Original Article

Role of Puffed Cheek Multi Detector Computed Tomography in The Evaluation and Extension of Gingivo-Buccal Carcinoma

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Abstract

Background: *In our country oral cancer is a frequent cancer, people usually affected by this cancer are older. Accurate evaluation of this cancer is difficult due to its proximity to bones and soft tissue, but MDCT can evaluate the extension of the lesion.*

Objective: *To determine the extension and spread of buccal mucosal lesions, multi-detector Computed Tomography (MDCT) is an appropriate imaging modality of choice, findings allow the radiologist to accurately determine the extent and staging of disease thereby helping clinicians plan appropriate treatment.*

Materials and Methods: *A retrospective study of 50 patients who underwent MDCT and were histopathologically proven cases of squamous cell carcinoma (SCC) of buccal mucosa was included in the study from the period 2022(January) to 2023(July) conducted in Radiology and Imaging department of Khwaja Yunus Ali Medical College and Hospital. After meeting the inclusion criteria patients underwent a CT scan. Imaging was performed from the paranasal sinus and neck region with axial sections from the pituitary fossa to the arch of the aorta, after injection of intravenous iodinated contrast media, multiplanar sagittal, coronal reformation images were obtained.*

Results: *The majority of them were female (30) compared to male (20). Among these 50 patients, 22 were classified as stage IVA with extension into masticator space. It was followed by stage IVB 20, stage III 6 and stage II 2. No patient having stage I cancer was found in this study.*

Conclusion: *Cancer of the buccal mucosa can spread deeply and superficially to various parts of the oral cavity and nearby structures. MDCT could outline their stages and spread patterns, so it can assist clinicians in making the right plan.*

Keywords: *Puffed Cheek MDCT, Buccal Mucosal Neoplasm, Histopathological Report.*

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Introduction

The sixth most frequent malignancy worldwide is oral cancer.[1] Every year, around 50,000 new cases are diagnosed, and roughly 30,000 people pass away.[2] Over 7000 new cases are detected in Bangladesh each year, with a 6.6% fatality rate.[3] According to the Bangladesh Bureau of Statistics, cancer ranks as the sixth most common cause of death in Bangladesh (BBS, 2004). According to the International Agency for Research on Cancer (IARC), Bangladesh's cancer-related death rate was 7.5% in 2005 and is expected to increase to 13% by 2030. In Bangladesh, oral cancer is the second most common cancer in men and the third most common cancer in women, respectively.[4] People over 50 who are elderly are frequently affected. On the other hand, among young females under 45, the incidence of oral cancer is on the rise. The cause of oral cancer is complex, with smoking and alcohol intake ranking highest among known risk factors.[5, 6] Additional known risk factors include chewing tobacco, sucking on snuff, using tobaccolike betel quid, being exposed to radiation and sunshine, viruses (such as the Epstein-Barr virus and the human papillomavirus), immunodeficiency, dental health and ethnicity.[3] Squamous cell carcinoma (SCC) accounts for around 85% to 95% of all cases of oral cancer.[7] Less than 10% of them come from the gingival buccal mucosa.[8] But in addition to the tumor's size, the extent of its invasion into the mandible, maxilla and subsequent extension into the surrounding face and neck areas always raises specific concerns.[10] A poor prognosis could result from a tumor spreading into such anatomic sites.[11] The maxillary and mandibular

