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Validity of CT/MRI in Cervical Lymph Nodes with Oral Squamous Cell Carcinoma in a Select Kenyan Population

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Abstract

Objectives: Accurate assessment of neck lymphadenopathy is crucial in Oral Squamous Cell Carcinoma (OSCC) due to its prognostic significance. This study aimed to evaluate the reliability and validity of radiological tools using histopathology as a reference for assessing cervical lymph nodes in these patients. **Methods:** A cross-sectional study was conducted involving 30 patients with OSCC, selected through purposive sampling, who underwent neck dissection at Kenyatta National Hospital between February and June 2023. Data from radiological (preoperative) and histopathological (postoperative) assessment of cervical lymph nodes was collected. The agreement, sensitivity, and specificity of different radiological examinations were evaluated. **Results:** Radiological and pathological nodal categories showed a consensus ($\kappa = 0.629$, $p = 0.009$), reporting CT scan sensitivity was 83.3% (51.6 - 97.9) and MRI sensitivity was 100% (39.8 - 100). Specificity for CT scan was 44.4% (13.7 - 78.8), while specificity for MRI was 60% (14.7 - 94.7). The positive predictive values for CT scan and MRI were 66.7% (51.4 - 79.1) each while the negative predictive values were 66.7% (40.6 - 85.4) and 100%, respectively. **Conclusions:** The radiological diagnostic tools demonstrated varying levels of reliability, with MRI showing higher validity than CT scan in the assessment of cervical lymph nodes in OSCC patients.

Keywords

Histopathology, MRI, CT Scan, Lymph Nodes

1. Introduction

Oral squamous cell carcinoma (OSCC) ranks as the fifteenth most common malignancy affecting both males and females worldwide with 300,000 new cases recorded every year [1]. The prognosis of patients with lymph node involvement markedly decreases by 50% affecting both recurrence of disease and poor chances of survival [2]. Twenty-three percent (23%) of lymph node metastases have been identified in OSCC, even at early stages of the disease [3].

Techniques utilized to detect the spread of lymph node metastasis include clinical and radiographic imaging (CT, MRI, US, and PET/CT scans). While each diagnostic imaging method has not been thoroughly examined, their use in preoperative evaluation remains under-researched, limiting their predictive reliability [4]-[6]. The meta-analysis published reports on the validity of each imaging modality, but the studies lacked refinement due to the inclusion of dissection slides or individual patient data. Comparing each lymph node region clinically and radiologically can improve both prognosis and treatment planning [7].

According to Bae *et al.* (2020), CT scans and MRI are less effective at detecting cervical lymph node metastasis [8]. This is demonstrated after therapeutic neck dissection, where some clinically N+ patients end up as N0 on histopathology. Similarly, after elective neck dissection, some clinically N0 patients end up as N+ on histopathology [9]. The decision as to whether or not to perform elective neck dissection on clinically N0 necks is a delicate balance. On one hand, there is the risk of unnecessary morbidity associated with neck dissection (e.g., numbness, lymphedema and limited shoulder movements) [10]. On the other hand, there is a risk of occult metastasis and subsequent recurrence if not dissected [11]. Some studies found that CT scans effectively estimate lymph node volume, with a sensitivity of 81.8%, specificity of 100%, and accuracy of 97.7%. However, sensitivity may appear lower because most lymph nodes studied were benign on histopathology [12] [13]. Accurate preoperative lymph node evaluation is essential for staging and prognosis, requiring sensitive and specific investigative techniques.

There are limited studies that evaluate the reliability of radiological diagnostic tools with histopathology as the reference for assessment of cervical lymph nodes in patients with OSCC. Therefore, this study assessed the accuracy of CT and MRI in detecting cervical nodes among patients with oral squamous cell carcinoma, using histopathology as the reference standard, within a specific Kenyan population.

