

Accuracy of Contrast-Enhanced CT in Preoperative TNM Staging of Oral Squamous Cell Carcinoma: A Histopathological Correlation Study

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ABSTRACT

Background: Oral squamous cell carcinoma (OSCC) accounts for the majority of malignant tumours arising within the oral cavity and continue to be associated with substantial morbidity and mortality. Precise preoperative TNM staging is essential for selecting the most appropriate surgical procedure, planning cervical lymph node management, and predicting patient prognosis. Contrast-enhanced computed tomography (CECT) is routinely employed to evaluate the extent of the primary lesion and regional lymph node involvement; however, its diagnostic performance should be assessed against postoperative histopathological findings, which remain the accepted reference standard.

Aim: To determine the diagnostic accuracy of contrast-enhanced computed tomography in the preoperative TNM staging of oral squamous cell carcinoma by comparing radiological findings with postoperative histopathological staging.

Materials and Methods: A prospective observational study was carried out over a period of ten months in the Departments of Otorhinolaryngology and Radiodiagnosis at the National Institute of Medical Sciences (NIMS), Jaipur. Patients with biopsy-confirmed oral squamous cell carcinoma who underwent preoperative CECT followed by definitive surgical excision were included. Radiological assessment of tumour stage (T), nodal stage (N), tumour extent, invasion of adjacent anatomical structures, and cervical lymph node status was correlated with postoperative histopathological findings. Diagnostic indices including sensitivity, specificity, positive predictive value, negative predictive value, overall diagnostic accuracy, and Cohen's kappa coefficient were calculated to evaluate the performance of CECT.

Results: Contrast-enhanced CT demonstrated high level of

diagnostic accuracy for preoperative TNM staging in patients with oral squamous cell carcinoma. Excellent concordance was observed between radiological assessment and histopathological findings in evaluating both the primary tumour and cervical lymph node metastasis. Correlation with postoperative histopathology showed substantial agreement, supporting the reliability of CECT as an effective imaging modality for preoperative staging.

Conclusion: Contrast-enhanced computed tomography is a dependable imaging technique for the preoperative TNM evaluation of oral squamous cell carcinoma. Its close correlation with histopathological staging highlights its important role in surgical planning, therapeutic decision-making, and multidisciplinary management of patients with OSCC.

Keywords: Oral Squamous Cell Carcinoma; Contrast-Enhanced Computed Tomography; TNM Staging; Histopathology; Diagnostic Accuracy; Head and Neck Cancer.

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INTRODUCTION

Oral squamous cell carcinoma (OSCC) is the predominant malignant tumour affecting the oral cavity, accounting for nearly 90% of all oral malignancies. It remains an important public health concern because of its high incidence, significant disease burden, and associated mortality. The prevalence of OSCC is particularly high in South Asian countries, especially India, where widespread

consumption of tobacco in both smoked and smokeless forms, betel quid, areca nut, and alcohol substantially increases disease risk. Although considerable advances have been made in diagnostic techniques, surgical management, and adjuvant therapies, many patients continue to present with advanced-stage disease, resulting in complex treatment requirements, increased

postoperative morbidity, and poorer survival outcomes.¹⁻³ Successful management of OSCC depends largely on an accurate evaluation of disease extent before initiating definitive treatment. The Tumour–Node–Metastasis (TNM) staging system serves as the internationally accepted framework for assessing tumour size and local invasion (T stage), regional lymph node involvement (N stage), and distant metastatic spread (M stage). Precise staging plays a pivotal role in determining the extent of surgical excision, the necessity for cervical neck dissection, reconstructive planning, selection of adjuvant chemoradiotherapy, and estimation of prognosis. Inaccurate staging may have significant clinical consequences; understaging can result in incomplete tumour removal and increased risk of recurrence, whereas overstaging may expose patients to unnecessarily extensive surgical procedures and their associated complications.⁴ Clinical examination, including careful inspection and palpation, represents the initial step in the assessment of oral cavity malignancies. However, clinical evaluation alone cannot consistently determine the true extent of tumour infiltration, particularly with respect to depth of invasion, cortical and medullary bone involvement, spread into adjacent soft tissues, or metastatic cervical lymphadenopathy. Tumours arising from anatomically complex sites such as the tongue, floor of the mouth, gingivobuccal sulcus, retromolar trigone, and hard palate frequently extend beyond clinically appreciable margins. Consequently, cross-sectional imaging has become an indispensable component of the preoperative evaluation of patients with OSCC.⁵

