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MDCT EVALUATION OF ORAL SQUAMOUS CELL CARCINOMA

Radio-Diagnosis

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ABSTRACT

Background: Oral squamous cell carcinoma (SCC) is a prevalent malignancy of the oral cavity, with a significant incidence in developing countries such as India, largely due to high-risk habits like tobacco and betel nut use. Multidetector computed tomography (MDCT) plays a crucial role in the staging and treatment planning of oral cavity cancers by providing detailed imaging of tumour extensions, bone invasion and nodal metastases. **Objective:** This study aims to evaluate the effectiveness of MDCT in assessing oral cavity SCC, correlating its findings with histopathological results to refine diagnostic and staging processes. **Methods:** A hospital-based cross-sectional prospective study was conducted at Silchar Medical College and Hospital over one year (March 2023 to February 2024). Twenty-nine patients with clinically suspected or histologically confirmed oral cavity SCC were included. MDCT scans were performed using a 128-slice scanner, with analysis focusing on tumour size, local extension, bone invasion and nodal metastases. Data were correlated with histopathological findings to determine diagnostic accuracy. **Results:** The study found that MDCT was highly effective in detecting tumour extension (72.4%), bone invasion (65.5%), and nodal metastases (58.6%). The accuracy of MDCT for identifying nodal metastases was 82%, with sensitivity and specificity of 88% and 75%, respectively. For bone invasion, the sensitivity was 85% and specificity was 87%, with an overall accuracy of 86.2%. The majority of patients presented with advanced-stage disease, predominantly stage IV (76.8%). Buccal mucosa was the most common primary site (31%) and the predominant histological type was well-differentiated SCC (48.2%). **Conclusion:** MDCT proves to be an indispensable tool in the management of oral cavity SCC, offering detailed visualization that aids in accurate staging and treatment planning. Despite its high accuracy, MDCT may miss early-stage cancer details, making it essential to complement with MRI for a comprehensive assessment of soft tissue involvement and perineural invasion. Continued emphasis on early detection and preventive measures is crucial, particularly given the rising incidence of oral cancers among younger populations.

KEYWORDS

Oral cancer, Oral Squamous Cell Carcinoma (SCC), MDCT.

INTRODUCTION

The oral mucosa is constantly exposed to a range of internal and external factors, making it vulnerable to various inflammatory and neoplastic conditions, ranging from benign to malignant.(1)

Only 7% oral cavity tumours are malignant, with squamous cell carcinoma (SCC) comprising 90% of these cases. In the Indian population, buccal mucosa represents the most prevalent site for oral cancer development. In contrast, carcinoma of the buccal mucosa is less frequent in developed countries compared to India and other nearby developing countries. The heightened incidence of oral cancer in these regions primarily stems from widespread practices such as smoking and betel nut chewing, often combined with tobacco. These habits significantly increase the susceptibility of the population to develop oral submucous fibrosis, a premalignant condition that predisposes individuals to a higher incidence of oral cancer at a younger age. With tobacco use, alcohol consumption, and human papillomavirus (HPV) infection identified as significant risk factors, the incidence of oral cavity tumours varies geographically and demographically. (2)

Oral squamous cell cancer can arise within the structures of the mouth, including the lips, tongue, gums, floor of the mouth, palate, and salivary glands. Multidetector computed tomography (MDCT offers detailed evaluation crucial for staging and treatment planning in oral cavity cancer, including assessments of tongue muscle involvement, masticator space extension, bone invasion, neurovascular bundle infiltration, and detection of nodal and distant metastases. The use of puffed cheek technique in CT simplifies evaluation of buccal and gingival mucosa, providing excellent visualization. This imaging modality plays a pivotal role in the pre-operative assessment of buccal mucosa cancer, offering precise information on soft tissue extensions, bone erosions, and nodal involvement which aids in treatment decisions and prognostic assessments.(3)

In our study, MDCT is used to evaluate oral cavity squamous cell carcinoma (SCC) to define their role in arriving the diagnosis, to evaluate their extensions to adjacent structures, bone erosions and nodal metastasis. The CT findings were correlated with histopathological findings.

Aims And Objectives: To describe the role of multidetector computed tomography in the evaluation of oral cavity squamous cell carcinoma.