2. Materials and Methods

This cross-sectional study took place at Kenyatta National Hospital (KNH), Kenya's largest referral and teaching hospital. Patients were purposively selected between February and June 2023. Inclusion criteria included patients to have neck dissection as treatment during resection of the OSCC, along with preoperative neck imaging (CT or MRI). Participants were recruited into the study after

providing written consent. Exclusion criteria included recurrent disease, prior neck treatment (surgery, radiotherapy, chemotherapy), or lymphadenopathy due to other causes such as HIV. Data on the sociodemographic variables (age, sex) and clinical characteristics (type of radiological imaging, primary tumor site, primary tumor categorization-T) was collected. Primary tumor (T) categorization was according to the Eighth Edition AJCC Cancer Staging [14].

CT and MRI images and reports were reviewed before surgery. Both the size and morphology of the node were taken into consideration for scoring as per Yoon *et al.* Suspicious nodes were defined by diameters over 9mm, abnormal hilar structure, or evidence of extra-nodal extension [15].

The cervical lymph nodes were sent to an oral pathologist for histological assessment, processed, stained with H&E, and examined under light microscopy. The lymph nodes were categorized as positive if tumour cells were observed on histologic examination. The patients' nodes were subsequently categorized (pN) according to the Eighth Edition AJCC Cancer Staging [14]. Information regarding the number of patients with abnormal (metastatic) lymph nodes, their pathological nodal classification, and specific characteristics of the metastatic lymph nodes was systematically recorded on data sheets and subsequently transferred to an MS Excel spreadsheet. This data from patients was recorded on data sheets and entered into an MS Excel file.

The statistical analyses were conducted with SPSS version 25 software. For descriptive statistics, median and IQR were used to describe continuous variables, while proportions were used to describe categorical variables. Cohen's Kappa was used to determine the level of agreement between clinical (radiological) and pathological nodal categorization and interpreted according to Landis and Koch [16]. Quantitative variables are reported using averages and standard deviations, while qualitative variables are described by frequencies and percentages. Sensitivity, specificity, and predictive values for radiological imaging were calculated against histopathology, with a 95% confidence interval. The association between Primary Tumor Categories (T) and Nodal spread (N) was analyzed by calculating Odds ratios (OR).

The study was reviewed and approved by the KNH-UON Ethics and Research Committee (reference number KNH-ERC/A/84). It was conducted in accordance with the principles of the Declaration of Helsinki of 1975 (available online: https://www.wma.net/what-we-do/medical-ethics/declaration-of-helsinki/, accessed on 27 March 2020), revised in 2013 [17].

3. Results

From February to June 2023, 30 patients were diagnosed with OSCC and all met the inclusion criteria for neck dissection surgery. The age ranged from 15 - 77 years ($\bar{x}$ = 58.1 yrs ± 12.5 SD) with a median age of 60.5 years (interquartile range: 52 - 66). The sociodemographic and clinical characteristics are summarized in **Table 1**.

Table 1. Sociodemographic and clinical characteristics of patients with OSCC undergoing neck dissection (N = 30).

Characteristics	Number of patients n (%)
Sex	
Male	16 (53.3)
Female	14 (46.7)
Age (years)	
≤40	1 (3.3)
41 - 50	6 (20)
51 - 60	8 (26.7)
61 - 70	11 (36.7)
>70	4 (13.3)

Evaluation of the site of primary lesion showed that 28 (93.4%) were in the oral cavity, 1 (3.3%) affected both oral cavity and oropharynx while 1 (3.3%) was in the oropharynx. Within the sub-sites majority 13 (28.9%) of the patients had a tumor in the anterior tongue, followed by 7 (15.6%) for both the floor of the mouth and buccal mucosa. The evaluation of histological diagnosis showed that 18 (60.0%) were well differentiated, 8 (26.7%) moderately differentiated and 4 (13.3%) poorly differentiated SCC. The site of the primary lesion, sub-sites, histological diagnosis and histological grading are summarized in Table 2.

Table 2. Anatomical and histological grade of OSCC.