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nerves may be able to invade the cavernous sinus through the neurovascular bundles if the pterygopalatine fossa and masticator space are involved. Therefore, determining the gingival cancer's extent is crucial for staging the disease before radiation or surgery.[9] Our goal was to use MDCT imaging to assess the involvement of carcinoma developing from the gingiva (i.e., gingival cancer). Because soft tissue, glandular structures and osseous linkages are so close together, radiologists find it difficult to diagnose oral cavity lesions radiologically. Artifacts from steel dentures and opposing mucosal surfaces can further complicate the diagnosis. Given its accessibility and speed of image capture, multidetector computed tomography (MDCT) is typically utilized as a first-line inquiry to help differentiate between varieties of disease conditions. MDCT offers a more accurate assessment of cortical bone involvement in head and neck cancer imaging.[10-12] However, traditional MDCT examination typically misses small mucosal cancers of the oral cavity and even when large, bulky tumors are detected, MDCT might not be able to identify the surface of origin of a large tumor.[13] To overcome this challenge, the dynamic "puffed cheek" method is performed to expand the lumen that is often contracted and aid in determining the degree of tumor spread, which aids in treatment.[14] The hypothetical question is how much extent puffed cheek MDCT can help in the evaluation and staging of buccal mucosal tumors.

This study was carried out to find out the role of multidetector computed tomography (MDCT) in the evaluation of squamous cell carcinoma of buccal mucosa and its staging. Determine the extent of disease by radio-imaging (MDCT) and help clinicians plan appropriate treatment.

Materials and Methods

This retrospective study was carried out in the Radiology and Imaging Department of Khwaja Yunus Ali Medical College and Hospital with the duration from 2022(January) to 2023(July). 50 patients who underwent MDCT and were histopathologically proven cases of squamous cell carcinoma (SCC) of buccal mucosa patients were included in the study. Cases were referred from different (ENT, dental and oncology) departments. Patients were scanned in CT scan on 'Philips 128 slice Ingenuity Core CT scanner' made in the Netherlands with the following parameters- tube voltage of 120kv, tube current was Auto calculated mAs, collimation was 64 mm (FOV). Images were acquired in axial, reconstructed in coronal and sagittal plane with slice thickness 0.625mm from paranasal sinus and neck region from skull base to clavicles. After injection of intravenous iodinated contrast media, multiplanar sagittal and coronal reformation images were also obtained by using Multi Planar Imaging (MIP) and 3D reconstruction algorithm. The "Puffed-Cheek" technique was performed to improve visualization of the superior and inferior gingivobuccal sulcus and RMT (retromolar trigone). All the CT images were independently evaluated by two expert radiologists with or without knowing the histopathological reports. Patients with histopathologically proven cases of squamous cell carcinoma of buccal mucosa and who had already undergone imaging followed by biopsy -histopathological confirmation cases were included in the study. Post-operative cases of buccal mucosa cancer, post-chemotherapy/radiotherapy status of buccal mucosa cancer, recurrence cases, patients with more than one-month interval between histopathological confirmation and CT scan were excluded.

TNM staging was considered as T-Tumour:
TX-.Primary tumor cannot be assessed
T0-.No e/o primary tumor
Tis-.Carcinoma in situ T1-2 cm or less
T2 - >2 cm but ≤4 cm
T3 -.>4 cm
T4a (Oral cavity)-Moderately advanced local disease-Invades through cortical bone, into deep (extrinsic) muscles of tongue, maxillary sinus, or skin of face

T4b-Very advanced local disease--Involves masticator space, pterygoid plates, or skull base or encases internal carotid artery
N-Lymph Nodes (regional metastasis):

NX-Cannot be assessed
N0-No regional lymph nodes metastasis
N1-Single ipsilateral lymph node, <3cm in greatest dimension
N2
N2a-Single ipsilateral lymph node, 3-6 cm in greatest dimension
N2b-Multiple ipsilateral lymph nodes, ≤6cm in greatest dimension
N2c-Bilateral or contralateral lymph nodes, ≤6cm in greatest dimension N3-Lymph node(s) >6 cm in greatest dimension
M-Metastasis:
M0-No distant metastasis
M1-Distant metastasis evident

Results

In the present study, there were a greater number of female patients (n=30) as compared to male patients (n=20) (Figure-1). The range of age varied from 35 years to 81 years with distribution in age groups: 35-44 years (n=10), 45-54 years (n=22), 55-64 years (n=16) and 65-74 years (n=10), 75-84 (n=2) as shown in (figure- 2). 88% of total patients had history of betel nut /tobacco chewing. 6% had a history of smoking and 4% had a history of oral infections while 2% of patients had no history of any addictions/ risk factors (Figure 3).

