ORIGINAL ARTICLE

CORRELATION OF PREOPERATIVE VOLUME OF ORAL TONGUE SQUAMOUS CELL CARCINOMA (SCC) ON CT SCAN WITH POST-SURGICAL TUMOUR SIZE

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Background: Computed tomography (CT) radiological investigation is commonly used worldwide as a reliable method for determining the existence of oral tongue squamous cell carcinoma. This research was carried out to determine the correlation between the pre-surgical results of the CT scan and the size of the post-surgical tumour. **Methods:** An analytical cross-sectional study was conducted at the radiology department of Jinnah Post Graduate Medical Centre (JPMC), Karachi, Pakistan from May to October 2020. All patients aged 18 years or above of either gender having malignant tumours of the tongue already proven on biopsy were consecutively enrolled. Pre-surgery CT scan images were performed. The preoperative volume on CT scan then correlated with the post-surgical tumour size findings. The tumour thickness level of anterio-posterior (AP), transverse dimension (TS) and craniocaudal (CC) on pre-surgery CT scan and post-surgery tumour size were the outcome variables. **Results:** Of 84 patients, the mean age of the patients was 48.38 ±11.40 years. There were 56 (66.7%) males and 28 (33.3%) females. A moderate positive correlation of AP tumour size on CT scan was observed with post-surgical AP tumour size (r=0.671, *p*-value <0.001). Similarly, a moderate positive correlation of TS tumour size was observed with post-operative TS tumour size (r=0.692, *p*-value <0.001). While, a strong positive correlation of CC tumour size was observed with post-operative surgical tumour size (r=0.787, *p*-value <0.001). **Conclusion:** This study has reported a strong positive correlation of tumour thickness level on CT scan with post-surgical findings for determining the oral tongue squamous cell carcinoma.

Keywords: Oral tongue squamous cell carcinoma; Surgical tumour size; Computed tomography

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INTRODUCTION

Among major neoplasms of head and neck, oral tumours account for approximately half of the cases.[1] It has a high prevalence among the Asian population, especially countries belonging to South East Asia. Among the Pakistani population, it is the second most common malignancy among both men and women, after lung cancer in men and carcinoma of the breast in women.[2] Tobacco smoking and alcohol intake are the most common risk factors among western people. In the subcontinent regions, the most common risk factors for oral tumours include betel nut chewing, taking snuff, or areca nuts.[3] The prevalence in Pakistan is estimated to be approximately 10.2%.[4]

The reliability of methods for measuring head and neck cancers, including oral cancers, have been investigated. Various measurements such as unidimensional measurement, anatomical extent of disease, and volumetric measurements have been described.[5,6] Tumour, node and metastasis (TNM) staging utilizes measurement in one dimension and combines the extension of disease to adjacent anatomical structures and status of adjacent lymph nodes. However, according to the studies the primary tumour volume is an important factor in determining the treatment outcome in oral and other head and neck tumours.[7]

Multiple studies have reported that for early-stage squamous cell carcinoma (SSC) of the oral tongue, primary surgery played a standard management role.[4,8] It is stated in the literature that the clinically and/or radiographically N0 neck is managed according to tumour thickness. In particular, thin tumours (≤2 mm) are usually observed whereas, for thick tumours (>2 mm), elective neck dissection is performed.[9] Furthermore, post-operatively, patients with potential risk factors for local regional recurrence are suggested adjuvant radiation than that of individuals who did not have potential risk for local or regional recurrence.[10] It is reported that this management technique is recommended for both Stage I and II oral tongue tumours irrespective of their management.[11,12] Thus, pre-surgical assessment of oral tumour thickness plays indeed a remarkable role in the decision making of management of oral tumour SCC.

Worldwide, computed tomography (CT) is a recommended radiological investigation and is reported as a reliable modality for the determination of oral tongue SCC. Diagnosis at an earlier stage is of prime importance to start the treatment early. In Pakistan, a limited number

of studies has been conducted so far that has correlated pre-surgical radiological findings with the post-surgical outcome. Therefore, this study was conducted with the aim to assess the reliable method for determining the oral tongue SCC volume with post-surgical tumour size.