Inclusion Criteria: This study included patients of various age groups referred for radiological evaluation who were suspected to have oral cavity cancer and whose imaging or FNAC/ histopathological study confirmed the presence of oral cavity cancer.

Exclusion Criteria:

1) Patients who have undergone previous surgery of oral cavity and oropharyngeal region for any cause.
2) Pregnant females presenting with oral mass as plain radiography and CT are contraindicated.

Source Of Data: The primary data source for this study comprised patients referred from the Department of ENT and other departments of Silchar Medical College and Hospital with suspected or confirmed oral cavity cancers. Each case involved comprehensive history-taking and local physical examinations. Informed consent was taken from all participants prior to initiating the study.

MATERIALS AND METHODS

- The study was conducted among 29 patients who were suspected or known to have oral cavity squamous cell cancer and referred for CT scan to the Department of Radiodiagnosis, SMCH, Silchar, Assam.
- Patients who were histopathologically proven cases and underwent imaging later and patients who already undergone imaging followed by biopsy and histopathological confirmation were included in the study.
- They were examined using 128 slice multidetector CT scanner. After administering intravenous iodinated contrast medium, imaging were obtained with axial sections from the skull base to the clavicles. Multiplanar Imaging and a 3D reconstruction technique were used to create multiplanar sagittal and coronal reformation pictures. In all cases, the puffed cheek manoeuvre was used to separate the oral buccal mucosa from the gingival tissue for better assessment.
- The size and extent of the original mass lesion, bony invasions and nodal metastasis were assessed using a MDCT scan with IV contrast use. The gathered data were statistically analysed in terms of the subject's demographics. Disease staging was conducted using the TNM classification of the American Joint Committee on Cancer (7th edition).

- **Study Design:** Hospital based Cross-sectional prospective study.
- **Period of Study:** The present study was conducted for a period of 1 year from 1-03-2023 to 29-02-2024 after taking approval from the Ethical Committee.

RESULTS

In our study, conducted in the Department of Radiology, Silchar Medical College & Hospital, Silchar, Cachar, Assam, 29 patients with oral cavity squamous cell cancer on the basis of inclusion criteria were examined by MDCT for one year from 01-03- 2023 to 29-02-2024.

The results of this study have been presented in tabular and pictorial representation under different headings and observations are summarized accordingly.

Patient Demographics

In our study, out of 29 cases, oral cavity squamous cell carcinoma was most frequent in 6th and 7th decades, accounting for 9 (31%) and 7 (24.1%) cases out of 29 cases respectively. 5 (17.2%) cases were seen in less than 40years of age. 5 (17.2%) cases were seen in less than 40years of age. (FIGURE 1).

In our study, oral squamous cell carcinoma was more common among males constituting 72% (21/29) and females constituted approx. 28% (8/29) of total cases (FIGURE 2).

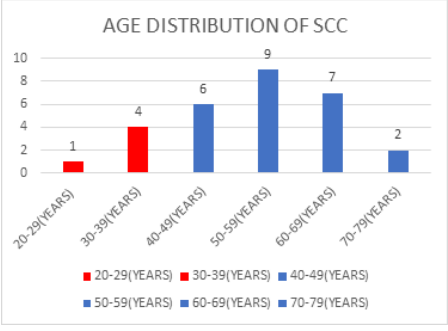

Figure 1: Age Distribution Of Squamous Cell Carcinoma

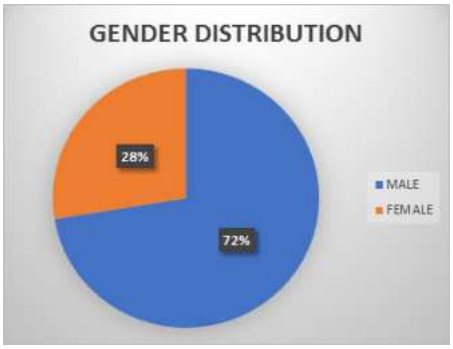

Figure 2: Distribution Of Oral Cavity Squamous Cell Carcinoma According To Gender

In our study, the majority of patients with oral squamous cell carcinoma had one or more high-risk habits. Out of 29 patients, 22 (75.8%) were tobacco users, 17 (58.6%) chewed betel nut, 5 (17.2%) were smokers, and 1 (3.4%) consumed alcohol. However, 2 patients did not report any such habits.

