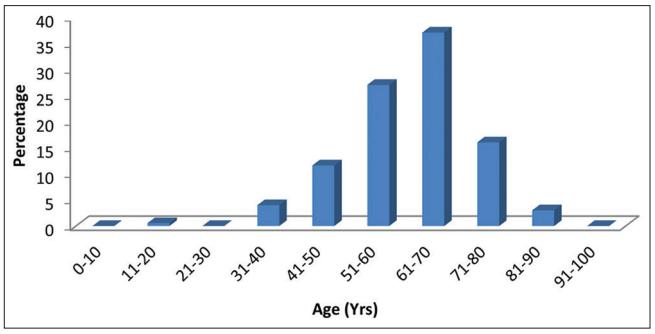

Figure 2: The bar chart of incidence among the various age groups (*n* = 181)

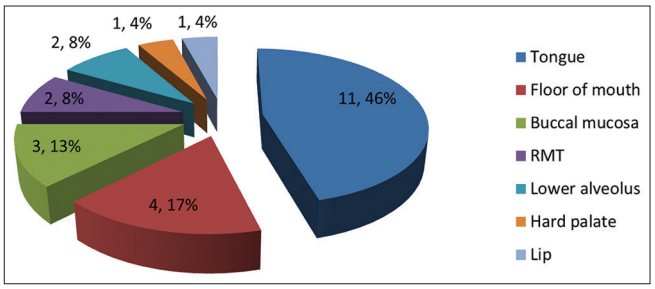

Figure 3: Pie chart the distribution of sites of oral cavity malignancies (*n* = 24)

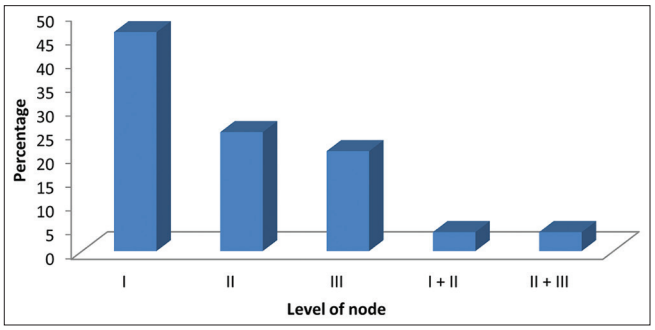

Figure 4: The bar chart depicting the levels of nodal involvement in oral cavity malignancies

Table 4: Cases with bilateral nodal metastasis (*n*=20)

Site	*n* (%)
Base of tongue	7 (35)
Pyriform fossa	6 (30)
Aryepiglottic fold	3 (15)
Posterior pharyngeal wall	2 (10)
Floor of mouth	1 (5)
Hard palate	1 (5)

Table 5: The patients with positive cervical lymph nodes (*n*=117)

Site	*n* (%)
Hypopharynx	34 (29.05)
Oropharynx	25 (21.36)
Oral cavity	24 (20.51)
Larynx	20 (17.54)
Nasopharynx	8 (6.83)
Nose and PNS	6 (5.12)

PNS: Paranasal sinus

Table 6: Oral cavity – subsites (*n*=24)

Subsite	*n* (%)
Tongue	11 (45.83)
Floor of mouth	4 (16.66)
Buccal mucosa	3 (12.5)
Retromolar trigone	2 (8.33)
Lower alveolus	2 (8.33)
Hard palate	1 (4.16)
Lip	1 (4.16)

Table 7: Incidence oral cavity malignancy with positive lymph nodes (*n*=24)

Level of node	*n* (%)
I	11 (45.83)
II	6 (25)
III	5 (20.83)
I+II	1 (4.16)
II+III	1 (4.16)

Hypopharynx (34/47)

Total nodal positive cases were 34/47 (72.34%). Most common subsite was found to be pyriform fossa in 26/34 (76.47%) [Table 10].

Among the cervical metastases in hypopharyngeal malignancies, Level II lymph nodes were most commonly involved in (58.82%), followed by Level III 4/34 (11.76%), [Table 11 and Figure 7].

Larynx (20/44)

Total cases of Ca larynx were observed in 44 patients, of these 20 (44.44%) showed nodal metastasis. This incidence was found to be low compared to hypopharynx and oropharynx. Carcinoma supraglottis was observed in 15 (75%) and found to be maximum incidence of lymph node metastasis [Table 12]. Among the supraglottis, aryepiglottic fold showed the maximum incidence of lymph node metastasis.