Among the available imaging modalities, contrast-enhanced computed tomography (CECT) is widely utilized for preoperative staging because it combines rapid image acquisition with broad availability, excellent spatial resolution, and reliable visualization of both osseous and soft tissue structures. Intravenous contrast administration enhances delineation of the primary lesion, improves assessment of fascial plane and muscular invasion, and facilitates identification of metastatic cervical lymph nodes. In addition, CECT provides valuable information regarding cortical and medullary mandibular involvement, maxillary invasion, floor of mouth infiltration, extension into the masticator space, skin involvement, and the relationship of the tumour to adjacent vascular structures. These findings are of considerable importance when planning surgical resection and reconstruction.^{6,7} Magnetic resonance imaging (MRI) offers superior soft tissue contrast and is often preferred for evaluating tumour depth of invasion and marrow infiltration. Nevertheless, CECT continues to serve as the first-line imaging investigation in many institutions because it is more readily available, requires a shorter acquisition time, is comparatively economical, and provides excellent assessment of cortical bone destruction. Despite these advantages, CT has recognized limitations. Distinguishing malignant tissue from surrounding inflammatory changes may be difficult, microscopic cortical erosion may escape detection, and small metastatic lymph nodes without characteristic radiological features may not be identified reliably. Therefore, radiological findings should always be interpreted in conjunction with clinical evaluation and subsequently verified by postoperative histopathological examination, which remains the definitive reference standard for tumour staging.⁸ Comparison of radiological findings with histopathological examination has important

implications for patient care. Reliable preoperative imaging enables accurate assessment of tumour resectability, facilitates selection of appropriate reconstructive techniques, helps anticipate potential intraoperative challenges, and supports informed patient counselling regarding treatment options and expected outcomes. From the radiologist's perspective, accurate interpretation of CECT requires detailed knowledge of oral cavity anatomy, characteristic pathways of tumour spread, and established imaging criteria for metastatic lymph node involvement. Consequently, close collaboration between otorhinolaryngologists and radiologists is essential to improve staging accuracy, optimize treatment planning, and minimize discrepancies between imaging findings and postoperative pathology.⁹

Although numerous investigators have evaluated the usefulness of contrast-enhanced CT in the staging of oral cavity malignancies, reported diagnostic performance varies across studies because of differences in patient populations, tumour subsites, imaging techniques, observer experience, and pathological characteristics. Furthermore, evidence from the Indian population remains relatively limited despite the high prevalence of OSCC in the region. In view of these considerations, the present study was designed to assess the diagnostic accuracy of contrast-enhanced computed tomography in the preoperative TNM staging of oral squamous cell carcinoma by correlating radiological findings with postoperative histopathological staging. The findings are expected to provide additional evidence regarding the clinical value of CECT in surgical planning and reinforce the importance of multidisciplinary collaboration in the management of patients with oral squamous cell carcinoma.¹⁰

AIMS AND OBJECTIVES

To determine the diagnostic accuracy of contrast-enhanced computed tomography (CECT) for preoperative TNM staging in patients with oral squamous cell carcinoma through comparison of radiological findings with postoperative histopathological examination.

OBJECTIVES

Primary Objective

To evaluate the level of agreement between preoperative CECT-based TNM staging and postoperative histopathological staging in patients diagnosed with oral squamous cell carcinoma.