In our study, most frequent primary site for developing oral squamous cell carcinoma (out of 29 cases) was buccal mucosa (31%) followed by inferior gingivo-buccal sulcus (24.1%), tongue (13.8%), and superior gingivobuccal sulcus (10.3%). Retromolar trigone and floor of mouth were the primary site in 6.8% cases each. Least common sites were hard palate and lip constituting 3.4% each (FIGURE 3).

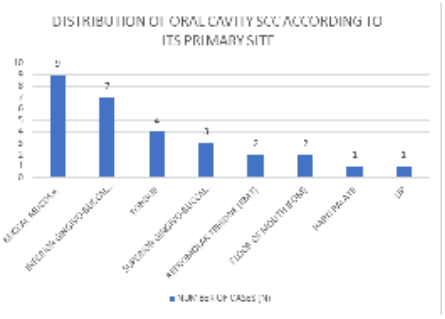

Figure 3: Distribution Of Oral Cavity Squamous Cell Carcinoma According To Its Primary Site

In this study, among 29 cases of oral cavity SCC, 21 (72.4%) cases showed extension into adjacent sites, 18 (62%) cases had bone invasion and 17(58.6%) cases had nodal metastasis.

Among the 17 cases of squamous cell carcinoma with nodal metastasis, 2 (11.7%) cases were categorised as N1, 9 (53%) cases were categorized as N2 and 6 (35.3%) as N3.

Table 1: Nodal Metastasis In Oral Cavity Squamous Cell Carcinoma Detected By Ct And Hpe Correlation

NODAL METASTASIS BY CECT	HISTOPATHOLOGICAL EXAMINATION (HPE)			
	PRESENT	ABSENT	TOTAL	*p* VALUE
PRESENT	15	3	18	0.002
ABSENT	2	9	11	
TOTAL	17	12	29	

SENSITIVITY=88%
SPECIFICITY=75%
PPV=83%
NPV=81%
p VALUE=0.002

In this study, among 29 cases of oral cavity squamous cell carcinoma, CT accurately identified 15 out of 17 histopathologically proven cases of nodal metastasis. For the 12 cases histopathologically negative for nodal metastasis, CT correctly identified 10 cases as negative. The sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall accuracy of CT evaluation were 88%, 75%, 83%, 81%, and 82%, respectively. The obtained p value was significant (0.002). (TABLE 1)

Table 2: Bone Invasion Detected By Ct And Hpe Correlation

BONE INVASION BY CT	HISTOPATHOLOGICAL EXAMINATION (HPE)			
	PRESENT	ABSENT	TOTAL	*p* VALUE
PRESENT	18	1	19	0.0036
ABSENT	3	7	10	
TOTAL	21	8	29	

SENSITIVITY=85%
SPECIFICITY=87%
PPV=94.7%
NPV=70%
p VALUE=0.0036

In this study involving 29 cases of oral cavity squamous cell carcinoma, CT accurately identified 18 out of 21 histopathologically proven cases of bone invasion. Among the 8 cases histopathologically negative for bone invasion, CT correctly identified 7 cases as negative. The sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall accuracy of CT evaluation were 85%, 87%, 94.7%, 70%, and 86.2%, respectively. The obtained p value was significant (0.0036). (TABLE 2)

In this study, patients with oral cavity SCC most commonly presented with stage IV disease, constituting 44.8 % stage IVA and 31% stage IVB. 3% patients presented with stage II and stage III each and only 1 patient (3.4%) presented in stage I (TABLE 3).

Table 3: Distribution Of Squamous Cell Carcinoma According To Stages

STAGES	NO OF CASES (OUT OF 29)	PERCENTAGE (%)
I	1	3.4
II	3	10.3
III	3	10.3
IV(A)	13	44.8
IV(B)	9	31

In this study, most common histopathological grading of squamous cell carcinoma was well differentiated constituting 48.2% (14/29), followed by moderately differentiated constituting 34.4% (10/29) and 17.2% (5/29) cases were poorly differentiated.