Most common level of lymph node involved in carcinoma Larynx was Level II (60%) [Table 11].

Nasopharynx (8/11)

There were 11 patients presenting with carcinoma nasopharynx and 8 out of 11 cases (72.72%) showed nodal metastasis. Most common level affected was Level II (50%), followed by Level II + Level V (37%) [Table 14].

Nose and PNS (6/11)

There were 11 patients presenting with carcinoma nose and PNS and 6 out of 11 cases (54.54%) showed metastasis

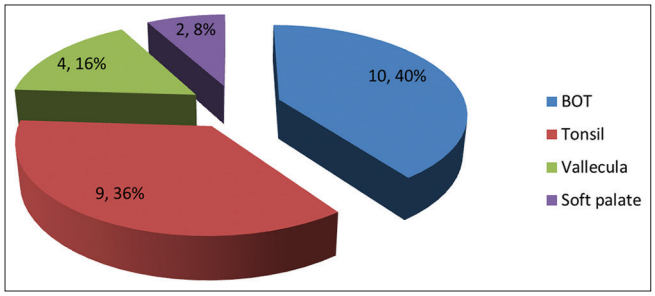

Figure 5: The subsites of oropharynx malignancies with nodal metastases (*n* = 25)

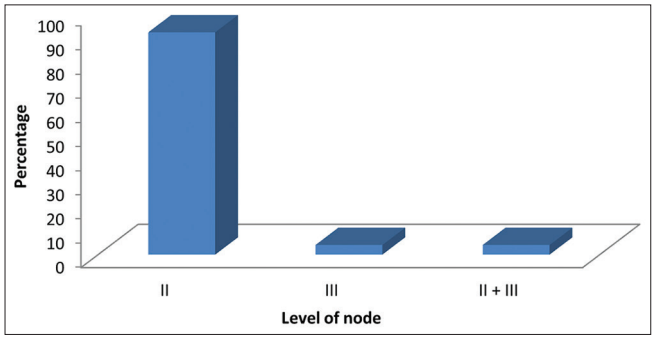

Figure 6: The levels of lymph nodes in oropharyngeal malignancies (*n* = 23)

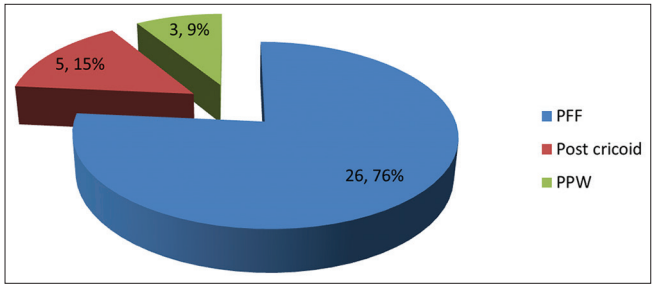

Figure 7: The subsites of hypopharyngeal malignancies with cervical secondaries (*n* = 34).

Table 8: The nodal metastases in malignancies of oropharynx (*n*=25)

Subsite	*n* (%)
Base of tongue	10 (40)
Tonsil	9 (36)
Vallecula	4 (16)
Soft palate	2 (8)

Table 9: Oropharynx – lymph nodes

Level of LN	*n* (%)
II	23 (92)
III	1 (4)
II+III	1 (4)

Table 10: Hypopharynx – subsites

Subsites	*n* (%)
Pyriform fossa	26 (76)
Post cricoid	5 (15)
Posterior pharyngeal wall	3 (9)

Table 11: Hypopharynx – lymph nodes

Level of LN	*n* (%)
II	20 (58.82)
II+III	5 (14)
III	4 (12)
II+V	2 (6)
II+III+IV	2 (6)
IV	1 (3)

Table 12: Malignant tumors of larynx with nodal involvement and their subsites (*n*=20)

Subsites	*n* (%)
Glottis	5 (25)
Epiglottis	2 (10)
Aryepiglottic fold	8 (40)
Arytenoid	2 (10)
Vestibular band	3 (15)

in lymph nodes. Most common level affected was Level I (50%), followed by Level II (34%). All the node positive cases were from carcinoma maxilla (100%) [Table 15].

Comparison of Accuracy between Clinical Assessment and Radiological Assessment was Done in this Study

A total number of patients who underwent neck dissection was 33/181 (18.23%). The distribution of different primary sites among the 33 patients was shown tabulated in Table 16.

The cellular differentiation on histopathological examination was tabulated in Table 17.

