ORIGINAL RESEARCH

Computed tomographic evaluation of oral cavity carcinomas: A retrospective observational study

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Aim: The aim of this study was to assess the role of computed tomography (CT) in oral cavity carcinoma and correlate clinical and pathological staging with CT and histopathological findings. **Background:** Oral cavity carcinomas are a rare form of cancer, and early detection is crucial for effective treatment. CT is a valuable diagnostic tool in evaluating oral cavity carcinomas. **Methods:** This retrospective observational study included 45 patients with histologically confirmed oral cavity carcinoma. CT imaging reports and histopathology reports were compared, focusing on tumor size, location, and characteristics. **Results:** The study found a high degree of concordance between CT and histopathological findings in staging oral cancer, with non-significant *P*-values indicating reliability. CT demonstrated high sensitivity, specificity, positive predictive value, and negative predictive value in assessing tumor size, tongue involvement, cortical bone involvement, maxillary sinus and masticator space involvement, and cervical lymph node involvement. **Conclusion:** CT is a reliable diagnostic tool in evaluating oral cavity carcinomas, closely aligning with histopathological findings. Its accuracy in determining tumor size, location, and characteristics makes it a valuable tool in pre-operative planning and treatment outcomes.

KEYWORDS: Cervical lymph node involvement, computed tomography, diagnostic accuracy, histopathological examination, oral cavity carcinomas, staging

INTRODUCTION

Oral cavity carcinomas are a type of cancerous tumor that can develop anywhere in the oral cavity, including the jaw bones and the oral soft tissues. They can also spread to other parts of the body. They account for only 1–4% of all oral cancers, making them an extremely uncommon form of the disease. Oral involvement with hepatocellular carcinoma, which is the most common primary hepatic tumor, is uncommon; <1% of cases show oral metastasis.[1] Infection with the human papillomavirus (HPV) is a significant element of danger for section of head and neck squamous cell carcinomas, but the link between HPV and oral cavity squamous cell carcinomas (OCSCC) is still debatable. The association between HPV and OCSCC has not been found to be significant in the majority of studies,[1] despite the fact that the overall prevalence of HPV-positive OCSCC is 6%. Oral cavity carcinomas are frequently diagnosed in India's lower socioeconomic strata of society, and treatment strategies vary widely depending on the patient's clinical presentation.[2]

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When evaluating oral cavity carcinomas, computed tomography (CT), or CT, is an extremely helpful diagnostic tool. When it comes to detecting bone erosion in the jaw, CT images equipped with bone algorithms offer a high level of specificity.[3] It is possible to identify regional lymphadenopathy with the assistance of contrast-enhanced CT images.[4] It has been demonstrated that a combination of CT and magnetic resonance imaging is worthwhile

in detecting metastatic neck nodes, which is essential for pre-operative planning as well as neck surveillance in superficial oral cancers.[5] When compared to histopathological examination, CT has excellent correlation and accuracy in measuring the depth of invasion in oral tongue squamous cell carcinoma (OTSCC).[6] This makes CT an extremely useful tool in the measurement of OTSCC. In addition, the utilization of post-operative CT planning, particularly when combined with positron emission tomography (PET), has been linked to an increased detection of early recurrence as well as improved treatment outcomes in oral squamous cell carcinoma (OSCC).[7] CT scans are simple to obtain, take less time to complete, and are among the first lines of investigation used to differentiate between diseases. In addition to this, CT is the method of choice for detecting metastatic lymphadenopathy and invasion of the cortical bone.[8]

The goal of this study is to perform a retrospective analysis and correlation of the findings obtained from CT imaging with the findings obtained from histopathological examinations during the evaluation of squamous cell carcinoma of the oral cavity with its staging. The use of CT, an investigation that is not invasive and has a low cost, is helpful in determining the stage of squamous cell carcinoma that has developed in the oral cavity. Prognosis can be estimated based on the stage of the cancer at the time that it was discovered, which is determined by how early the cancer was detected. The accuracy of CT scans in determining the stage at which oral cavity cancers are present will be the primary focus of this research. Hence, the present study was carried to evaluate the role of CT in oral cavity carcinoma and to correlate between clinical and pathological staging of oral cavity carcinomas on CT and histopathological findings.

MATERIALS AND METHODS

This retrospective observational study, "Computed Tomographic evaluation of oral cavity carcinomas," was conducted at Rohilkhand Medical College and Hospital, Bareilly, over a period of 1 year after obtaining clearance from the Board of Studies and Ethical Committee. The study included adults aged 18 and above with histologically confirmed oral cavity carcinoma, complete CT imaging data, and informed consent. Exclusion criteria included patients with non-oral cavity cancers, incomplete CT data, prior treatment, significant comorbidities, no informed consent, pregnancy, and language barriers.