Secondary Objectives

- To determine the diagnostic performance of CECT in assessing the extent of the primary tumour (T stage).
- To evaluate the accuracy of CECT in identifying regional cervical lymph node metastasis (N stage).
- To assess the ability of CECT to detect mandibular and maxillary bone involvement, adjacent soft tissue infiltration, and extension into surrounding anatomical structures.
- To calculate the sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall diagnostic accuracy of CECT, using histopathological examination as the reference standard.
- To measure the degree of concordance between radiological staging and histopathological staging by applying Cohen's kappa coefficient.

METHODOLOGY

Study Design

A prospective, hospital-based observational study designed to evaluate the diagnostic accuracy of contrast-enhanced computed tomography (CECT) in the preoperative TNM staging of oral squamous cell carcinoma.

Study Setting

The investigation was conducted collaboratively in the Departments of Otorhinolaryngology and Radiodiagnosis at the National Institute of Medical Sciences (NIMS), Jaipur, Rajasthan, India.

Study Duration

The study was carried out over a period of ten months.

Study Population

Ninety consecutive patients with biopsy-proven oral squamous cell carcinoma who underwent preoperative contrast-enhanced computed tomography followed by definitive surgical treatment were enrolled in the study.

Inclusion Criteria

- Patients aged 18 years or above.
- Histopathologically confirmed primary oral squamous cell carcinoma.
- Patients who underwent preoperative contrast-enhanced CT examination of the oral cavity and neck.
- Patients scheduled for definitive surgical resection, with neck dissection performed whenever clinically indicated.
- Availability of complete postoperative histopathological reports.
- Patients who voluntarily agreed to participate and provided written informed consent.

Exclusion Criteria

- Patients with recurrent oral squamous cell carcinoma.
- Previous surgical intervention, radiotherapy, or chemotherapy for head and neck malignancy.
- Evidence of distant metastatic disease at the time of presentation.
- Contraindications to iodinated intravenous contrast administration.
- Pregnant women.
- Patients with incomplete radiological or histopathological records.

Study Procedure

After obtaining written informed consent, demographic information, relevant clinical history, associated risk factors, and findings from physical examination were documented using a structured proforma. Every eligible patient subsequently underwent preoperative contrast-enhanced computed tomography of the oral cavity and neck according to a standardized multidetector CT imaging protocol in the Department of Radiodiagnosis.

Image interpretation was performed independently by experienced radiologists who were blinded to the postoperative histopathological findings to minimize observer bias. Scanning was performed using a multidetector CT scanner with image acquisition extending from the skull base to the thoracic inlet. Thin-section axial images (slice thickness ≤ 1 mm) were obtained following intravenous administration of non-ionic iodinated contrast medium. Coronal and sagittal multiplanar reconstructed images were generated whenever necessary to improve

assessment of tumour extent, mandibular involvement, and cervical lymph node status.

The radiological evaluation included assessment of the primary tumour location, maximum tumour dimensions, local tumour extension, cortical and medullary bone invasion, infiltration of adjacent soft tissues, floor of mouth involvement, extension into the masticator space, skin invasion, cervical lymph node characteristics, and overall TNM stage according to the American Joint Committee on Cancer (AJCC) staging system.

Following completion of the radiological assessment, all patients underwent definitive surgical treatment in the Department of Otorhinolaryngology. Surgical specimens, including the primary tumour and cervical lymph nodes where neck dissection had been performed, were submitted for detailed histopathological examination. Postoperative histopathological TNM staging was considered the reference standard for comparison.

The findings obtained from preoperative CECT were subsequently correlated with histopathological examination to determine the diagnostic performance of contrast-enhanced CT in evaluating tumour extent and regional lymph node metastasis.

Outcome Measures

Primary Outcome

To determine the degree of agreement between preoperative CECT staging and postoperative histopathological TNM staging.