The study showed that maximum incidence of lymph node metastasis occurred from the poorly differentiated tumors 9/21 (42.85%) [Table 17].

Clinical Assessment of Neck Nodes

A cross-check was made between the clinical nodal staging and histopathological staging and tabulated in Table 18.

Table 13: The levels of nodal involvement in carcinoma larynx (*n*=20)

Levels of metastases	*n* (%)
II	12 (60)
III	4 (20)
II+III	4 (20)

Table 14: Nasopharynx – lymph nodes (*n*=8)

Level of LN	*n* (%)
II	4 (50)
II+V	3 (38)
V	1 (12)

Table 15: Nose and PNS – level of lymph nodes (*n*=6)

Level of LN	*n* (%)
I	3 (50)
II	2 (33.33)
I+II	1 (16.66)

PNS: Paranasal sinus

Table 16: Site distribution of cases

Site	*n* (%)
Ca pyriform fossa	8 (24.2)
Ca larynx	6 (18.2)
Ca tongue	5 (15.2)
Ca alveolus	4 (12.1)
Ca floor of mouth	2 (6.1)
Ca maxilla	2 (6.1)
Ca retromolar trigone	2 (6.1)
Ca tonsil	2 (6.1)
Ca base of tongue	1 (3)
Ca nasal cavity	1 (3)

Out of the 16 clinically N_0 cases, 7 cases (43.8%) were proved to be pathologically positive, demonstrating the possibility of occult metastasis which justifies the role of prophylactic neck dissection in high-risk cases, even if the nodal status is N_0. From Table 19, it is clear that by clinical assessment of the neck node metastasis; there is a 40–60% chance of downstaging of the nodal status [Table 19].

CT Assessment of Neck Nodes

A similar cross-check was done between CT scan nodal staging and histopathological nodal staging, and the results were tabulated in Table 20.

Out of the 8 CT negative cases (N_0), 37.5% were proved to be pathologically positive, which again justifies that there is a role for neck dissection in cases with a high chance of occult metastasis even if the CT assessment is N_0. In about 40-58% of the cases, there is a chance for overestimation of the nodal stage by CT assessment [Table 21].

Sensitivity and Specificity of Clinical Examination and Contrast enhanced CT

A cross-check was made between the clinical examination and CT scan enhanced with contrast and tabulated in Table 22; the $\varkappa$ value was 0.295; $P = 0.077$.

Overall, the clinical examination of lymph node has sensitivity, specificity, positive predictive value, and negative predictive value as 66.7%, 75%, 82.4%, and 56.3%, respectively (kappa significance 0.389, $P = 0.021$). The CT examination has sensitivity, specificity, positive predictive value, and negative predictive value as 85.7%, 41.7%, 72%, and 62.5%, respectively, $\varkappa$value0.389; $P = 0.021$ [Table 23].

DISCUSSION

More than one-third of all cancers in India occur in the head and neck region (Incidence rate 2, 11, 200/year), compared to <10% in the Western world an 4% in the USA.[10] The primary reason for this unusually high incidence of head and neck cancer in India may be the indiscriminate use of tobacco in its various forms. Undetected nodal metastasis is the most common cause of treatment failure in head and neck cancer. Hence, regional lymph node metastasis is an important factor in predicting the clinical course and outcome of the patient with head and neck malignancy.[11] Palpable nodes at presentation reduce the survival by about half, and this is due to the aggressive primary tumor and its ability to metastasize not only loco-regionally but also to distant sites.[1] In the present study, we had a total of 181 newly diagnosed cases of squamous cell carcinoma in the head and neck region, of which 117 cases (64%) were found to have nodal metastasis and 20 cases presented with bilateral neck nodes.

Table 17: Lymph node metastasis and differentiation of the primary tumor (*n*=21)

Differentiation	*n* (%)
Well-differentiated	5 (23.80)
Moderately differentiated	7 (33.33)
Poorly differentiated	9 (42.85)

Table 18: The cross-check between clinical and pathological accuracies

Clinical Nodal staging	Pathological N stage				Total (%)
	0 (%)	1 (%)	2a (%)	2b (%)	
0	9 (75)	3 (60)	3 (21.4)	1 (50)	16 (48.5)
1	1 (8.3)	0	3 (21.4)	0	4 (12.1)
2a	1 (8.3)	0	7 (50)	0	8 (24.2)
2b	1 (8.3)	2 (40)	1 (7.1)	1 (50)	5 (15.2)
Total	12 (100)	5 (100)	14 (100)	2 (100)	33 (100)

Table 19: The result of cross-check between the clinical and pathological staging.