Case 1: Squamous Cell Carcinoma Of Gingivobuccal Sulcus

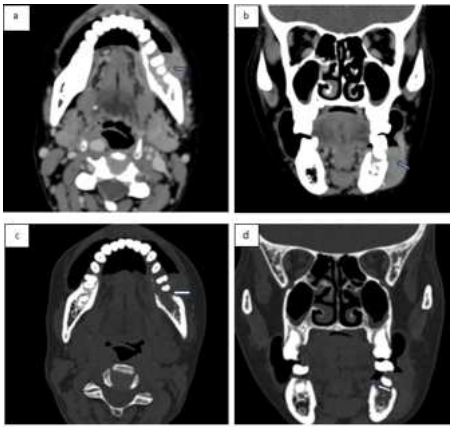

Figure 4.1: squamous cell carcinoma of gingivobuccal sulcus with bone invasion. (a) Axial and (b) coronal contrast-enhanced CT image (soft-tissue window) demonstrates an enhancing soft-tissue mass (arrows) along the left inferior gingivobuccal sulcus extending to the buccal mucosa. (c) Axial and (b) coronal contrast-enhanced CT image (bone window) shows cortical erosion (arrow) along the left buccal and lingual aspect of the mandibular alveolus.

Case 2: Squamous Cell Carcinoma Of Tongue

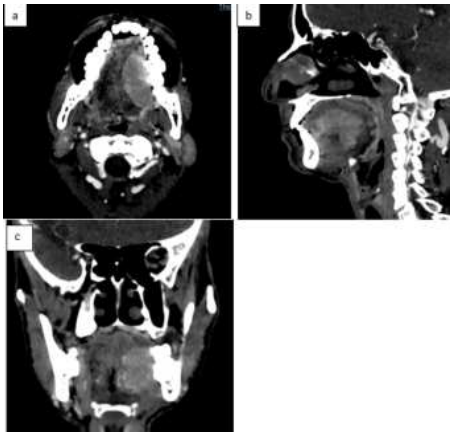

Figure 4.2: Squamous cell carcinoma of tongue. Axial(a), sagittal(b) and (c) coronal sections of contrast enhanced CECT (soft tissue window) show a heterogeneously enhancing well defined mass lesion involving the left lateral aspect of the tongue extending to root of tongue.

Case 3: Squamous Cell Carcinoma Of Floor Of Mouth

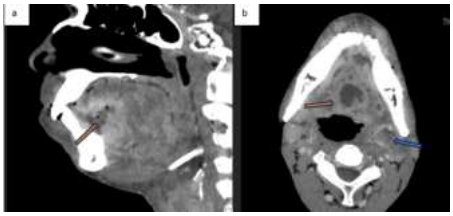

Figure 4.3: Squamous cell carcinoma of the floor of mouth. sagittal (a) and axial (b) sections of contrast enhanced CECT (soft tissue window) show a ill-defined heterogeneously enhancing soft tissue lesion (orange arrow) in the floor of mouth extending to the root of tongue. A rim enhancing enlarged lymph node is seen in the left submandibular region (blue arrow).

DISCUSSION

Age And Gender

In my study, most of the patients with oral squamous cell carcinoma were between 50 to 59 years of age (31%). Males were more commonly affected than females with male to female ratio of 2.6:1.

In the study by **Bhattacharjee A et al (2006)(4)**, the commonest age group was 6th decade, comprising of 348 cases (31.13%) and male to female ratio of 2.9:1.

In the study by **Thaduri A et al (2018)(5)** on head and neck cancer, 6th decade was the commonest age group with 36.84% cases. In their study, male to female ratio was 3:1.

In the study by **Moro JDS et al (2018)(6)**, majority of the cases of oral cavity and oropharyngeal cancer were in 5th decade and 87% patients were male and only 13% patients were female.

In the study by **Gupta M et al (2016)(7)** majority of the cases of oral cavity and oropharyngeal malignancy (31.5%) were in 6th decade of life with male to female ratio of 2.7:1.

In the study by **Tandon A et** al. **(2018)(8)** majority of the cases (62.24%) of oral squamous cell carcinoma were in the age group of 40-60 years with male to female ratio of 3.26.

In the study by **Agarwal S et al (2017)(9)** on oral cavity and oropharyngeal malignancy, male to female ratio was 2.61.