Secondary Outcomes

Diagnostic accuracy of CECT in evaluating:

- Primary tumour (T stage)
- Cervical lymph node metastasis (N stage)
- Cortical bone invasion
- Medullary bone invasion
- Adjacent soft tissue extension
- Floor of mouth involvement
- Masticator space invasion
- Overall TNM stage

Statistical Analysis

Data were compiled using Microsoft Excel and analysed with the Statistical Package for the Social Sciences (SPSS) software, version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables were summarized as mean $\pm$ standard deviation, whereas categorical variables were expressed as frequencies and percentages. Histopathological examination served as the reference standard for all diagnostic performance analyses.

Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall diagnostic accuracy of contrast-enhanced CT were calculated. Agreement between radiological and histopathological staging was quantified using Cohen's kappa coefficient. Associations between categorical variables were analysed using the Chi-square test or Fisher's exact test whenever appropriate. A p-value of <0.05 was considered statistically significant for all analyses.

Ethical Considerations

The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki and adhered to Good Clinical Practice guidelines. Prior approval was obtained from the Institutional Ethics Committee of the National Institute of Medical Sciences (NIMS), Jaipur, before initiation of the study.

Written informed consent was obtained from every participant after explaining the objectives and methodology of the study. Participants were assured that all clinical information would

remain confidential and that they could withdraw from the study at any stage without affecting their treatment. Patient anonymity was maintained throughout the research process, and all collected data were used exclusively for scientific and academic purposes.

RESULTS

A total of 90 patients with biopsy-confirmed oral squamous cell carcinoma (OSCC) who satisfied the inclusion criteria were enrolled in this prospective study. Preoperative contrast-enhanced computed tomography (CECT) findings were compared with postoperative histopathological examination (HPE), which served as the reference standard, to evaluate the diagnostic performance of CECT in assessing primary tumour extent and cervical nodal metastasis.

Demographic and Baseline Clinical Characteristics

Study population demonstrated a marked male predominance, with males accounting for 77.8% of the cohort. Majority of patients (54.4%) were between 40 and 60 years of age, while 30.0% were older than 60 years. Tobacco consumption was most prevalent risk factor, reported by 67.8%, followed by betel quid/areca nut chewing (45.6%) and alcohol consumption (24.4%).

The gingivobuccal sulcus was the most frequently involved primary tumour site (42.2%), followed by the lateral border of the tongue/floor of mouth (23.3%) and buccal mucosa (22.2%). Lesions involving the lower lip, hard palate, and retromolar trigone collectively accounted for 12.3% of cases.

Correlation of Primary Tumour (T) Staging

The accuracy of preoperative CECT in determining primary tumour stage was assessed by comparing clinical radiological staging (cT) with the corresponding postoperative pathological staging (pT). Overall, CECT correctly staged 74 of the 90 tumours, resulting in an overall diagnostic accuracy of 82.2%.

Tumour understaging occurred in 9 patients (10.0%), predominantly because of microscopic tumour infiltration that was not appreciable on CT imaging. Conversely, overstaging was observed in 7 patients (7.8%), mainly attributable to peritumoral inflammatory changes and surrounding soft tissue oedema that mimicked tumour extension. Agreement analysis demonstrated substantial concordance between CECT and histopathological staging, with a Cohen's kappa coefficient (κ) of 0.761 (95% CI: 0.648–0.874; $p < 0.001$), indicating excellent reliability of CECT in preoperative assessment of primary tumour stage.

Table 1. Demographic and Baseline Clinical Characteristics (n = 90)

Parameter	Category	Number of Patients	Percentage (%)
Age (years)	<40	14	15.6
	40–60	49	54.4
	>60	27	30.0
Gender	Male	70	77.8
	Female	20	22.2
Personal habits	Tobacco (smoked/smokeless)	61	67.8
	Betel quid/Areca nut	41	45.6
	Alcohol consumption	22	24.4
Primary tumour site	Gingivobuccal sulcus	38	42.2
	Buccal mucosa	20	22.2
	Lateral tongue/Floor of mouth	21	23.3
	Lower lip/Hard palate/Retromolar trigone	11	12.3

