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Multidetector computed tomography in evaluation of buccal mucosa cancer

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ABSTRACT

Background: Squamous cell carcinoma is the most prevalent kind of tumor of the buccal mucosa. For the purpose of planning surgery and radiotherapy for tumors of the tongue, floor of the mouth, and oropharyx, imaging to locate the size and extent of the original tumor is essential. Therefore, it is beneficial to determine the radiation field, to ensure adequate tumor margin excision, and overall to improve the patient's prognosis. **Aims and Objectives:** The aim of the study was to evaluate the role of computed tomography (CT) scan in diagnosis of buccal mucosal malignancies and its characteristics. **Materials and Methods:** Total 50 patients suspecting buccal mucosa cancer were referred to Radiology Department. They were subjected for CT scan examination on 16 slice CT scanner. CT scan evaluation was made for size and extent of primary mass lesion. The staging of disease was performed with TNM classification. **Results:** In our study, out of 50 patients, the fourth decade (30%) and fifth decade (26%) saw the highest incidence of buccal mucosa cancer. The majority of the patients were suffering from severe disease; 44% had T4 stage and 58% had Stage IV. **Conclusion:** CT plays a very important role in staging of buccal mucosa malignancy and effectively detects bone erosion (98% sensitive) and invasion to infratemporal fossa. However, during the early stages of cancer, a CT scan might not be very helpful.

Key words: Buccal mucosa; Cancer staging; Computed tomography scan

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INTRODUCTION

The most prevalent type of cancer in India is buccal mucosa cancer, which is especially prevalent among the male community and tobacco chewers. On a clinical examination, the malignancy can be seen directly, but it is challenging to assess its deeper extent. To diagnose buccal mucosa cancer and determine its spread, computed tomography (CT) plays a crucial role. In India, there is a higher incidence of squamous cell malignancies of the gingivobuccal mucosa, which account for more than 90% of cases. As a result, it is also known as Indian oral cancer. In fact, it makes up about 30–35% of all cancers.[1]

The development of CT has improved the staging of buccal mucosa tumors, allowing for more effective treatment planning and execution. We would like to provide our experience with the CT examination of buccal mucosa tumors and show how to diagnose and stage these tumors.

Aims and objectives

The aim of the study was to evaluate the role of CT scan in diagnosis of buccal mucosal malignancies and its characteristics.

MATERIALS AND METHODS

Total 50 patients suspecting buccal mucosa cancer were referred to Radiology Department. All patients diagnosed and suspicious of lesion involving buccal space are included in the study. Patients allergic to CT contrast media who have undergone surgical resection of tumor and who were having buccal mucosa malignancy in the past and completely cured were excluded from the study.

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On a 16 slice CT scanner, they were examined using a CT scan. After administering intravenous iodinated contrast medium, imaging was carried out from the paranasal sinus and neck region 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 maneuver was used to separate the oral buccal mucosa from the gingival tissue for a more thorough assessment.[2]

The size and extent of the original mass lesion were assessed using a CT scan. Based on CT criteria such as bone erosion, skin infiltration, buccal space infiltration, and expansion to the retromolar trigone, the disease was judged advanced. The size, augmentation, and presence of necrosis of the nodes were all assessed. The radiological data were linked with the lesion's clinicopathological findings. The gathered data were statistically analyzed in terms of the subject's demographics, and disease staging was conducted using the TNM classification of the American Joint Committee on Cancer (7th edition).

TNM staging for squamous cell carcinoma in oral cavity and lips

Tumor

- TX – Primary tumor cannot be assessed
- T0 – No evidence of primary tumor
- Tis – Carcinoma *in situ*
- T1 – Tumor size ≤2 cm
- T2 – Tumor size 2–4 cm
- T3 – Tumor size >4cm

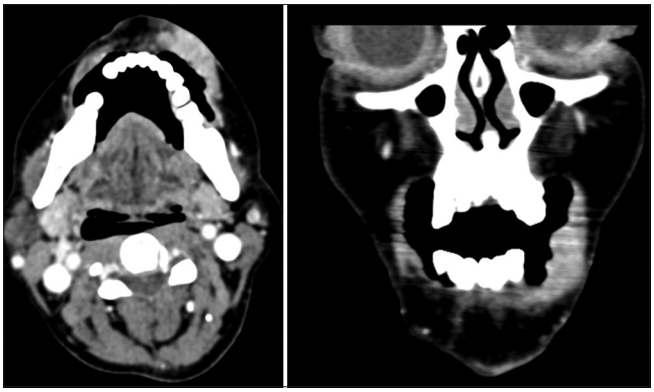

Figure 1: Stage I tumor involving left gingivobuccal sulcus with no bone erosion

- T4a – Oral cavity tumor invades through cortical bone, into deep muscle of tongue, maxillary sinus, or skin of face
- T4b – The internal carotid artery may be enclosed by a tumor that affects the masticator space, pterygoid plates, or skull base. It takes more than just superficial bone or tooth socket erosion from gingival primary to be classified as T4.