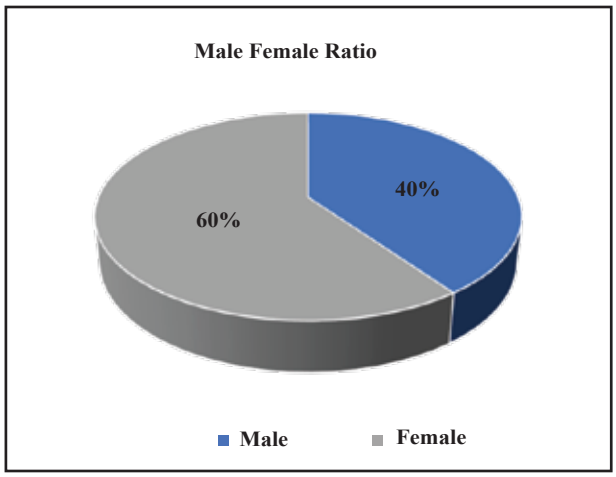

Figure 1: Distribution of patients according to sex.

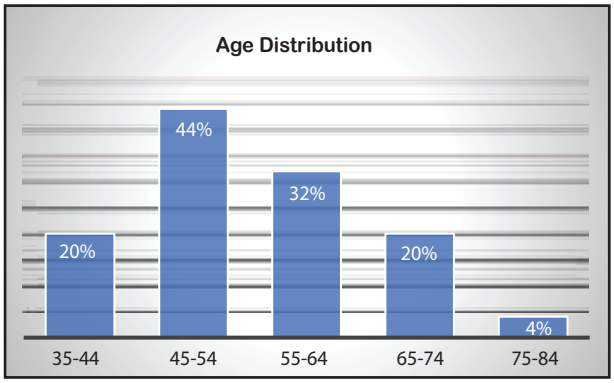

Figure 2: Bar diagram depicting the distribution of patients according to age.

Among 50 patients, the majority of them (20 patients - 40%) were classified as stage IVB with extension into masticator space. It was followed by stage IVA (22 patients - 44 %), stage III (6 patients - 12.0%) and stage II (2 patients - 4%). No patient having stage I cancer was found in this study. (Figure 4)

Tumor size: Out of all patients, 2 patients (4%) had less than 2 cm size lesion, 26 patients (52%) had a size in the range of 2-4 cm and 22 patients (44%) had size more than 4 cm. (Table I)

Gingivobuccal sulcus: 39 patients out of 50 (78%) had involved upper or lower or both upper lower gingivobuccal sulcus among them IVB cancer 12, stage IVA 9 Stage III 11 stage II 7. (Figure 5)

RMT (retromolar trigone): 36 patients out of 50 (55%) had extension into retromolar trigone. The majority of such patients had stage IV B cancer (16, 44%). Others had stage II (2.4%) and stage IVA (18.50%). (Figure 6)

Extrinsic and intrinsic muscles of the tongue: 6 patients (12%) with buccal mucosa cancer had extension into extrinsic and intrinsic muscles of the tongue. RMT and tongue both were involved in 4 patients (8%).

Masticator space: 20 patients (40%) had extension into masticator space with involvement of masticator muscles. Most of the cases had simultaneous involvement of two or more muscles. Pterygoid muscle was the most commonly involved muscle (14 patients- 28% among them medial pterygoid 9, 64.2%, lateral pterygoid 5, 35.8%), followed by, masseter muscle (12 patients- 24%) and temporalis muscle (10 patients- 20%).