Pathological N stage	Clinical N stage		
	Under estimation (%)	Same (%)	Over estimation (%)
N0		75	25
N1	60	0	40
N2a	42.8	50	7.1
N2b	50	50	-

Table 20: Cross tab (CT vs. Pathological)

CT Nodal stage	Pathological N stage				Total (%)
	0 (%)	1 (%)	2a (%)	2b (%)	
0	5 (41.7)	3 (60)	0	0	8 (24.2)
1	5 (41.7)	0	0	1 (50)	6 (18.2)
2a	1 (8.3)	0	7 (50)	0	8 (24.2)
2b	1 (8.3)	2 (40)	6 (42.9)	1 (50)	10 (30.3)
3	0	0	1 (7.1)	0	1 (3)
Total	12 (100)	5 (100)	14 (100)	2 (100)	33 (100)

CT: Computed tomography

Table 21: The results of cross-check between CT scan and pathological nodal staging

Pathological N stage	CT N stage		
	Under estimation (%)	Same (%)	Over estimation (%)
N0		41.7	58.3
N1	60	0	40
N2a		50	50
N2b	50	50	

CT: Computed tomography

Table 22: Comparison between clinical result and contrast enhanced CT scan results

Clinical	Histopathology		Total
	Yes	No	
Yes			
Number	14	3	17
% within clinical	82.4	17.6	100
% within HPR	66.7	25	51.5
No			
Number	7	9	16
% within clinical	43.8	56.3	100
% within HPR	33.3	75	48.5
Total			
Number	21	12	33
% within clinical	63.6	36.4	100
% within HPR	100	100	100

CT: Computed tomography, HPR: Histopathological report

Table 23: Comparison between histopathological result and CT examination

CT	Histopathology		Total
	Yes	No	
Yes			
Number	18	7	25
% within CT	72	28	100
% within HPR	85.7	58.3	75.8
No			
Number	3	5	8
% within CT	37.5	62.5	100
% within HPR	14.3	41.7	24.2
Total			
Number	21	12	33
% within CT	63.6	36.4	100
% within HPR	100	100	100

CT: Computed tomography, HPR: Histopathological report

Site Distribution of the Cases

Laryngeal carcinoma is the most common head and neck cancer worldwide, contributing to 25% of all head and neck malignancies.[1] A recent epidemiological study conducted in India found that most common head and neck malignancy in India is oropharynx (28.6%), followed by carcinoma esophagus (19.4%), oral cavity (16.3%), hypopharynx (14.1%), and larynx (11.8%).[12] In the present study, conducted in our department maximum number of cases were carcinoma hypopharynx (26%), followed by carcinoma larynx (24.3%), oral cavity (20.4%), and oropharynx (17.1%), which indicates a high incidence of carcinoma hypopharynx and larynx in our study population. The less number of carcinoma esophagus may be attributed to the fact that many of the patients may be attending other departments who were not included in our study.

Age

There is a progressive increase in the incidence of cancer with age, especially after 50 years. Although most patients are between 50 and 70 years of age, younger patients can develop head and neck cancer, especially in smokers and human papillomavirus associated cancers.[13] The present study also reflects the same pattern with maximum cases

in the seventh decade (37%) followed by sixth decade (27%). The results are comparable with the study by Mehrotra *et al*.[14] in India. They found that prevalence of head and neck cancer was highest in patients belonging to 50–69 years age group.

Sex

As evident from the table, the incidence of head and neck cancer in this study is more common in males with male:female ratio of 6:1. Literature reviews showed that M:F ratio of head and neck cancer being 3:1;[15] a study by Ridge *et al*.[15] also showed a M:F ratio of 3:1. Study by Mehrotra *et al*.[14] showed that M:F ratio in Indian population was 3.8:1. The low prevalence of addictions in females in our area may be the cause for the low incidence of head and neck carcinoma in our study population.

