Role Of 3 Tesla MRI In Evaluation Of Oral Malignancies In A Tertiary Care Hospital-An Observational Study

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Abstract:
Background*: The study was done to evaluate the accuracy of MRI in diagnosing and staging oral malignancies in a tertiary care hospital and to correlate MR imaging staging with histopathological staging.*
Materials and Methods*: A cross-sectional study on 34 patients with clinical diagnosis of oral malignancy referred for MRI was done during January 2021 and October 2022. MRI was performed with GE 3T MR scanner. Clinical and radiological TNM staging was done preoperatively and post-surgery histopathology staging was obtained. The observations found clinically, on histopathology examination and on MR imaging were analyzed using Statistical Package for the Social Sciences and were correlated using Pearson's chi squared test and Cramer's V value.*
Results*: In the study, the highest number of patients was found to have tongue malignancy (53%) and most of them were in the age group of 40–60 years (53%). The incidence was higher in males (80%). Very high association (Cramer's V = 0.885) was noted for T staging between clinical and MRI staging, while N stage association was moderately high (Cramer's V =0.708). The association for the T stage was moderately high (Cramer's V = 0.610) between MRI and histopathology staging, whereas the association for the N stage was average (Cramer's V =0.531) between them.*
Conclusion:*MRI is the imaging modality of choice in evaluation and staging of oral malignancies which is crucial for planning treatment options.*
Key Word:*Magnetic Resonance Imaging, Oral cavity, Squamous cell carcinoma, Cross sectional study*

I. Introduction

Oral cavity cancer represents a major health problem in Indian subcontinent and its increase in incidence in our country is because of the habits like use of tobacco, tobacco with lime, or betel nut chewing and consumption of alcohol. Oral cavity can be classified into various sub sites *viz.,* buccal mucosa, alveolus with gingiva, hard palate, retro molar trigone, floor of mouth and tongue.

Magnetic resonance Imaging (MRI) provides excellent soft tissue contrast, direct multi planar formats without any biological effects of ionizing radiation and also delineates detailed anatomy of the oral cavity compared with CT. It accurately provide information regarding the borders, extent of tumor infiltration determining the depth of invasion, involvement of surrounding structures like bone invasion and vascular infiltration and also regarding the perineural spread.

Tumor extension is often underestimated by clinical examination, and its infiltration and invasion of deeper structures may not be well appreciated. Often most of metastatic lymph nodes (< than 10 mm) are interpreted as regular cervical lymph nodes. Hence, for tumor staging and appropriate treatment planning a preoperative imaging is mandatory.

MRI has thus become the cornerstone for pretreatment evaluation of oral malignancy and provides accurate information regarding the extent of the lesion and depth of invasion that helps the clinician to optimize treatment strategy.

II. Material And Methods

This was a prospective Cross-sectional study conducted at a tertiary care hospital in India. Prior approval was taken from the Institutional Ethical Committee. The study was conducted in accordance with the ethical norms as laid down in the Declaration of Helsinki. Written consent was obtained from the participants.

Study Design: Prospective observational study

Study Location: This was a tertiary care teaching hospital-based study done in Department of Radio diagnosis, at Yenepoya Medical college Hospital, Mangalore, Karnataka, India.

Study Duration: January 2021 and October 2022.

Sample size: 34 patients.

Sample size calculation: The sample size was calculated using G* Power software. According to a study conducted in Bhopal by Valecha J et.al [1], the sensitivity analysis of MRI in diagnosing the oral cavity malignancies was 94%. With considering 8% precision of the study and level of significance at 5%, the sample size recommended for the present study was N = 34.

Subjects & selection method:
All the studies were performed on patients with clinical diagnosis of oral malignancy referred for MRI during the period January 2021 to October 2022.
Purposive sampling was done.

Inclusion criteria:
1. All the patients who were referred for MRI with clinical diagnosis of oral malignancy.