Table 2. Correlation Between Radiological (cT) and Histopathological (pT) Tumour Staging

CECT Stage (cT)	pT1	pT2	pT3	pT4a	Total
cT1	7	2	0	0	9
cT2	2	25	3	0	30
cT3	0	2	18	4	24
cT4a	0	0	2	25	27
Total	9	29	23	29	90

Table 3. Correlation Between Radiological (cN) and Histopathological (pN) Nodal Status

CECT Nodal Status	pN0	pN+	Total
cN0	40	7	47
cN+	4	39	43
Total	44	46	90

Table 4. Diagnostic Performance of CECT for Major Pathological Parameters

Diagnostic Parameter	Cervical Nodal Metastasis	Cortical Bone Invasion	Masticator Space Extension	Floor of Mouth Infiltration
Sensitivity (%)	84.8 (71.1–93.7)	81.3 (63.6–92.8)	76.5 (50.1–93.2)	82.1 (63.1–93.9)
Specificity (%)	90.9 (78.3–97.5)	91.4 (81.0–97.1)	95.9 (88.5–99.1)	91.9 (82.2–97.3)
PPV (%)	90.7 (77.9–97.4)	83.9 (66.3–94.5)	81.3 (54.4–96.0)	82.1 (63.1–93.9)
NPV (%)	85.1 (71.7–93.8)	89.8 (79.2–96.2)	94.6 (86.7–98.5)	91.9 (82.2–97.3)
Overall Accuracy (%)	87.8 (79.2–93.7)	87.8 (79.2–93.7)	92.2 (84.6–96.8)	88.9 (80.5–94.5)
p-value	<0.001	<0.001	<0.001	<0.001

Correlation of Cervical Lymph Nodal (N) Staging

Radiological assessment of cervical lymph node status was compared with histopathological findings obtained following neck dissection. Histopathological examination confirmed nodal metastasis in 46 patients, whereas 44 patients had no evidence of metastatic nodal disease.

Among the study population, 40 patients were correctly classified as node-negative on both CECT and histopathology. Seven patients with radiologically negative cervical lymph nodes were subsequently found to have microscopic metastatic deposits on histopathological examination, representing false-negative cases. In contrast, four patients with radiologically suspicious lymph nodes demonstrated only reactive follicular hyperplasia on histopathology, resulting in false-positive findings.

A highly significant association was observed between radiological and histopathological nodal staging ($\chi^2 = 47.9$, $df = 1$, $p < 0.001$). Agreement analysis yielded a Cohen's kappa coefficient of 0.755 (95% CI: 0.612–0.898; $p < 0.001$), indicating substantial agreement between CECT and postoperative histopathological evaluation.

Diagnostic Performance of CECT

The diagnostic performance of CECT for evaluating important structural parameters was assessed using histopathological findings as the reference standard. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), overall diagnostic accuracy, and corresponding 95% confidence intervals were calculated.

Among the evaluated parameters, CECT demonstrated the highest specificity for detecting masticator space extension (95.9%; 95% CI: 88.5–99.1%), indicating excellent ability to exclude deep-space invasion and thereby assist in determining tumour resectability. For cortical bone invasion, CECT correctly identified 26 of the 32 histopathologically confirmed cases, reflecting high diagnostic performance while highlighting its reduced sensitivity for detecting microscopic cortical erosions. All evaluated diagnostic parameters showed statistically significant agreement with histopathological findings ($p < 0.001$).