After approval from the Institutional Ethical committee, all patients were selected as per inclusion and exclusion criteria. In this retrospective observational study, approved by the Institutional Ethics Committee, we collected and analyze the medical records of 45 patients with histopathologically confirmed oral cavity carcinoma. The study involved retrieving and comparing both the CT imaging reports and histopathology reports for these cases, focusing on factors such as tumor size, location, and characteristics. By systematically correlating these two sources of diagnostic information, we aimed to assess the degree of concordance between CT findings and histopathological diagnoses, quantifying the accuracy of CT imaging in diagnosing and characterizing oral cavity carcinomas. Ethical considerations were be upheld throughout the study, including the protection of patient confidentiality and privacy.

Contrast-enhanced CT (CECT) scan was done on 16 slice GE BRIGHT SPEED ELITE fifth-generation machine installed in our department.

The protocol for a contrast-enhanced CT scan of the oral cavity was as follows: the patient was positioned supine with their head in a neutral position. A contrast agent, Iohexol 300, was administered at a dose of 1.2–1.6 mL/kg body weight, with a total volume of 90 mL, using a power injector at a rate of 1.3–1.5 mL/s. The scan range was from the skull base to the sternal notch, with a spiral scan type. The scan parameters were set at 150 mAs and 120 kV, with a slice collimation of 0.75 mm. Reconstruction thickness was set at 1.25 mm and 3 mm for axial slices, and 3 mm for coronal slices. To ensure optimal image quality, patients were given voice instructions to blow uniformly through pursed lips, breathe gently, and avoid swallowing, using the "puffed cheek" technique (Figure 1).

Statistical Analysis

Data were analyzed using SPSS version 23.0, with quantitative data presented as mean ± SD and qualitative data as frequency and percentage. Statistical significance was determined using t-tests and Chi-square tests, with $P < 0.05$ considered significant.

RESULTS

The distribution of patients with oral cancer, as presented in the Table 1, reveals that the majority of the cases were concentrated among individuals aged between 51 and 70 years. Specifically, the 61–70 years age group accounted for the highest proportion of cases, constituting 37.78% (n = 17) of the total patient cohort. This was closely followed by the 51–60 years age group, which comprised 31.11% (n = 14) of the cases. Individuals in the 41–50 years age bracket made up 20.00% (n = 9) of the patient population. Conversely, the younger age group of 31–40 years and the older age group of 71–80 years had comparatively fewer cases, contributing to 4.44% (n = 2) and 6.67% (n = 3) of the total cases, respectively. In summary, these findings suggest that oral cancer is more prevalent among middle-aged to older individuals, with a noticeable peak in occurrence between the ages of 61 and 70 years.

Table 2 presents a comparative analysis between the staging of oral cancer as determined by CECT and histopathological

Table 1: Describing the study groups as per age

Age	*n*	%
31–40 years	2	4.44
41–50 years	9	20.00
51–60 years	14	31.11
61–70 years	17	37.78
71–80 years	3	6.67
Total	45	100.0

examination. For Stage I, CECT identified 35.56% (n = 16) of cases, while histopathology reported slightly fewer at 33.33% (n = 15), yielding P = 0.825. Stage II cases as detected by CECT were 24.44% (n = 11) compared to 26.67% (n = 12) by histopathology, with a similar P = 0.825. In Stage III, CECT detected 13.33% (n = 6) of the cases, while histopathology identified 15.56% (n = 7), resulting in a P = 0.76. For Stage IV A, CECT and histopathology reported 17.78% (n = 8) and 15.56% (n = 7), respectively, with P = 0.779.

Stage IV B was consistently identified by both CECT and histopathology as 8.89% (n = 4), yielding a P = 1.00. No cases were detected in Stage IV C by either method. These results indicate that there is a high degree of concordance between the staging of oral cancer by CECT and histopathology, as evidenced by the closely aligned percentages and non-significant P-values, suggesting that CECT is a reliable tool for staging oral cancer.