Characteristics		n	%
Site of Primary Lesion	Oral Cavity	28	93.4
	Oral Cavity & Oropharynx	1	3.3
	Oropharynx	1	3.3
	Total	30	100.0
Sub sites	Mucosal lips	3	6.7
	Anterior tongue	13	28.9
	Floor of the mouth	7	15.6
	Buccal mucosa	7	15.6
	Mandibular alveolar ridge	3	6.7
	Maxillary alveolar ridge	1	2.2
	Hard palate	3	6.7
	Retro molar trigone	2	4.4
	Base of the tongue	2	4.4
	Tonsillar complex	2	4.4
	Soft palate	2	4.4

Continued

Total		45	100.0
Histological Diagnosis	OSCC	29	96.7
	OPSC	1	3.3
	Total	30	100.0
Histological Grading	Well differentiated	18	60.0
	Moderately differentiated	8	26.7
	Poorly differentiated	4	13.3
	Total	30	100.0

3.1. Radiological Assessment of Cervical Lymph Nodes in OSCC/OPSCC

Reviewing patient records revealed that 22 patients (73.3%) had CT scans, while 8 (26.7%) underwent MRI. Among 30 patients, 21 (70.0%) had suspicious nodes; 9 (30.0%) did not. Out of 21 patients with suspected lymph nodes, Level I involvement was found in 18 cases (85.7%), while Level II was seen in 10 cases (47.6%), and Level III appeared in just 2 cases (9.5%). In 8 patients (38.1%), suspicious nodes were present across multiple cervical levels. Characterization of the radiological features of the 38 suspicious nodes showed 28 (73.6%) nodes had diameters greater than 9 mm, 2 (5.3%) nodes had a round shape, 6 (15.8%) nodes had abnormal hilum architecture, and 2 (5.3%) nodes were matted. The lymph node size ranged from 0.0 - 62 mm with a mean size of 12.7 mm (±13.3 SD), a median of 11.5 mm and a mode of 0.0 mm. Some of the patients exhibited more than one evaluation criterion. The radiological nodal categorization had 9 (30.0%) patients with cN0 followed by 8 (26.7%) and 7 (23.3%) patients with cN2b and cN1 respectively in Table 3. The radiological features of the patients are summarized in while the distributions of suspicious nodes by levels are summarized in Figure 1. The histological nodal classification indicated that 14 (46.7%) patients were categorized as pN0, while 6 (20.0%) patients were classified as pN3b. Additionally, 3 (10.0%) patients each were staged as pN1, pN2b, and pN2c. Only 1 (3.3%) patient was staged pN3a. The histological features of the patients are summarized in Table 4.

Table 3. Summary of radiological nodal assessment.

Characteristics		n	%
Imaging Modality	CT Scan	22	73.3
	MRI	8	26.7
	Total	30	100
Patients with Suspicious Nodes	No	9	30.0
	Yes	21	70.0
	Total	30	100

Continued

Levels with suspicious nodes of the 21 patients	Level I	18	85.7
	Level II	10	47.6
	Level III	2	9.5
Patients with multiple levels of suspicious nodes	One level	13	61.9
	Two levels	7	33.3
	Three levels	1	4.8
	Total	21	100
Radiological features of suspicious Nodes	Nodes > 9 mm in Diameter	28	73.6
	Round Shape Node	2	5.3
	Abnormal Hilum Architecture	6	15.8
	Matted Nodes	2	5.3
	Total	38	100
Radiological Nodal Category	N0	9	30.0
	N1	7	23.3
	N2a	1	3.3
	N2b	8	26.7
	N2c	3	10.0
	N3a	1	3.3
	N3b	1	3.3
	Total	30	100