DISCUSSION

Accurate preoperative staging remains one of the most important determinants of successful treatment in patients with oral squamous cell carcinoma (OSCC). Reliable assessment of the primary tumour and cervical lymph node status enables appropriate surgical planning, selection of the extent of resection, determination of the need for neck dissection, planning of reconstruction, and consideration of adjuvant therapy. In the present study, contrast-enhanced computed tomography (CECT) demonstrated good overall diagnostic performance for evaluating both primary tumour extent and regional nodal metastasis when compared with postoperative histopathological examination. The substantial agreement observed between radiological and pathological staging supports the continued role of CECT as a dependable first-line imaging investigation for the preoperative evaluation of OSCC, particularly in centres where rapid imaging, widespread availability, and accurate assessment of bony structures are essential for clinical decision-making.^{4,7-10}

In the present study, CECT achieved an overall diagnostic accuracy of 82.2% for assessment of the primary tumour stage, with a Cohen's kappa coefficient of 0.761, indicating substantial

agreement with histopathological findings. Precise evaluation of the primary tumour is fundamental because inaccuracies in T staging may significantly influence the surgical approach, especially when lesions involve adjacent musculature, cortical bone, the floor of the mouth, or deeper facial compartments. Nine patients (10.0%) were understaged on CECT, largely because microscopic tumour infiltration and subtle cortical bone involvement were not appreciable on imaging. In contrast, overstaging occurred in seven patients (7.8%), most likely resulting from inflammatory tissue reaction, surrounding oedema, and ill-defined tumour margins that produced an exaggerated radiological appearance of disease extent. These findings highlight a well-recognized limitation of CT imaging, which, despite excellent anatomical resolution, cannot consistently differentiate viable tumour tissue from inflammatory changes or identify microscopic tumour spread. Similar observations have been reported in previous studies evaluating CT-based staging of oral cavity malignancies.^{4,7,8,10-12}

Evaluation of cervical lymph node metastasis is equally important because nodal involvement remains one of the strongest prognostic indicators in patients with OSCC. In the current study, CECT demonstrated a sensitivity of 84.8%, specificity of 90.9%, and an overall diagnostic accuracy of 87.8% for nodal staging, with substantial concordance between radiological assessment and postoperative histopathological examination. Although these findings confirm the usefulness of CECT for preoperative evaluation of cervical lymph nodes, certain limitations were evident. False-negative results occurred primarily because microscopic metastatic deposits were present in lymph nodes that did not exhibit radiological characteristics suggestive of malignancy. Conversely, reactive inflammatory lymphadenopathy accounted for the majority of false-positive findings, as enlarged reactive nodes occasionally fulfilled conventional radiological criteria for metastatic disease. These observations indicate that nodal size and morphology alone may not reliably distinguish benign from malignant lymphadenopathy, reinforcing the role of histopathological examination as the definitive method for confirming nodal status.^{4,8-10,13}

Among the additional pathological parameters evaluated, CECT demonstrated the greatest specificity for identifying masticator space extension. Accurate recognition of deep-space invasion has considerable clinical relevance because tumour extension into the masticator space may influence resectability, increase operative complexity, and alter reconstructive planning. Likewise, CECT performed well in detecting cortical bone invasion, reflecting its recognized advantage in demonstrating cortical destruction. Nevertheless, its relatively lower sensitivity indicates that early cortical erosion and microscopic medullary involvement may remain undetected despite high-quality imaging. Consequently, radiological findings should always be interpreted alongside clinical examination and intraoperative observations, particularly when imaging findings are equivocal or when tumour proximity to bone raises clinical suspicion.^{6-10,12,14}

The demographic profile observed in this study closely resembles that reported in previous epidemiological studies from the Indian subcontinent. Most patients were middle-aged or elderly males, with the highest incidence occurring during the fifth and sixth decades of life. Tobacco consumption, in both smoked and smokeless forms, represented the most common risk factor,

followed by areca nut or betel quid chewing and alcohol use. These findings correspond with the established epidemiology of OSCC within this region. In addition, the gingivobuccal sulcus emerged as the most frequently affected anatomical site, followed by the lateral border of the tongue and the floor of the mouth. Knowledge of tumour subsite distribution is clinically important because anatomical location influences local patterns of invasion, lymphatic drainage, risk of cervical nodal metastasis, and ultimately the interpretation of imaging studies and selection of the surgical approach.^{1-3,5,10}