Bone: 36 patients (55%) had bone involvement (mandible/maxilla/pterygoid plates). Out of these 36 patients, only the mandible was involved in 28 patients (77.7%), the maxilla was involved in 6 patients (16.6%) and mandible-maxilla-pterygoid plates all three were involved in 2 patients (5.5%).

Perineural spread: 18 patients (36%) had extension in the mental foramen and mandibular canal with its widening and destruction, s/o perineural spread.

Maxillary sinus: 4 patients (8%) had an extension into the maxillary sinus.

Skin: 10 patients (20%) had involvement skin with its thickening and ulcer formation.

Lymph nodes: 45 patients (90%) had regional lymph nodal metastasis. Of these, 20 patients (44.4%) had ipsilateral lymph nodal involvement while 15 patients (33.3%) had bilateral lymph nodal involvement.

Distant metastasis: No patient had any distant metastasis.

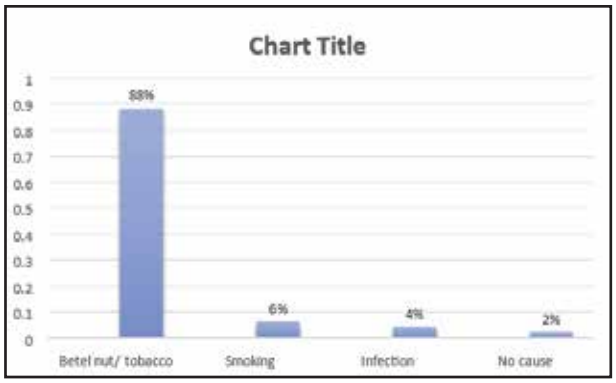

Figure 3: Bar diagram depicting distribution of patients according to cause.

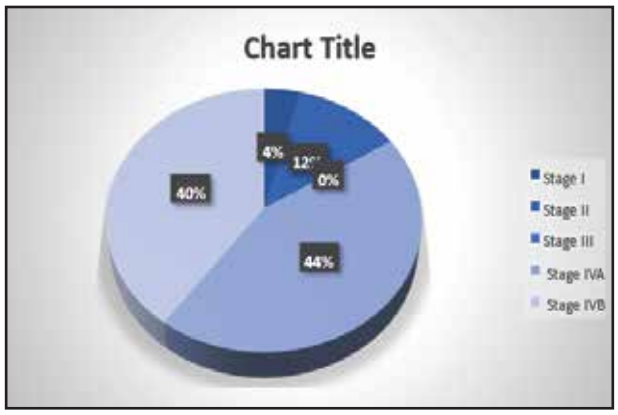

Figure 4: Pie chart showing the distribution of patients according to stage.

Tumor size	Number (Percentage)
Less than 2cm	02 (04%)
Between 2-4 cm	26 (52%)
More than 4cm	22 (44%)

Table I: shows the TNM staging-wise distribution of patients and tumor size distribution.