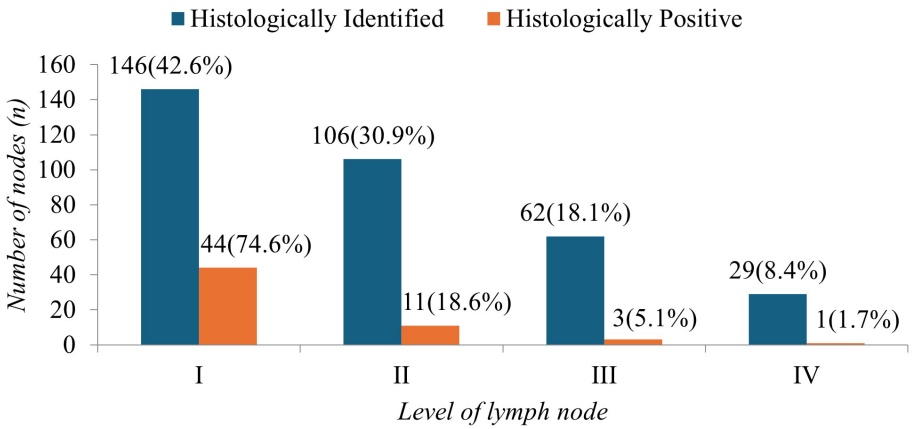

Figure 1. Number of histologically identified and involved lymph nodes by levels.

Table 4. Summary of histological assessment.

Nodal Characteristics		n	%
Level of Neck Dissection	Level I	30	100
	Level II	25	83.3

Continued

	Level III	20	66.7
	Level IV	11	36.7
Nodes identified histologically per Level	Level I	146	42.6
	Level II	106	30.9
	Level III	62	18.1
	Level IV	29	8.4
	Total	343	100
Patients with metastatic nodes	Yes	16	53.3
	No	14	46.7
Levels with metastatic nodes of the 16 patients	Level I	16	100.0
	Level II	7	43.8
	Level III	3	18.8
	Level IV	1	6.3
Number of metastatic lymph nodes per level	Level I	44	74.6
	Level II	11	18.6
	Level III	3	5.1
	Level IV	1	1.7
	Total	59	100
Histological features of metastatic nodes	Abnormal Hilum Architecture	30	50.8
	Nodes > 9 mm in Diameter	24	40.7
	Matted Nodes	5	8.5
	Total	59	100
Extra nodal extension among the 16 patients with nodal metastasis	Yes	6	37.5
	No	10	62.5
	Total	16	100
Pathological nodal categories	N0	14	46.7
	N1	3	10.0
	N2b	3	10.0
	N2c	3	10.0
	N3a	1	3.3
	N3b	6	20.0
	Total	30	100

3.2. Histopathological Assessments of Cervical Lymph Nodes in OSCC/OPSCC

Out of a total of 343 lymph nodes identified during neck dissection for histopathological examination, 59 were confirmed to be positive for tumor. A paired t-test was conducted to compare the number of lymph nodes dissected out and the number of

metastatic lymph nodes confirmed on histology. There was a statistically significant difference in the number of lymph nodes dissected out (M = 11.43, SD = 6.83) and the number of metastatic lymph nodes (M = 1.97, SD = 2.81); t (29) = 7.349, p < 0.001 from the patients. The effect size was large, with a Cohen's d of 1.81, indicating that more than 96% of the number of lymph nodes involved would be below the average number of lymph nodes dissected. The comparison of the number of lymph nodes identified and involved is summarized in Table 5.

Table 5. Comparison of the number of lymph nodes identified and involved.

				95% Confidence Interval of the Difference		*t*	*df*	*P*
Number of lymph nodes	n	Mean	SD	Lower	Upper			
Histologically identified	30	11.43	6.83	6.83	12.10	7.349*	29	<0.001
Histologically positive	30	1.97	2.81					

Note: Paired *t*-test was applied. *: The mean difference is statistically significant at the level of 0.05.

Histopathological evaluation of the number of nodes dissected per level showed Level I {146 (42.6%)} had the most nodes, followed by Level II {106 (30.9%)}, then Level III {62 (18.1%)} and Level IV {29 (8.4%)}. Of the 30 patients, 16 (53.3%) were positive for tumor in the cervical lymph nodes, while 14 (46.7%) did not exhibit any lymph node involvement. Analysis of the 16 patients with metastatic nodes showed 14 (87.5%) had clinically suspicious nodes but 2 (12.5%) were clinically negative nodes prior to surgery. Of the 16 (53.3%) histologically positive cases, the most common Tumor (T) categorization was T4a with 11 (68.8%) cases followed by T3 with 2 (12.5%) cases while T1, T2, and T4b had 1 (6.3%) case each. The distribution of Tumor (T) categorization among the histologic positive cases is summarized in Figure 2.