In a study conducted by **Arain et al. (2020)(10)** on oral cavity cancer, there were 38 males and 12 females and mean age was 47 (range 25-72).

All the above studies are correlating with the present study with respect to age and gender distribution.

Habits

In our study, the majority of patients with oral squamous cell carcinoma had one or more high-risk habits. Out of 29 patients, 22 (75.8%) were tobacco users, 17 (58.6%) chewed betel nut, 5 (17.2%) were smokers, and 1 (3.4%) consumed alcohol. However, 2 patients did not report any such habits.

In the study done by **Gupta et al (2016)(7)** it was observed that in malignant lesions 31.0% cases were associated with smoking and 23.0% cases were associated with tobacco chewing.

In the study done by **Shaikh Parvin Abdul Rauf et al. (2020)(11)** it was observed that 54% cases had a habit of tobacco chewing, 40% cases had habit of smoking and 13% were alcoholic.

In a separate study led by **Rai HC et al. (2016)(19),** the most prevalent habits linked to the development of oral squamous cell carcinoma were tobacco or betel quid use and regular consumption of alcoholic beverages. These findings are correlating well with the present study.

Subsites

In the present study, buccal mucosa was the most common subsite of

oral squamous cell carcinoma, 9 cases out of 29 cases (31% cases) followed by inferior gingivobuccal sulcus (24.1%) and tongue (13.8 %).

In a study conducted by **Shaikh Parvin Abdul Rauf (2020)(11)**, the predominant malignancy observed was squamous cell carcinoma, with the buccal mucosa being the most affected site (16 cases), followed by the tongue (14 cases).

According to the study by **Agarwal S et al. (2017)(9)** , buccal mucosa was the most predominant subsite identified, followed by the tongue, and the gingivobuccal sulcus.

Sharma P et al. (2018)(12) documented that the buccal mucosa was the most commonly affected site in their study, followed by the tongue and the gingivobuccal sulcus.

In Shah P Y et al.'s study **(2017)(13)** as well, the buccal mucosa was the most frequent site (41.33%).

According to **Arain et al. (2020)(10)**, the oral squamous cell carcinoma was most frequently located in the buccal mucosa in 50% of cases.

Rai HC et al. (2016) (14) found that squamous cell carcinoma most commonly developed in the buccal mucosa, followed by the floor of the mouth, labial mucosa, palate, and tongue.

All the above studies are correlating with the present study with respect to most common subsite of oral cancer.

Lymph Node Status

In this study, among 29 cases of oral cavity squamous cell carcinoma (SCC),17(58.6%) cases had nodal metastasis.

In a study done by **Pandeshwar et al. (2013)(17)**, 27 out of 50 cases (54%) of oral squamous cell carcinoma (SCC) showed nodal metastasis.

Similarly, in another study by **Arain et al. (2020)(10),** more than 50% of patients with oral SCC had nodal metastasis.

In the current study, among 29 cases of oral cavity SCC, CT imaging correctly identified nodal metastasis in 15 out of 17 cases confirmed by histopathological examination (HPE). Additionally, out of 12 cases confirmed negative for nodal metastasis by HPE, CT accurately identified 10 cases as negative. The sensitivity, specificity, and overall accuracy of CT evaluation for nodal metastasis detection were 88%, 75%, and 82%, respectively.

Pandeshwar et al. (2013)(17) reported a sensitivity, specificity, and overall accuracy of CT for detection of nodal metastasis in oral cavity squamous cell carcinoma (SCC) as 92%, 84%, and 88%, respectively. These findings align closely with the results of the current study.

Bone Invasion

In this study, among 29 cases of oral cavity SCC,19 (65.5%) cases had bone invasion. CT could correctly detect 18 cases of bone invasion out of 21 HPE proven cases of bone invasion. Out of 8 HPE proven cases of negative for bone invasion, CT could correctly detect 7 cases as negative. The sensitivity, specificity, and overall accuracy of CT evaluation were 85%, 87%, and 86.2% respectively.

In a study by **Mukherji et al. (2001)(18),** it was documented that CT imaging correctly identified mandibular invasion in 25 out of 26 cases where invasion was present. Additionally, CT correctly ruled out mandibular invasion in 20 out of 23 cases where invasion was absent. In their study, the sensitivity , specificity, positive predictive value and negative predictive value of CT for detecting bone invasion in oral cavity squamous cell carcinoma in were 96%, 87%, 89%, and 95% respectively.