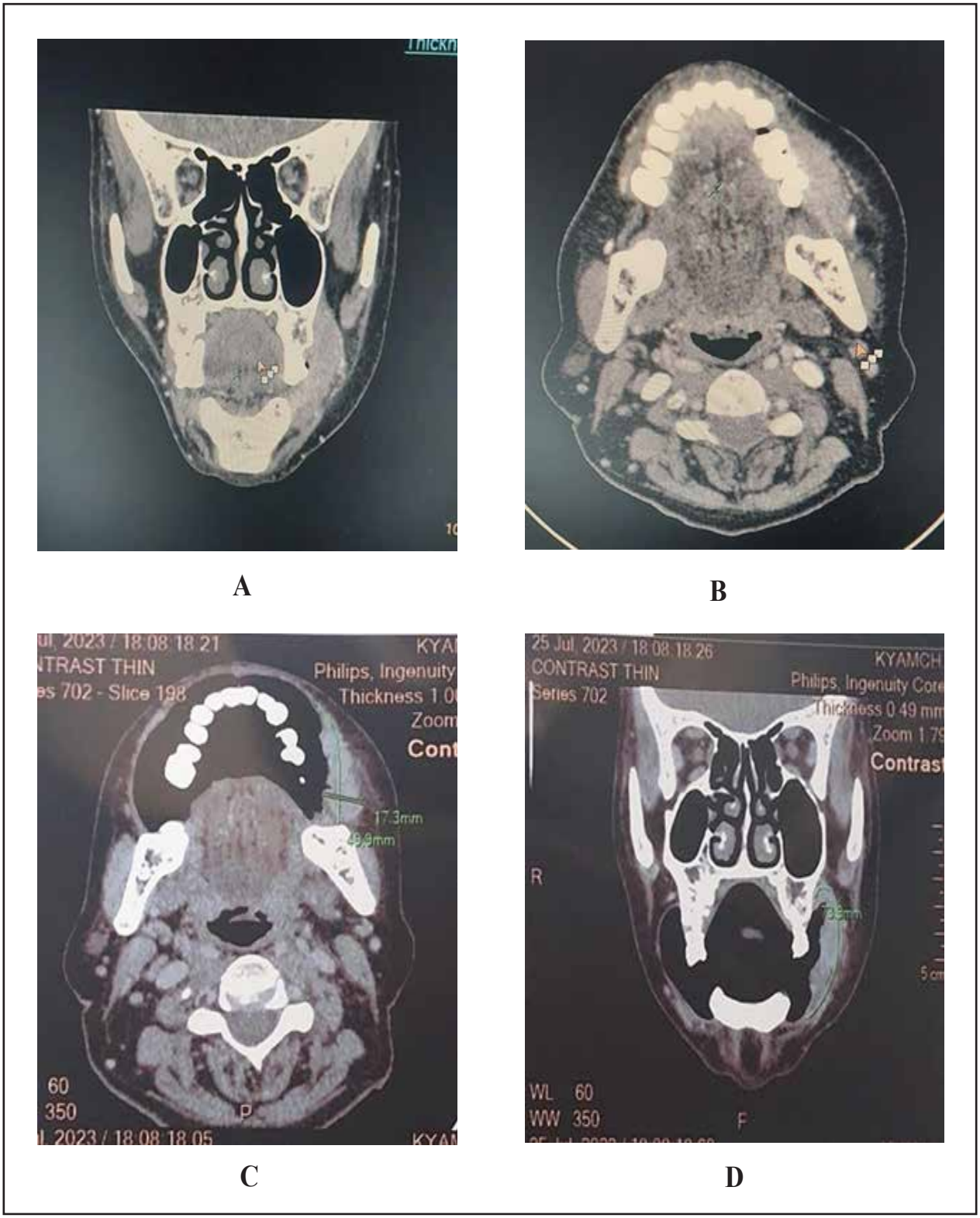

Figure 5: 61-year-old man with invasive squamous cell carcinoma of the left buccal mucosa. (a, b) Conventional axial, coronal CT scan through the occlusal plane shows enhancing thickening along left buccal mucosa. (c, d) Puffed-cheek axial, coronal CT scan shows an enhancing soft tissue lesion on the left buccal mucosa. The buccal mucosa and buccinator muscle together, infiltrate the superior gingiva-buccal sulcus.