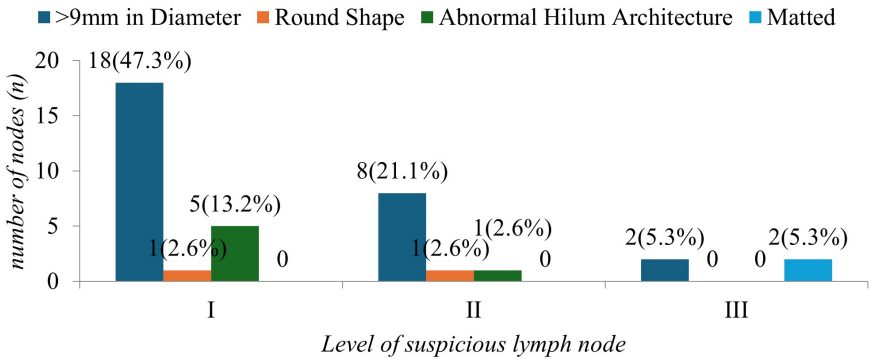

Figure 2. Distribution of radiological features of suspicious nodes by levels.

The histological nodal categorization had 14 (46.7%) patients at pN0 followed by 6 (20.0%) patients staged pN3b. pN1, pN2b and pN2c had 3 (10.0%) patients

each. Only 1 (3.3%) patient was staged pN3a. Sixteen patients (53.3%) were found to have histologically confirmed tumours within their cervical lymph nodes (pN+). These histopathological characteristics of the nodes were described as follows; 14 patients had nodes > 9 mm in diameter (radiographically), 9 had with abnormal hilum architecture with 6 showing extra-nodal extension. Within this group of pN+ patients, the predominant nodal classification was N3b, identified in six patients Table 4.

Out of 59 metastatic lymph nodes, 44 (74.6%) were located in Level I, followed by 11 (18.6%) in Level II, 3 (5.1%) Level III and 1 (1.7%) in Level IV 3 (5.1%). On characterization of the 59 involved lymph nodes, 30 (50.8) nodes had abnormal hilar architecture, 24 (40.7%) nodes were greater than 9mm in diameter, 5 (16.7%) nodes were matted. The distribution of the metastatic nodes per criteria and cervical level is summarized in Table 4.

3.3. Pattern of Agreement between Radiological and Histopathological Assessment of Cervical Lymph Nodes in OSCC/OPSCC

Due to the small sample size of 30, Cohen's Kappa (κ) test was used to determine the patterns of agreement based on matched (paired) cases for the study. There was fair agreement between the two groups of patients, $\kappa = 0.384$, $p < 0.05$. The pattern of agreement between patients with suspicious nodes and patients with involved lymph nodes is summarized in Table 6. Cohen's κ was run to determine the pattern of agreement between levels of suspicious nodes and levels of involved lymph nodes. There was a moderate agreement between the two groups of levels of nodes, $\kappa = 0.512$, $p < 0.05$. The pattern of agreement between clinically suspicious and histologically confirmed involved lymph nodes is summarized in Table 7. Cohen's κ was run to determine the pattern of agreement between radiological and pathological nodal categories. There was a substantial agreement between the two groups of nodal categories, $\kappa = 0.629$, $p < 0.05$. The pattern of agreement between radiological and pathological nodal categories is summarized in Table 8.

Table 6. Pattern of agreement between patients with clinically suspicious nodes and patients with histological confirmation of involved lymph nodes.

			Patients with suspicious node		Total	Kappa (κ)	p
			No	Yes			
Patients with involved lymph nodes	No	n	7	7	14	0.384*	0.025
		%	23.3	23.3	46.7		
	Yes	n	2	14	16		
		%	6.7	46.7	53.3		
Total		n	9	21	30		
		%	30.0	70.0	100.0		

Note: Cohen's Kappa (κ) test was applied. *: Cohen's Kappa (κ) is significant at the level 0.05.

Table 7. Pattern of agreement between cervical levels with suspicious and involved lymph nodes.