Exclusion criteria:
1. Patients with any contraindication to undergo MRI.
2. Previously treated or recurrent oral malignancies.
3. Patient whose histopathologic examination report is not available.

Procedure methodology
Routine MR Protocol for oral malignancy was performed using GE 3T MR scanner using head coil.
The lesions were evaluated with respect to the size of the lesion, location and extension of the lesion, signal intensity, presence of nodal metastasis, bone invasion, soft tissue infiltration and vascular infiltration. Clinical and radiological TNM staging was done preoperatively based on The American Joint Committee on Cancer 8th edition and post-surgery histopathology staging was obtained. The observations found clinically, on histopathology examination and on MR imaging were analyzed and were correlated.

Statistical analysis
Data was entered in Microsoft excel sheet and analysis was done using Statistical Package for the Social Sciences and were correlated using Pearson's chi squared test and Cramer's V value.

III. Result
Age group distribution:
The majority of the patients (53%) belonged to the age group of 40–60 years, which was followed by 32% (20-40 years) and 15% (60–80 years) (Figure 1).
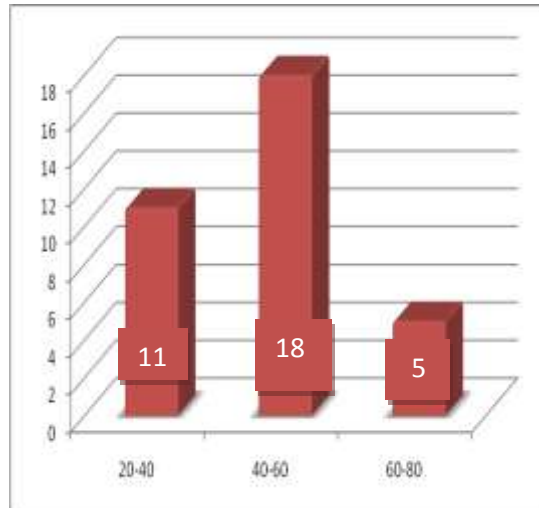
Figure 1: Distribution of the Participants in Terms of Age (n = 34)

Distribution based on Sex:

The incidence of oral cancers is higher in males constituting 80% of total patients (Figure 2).
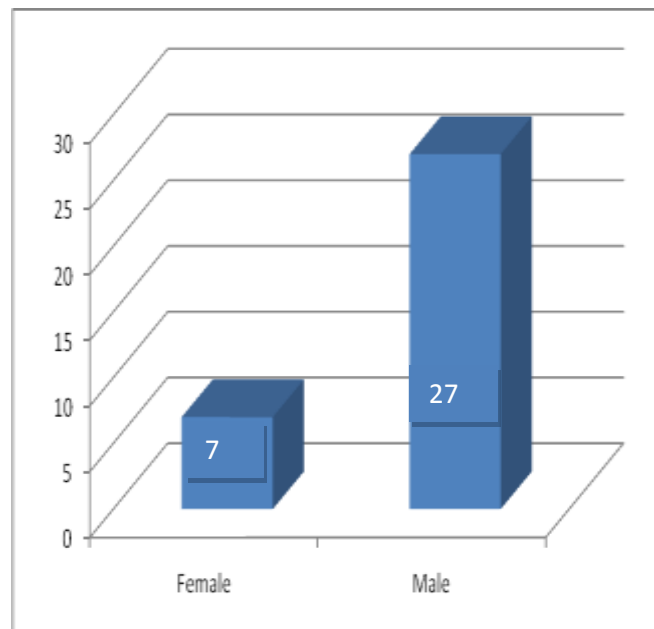

Figure 2: Distribution of the Participants in Terms of Gender (n = 34)

Lesion site:

The highest percentage of patients was found to have tongue malignancy (53%) (Figure 3, 4) followed by buccal mucosa (Figure 5) (35%). The gingivo-buccal sulcus and retromolar trigone malignancy constituted about 6 % each.