MATERIAL AND METHODS

This analytical cross-sectional study was conducted at the department of radiology, Jinnah Post Graduate Medical Centre (JPMC) Pakistan from May to October 2020. Approval from ethical review committee of JPMC was obtained prior to conducting of the study (Ref No: F.2-81/2020-GENL/42937/JPMC). The inclusion criteria were all patients aged 18 years or above of either gender having malignant tumours of tongue already proven on biopsy. Whereas exclusion criteria were unavailable imaging or pathological tumour thickness, un-assessable radiological tumour thickness due to imaging artifacts, pregnant ladies, and/or allergic to intravenous contrast.

Online sample size calculator is used for the estimation of sample size taking significance level 0.01, power of the test 80%, and reported correlation 0.78.[13] The estimated sample size came out to be 42. The sample size came out to be small. However, we have included 84 eligible participants that meet the inclusion criteria during our study period.

Detailed history and physical examination were carried out. Pre-surgery CT scan images of all these patients were collected and analysed on a workstation by a radiologist with more than 5 years' experience. The preoperative volume on CT scan was then correlated with the post-surgical tumour size findings. The tumour thickness level of anterio-posterior (AP) level, transverse dimension (TS) level, and craniocaudal (CC) level on the pre-surgery CT scan and post-surgery tumour size were the outcome variables. This information along with the other predictor variables like age, gender, presence of any addiction/use of substance abuse, tumour site, presence of metastasis, T-Stage, and tumour differentiation were noted. SPSS version 21 was used for the purpose of statistical analysis. Mean and standard deviation was calculated for quantitative variables like age, tumour size on CT, and post-surgery tumour size. Qualitative variables like gender, smoking, beetle chewing, *gutka*, tumour site, degree of differentiation, T stage, and metastasis were expressed in terms of frequencies and percentages. Pearson correlation test was applied to see the relationship of tumour thickness level on CT scan with the post-surgical tumour thickness. *p*-value <0.01 was taken as significant.

RESULTS

The mean age was 48.38±11.40 years. There were 56 (66.7%) males and 28 (33.3%) females. Substance abuse history was found in most of the patients, i.e., 79 (94%) patients. Of these 79 patients, 24 (30.4%) used betel nut, 22 (26.2%) used pan, 20 (23.8%) used *gutka*, while 13 (15.5%) were smokers. The frequency of tumour site showed that the left lateral border was affected in 36 (42.9%) patients, right lateral border in 20 (23.8%) patients, posterior in 24 (28.6%) whereas the anterior tumour site was observed in 4 (4.8%) patients. The majority of the patients had poorly differentiated tumours, i.e., 35 (41.7%), 29 (34.5%) had moderately differentiated tumours, 12 (14.3%) had well differentiated tumours while 8 (9.5%) had undifferentiated tumours. There were 32 (38.1%) with distant metastasis, 48 (57.1%) with nodal metastasis and 4 (4.8%) with no metastasis. Furthermore, T stage analysis revealed that 32 (38.1%) were presented with <2cm depth of tumour, 17 (20.2%) with 2-4 cm depth of tumour, 15 (17.9%) with >4cm depth of tumour and 20 (23.8%) with adjacent bone or structures invasion.

The mean AP tumour size on CT scan was 3.01±1.11 cm while the post-surgical AP tumour size was 2.87±1.18 cm. The mean TS tumour size on CT scan was 2.50±1.10 while post-surgical TS tumour size was 2.56±1.03 cm. The mean CC tumour size was 3.18±1.44 cm while post-surgical tumour size was 2.91±1.48 cm.

