Intra-Operative Per-Oral Ultrasonography To Guide Resection of The Deep Surgical Tumor- Free Margins in Carcinoma Tongue

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ABSTRACT

Introduction: Squamous cell carcinoma(SCC) of the oral tongue is the second most common sub site in the oral cavity malignancy in India surgery being the first modality of treatment, needs a 1.5 cm three dimensional resection margins in order to achieve proper tumor oncological clearance. The deep margins are the one which is usually compromised; can per-operative image guided excision be done to aid the surgeon in adequate resection? So as not to compromise on the specialized function of the tongue or the tumor clearance.

Methods: A prospective non-randomized pilot study with a sample size of 15 who were newly diagnosed SCC of oral tongue between June, 2013 and March, 2014. A finger probe was use to mark the deep soft tissue margin of 1.5 cm from the deep edge of the tumor. The depth of the tumor and the post operative resection margin was again measured sonographically immediately following the excision of the tumor specimen. This was correlated with the final histopathological depth of the tumor and the margin. The findings were analyzed using descriptive statistics and correlation co-efficient calculated using SPSS17.

Results: The mean deep soft tissue pathological margin was 1.2 cm (SD 4.1). Sonographically measured tumor depth had a positive correlation of 0.955while the deep soft tissue margin had a correlation of 0.261with the final histopathology.
Conclusion: Intra-operative sonography using the finger-probe is feasible and simple technique to measure the depth of tumor in the carcinoma of the oral tongue and helps achieving the desired resection margin.

Introduction

SCC of tongue is aggressive with regional lymph nodes spread and high local recurrence. Hence this malignancy has a low 5 year disease-free survival. Adequate loco regional surgical clearance is important to improve the outcome. The recommendation for resection of the SCC is excision of the primary with a three dimensional margins of 1.5 -2 cm and prophylactic/elective neck dissection followed by adjuvant radiotherapy.

Post –operative adjuvant treatment causes short and long term morbidity and worsens tongue function .Resection by clinical assessment varies according to surgical skills and it may impair the tongue's specialized functions, especially swallowing and speech. Frozen section biopsy for tumor clearance has several limitations like availability, cost and time. Hence it has limited utility in guiding the resection margins in SCC of the tongue.

Per-operative sonography to determine tumor depth has shown good correlation with histopathology .Trials using sonography in guiding the resection margins especially, the deep soft tissue margins have shown good correlation with histological margins. With sonography-guided resection, adjuvant therapy can be avoided, if uniform and reproducible tumor-free deep soft tissue margins can be ensured. .

The purpose of this study was to objectively determine adequate and uniform margins of resection especially at the depth and to compare and correlate the margins of resection using sonography and with the pathological margins.

Material and methods

We decided to do a focus research on how imaging can improve surgical tumor clearance and decided to explore the role of intraoperative intraoral sonography using a finger probe in marking the deep soft tissue resection margins and so improve local control rate.

Using the original work done by previous researcher where intraoperative real time use of sonography in measuring the depth of tumor invasion give a correlation coefficient of 0.8-0.9 when compared to pathological depth of tumor measurement (taken as the gold standard) .Then together with statistician we reviewed literature and designed a diagnostic prospective study and the protocol needed based on the paper by Yamane et al, on "Noninvasive quantitative assessment of oral tongue cancer by intraoral ultrasonography," Head and Neck, vol. 29, no. 4, pp. 307–314, 2007 which give a correlation of 0.9 and calculated our sample size which,needed to be statistically relevant was 59.

We used an Aloka sonography machine- ALPHA A6,Aloka finger probe – UST-995-7.5;4-10 MHz,65 degree/20mm radius.

After the patient is anaesthetized and draped and after placing of buccal retractor and mouth gag and a throat pack, we place stay sutures on the undersurface tip of tongue to stabilize the tongue and also on the lesion for retraction during resection [Fig 1]. We mark the mucosa resection with a soft paper scale using cutting cautery .Then we place the probe on the dorsal and lateral surface to measure the depth of tumor and marked

the vertical and horizontal deep soft tissue resection margins of 1.5cms using 8 to 10 cm diameter round body needle[Fig2]. Then we start resecting the lesion around the needle ,when the specimen is resected we repeat the ultrasound on the specimen to make sure that the desired excision was done before putting the specimen in formalin and sending to the pathologist. Analysis was done in SPSS software version 16.0 (licensed by IBM) with the help of the statistician. All study variables were described using descriptive statistical methods. Continuous variables were summarized using mean with a standard deviation.