Lymph Nodes			Involved			Total	Kappa (κ)	p
			Level I	Level II	Level III			
Suspicious	Level I	n	8	1	1	10	0.512*	<0.001
		%	57.1	7.1	7.1	71.4		
	Level II	n	0	1	1	2		
		%	0.0	7.1	7.1	14.3		
	Level III	n	0	2	0	2		
		%	0.0	14.3	0.0	14.3		
Total		n	8	4	2	14		
		%	57.1	28.6	14.3	100.0		

Note: Cohen's Kappa (κ) test was applied. *: Cohen's Kappa (κ) is significant at the level 0.05.

Table 8. Pattern of agreement between radiological and pathological nodal categories.

Nodal categories			Histological							Kappa (κ)	p
			N0	N1	N2b	N2c	N3a	N3b	Total		
Radiological	N0	N	9	0	0	0	0	0	9	0.629*	0.009
		%	30.0	0.0	0.0	0.0	0.0	0.0	30.0		
	N1	N	4	3	0	0	0	0	7		
		%	13.3	10.0	0.0	0.0	0.0	0.0	23.3		
	N2a	N	1	0	0	0	0	0	1		
		%	3.3	0.0	0.0	0.0	0.0	0.0	3.3		
	N2b	N	0	0	3	0	0	5	8		
		%	0.0	0.0	10.0	0.0	0.0	16.7	26.8		
	N2c	N	0	0	0	3	0	0	3		
		%	0.0	0.0	0.0	10.0	0.0	0.0	10.0		
	N3a	N	0	0	0	0	1	0	1		
		%	0.0	0.0	0.0	0.0	3.3	0.0	3.3		
	N3b	N	0	0	0	0	0	1	1		
		%	0.0	0.0	0.0	0.0	0.0	3.3	3.3		
Total		N	14	3	3	3	1	6	30		
		%	46.7	10.0	10.0	10.0	3.3	20.0	100.0		

Note: Cohen's Kappa (κ) test was applied. *: Cohen's Kappa (κ) is significant at the level 0.05.

3.4. Sensitivity, Specificity, False Positives and False Negatives of Radiological Investigations

The sensitivity, specificity, false positives and false negatives of the two diagnostic tests (MRI and CT scan) were compared with the histopathological results as the

gold standard. Evaluation of the MRI results showed a sensitivity (true positive) rate of 100.0%, a specificity (true negative) rate of 60.0%, a false positive rate of 40.0% and a false negative rate of 0.0%. A McNemar's exact test determined that the difference in the proportions of MRI positive results and histological results was not statistically significant, $p = 0.500$.

Evaluation of the CT Scan results showed a sensitivity (true positive) rate of 83.3%, a specificity (true negative) rate of 44.4%, a false positive rate of 55.6% and false negative rate of 16.7%. A McNemar's exact test determined that the difference in the proportions of CT scan positive results and histological results was not statistically significant, p = 0.453. A comparison between the two imaging modalities showed that there was a difference of 16.7% sensitivity rate between MRI (100.0%) and CT scan (83.3%). A McNemar's exact test determined that the difference in the proportion of positive radiological results and histological results was not statistically significant, $p = 0.180$. The sensitivity, specificity, false positives and false negatives of the radiological investigations are summarized in Table 9.

Table 9. Sensitivity, specificity, false positives and false negatives of the radiological investigations.

Diagnostic Tests	Radiological Results		Histological Results		Total	McNemar's test	
			Negative	Positive		n	*p*
MRI	Negative	n	3	0	3	9	0.500
		%	60.0%	0.0%	33.3%		
	Positive	n	2	4	6		
		%	40.0%	100.0%	66.7%		
	Total	n	5	4	9		
		%	100.0%	100.0%	100.0%		
CT Scan	Negative	n	4	2	6	21	0.453
		%	44.4%	16.7%	28.6%		
	Positive	n	5	10	15		
		%	55.6%	83.3%	71.4%		
	Total	n	9	12	21		
		%	100.0%	100.0%	100.0%		

Note: A McNemar's exact test was applied.