Nodal Metastasis

In our study, 117 cases (64%) were found to have neck nodes at the time of presentation, and 20 cases had bilateral neck diseases (11%). Percentage of nodal metastasis at presentation was more in our study population compared to the study by Ridge *et al*.,[15] which showed nodal metastasis in 43% of the cases. Another study by Hussey *et al*.[16] also showed the risk of clinically positive cervical lymph node metastasis ranging from 2% to 45% at the time of presentation with a chance of bilateral nodes in 5–15%. In our study population, maximum cases with nodal metastasis were from carcinoma hypopharynx (29%), followed by oropharynx (21%) which indicates a high incidence of hypopharyngeal malignancy in our area and increased the chance of lymph node metastasis from carcinoma hypopharynx. Bilateral nodal metastasis was most commonly from carcinoma of the base of tongue (35%), followed by pyriform fossa malignancy (30%) and carcinoma supraglottis (aryepiglottic fold) (15%). Literature reviews also showed that the common primary sites with bilateral neck disease are tongue base, supraglottic larynx, and hypopharynx.[1]

Oral Cavity

The oral cavity has a wide area of drainage. The most common subsites of oral cavity involved by tumor are tongue (35%) and floor of mouth (30%). Incidence of lymph node metastasis in tongue malignancy is 50%.[17] In the present study, total cases of oral cavity malignancy were 37, out of which 24 cases (65%) showed nodal metastasis. Tongue was found to be the most common subsite with secondary nodes (46%). The occurrence of nodal metastasis in tongue malignancy was found to be 78.6%. Literature reviews showed that the metastatic rates from oral cavity cancers to various levels of lymph nodes are Level I (58%) followed by Level II (51%).[1] Study by Shah[4] showed that Level I, II, and III lymph nodes were at high risk for metastasis from oral cavity malignancy. The present study also showed the similar pattern, and the lymph nodes most commonly involved were Level I (46%) followed by Level II (25%). There were no cases with involvement of Level IV or Level V nodes, which justifies the role of supraomohyoid neck dissection in case of oral cavity malignancy.

Oropharynx

A recent study has shown that carcinoma oropharynx is the most common head and neck malignancy in India[12] and it comes in the second position among our node positive cases. Lin *et al*.[18] have shown that 45–78% of patients with oropharyngeal primary may present with secondary nodes. Lymph node metastasis mostly involves Level II, III, and IV. Almost 20% patients with base of tongue malignancy will have bilateral nodal metastasis. Vartanian *et al*.[19] showed that 73% of patients with oropharyngeal malignancy had lymph node metastasis. Most common Level of lymph node affected was Level II. The present study also showed the same pattern. 80% had nodal metastasis. Base of the tongue was found to be the most common subsite (40%), and Level II lymph nodes were found to be involved most commonly (92%) followed by Level III. The occurrence of bilateral nodal metastasis in the base of tongue malignancy was found to be 70%, which is very high compared to the available literature reviews.

Hypopharynx

We had a total of 47 cases of carcinoma hypopharynx, out of which 72% showed nodal metastasis indicating high incidence of nodal involvement. Most common subsite with nodal metastasis was pyriform fossa (76%). 22% of the carcinoma pyriform fossa showed bilateral nodal metastasis, indicating the need for addressing both sides of the neck while considering treatment. Lin *et al*.[18] showed that 25% of the patients with hypopharyngeal cancer present with symptoms of neck mass and 70% will have palpable adenopathy on initial presentation. The present study is comparable with the above study by Lin *et al*.[18] Another literature review showed that 70–80% of patients with pyriform fossa cancer will have lymph node metastasis at the time of diagnosis and <10% of the cases are associated with bilateral nodes.[20] In our study, the most common level of lymph node involved was Level II (58%), followed by Level III. 2 cases showed the involvement of Level II + V, which indicates that Level V nodes should be cleared in the clinically N+ neck.

Larynx

Larynx includes supraglottis, glottis, and subglottis. No cases of carcinoma subglottic carcinoma were reported in our study. We had a total of 44 cases of carcinoma larynx, of which 20 (45%) showed nodal metastasis. Of these,

75% cases were contributed by supraglottis, aryepiglottic fold was found to be the most common subsite with lymph node metastasis. Occurrence of lymph node metastasis in carcinoma glottis was found to be low (21.7%) indicating the sparse lymphatic drainage of vocal cords. Waldfahrer *et al.*[21] found the incidence of a clinically positive node in glottic carcinoma was 8.6%. Dikshit *et al.*[12] reported that Level II, III, and IV were at highest risk for metastasis in carcinoma larynx and hypopharynx. The present study also agrees with this observation, with maximum incidence of metastasis in Level II (60%), followed by Level III (20%). No cases were presented with Level I or Level V nodes, suggesting that an anterolateral neck dissection clearing Level II, III, IV, and VI may be adequate for carcinoma larynx. In our study, the incidence of bilateral nodal metastasis in supraglottic carcinoma was found to be 19% indicating that both sides of the neck may have to be addressed especially in late-stage tumors.