A moderate positive correlation of AP tumour size on CT scan was observed with post-surgical AP tumour size (r 0.671, *p*-value <0.001). Similarly, a moderate positive correlation of TS tumour size was observed with post-operative TS tumour size (r 0.692, *p*-value <0.001). While, a strong positive correlation of CC tumour size was observed with post-operative surgical tumour size (r 0.787, *p*-value <0.001). (Figure-1) Somewhat similar findings were observed when stratifies based on predictor variables. (Table-1)

Table 1: Correlation of pre-surgery CT scan tumour size with post-surgical tumour size with respect to prognostic factors

Pre-surgery CT scan vs. Post-surgical	AP	TS	CC
≤50	r=0.763, *p*-value <0.001	r=0.813, *p*-value <0.001	r=0.792, *p*-value <0.001
>50	r=0.293, *p*-value 0.130	r=0.238, *p*-value 0.223	r=0.799, *p*-value <0.001
Males	r=731, *p*-value <0.001	r=0.472, *p*-value <0.001	r=0.791, *p*-value <0.001
Females	r=0.622, *p*-value <0.001	r=0.792, *p*-value <0.001	r=0.840, *p*-value <0.001
Well/moderate differentiated	r=0.679, *p*-value <0.001	r=0.557, *p*-value <0.001	r=0.812, *p*-value <0.001
Poorly differentiated	r=0.652, *p*-value <0.001	r=0.679, *p*-value <0.001	r=0.685, *p*-value <0.001
Metastasis	r=0.604, *p*-value <0.001	r=0.637, *p*-value <0.001	r=0.779, *p*-value <0.001
≤4 tumour depth	r=0.623, *p*-value <0.001	r=0.567, *p*-value <0.001	r=0.722, *p*-value <0.001
>4 tumour depth	r=-0.045, *p*-value 0.873	r=0.280, *p*-value 0.311	r=-0.354, *p*-value 0.195
Adjacent bone or structures invasion	r=0.868, *p*-value <0.001	r=0.7970, *p*-value <0.001	r=0.778, *p*-value <0.001

AP: Anterio-posterior, CC: Cranicaudal, TS: Transverse Dimension

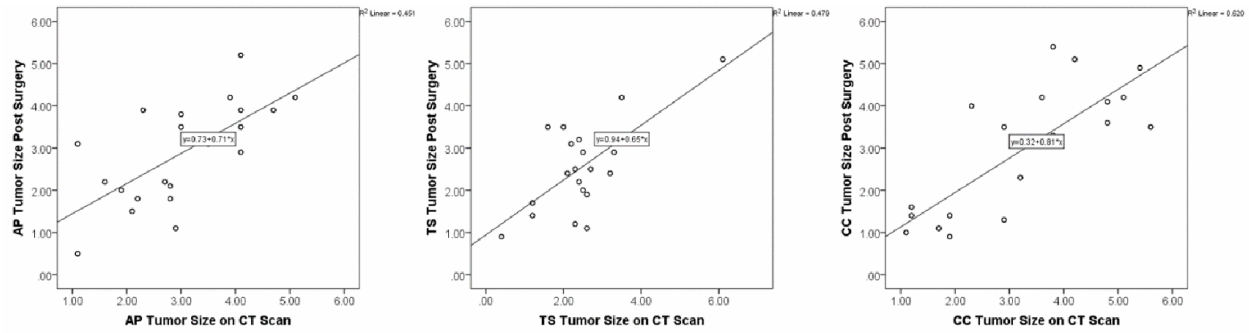

Figure-1: Correlation of Anterio-posterior (AP), Transverse Dimension (TS), and Craniocaudal (CC) tumour size on CT scan with post-surgical tumour size