4. Discussion

4.1. Radiological Assessment of Cervical Lymph Nodes in OSCC/OPSCC

This study found that CT scan was the most common radiological modality requested for assessing cervical lymph node metastasis. This was similar to other studies by Horváth *et al.* and Thoenissen *et al.* [9] [18]. The preference for CT

scans may partly stem from their greater availability, lower cost, and quicker procedure time when compared to MRI.

Approximately 30% of the patients did not have radiological evidence of cervical lymph node metastasis (cN0) but still underwent neck dissection to rule out occult metastasis. Previous studies have shown the prevalence of this prophylactic neck dissection to range from 31% to 60% [11] [18]-[21]. Elective neck dissection is supported by evidence of occult metastasis from previous studies [11] [22] [23].

Cervical Level I had the greatest number of suspicious lymph nodes. This was similar to a prospective study by Narayana *et al.*, of 24 patients which found Level I (combined Ia and Ib) to be the most prevalent suspicious cervical level. It is well demonstrated that level I has the most sentinel lymph nodes for primary tumors located in the floor of the mouth [24] [25]. Thus, meticulous clinical assessment of Level I is very important [25].

In this study, the most common radiological feature of suspicious lymph nodes identified was an enlarged node of more than 9 mm in diameter. Most studies advocate for assessment criteria based on a combination of nodal size, architecture and signs of extra nodal spread like matted nodes [26]-[28]. Relying on size criteria for diagnosis of clinical cervical lymph node metastasis reduces the accuracy of CT scan to 45% compared to 95% - 100% accuracy when based on central necrosis [29]. This aspect is important in this study given that calculation of sensitivities and specificities was one of the objectives.

The most frequent clinical nodal categories in this study were cN2b and cN1. This differed from a German retrospective study of 242 patients by Voss *et al.* in 2022 which found cN1 to be the most prevalent clinical nodal category [20]. The higher nodal categorization in this current study could be due to the higher number of patients with higher T categorization. It could also be due to factors associated with delays in diagnosis of oral cancer, especially in developing countries [30].

4.2. Histopathological Assessment of Cervical Lymph Nodes in OSCC/OPSCC

In the current study, level I had the highest number of positive lymph nodes confirmed on histology. Several previous studies found similar results [11] [21] [31] [32]. Thoenissen *et al.*, found a near equal prevalence between Levels I and II (9). On the other hand, Nithya *et al.*, when looking specifically at carcinoma of the tongue, found level II to be most commonly involved [33]. Levels I and II are known sentinel lymph nodes of primaries from the oral cavity [24]. These levels have to be thoroughly dissected out during neck dissection.

Almost half the patients who underwent neck dissection in the current study did not have cervical lymph node metastasis. Previous studies support this finding [11] [23] [31]-[35]. In contrast, Qiao *et al.*, and Mehta *et al.*, in retrospective studies found a lower prevalence of 30% and 20% respectively [19] [31]. As demonstrated by Kligerman *et al.* in a randomized controlled trial of 67 patients with

stage 1 and 2 OSCC of the floor of the mouth and tongue, survival rate is better when elective neck dissection is done [36].

In this study, the most common histopathological feature of positive lymph nodes was abnormal hilum architecture. Pandeshwar *et al.*, found most metastatic cervical lymph nodes to have central necrosis. Presence of tumor distorts the architecture of the lymph node by causing necrosis, deposition of keratin pearls, among others. Most of these architectural changes can be seen on radiological examination and inform their assessment and subsequent clinical staging [21].

A third of all the positive nodes in this study had extra nodal extension. The prevalence of extra nodal extension in other studies ranges from 24% to 45% [20] [32] [37]. Extra nodal extension lowers the prognosis in OSCC [35]. It is recommended that adjuvant chemotherapy be administered after neck dissection in patients with extra capsular spread [38].

The most prevalent pathological nodal category in this study was pN3b. This was similar to studies by Rabie *et al.*, and Voss *et al.*, [20] [37]. This, however, contrasted to the study by Thoenissen *et al.*, who found N1 and N2b to be most prevalent [9]. N3b was introduced as part of TNM staging in the AJCC 8th edition of 2018 and may not be captured in research done prior to 2018 [14]. N3b denotes extra nodal extension and has poor prognosis [35]. AJCC recommends adjuvant chemotherapy for N3b [14].