In another study done by **Struckmeier et al**. **(2024)(19),** it was reported that CT imaging showed a sensitivity of 76.85% and a specificity of 82.20% in detecting bone invasion in oral squamous cell carcinoma (SCC). The positive predictive value (PPV) was 47.14%, indicating the probability that a positive CT finding truly indicates bone invasion. The negative predictive value (NPV) was 89.67%, indicating the probability that a negative CT finding truly rules out bone invasion. (19)

All these studies well correlating with the current study.

Stages

In our study, out of 29 cases of oral squamous cell carcinoma, maximum number of cases (23 patients – 75.8%) presented with stage IV disease, followed by stage II (3 patients -10.3 %) and stage III (3 patients – 10.3%) and only 1 patient presented with stage I disease (3.4%).

In a study conducted by **Sankhe A et al. (2021)(3)** among 40 patients, majority of them (20 patients - 50%) were classified as stage IVB which was followed by stage IVA (13 patients - 32.5 %), stage II (5 patients - 12.5%) and stage I (2 patients - 4%). No patient having stage III cancer was found in their study.

In another study done by **Nikhilendra Reddy et al. (2023)(15)**, the majority of the patients were suffering from T4 stage and 58% had stage IV disease. Stage I illness was present only in eight patients, stage II was present in nine patients and stage III in four patients.

In a study by **Saurabh Bobdey et al. (2020)(7)**, majority of the patients (77.9%) were diagnosed at advanced stages (III and IV), whereas only 22.1% patients were diagnosed at an early stage (I and II).

In a study conducted by **Albuquerque et al. (2009)(16)**, it was noted that 21 out of 25 patients with oral cancer were categorized as stage IV (84%), with 52% classified as stage IVA and 32% as stage IVB.

All these studies show consistent correlations with our study regarding the most frequent stage at which oral cancer patients present.

Histological Differentiation

In the present study, most of the cases were well differentiated squamous cell carcinoma (48.2%) followed by moderately differentiated squamous cell carcinoma (34.4%) and poorly differentiated squamous cell carcinoma (17.2 %).

Rai HC et al. (2016)(14) reported in their study that, the most frequent histological differentiation of oral squamous cell carcinoma was well-differentiated squamous cell carcinoma, followed by moderately differentiated squamous cell carcinoma and poorly differentiated squamous cell.

In **Tandon A et al.'s** study **(2018)(8),** majority of the cases were classified as well-differentiated squamous cell carcinomas, followed by moderately differentiated squamous cell carcinomas and poorly differentiated squamous cell carcinomas.

In another study conducted by **Shaikh Parvin Abdul Rauf (2020)(11) ,** out of 60 cases of squamous cell carcinoma (SCC), 49 (81.67%) were well-differentiated, 9 were (15%) moderately differentiated and only 2 (3.33%) were poorly differentiated Squamous cell carcinoma. Histopathologic findings in all the above studies are correlating with the present study.

CONCLUSION

The rising incidence of oral cavity cancers is a significant concern due to their high morbidity and mortality rates. Associated risk factors include low socio-economic status, tobacco use in various forms, consumption of betel nuts mixed with tobacco, and habits such as alcohol consumption and smoking.

Moreover, lack of education and awareness about cancer have made the scenario even worse. Furthermore, there is a concerning rise in oral cancers among younger individuals, largely attributed to tobacco use.
MDCT is unequivocally the preferred imaging modality for evaluation of any oral cavity mass specifically for malignant lesions, and thin-section (3-mm) CT reconstructed with bone window algorithm proves to be a precise technique for detecting bone invasion in oral cavity squamous cell cancer.

CT is crucial for staging oral cavity malignancies, pivotal in planning of patient management and follow up. Yet, in the initial stages of cancer, CT may miss the necessary information.

However, MRI is known to be the best modality for extensions, involvement of adjacent soft tissue and perineural invasions in case of oral squamous cell carcinoma. Therefore, combined CT and MRI are the ultimate modalities for the evaluation of oral cavity malignancy.

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