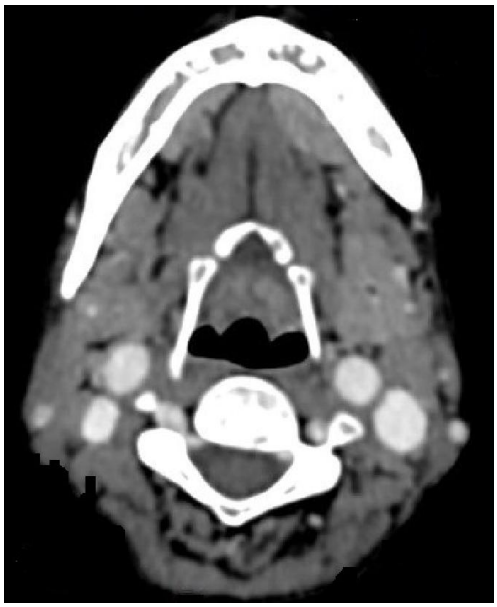

Figure-2: Ill-defined poorly enhancing soft tissue density is seen along left lateral border of tongue. It is not crossing the midline showing mild superficial ulcerations. No evidence of underlying bony erosion seen. Multiple enlarged bilateral cervical lymph nodes noted at level l and level II.

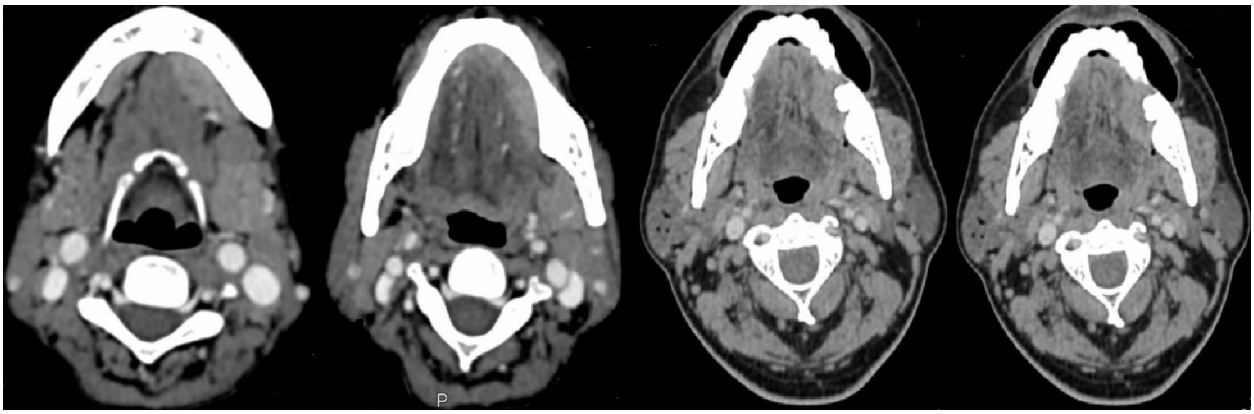

Figure-3: Contrast enhanced CT of face and neck demonstrates enhancing soft tissue mass along left antero-lateral aspect of tongue. It does not cross the midline and is limited to intrinsic muscle of tongue. Multiple bilateral cervical lymph nodes also noted

DISCUSSION

The CT scan is an important radiological modality that is useful in evaluating the diagnosis, extent, and local or regional invasion of tumours. Various studies have reported that as local and regional recurrence of early oral cancers is unusual and local recurrence is specific, the treatment of recurrent diseases is managed on case-to-case basis.[14,15] Treatment of the relapse of tongue cancer is affected by the control of the original tumour. It is reported that the administration of adjuvant radiation, the local or regional nature of the disease, and the time between initial treatment and diagnosis of recurrence can all affect management choices. Thus, a thorough study of early oral cancer recovery requires a comprehensive review of the management of previous oral cancer of the tongue.[15,16]

According to the current study finding, a moderate positive correlation of AP tumour size on CT scan was observed with post-surgical AP tumour size. (Figure 2 & 3) Similarly, a moderate positive correlation of TS tumour size was observed with post-operative TS tumour size. While a strong positive correlation of CC tumour size was observed with post-operative surgical tumour size.