Figure 3a, b, c: Homogeneously enhancing infiltrative lesion in the right lateral border of tongue in its anterior and posterior aspect, involving the intrinsic muscles and not crossing the midline; Clinical TNM staging: T2N0M0, Radiological TNM staging: T2N1M0 and Histopathological TNM staging: pT2N0.

a) Axial T1   b) AxialT2   c) Axial T1 with contrast
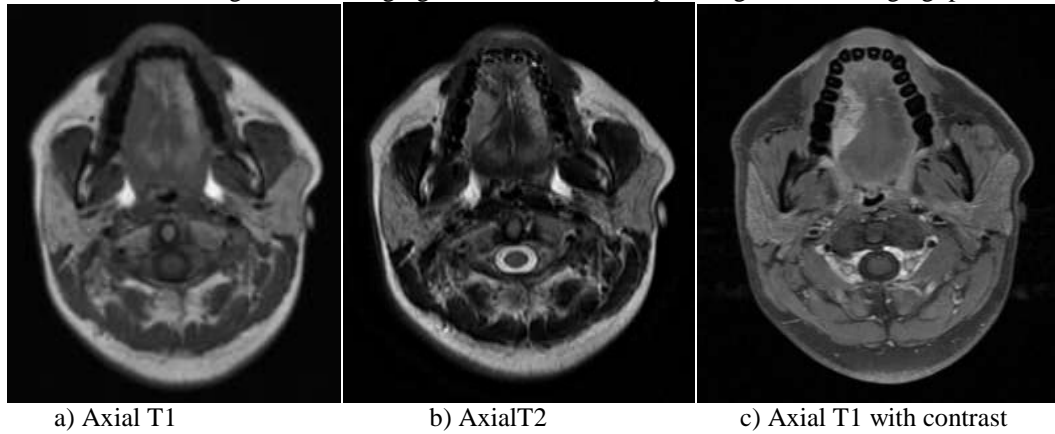
Figure 4 a, b, c: Heterogeneously enhancing lesion in the right half of anterior 2/3rd of tongue with extension across the midline and involvement of the extrinsic muscles on the right side; Clinical TNM staging: T4aN1M0, Radiological TNM staging: T4aN2cM0 and Histopathological TNM staging: pT3N2c.

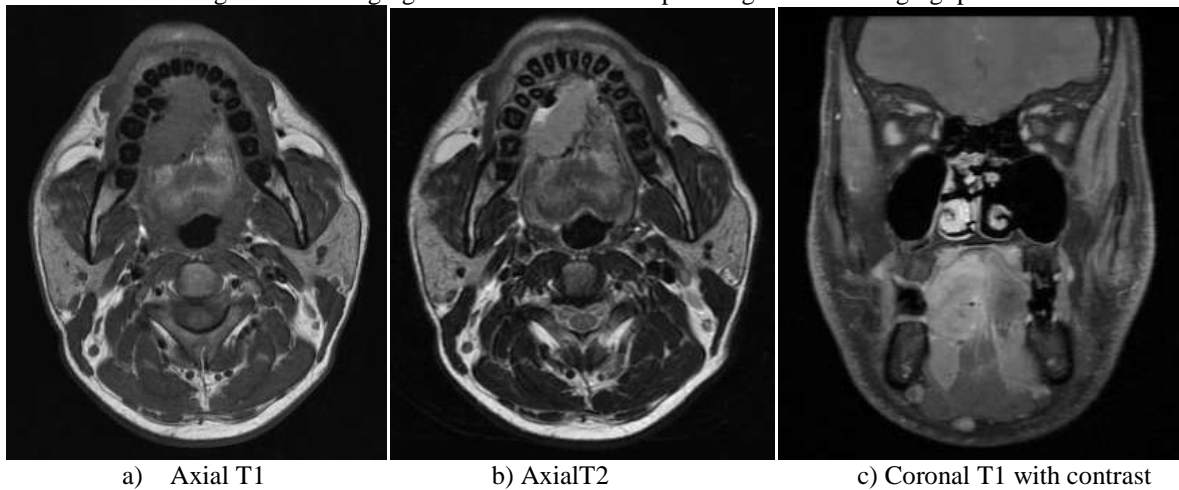a)   Axial T1   b) AxialT2   c) Coronal T1 with contrast