Table 3 provides a comparative analysis of oral cancer patients based on tumor size as determined by CECT and histopathological examination. For tumors smaller than 2 cm, CECT detected 35.56% (n = 16) of cases, while histopathology also identified similar 35.56% (n = 16), resulting in a P = 1.00. In the 2–4 cm range, CECT reported 24.44% (n = 11) of cases, whereas histopathology also found 24.44% (n = 11), with a P = 1.00. For tumors larger than 4 cm, both diagnostic methods consistently identified 40% (n = 18) of cases, yielding P = 1.00. These findings suggest that there is a strong agreement between CECT and histopathological examination in determining the size of oral cancer tumors. The non-significant P-values indicate that the discrepancies observed in the <2 cm and 2–4 cm categories are not statistically significant, and thus, CECT can be considered as a reliable tool for assessing tumor size in oral cancer cases.

Table 4 presents a comparison between CECT and histopathological examination in detecting the involvement of cervical lymph nodes in oral cancer cases. CECT identified cervical lymph node involvement in 31.11% (n = 14) of cases, while histopathology reported a slightly higher percentage of 33.33% (n = 15), yielding P = 0.818. Conversely, for cases without cervical lymph node involvement, CECT found 68.89% (n = 31) while histopathology reported 66.67% (n = 30), with the same P = 0.818. The close alignment of these percentages and the non-significant P-values suggest a high degree of agreement between CECT and histopathological findings in assessing cervical lymph node involvement in oral cancer cases, indicating that both diagnostic methods are comparably reliable for this aspect of evaluation.

Table 5 provides an evaluation of the predictive values of CECT compared to histopathological findings in the assessment of various parameters in oral cancer patients. For tumor size, CECT demonstrated a sensitivity of 100%, specificity of 100%, positive predictive value (PPV) of 100%, and negative predictive value (NPV) of 100%. In assessing tongue involvement, CECT showed a sensitivity of 80%, specificity and PPV of 100%, and an NPV of 94.87%. For cortical bone involvement, the sensitivity was 92.31%, with specificity, PPV, and NPV all at 100%. In cases of maxillary sinus and masticator space involvement, CECT displayed perfect predictive values with 100% sensitivity, specificity, PPV, and NPV. Finally, for cervical lymph node involvement, CECT exhibited a sensitivity of 93.33%, and specificity, PPV, and NPV were all 100%. These values indicate that CECT is a highly reliable diagnostic tool in assessing and predicting various aspects of oral cancer, closely aligning with histopathological findings.

Table 2: Comparison of stages of cancer with CECT and histopathology

Stages	CECT		Histopathological		*P*-value
	n	%	*n*	%	
Stage I	16	35.56	15	33.33	0.825
Stage II	11	24.44	12	26.67	0.825
Stage III	6	13.33	7	15.56	0.76
Stage IV A	8	17.78	7	15.56	0.779
Stage IV B	4	8.89	4	8.89	1.00
Stage IV C	0	0.00	0	0.00	-
Total	45	100	45	100	-

CECT: Contrast-enhanced computed tomography

Table 3: Comparison as per tumor size

Tumor size	CECT		Histopathological		*P*-value
	n	%	*n*	%	
<2 cm	16	35.56	16	35.56	1.00
2–4 cm	11	24.44	11	24.44	1.00
>4 cm	18	40	18	40	1.00
Total	45	100	45	100	-

CECT: Contrast-enhanced computed tomography

DISCUSSION

CECT may be the preferred for pre-treatment evaluation because the easily accessible, provides quick image acquisition, and less expensive.[2,9-12] The majority of the cases in the present study were concentrated among people aged 51–70. The 61–70 age group, in particular, accounted for the highest proportion of cases, accounting for 37.78% (n = 17) of the total patient cohort. The top incidence in mentioned age group may be explicated by longer exposure to the causative agent, tobacco, in this geographical area. When compared to young patients, traditional patients (aged 46–75) have a higher risk of local recurrences, regional metastasis, disease death, and a lower overall survival.

Table 4: Comparison as per cervical lymph nodes

Cervical lymph nodes	CECT		Histopathological		*P*-value
	n	%	*n*	%	
Yes	14	31.11	15	33.33	0.818
No	31	68.89	30	66.67	0.818
Total	45	100	45	100	-

CECT: Contrast-enhanced computed tomography

Table 5: Describing the study groups as per predictive values of CECT and histopathological findings

Component	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
Tumor size	100	100	100	100
Tongue involvement	80	100	100	94.87
Cortical bone involvement	92.31	100	100	96.29
Maxillary sinus involvement	100	100	100	100
Masticator space involvement	100	100	100	100
Cervical lymph nodes	93.33	100	100	96.77

CECT: Contrast-enhanced computed tomography, PPV: Positive predictive value, NPV: Negative predictive value