In a study conducted by Park *et al*., the MRI efficiency to measure the depth of invasion of different oral cavity cancers showed a clear positive association for histological and imaging depths of invasion in the oral tongue, tongue base, and tonsil cancers.[17]

Another study conducted by Lwin *et al* reported a correlation of MR imaging and histopathological findings in patients with oral SCC cases and concluded that radiological neck staging or the thickness of the tumour could not safely predict the need of neck dissection.[18] In fact, no reliable radiological tumour thickness threshold that could be used clinically to predict nodal involvement. In addition, a total of eleven tumours, ranging in size from two mm to twenty-four mm, were not identified on radiology.

Madana *et al*. reported a significantly strong association between CT and postoperative tumour thickness in their analysis. The author further concluded that the CT-assessed thickness of the tumour may provide a reliable approximation of the true thickness and may be used in treatment planning.[19]

A significant positive correlation between the tumour sizes of TS, AP, and CC and the radiological staging of the tumour was reported in a study conducted by Khan *et al*.[20] In addition, a strong positive correlation between TS tumour thickness and level II lymph nodes was also found in their study. It therefore indicates that for primary tumours greater than 4 mm TS, there is a clear correlation between the lymph nodes and the tumour.

The findings of the current study have reported that strong positive correlation of tumour thickness level on CT scan and post-operative findings was also found for patients with less than fifty years of age and adjacent bone or structure invasion. In particular, tumour thickness on CC was strongly correlated in our study. Moreover, the findings of the current study also revealed that individuals with more than fifty years of age have a weak correlation of tumour thickness level on CT with post-operative surgical finding.

The findings of this study could be highlighted in the light of the limitation that this study is cross-sectional in nature. Therefore, temporal relationships could not be ascertained. Moreover, no follow-up in terms of survival was done in this study. Previous studies were also conducted on determining the tumour thickness level on ultrasound, CT and magnetic resonance imaging as well.[13,18,19] Furthermore, imaging to surgery time interval was also studied in a previous study.[13] Despite these limitations, this study has reported a fairly large sample of oral tumour patients from a public sector hospital of metropolitan city of Pakistan. Further studies are recommended that included data from multi-centers hospital including other important variables like need of hospitalization and survival status of the patients.

CONCLUSION

A strong positive association between the degree of tumour thickness on the CT scan and post-surgical findings for the determination of oral tongue squamous cell carcinoma was documented in this study. In the case of preoperative tumour staging, the thickness of the tumour is best measured using CT.

AUTHORS' CONTRIBUTION

Aneeta: Conception of the study, manuscript writing and data interpretation. SS: Conception, supervision and final proof reading. FF: Data Collection and literature search. AK: Data Collection and manuscript writing. VK: Data analysis and initial proofread of manuscript.

REFERENCES

1. Chi AC, Day TA, Neville BW. Oral cavity and oropharyngeal squamous cell carcinoma—an update. CA Cancer J Clin 2015;65(5):401–21.
2. Bhurgri Y, Bhurgri A, Hassan SH, Zaidi SH, Rahim A, Sankaranarayanan R, *et al*. Cancer incidence in Karachi, Pakistan: first results from Karachi cancer registry. Int J Cancer 2000;85(3):325–9.
3. Anwar N, Pervez S, Chundriger Q, Awan S, Moatter T, Ali TS. Oral cancer: Clinicopathological features and associated