Figure 5 a, b, c: Heterogeneously enhancing ulcero-proliferative lesion in the left buccal mucosa, involving the retro molar trigone postero-medially with extension into the floor of mouth and left submandibular gland inferiorly and the soft tissue of the cheek laterally; Clinical TNM staging: T2N1M0, Radiological TNM staging: T2N2bM0 and Histopathological TNM staging: pT2N0.

a)   Axial T1   b) Axial STIR   c) Axial T1 with contrast
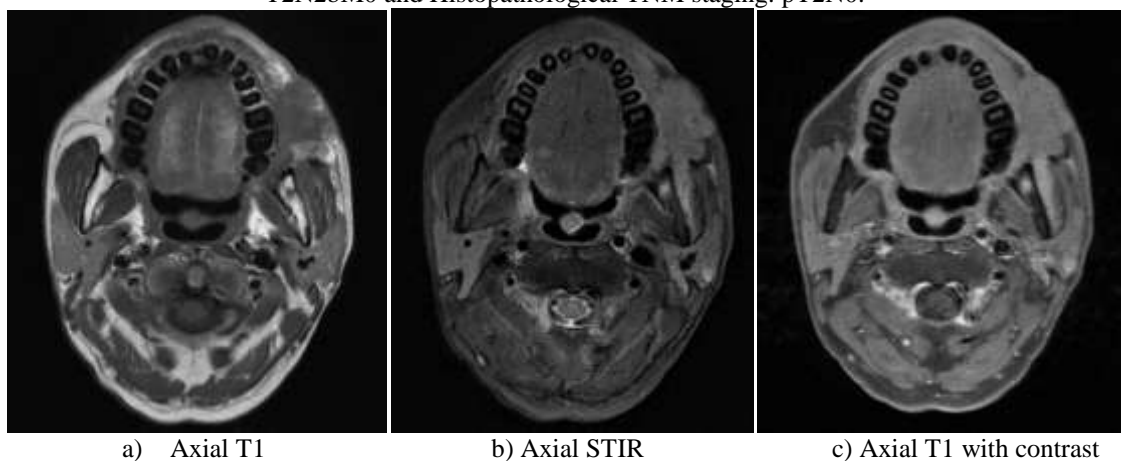
N staging:

On comparison of nodal stages by MRI and HPE, 14 cases were changed by HPE. The three cases down staged on MRI were two cases of N2 which were changed to N1 and one case of N2 which was changed to N0 on MRI. Upstaging on MRI included seven cases from T0 to T1 and four cases of T0 to T2 on MRI (Table 2a, b, c).

Table no 2a, b, c: N stage correlation

CLINICAL N Stage (Table 2a)   RADIOLOGICAL N Stage (Table 2b)

	Frequency	Percent
N0	12	35.3
N1	11	32.4
N2	10	29.4
N3	1	2.9
Total	34	100.0

	Frequency	Percent
N0	9	26.5
N1	10	29.4
N2	15	44.1
Total	34	100.0

HISTOPATHOLOGICAL N Stage (Table 2c)

	Frequency	Percent
N0	19	55.9
N1	1	2.9
N2	14	41.2
Total	34	100.0

M Staging:
Bony involvement was seen in two cases of buccal mucosa and gingivo-buccal sulcus carcinoma and skin infiltration was found in one case of carcinoma buccal mucosa.
Distant metastasis to lung was found in a case of carcinoma of retro-molar trigone.
Correlation between MRI and clinical tumor (T) staging:
There was very high association (Cramer's V = 0.885) for the T stage between the clinical and MRI staging assessments with highly significant Chi-Square value.
Correlation between MRI and clinical nodal (N) staging:
N stage association between MRI and clinical staging assessments was moderately high (Cramer's V =0.708) with highly significant Chi-Square value.
Correlation between MRI and histopathological Tumor (T) staging:
Moderately high association (Cramer's V = 0.610) for the T stage was seen between MRI and histopathology staging assessments.
Correlation between MRI and histopathological Nodal (N) staging:
The association for the N stage was average (Cramer's V =0.531) between MRI and histopathology staging assessments.