Node

- Nx – Regional lymph nodes could not be assessed
- N0 – No regional lymph node metastasis
- N1 – Metastasis in a single ipsilateral lymph node, 3 cm/less in largest dimension
- N2 – Metastasis in ipsilateral or contralateral node or nodes <6 cm in largest dimension
- N2a – Metastasis in a single ipsilateral lymph node – 3–6 cm in largest dimension
- N2b – Metastasis in multiple ipsilateral lymph nodes, not more than 6 cm in largest dimension
- N2c – Metastasis in bilateral/contralateral lymph nodes, not more than 6 cm in largest dimension
- N3 – >6 cm in diameter lymph node metastasis.

Metastases

- Mx – Distant metastasis cannot be assessed
- M0 – No distant metastasis
- M1 – Distant metastasis.

Statistical analysis

Statistical analysis was carried out for 50 patients with buccal mucosa cancer. Data shall be analyzed using the Statistical Package for the Social Sciences, version 20. Student's t-test shall be used for statistical comparisons between the right and left sides. The discriminant function analysis will be carried out to find out whether the values can be used for genders determination.

RESULTS

Patient demographics

Out of 50 patients, the fourth decade (30%) and fifth decade (26%) saw the highest incidence of buccal mucosa cancer (Table 2). Out of 50 patients, there were 33 females and 17 males with a mean age of 57.6 years.

Table 1: Staging criteria for buccal mucosal malignancy[3]

Stage	TNM staging	Criteria
I	T1N0M0	Tumor <2 cm
II	T2N0M0	2 cm >tumor <4 cm
III	T3N0M0 or T1/T2/T3-N1M0	Tumor >4 cm OR ipsilateral node <3 cm
IV	T4N0M0 or T1/T2/T3-N2/N3M0 or M1	Invasive lesions infiltrating skin and eroding bone All N2 N3 lesions-bilateral or multiple ipsilateral nodesAll M1 lesions – distant metastases

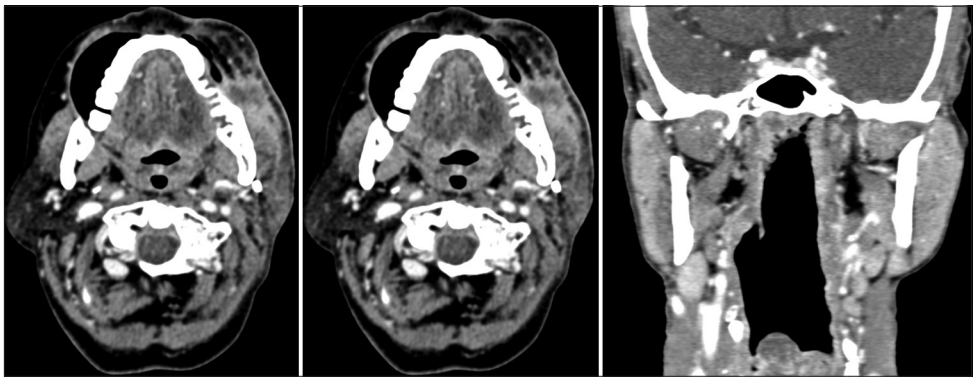

Figure 2: Stage IV lesion involving left buccal mucosa involving subcutaneous tissue, erosion of mandibular alveolus, and lymphadenopathy

Table 2: Age-wise distribution

Age group (years)	Frequency	Percent
21–30	1	2.0
31–40	4	8.0
41–50	8	16.0
51–60	15	30.0
61–70	19	38.0
71–80	3	6.0
Total	50	100.0

Table 3: TNM stage-wise distribution of tumor

T stage						
T stage	T1	T2	T3	T4a	T4b	
No. of patients	9	14	5	22	0	
N stage						
N stage	N0	N1	N2a	N2b	N2c	N3
No. of patients	26	02	04	5	13	0
M stage						
M stage	M0				M1	
No. of patients	50				0	
Over all staging						
Stage	I	II	III	IV		
No. of patients	8	9	4	29		

The majority of the patients were suffering from severe disease; 44% had T4 stage and 58% had stage IV. The primary criteria for staging the lesions as T4a were local skin invasion and alveolar bone erosion Figure 1. In this study, Stage I illness, which was more of a clinical diagnosis, was only present in eight patients. In these circumstances, a CT scan could not contribute any new information Figure 2. Stage II was only present in nine patients and Stage III in four patients, N2c nodal involvement, defined as bilateral or contralateral lymph nodes <6 cm, was present in 26% of patients Table 3.

DISCUSSION

In India, oral cavity tumors are the most common malignancy, with a 2:1 (male: Female) gender ratio. According to a study by Sankaranarayanan et al.,[4] males are twice as likely to have buccal mucosa tumors than females. However, in our study, we found a 1.6: 1 (male: Female) sex preponderance, with 63% of the population being male and only 37% being female.