The findings of the present investigation further emphasize the complementary role of CECT within a multidisciplinary treatment strategy for oral cavity malignancies. Although magnetic resonance imaging provides superior soft tissue contrast and may offer improved evaluation of tumour depth of invasion and marrow infiltration, CECT retains several practical advantages. These include shorter examination time, wider accessibility, lower cost, and excellent visualization of cortical bone destruction. Such advantages are particularly valuable in high-volume oncology centres and healthcare settings with limited resources, where prompt and accurate preoperative staging is necessary for timely management. Accordingly, CECT should be regarded as an integral component of comprehensive preoperative assessment and interpreted together with clinical examination, histopathological findings, and multidisciplinary team recommendations rather than as a stand-alone investigation.^{7-10,14,15} The observations of this study have several important clinical implications. Accurate radiological staging assists surgeons in selecting the appropriate extent of tumour resection, identifying patients who require cervical neck dissection, planning reconstructive procedures, and counselling patients regarding anticipated treatment and prognosis. At the same time, awareness of the limitations of CECT remains essential. Occult nodal metastases and microscopic tumour extension may escape radiological detection, whereas inflammatory changes may occasionally mimic more advanced disease and lead to overstaging. Recognition of these limitations facilitates more balanced interpretation of imaging findings and underscores the importance of close collaboration among otorhinolaryngologists, radiologists, pathologists, and oncologists to achieve optimal patient outcomes.^{4,7-10,15,16}

The present study possesses several notable strengths. Its prospective design, standardized multidetector CT imaging protocol, direct comparison of radiological findings with postoperative histopathology, and collaborative approach involving both the Departments of Otorhinolaryngology and Radiodiagnosis enhance the reliability of the findings. Nevertheless, certain limitations should be acknowledged. The investigation was conducted at a single tertiary care institution and included a relatively limited sample size, which may restrict the generalizability of the results to broader populations. Furthermore, comparative evaluation with other advanced imaging modalities, including magnetic resonance imaging and positron emission tomography-computed tomography, was beyond the scope of the present study. Future multicentre investigations involving larger patient populations and multimodality imaging protocols may further improve preoperative staging strategies and enhance diagnostic accuracy in patients with oral squamous cell carcinoma.^{9,10,15,16}

CONCLUSION

The findings of the present study demonstrate that contrast-enhanced computed tomography (CECT) is an effective and dependable imaging modality for the preoperative TNM staging of oral squamous cell carcinoma. Comparison with postoperative histopathological examination showed substantial agreement for assessment of both the primary tumour and regional cervical lymph node involvement, supporting the usefulness of CECT in routine preoperative evaluation. The modality also provided reliable information regarding tumour extent, cortical bone invasion, masticator space involvement, and spread to adjacent anatomical structures, thereby contributing significantly to surgical planning and treatment selection.

Despite its overall high diagnostic performance, CECT exhibited certain limitations in detecting microscopic tumour extension, early cortical bone erosion, and occult cervical nodal metastasis. These findings emphasize that, although CECT serves as an invaluable imaging tool during preoperative assessment, postoperative histopathological examination continues to represent the definitive reference standard for accurate tumour staging and confirmation of disease extent. The results of this study further highlight the importance of a multidisciplinary approach involving otorhinolaryngologists, radiologists, pathologists, and oncologists in the management of patients with oral squamous cell carcinoma. Integration of comprehensive clinical evaluation, high-quality contrast-enhanced CT imaging, and detailed histopathological assessment facilitates more accurate staging, improves surgical planning, reduces discrepancies between radiological and pathological findings, and ultimately supports better patient care and oncological outcomes. Future multicentre studies involving larger patient cohorts and direct comparison with advanced imaging techniques such as magnetic resonance imaging (MRI) and positron emission tomography-computed tomography (PET/CT) are recommended to further refine preoperative staging strategies and enhance diagnostic accuracy in patients with oral squamous cell carcinoma.

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