IV. Discussion

Oral cancer is of significant public health importance to India [1]. Squamous Cell Carcinoma is the commonest oral malignant pathology worldwide [1, 2], accounting for more than 90% of all oral malignant tumors. The appropriate treatment selection for oral cavity malignancies between medical management (chemotherapy and radiotherapy) and surgery mainly depends on the precise staging of the disease. In MR, the primary tumor involving only the mucosa appears as intermediate-high signal intensity at T2 weighted image. Bussels et al. [3] and Clark et al. [4] reported that carcinoma of buccal mucosa is better delineated in T2 weighted imaging. This implies that MR with its excellent soft tissue resolution and multiplanar capability is able to detect tumors at an early stage when there is no extension into adjacent organs and tissue.

In the present study conducted on 34 patients, most of them (53%) belonged to age group of 40–60 years, similar to studies by Khandekar et al. [5] and Agarwal et al. [6], where most of the cases were above 40 years. Another similar study done by Shunyu et al. [7] found that fourth decade was the most common age group for oral and oropharyngeal cancer.

In the current study, the incidence of oral cancers is higher in males constituting 80% of total patients whereas females constituted 20% of total patients. Similar results of male predominance were obtained in studies done by Dikshit et al. [8] and Bhat et al. [9]

The highest number of patients in our study was found to have tongue malignancy (53%) followed by buccal mucosa, gingivo-buccal sulcus and retromolar trigone malignancy which constituted about 35%, 6% and 6% respectively. In a study conducted by Ahluwalia et al. [10] buccal mucosa was the commonest site for oral malignancy.

Tumor size plays an important role in staging of oral cavity tumors. Out of total 34 patients, 7 (20.6%) of them had tumor size < 2cm in MRI, 23 (67.6%) showed tumor size of 2-4 cm and 4 (11.8%) had > 4 cm size in MRI. When T staging was correlated, there was very high association (Cramer's V = 0.885) for the T stage assessment between the clinical and MRI staging and moderately high association (Cramer's V = 0.610) for the T stage between MRI and histopathology staging assessments. This observation was similar to the study conducted by Agarwal et al. [6] and Vidiri et al. [11], who observed a higher T stage accuracy on MRI in comparison to clinical examination. They observed an accuracy of 42.56% and 62 % in clinical data and MRI accuracy resulted to be 87% and 82%, respectively.

Cervical nodal status is important in the prognosis and therapy planning for patients with oral cavity tumors. The parameters used by conventional imaging techniques are shape, size, extracapsular spread and an abnormal inner architecture. The size is certainly the most used criterion for the diagnosis, whereas the presence of central necrosis is the most reliable sign of malignancy [12].

Cervical lymph node metastasis was found in 25 cases out of 34 cases radiologically in our study, with the most commonly involved being N1 stage.

N stage association between MRI and clinical staging assessments was moderately high (Cramer's V =0.708) and was average between MRI and histopathological N staging with Cramer's V of 0.531.

V. Conclusion

MRI is the imaging modality of choice for evaluation of oral cavity malignancies as it helps in accurate staging of the tumor using TNM classification which is crucial for optimizing treatment options. High correlation was noticed between MRI and histopathology in the evaluation of thickness of oral cavity tumor.
The major advantage of MRI is that it provides detailed soft tissue visualization without any biological risks for the patient.
In conclusion, MRI is the most appropriate imaging modality of choice for the evaluation and pre-therapeutic staging of oral cavity malignancies

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