The use of CT and magnetic resonance imaging (MRI) is complimentary. However, because it is more accessible and acquires images more quickly than MRI, CT scan is thought to be the preferred modality. MRI can detect marrow involvement and brain involvement better than CT, while CT shows cortical bone deterioration more clearly than MRI.[5,6] On a CT scan, bone degradation, nodal involvement, and tumor spread can all be precisely identified. A solid understanding of the anatomy of the oral cavity is necessary for accurate reporting.

CT anatomy of buccal mucosa

CT is the modality of choice for assessing buccal mucosa lesions since it is easily available and a quicker procedure. Techniques such as the puffed cheek technique and oblique scans to prevent dental amalgam artifacts have also contributed to a better image of the lesions. CT allows for a more accurate evaluation of cortical bone degradation.

To comprehend the pathophysiology, it is critical to grasp the CT architecture of the buccal mucosa as well as the course of dissemination of the malignant lesion.[7] The oral cavity comprises the tongue's front two-thirds, the floor of the mouth, the mandibular alveolus, the maxillary alveolus, the hard palate, the lips, and the cheeks (bucco-masseteric region).[8] The buccal mucosa lines the upper and lower alveolus. Gingivo-oral mucosa is found along the alveolar bony edges, whereas gingivobuccal mucosa is found on the buccal mucosal surface.

These are clearly seen during the puff cheek move. The alveolar canal is visible in the ramus of the mandible and is made up of neurovascular bundles.

The buccal fat space is located laterally to the buccal mucosa and is limited by the zygomaticus major muscle

laterally and the buccinator muscle medially. It is made up of the buccal fat, the facial artery and vein, the buccal artery and nerves (which are not visible on imaging), the parotid duct's terminal section, and the facial node. This gap links to the masticator space superiorly, with typically insufficient fascial barriers between.[9] Buccal mucosa is continuous with retromolar trigone posteriorly. The retromolar trigone is a triangular region defined anteriorly by the final mandibular molar tooth and posteriorly by the anterior surface of the lower ascending ramus of the jaw. The retromolar trigone can be detected on CT imaging in consecutive axial sections, with the top limit behind the maxillary final molar and the lower limit behind the mandibular last tooth.

Buccal mucosa tumors staging on CT

Understanding the path of dissemination of buccal mucosa malignancies is critical for correctly staging the illness Table 1.

Pattern of spread of buccal mucosal tumor

Buccal mucosa cancer has the potential to spread from the gingivobuccal mucosa to the buccal fat area and to the overlaying skin. The lesion may start in the gingivooral mucosa and spread to the floor of the mouth. The lesion may progress posteriorly into the retromolar trigone and masticator space and superiorly into the infratemporal fossa. The lesion in the retromolar trigone may spread to the oral cavity, namely, the tonsillar area. It can erode the mandibular alveolus and produce perineural extension through the alveolar canal. The lesion can erode the pterygoid plates and spread to the pterygoid fossa and infratemporal fossa. The lesion in the central arch area may spread down the gingival mucosa and invade the lips, or it may infiltrate the anterior floor of the mouth.

Nodal spread of buccal mucosa tumor

The oral mucosal area drains to the submental and submandibular lymph nodes on both sides. The criteria for determining nodal involvement were nodal hypertrophy, augmentation, and necrosis. Even subcentimeter nodes at the major drainage site, however, should be regarded suggestive of malignancy.

According to a study by Leslie et al., CT imaging is more accurate than MRI in detecting recurrent cancers and has a 100% of accuracy rate for detecting primary buccal mucosa tumours.[10] In our investigation, bone degradation was detected by CT with a 98% of accuracy rate and verified by surgery. However, for N0 stage nodal involvement, accuracy of 60% was observed.

Assessment for staging of buccal mucosa tumors included evaluation for skin invasion, bone erosion, retromolar trigone, infratemporal fossa, and pterygopalatine fossa involvement. The management of the lesions was directly impacted by the CT staging of the tumors. Up until T4a stage disease, the lesions were thought to be resectable.

Limitations of the study

The current study is small, and includes only CT studies. During the early stages of cancer, a CT scan might not be very helpful.

CONCLUSION

Buccal mucosa cancers are alarmingly increasing in younger population due to tobacco usage. CT plays a very important role in staging of buccal mucosa malignancy and effectively detects bone erosion (98 % sensitive) and invasion to infratemporal fossa. The CT staging of the disease is a key factor in both treatment planning and implementation. However, during the early stages of cancer, a CT scan might not be very helpful.

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NRAVS- Concept and design of the study and prepared first draft of manuscript; **DN-** Interpreted the results, reviewed the literature, and manuscript preparation; **AKS-** Concept and coordination; **RJ-** Statistical analysis and interpretation; **YUL-** Preparation of manuscript; **RRB-** Revision of the manuscript; and **SA-** Revision of the manuscript.

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