Nasopharynx

Number of cases of carcinoma nasopharynx in the present study was 11, of which 72% showed nodal metastasis which was slightly lower than the meta-analysis by Ho *et al.*[22] which showed an incidence of 85% and the most common lymph node involved was Level II. The present study also showed that most common lymph node involved in nasopharyngeal carcinoma was Level II (50%) followed by Level II + V.

Nose and PNS

We had a total of 11 cases of carcinoma nose and PNS. 54% showed metastasis to cervical lymph nodes. Most common level of lymph node affected was Level I (50%), followed by Level II (34%). All were from carcinoma maxilla. Literature reviews showed that the incidence of lymph node metastasis in PNS malignancy is 10%.[22] The wide disparity of neck node involvement in our series may be due to the less number of cases and the advanced stage of the available cases (4 out of 6 cases were stage T4b).

Occult Metastasis

A total of 33 cases underwent neck dissection and were evaluated for the presence of occult metastasis in the lymph nodes and the comparison between clinical examination of the lymph node and lymph node assessment with contrast enhanced CT. In the present study, out of the 16 clinically N_0 cases, 7 cases (43.8%) proved to be pathologically positive. Moreover, out of the 8 CT N_0 cases 3 cases (37.5%) proved to have metastasis by pathological examination, which indicates that there is fairly high chance of occult metastasis to lymph nodes in head and neck malignancies, justifying the role of selective neck dissection in cases with high chance of node metastasis, even if the CT assessment is N_0. The results are comparable with the study by O'Brien *et al.* (2000)[27] who found that the incidence of occult metastasis in selective neck dissections was 30%. Waseem Jerjes *et al.*[23] noted that the incidence of occult lymph node metastasis in early oral cavity carcinoma was 27-40%. Alvi and Johnson[24] found that neck dissection in N_0 neck showed 34% occult metastasis and extracapsular spread in 49%. In our study, the maximum lymph node metastasis occurred from poorly differentiated tumors (42.9%). Lymph node metastasis always followed the expected pattern. There were no cases of skip metastasis. Another observation in our study was that in the clinical examination, there is more chance of underestimation of the nodal status and in CT assessment, there is more chance of overestimation of the nodal status.

Sensitivity and Specificity of Clinical Examination and Contrast Enhanced CT

In our study, the sensitivity of clinical examination was found to be low 66.7% and specificity was found to be high 75%. The positive predictive value and the negative predictive value were 82.4% and 56.3%, respectively. CT examination was found to have high sensitivity (85.7%) but low specificity (41.7%). The positive predictive value and negative predictive value were 72% and 62.5%, respectively. The results are comparable with the observation of Haberal *et al.* (2004)[25] who observed that clinical examination has a sensitivity and specificity of 64% and 85%, respectively, and that for CT examination was 81% and 96% specificity for CT examination in our series was too low compared to this study. Another study by Rottey *et al.*[26] found that sensitivity and specificity were 48.7% and 95.5% for palpation and 52.5% and 83.6% for CT examination, respectively. To conclude, even though the node detection is more with CT, it has a low specificity, and there is more chance of false positives. Hence, the clinical examination can be considered to be a better cost effective test for the basic evaluation of lymph node metastasis.

CONCLUSIONS

Higher incidence of head and neck squamous cell carcinoma was observed among the 61–70 years group. Males were more commonly affected. The most common head and neck malignancy with nodal metastasis was observed to be the hypopharyngeal malignancy, followed by carcinoma oropharynx. The occurrence of nodal metastasis was more common in carcinoma oropharynx. Bilateral nodal metastasis was observed to be high from carcinoma of base of tongue, followed by pyriform fossa malignancy and carcinoma supraglottis. Level I lymph node was observed to be the most common lymph node involved in oral cavity and PNS malignancy. All other head and neck malignancy showed maximum occurrence of metastasis

to Level II lymph nodes. Occult metastasis in CT N_0 neck was found to be 37.5%. Poorly differentiated carcinomas were observed to be associated with an increased risk of nodal metastasis. The sensitivity and specificity of clinical examination was found to be 66.7% and 75%, respectively. The sensitivity and specificity of contrast enhanced CT was found to be 85.7% and 41.7%, respectively. Clinical examination can be considered as a better cost-effective test for the diagnosis of metastatic lymph nodes, but it should be always supported by appropriate radiological imaging and pathological evaluation.

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