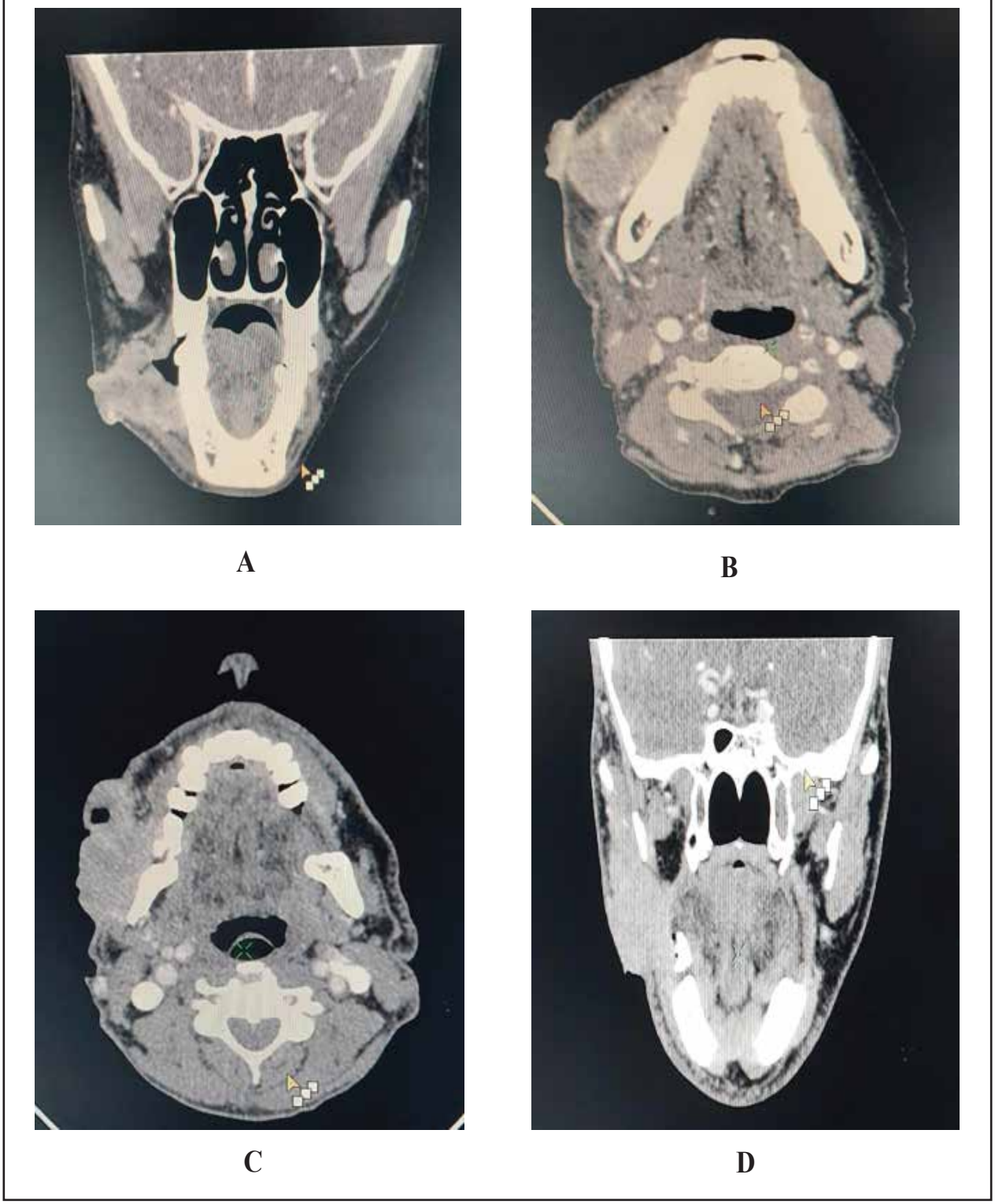

Figure 6: 58-year-old man with invasive squamous cell carcinoma of the right buccal mucosa. (a, b, c, d) Conventional axial, coronal CT scan through the occlusal plane shows enhancing thickening along the right buccal mucosa infiltrating the buccal mucosa, buccinator, masseter muscle together, superior-inferior gingiva-buccal sulcus, cheek, overlying skin.