4.3. Pattern of Agreement between Radiological and Histological Assessment of Cervical Lymph Nodes in OSCC/OPSCC

In this study, there was a fair agreement between patients with clinically suspicious nodes and the patients with histologically confirmed nodal metastasis. This low pattern of agreement could be due to the overreliance on size criteria in identifying suspicious nodes on radiology. Assessing lymph node architecture on imaging, rather than size alone, may improve detection of malignant invasion. The level of agreement increased to moderate when the unit of comparison was the cervical nodal level. The agreement increased to substantial when the comparison was between clinical (cN) and pathological (pN) nodal categories. This suggests that ultimately, the clinical (radiological) nodal assessment in TNM staging, which considers a combination of size, numbers, laterality and extra nodal extension, is an effective tool in predicting lymph node metastasis.

4.4. Sensitivity and Specificity of Radiological Investigations in Diagnosis of Cervical Lymph Node Metastasis

In this study population, CT had a sensitivity (true positive) of 83.3%. This was within the range of 52% to 83% found in other similar studies. However, the 44.4% specificity of CT scan in this study was lower than the range of 68% - 98% from other studies [9] [26]-[28] [39]. A common factor in the studies by Suryavanshi *et al.*, Sumi *et al.*, and Saafan *et al.*, was their use of three or more criteria in assessing cervical lymph node metastasis (Central necrosis with peripheral enhancement, conglomeration of three or more lymph nodes and short axial diameter size

criteria) [26]-[28]. The lower ability to exclude metastasis (specificity) in this study could be due to the overreliance on the size criteria. As a result, overtreatment of the neck may occur, leading to a considerable number of patients undergoing unnecessary neck dissections and experiencing related complications and increased morbidity.

The sensitivity (true positive) of MRI in this study was higher at 100%. The range observed in other studies was between 66% - 81%. On the other hand, the specificity of MRI in this study was 60%. This was lower than other studies which ranged from 68% to 80% [9] [39]. The wide variation in sensitivity and specificity of MRI in this study could be due to the smaller number of patients who had MRI as their radiological investigation before surgery.

In this study, the false positive rates were 55.6% and 40% for CT and MRI, respectively (cumulatively 50% false positive for radiological assessment). This implies approximately half of the patients without metastatic nodal disease were found to have been falsely categorized as positive on radiological assessment. Other studies have shown false positive rates of 2% - 32% from radiological assessment. The relatively higher false positive rate in this study correlates to the lower specificity of CT and MRI found. On the other hand, the false negative rates in this study were 16.7% for CT and none for MRI. This is similar to previous studies which found a false negative rate of 17% - 48% [9] [26]-[28] [39]. This study's small sample size means that the comparison between CT and MRI performance was not statistically significant and does not confirm an actual lack of difference between the two modalities.

Our study had a few limitations. First, the sample size was relatively small. However, this was similar to other cross-sectional studies where data was collected before and after surgery [25] [26]. Secondly, there was possibility of bias in the reporting of the radiological images. This was mitigated by having an independent radiologist re-assess the radiological images for inter observer variability. Thirdly, the wide variation in MRI sensitivity and specificity could be due to the small number who were had an MRI investigation. Fourthly, the surgeries were performed by different surgeons thus raising the possibility of different qualities of neck dissection. The principal investigator was present at all neck dissections to ensure they followed ASCO guidelines [38].

5. Conclusions

The most common radiological feature of suspicious lymph nodes identified was an enlarged node of more than 9 mm in diameter while the most common histopathological feature of positive lymph nodes was abnormal hilar architecture. There was a substantial agreement between radiological and histopathological assessment of cervical lymph nodes in patients with OSCC/OPSCC. MRI and CT scan had higher sensitivity (true positives) but lower specificity (true negatives).

Future studies with larger or multicentric samples should incorporate diagnostic criteria such as irregular node margins or central necrosis, using advanced techniques like diffusion-weighted imaging.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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