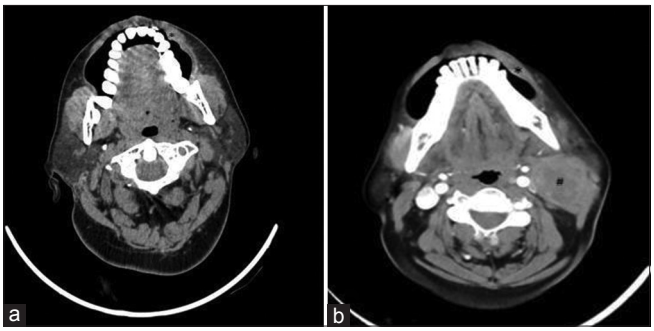

Figure 1: Axial plain (a) and contrast-enhanced computed tomography images (b) at the level of floor of mouth show an ulcerative soft-tissue density lesion (*) adjacent to the premolars on the left side. There is mild enhancement on post-contrast study. This lesion is seen extending into subcutaneous plane. There are few enlarged, enhancing conglomerated lymph nodes (#) with central non-enhancing areas in level II region on the left side

Patients over the age of 75 are at the greatest risk in all of these areas. Younger patients begin smoking and drinking at a younger age and consume more tobacco and alcohol, which may contribute to the development of oral squamous cell carcinoma.[13,14] Due to more severe comorbidity and conservative treatment, older patients have a worse prognosis. PET/CT scanning is useful in staging oral cancer, allowing for more accurate disease staging and treatment planning.[15,16] Our findings were consistent with those of Turner RR *et al*.,[16] who discovered that 91% of the subjects were more than 46 years, with an average age at presentation of 62 years.

In the present study, closely aligned percentages and non-significant *P*-values indicate that there is a high degree of concordance between the staging of oral cancer by CECT and histopathology, implying that CECT is a reliable tool for staging oral cancer. Arya *et al*.[17] and Lam *et al*.[18] found that CECT is a very sensitive method for assessing size and stage during pre-treatment evaluation. Since early-stage cancer is treated using only one method, but advanced-stage cancer requires a combination of treatments, CECT is sufficient for differentiating between stages I/II, III, and IV. This distinction is crucial for developing an effective treatment plan. Furthermore, stages I through IV A are treated curatively, whereas stages IV B and C are treated palliatively.

In the evaluation of sites such as cortical bone, cervical lymph nodes, maxillary sinus, and masticator space, our study found a perfect correlation between CECT and histopathological results. These findings were also observed in studies conducted by Arya *et al*.[17] and Lam *et al*.[18] which discovered that CT evaluation is preferred for assessing bone erosion and lymph node necrosis. CECT evaluation of tongue involvement, on the other hand, does not produce reliable results. Poor assessment of tongue involvement was also observed in the study conducted by Ong CK *et al*.[19] and Tibrewala S *et al*.,[20] Arya *et al*.,[17] and Law *et al*.[18] who state that CT is not a good modality for evaluation of involvement tongue and skin due to a lack of contrast between the soft tissues of the oral cavity.

Despite the few discrepancies in the correlation of CECT and histopathology, CECT demonstrated relatively high sensitivity, specificity, and PPV and NPV of 75%, 70–90%, and 70–80% for assessment of tumor size, oral tongue involvement, and facial skin involvement, respectively. As a result, CECT findings can be used in the overall assessment of tumor spread. CECT is a technique used to detect oral cancer. For assessing the primary tumor, it was discovered to have a sensitivity of 62.38% and a specificity of 70.21%.[21] CECT, on the other hand, has limitations in terms of accuracy and diagnostic accuracy, as it demonstrated lower sensitivity and specificity when compared to PET/CT.[22] In comparison to CECT, PET/CT has be more in staging.[23] It can precisely delineate the primary tumor and detect metastatic disease, resulting in more accurate disease staging and treatment planning.[24] As a result, while CECT can be used to diagnose oral cancer, PET/CT is thought to be a more reliable and accurate imaging technique for staging oral cancer.[25]

CONCLUSION

The comparative analysis revealed that CECT is a reliable diagnostic tool, with sensitivity, specificity, and predictive values close to 100% in several aspects, indicating its effectiveness in the assessment and staging of oral cavity carcinomas. This study underscores the significance of age, gender, and specific oral cavity locations in the prevalence of oral cancer. It also highlights the critical nature of certain symptoms in prompting early diagnostic procedures. The high concordance between CECT and histopathological findings affirms the reliability of CECT as a diagnostic tool, paving the way for its use in the effective assessment, diagnosis, and management of oral cavity carcinomas. The findings of this study provide valuable insights that could contribute to improved diagnostic strategies, timely interventions, and ultimately, better outcomes for patients with oral cancer.

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