Discussion

In recent situation, the buccal mucosal tumour is not an uncommon tumour in Bangladesh. Female patients are more prone to this lesion as male-female ratio is 40:60, mean age group is 54.94±12.4. The median age was 55 years proximity to Indian research.[15] MDCT evaluation of buccal mucosal tumour can present as a focal minimal thickening, irregular fungating mass or ulcero-proliferative growth or in complicated cases can show percutaneous fistula with overlying skin ulceration. The spreading of buccal mucosal tumour is locoregional, distant metastasis is rare. According to our study most common site of involvement gingivobuccal sulcus similar to research published in AJNR 2002.[16] Bones and retromolar trigon were the second most common sites but Indian research got more percentage of bony involvement than retromolar trigon. The most common site is masticator space which relates to a study of an Indian research.[15] While describing buccal mucosa cancer on MDCT following points should be kept in mind: 1. Buccal mucosa-buccinator complex, 2. Buccal space, 3. Superior and inferior gingivabuccal sulcus, 4. Retromolar trigone, 5. Pterygoid muscles, 6. Masseter muscle, 7. Temporalis muscle, 8. Maxillary bone and sinus, 9. Mandibular bone involvement and residual height, 10. Mandibular canal/ perineural spread, 11. Parotid duct involvement, 12. Cervical lymph nodes. How spreading of the buccal mucosal tumour occurs in different organs. First of all, direct extension- Most primary buccal SCCAs remain confined to the mucosal layer during the early stages. As the disease evolved, carcinoma infiltrated the underlying submucosa and muscle and extended submucosally and posteriorly along the buccinator muscle to the pterygomandibular raphe, anteriorly to the orbicularis oris and lip, extending to the subcutaneous fat tissue and dermis in the cheek, including the investing fascia, which presented as linear reticulations in the subcutaneous fat, skin thickening.[17] Dermal infiltration is a characteristic of T4a stage disease. The buccal mucosa is continuous with the mucosa covering the superior and inferior gingivobuccal sulcus, the maxillary and mandibular alveolar ridges and the RMT so carcinoma spreads superiorly and inferiorly, thereby infiltrating the gingivobuccal sulcus, buccal gingiva and the RMT, which was considered the most common spread pattern. Medially, it crosses the alveolar ridges and involves the lingual gingiva intrinsic and extrinsic muscles of the tongue. A potential pathway of gingival carcinoma spread into the masticator space is via the buccinator muscle, which may be involved by the tumour that has tunnelled into the alveolar bone. The buccal fat pad is contiguous with the anterior aspect of the mandibular ramus cancer that extends into the posterior portion of the buccal space immediately anterior to the mandibular ramus and may invade the mandibular ramus and masticator space relatively easily. Further extending to the infratemporal fossa and infiltrating the base of the skull. The masticator space contains the mandibular division of the trigeminal nerve, which enters into the skull via the foramen ovale. So perineural tumour spread along this nerve into the cranial cavity can occur. Tumours infiltrate the ramus and body of the mandible to involve the mandibular or mental foramen through which it can also infiltrate the mandibular branch of the trigeminal nerve. Dissemination also occurs via lymphatic drainage pathways to cervical lymph nodes. The different stages of cancer describe how far the cancer has grown and spread at the time of diagnosis. An earlystage cancer may call for surgery while an advanced-stage cancer may need chemotherapy. According to our study, the commonest imaging extent of the tumour was noted as stage IVA, the second most common type was IVB. Less than 10% of the diagnosed intraoral carcinoma is comprised of SCC of the gingival buccal sulcus.[18] Early detection of the disease is extremely difficult due to the common presenting symptoms including alveolar growth and trismus, thereby leading to improper evaluation and indistinct presenting complaints of pain and discomfort often pass unrecognized.

Conclusion

Squamous cell carcinoma is the most common malignancy of the oral cavity and its incidence is higher in females. Cancer of the buccal mucosa has the potential to spread both deeply and superficially to various parts of the oral cavity and nearby structures. Early detection can reduce the morbidity of buccal mucosa carcinoma and MDCT could outline their stages and spread patterns, so it can assist clinicians in making the right plan.

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