risk factors in a high risk population presenting to a major tertiary care center in Pakistan. PloS One 2020;15(8):e0236359.
4. Ahmad Z, Idrees R, Fatima S, Uddin N, Ahmed A, Minhas K, *et al*. Commonest cancers in Pakistan-findings and histopathological perspective from a premier surgical pathology center in Pakistan. Asian Pac J Cancer Prev 2016;17(3):1061–75.
5. Been MJ, Watkins J, Manz RM, Gentry LR, Leverson GE, Harari PM, *et al*. Tumour volume as a prognostic factor in oropharyngeal squamous cell carcinoma treated with primary radiotherapy. Laryngoscope 2008;118(8):1377–82.
6. Janssens GO, van Bockel LW, Doornaert PA, Bijl HP, van den Ende P, de Jong MA, *et al*. Computed tomography based tumour volume as a predictor of outcome in laryngeal cancer: results of the phase 3 ARCON trial. Eur J Cancer 2014;50(6):1112–9.
7. Studer G, Lutolf UM, El-Bassiouni M, Rousson V, Glanzmann C. Volumetric staging (VS) is superior to TNM and AJCC staging in predicting outcome of head and neck cancer treated with IMRT. Acta Oncol 2007;46(3):386–94.
8. Preis M, Hadar T, Soudry E, Shpitzer T, Strenov Y, Hod R, *et al*. Early tongue carcinoma: analysis of failure. Head Neck 2012;34(3):418–21.
9. Yuen AP, Ho CM, Chow TL, Tang LC, Cheung WY, Ng RW, *et al*. Prospective randomized study of selective neck dissection versus observation for N0 neck of early tongue carcinoma. Head Neck 2009;31(6):765–72.
10. Hinerman RW, Mendenhall WM, Morris CG, Amdur RJ, Werning JW, Villaret DB. Postoperative irradiation for squamous cell carcinoma of the oral cavity: 35-year experience. Head Neck 2004;26(11):984–94.
11. Ganly I, Goldstein D, Carlson DL. Long-term regional control and survival in patients with "low-risk", early stage oral tongue cancer managed by partial glossectomy and neck dissection without postoperative radiation: the importance of tumour thickness. Cancer 2013;119(6):1168–76.
12. Iyer NG, Kim L, Nixon IJ. Outcome of patients with early T1 and T2 squamous cell carcinoma of the base of tongue managed by conventional surgery with adjuvant postoperative radiation. Head Neck 2013;35(7):999–1006.
13. Weimar EA, Huang SH, Lu L, O'Sullivan B, Perez-Ordonez B, Weinreb I, *et al*. Radiologic-Pathologic Correlation of Tumour Thickness and Its Prognostic Importance in Squamous Cell Carcinoma of the Oral Cavity: Implications for the Eighth Edition Tumour, Node, Metastasis Classification. Am J Neuroradiol 2018;39(10):1896–902.
14. Salman R, Hussain M, Adil SO. Diagnostic accuracy of Multislice CT scan in the detection of occult cervical lymph node metastasis in head and neck cancers. J Coll Physicians Surg Pak 2017;27(5):275–8.
15. Arya S, Rane P, Deshmukh A. Oral cavity squamous cell carcinoma: role of pretreatment imaging and its influence on management. Clin Radiol 2014;69(9):916–30.
16. Chinn SB, Myers JN. Oral cavity carcinoma: current management, controversies, and future directions. J Clin Oncol 2015;33(29):3269–76.
17. Park JO, Jung SL, Joo YH, Jung CK, Cho KJ, Kim MS. Diagnostic accuracy of magnetic resonance imaging (MRI) in the assessment of tumour invasion depth in oral/oropharyngeal cancer. Oral Oncol 2011;47(5):381–6.
18. Lwin CT, Hanlon R, Lowe D, Brown JS, Woolgar JA, Triantafyllou A, *et al*. Accuracy of MRI in prediction of tumour thickness and nodal stage in oral squamous cell carcinoma. Oral Oncol 2012;48(2):149–54.
19. Madana J, Laliberté F, Morand GB, Yolmo D, Black MJ, Mlynarek AM, *et al*. Computerized tomography based tumour-thickness measurement is useful to predict postoperative pathological tumour thickness in oral tongue squamous cell carcinoma. Otolaryngol Head Neck Surg 2015;44(1):1–4.
20. Khan SA, Zia S, Naqvi SU, Adel H, Adil SO, Hussain M. Relationship of Oral Tumour Thickness with the rate of lymph node metastasis in Neck based on CT Scan. Pak J Med Sci 2017;33(2):353–7.

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