The association between intraoperative sonography and pathology for depth of tumor and deep soft tissue resection margins were assessed using Pearson correlation coefficient.

Fig 1. Marking the mucosal margins and accessing   the depth of the tumor

Fig 2. Curved round needle is being used to mark 1.5 cm from the deep margins of ulcer

Fig4. USG of the resected specimen To confirm the depth

We also try to analyze other association which is not a part of my study in order to have an idea for further research. We also try to analyze the association of pre op MRI with contrast and pathology for depth of tumor in the patients who had an MRI done in the immediate preoperative period (within 1 week of surgery) using Pearson correlation coefficient

We also try to analyze if depth of pathological depth of tumor>4mm increase the likelihood of lymph node metastasis All cases had at least a prophylactic neck dissection(level 1a,1b,2a,2b and 3) on the same side of the tumor using a cross tabulation table

Table 1

Modality	Number	Minimum mm	Maximum mm	Mean mm	Std. Deviation mm
USG depth	15	3.0	40	10.87	8.831
MRI depth	11	0.0	36	12.182	11.5829
Pathological depth	15	2.0	50	10.00	11.408
Pathological deep soft tissue margin	15	8.0	20	12.60	4.188
USG deep soft tissue margin	15	11.0.	18	13.67	2.225

Comparison of tumor depth using Ultrasound imaging and Histopathology:
All fifteen patients had an intra-operative Ultrasound for confirmation of extent of the tumor. This was compared

with the depth of tumor on histopathology. There was a positive correlation of 0.955between the two that was statistically significant p= 0.01[Graph 2]
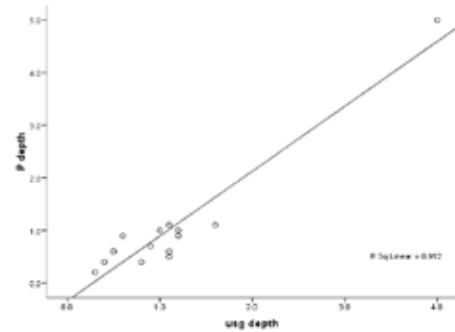
Correlation graph 2

Comparison of deep soft tissue margin on Ultrasound imaging and on Histopathology:
All fifteen patients had an intra-operative Ultrasound to measure the deep soft tissue resection margin. This was compared with the deep soft tissue resection margin on histopathology. There was a positive correlation of 0.261between the two that was not statistically significant. [Graph3]
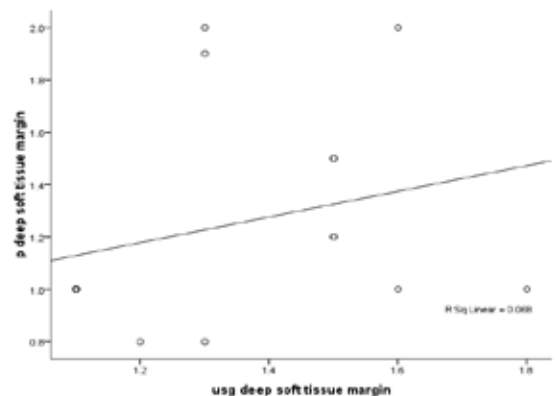
Correlation graph 3

The grade of tumor differentiation in SCC of oral tongue does seem to have an influence on lymph node metastasis although it is not statistically significant. Three patients had a tumor depth equal to or less than 4mm, and none of these had lymph nodal metastases, 5 out of the 12, who had a depth more than 4mm, had lymph nodal metastasis.

Management of the SCC of the oral cavity has followed the Halstedian principles of three dimensional oncological resection of the tumor with a margin of 1 cm of the normal adjacent tissue as per the recommendation for the skin non melanomatous SCC, Broadland and Zitelli et al could achieve tumor free margin of 0.5cm in more than 98.5% of their cases.[69] It is pertinent to note that the current National Comprehensive Cancer Network (NCCN) has recommended 1.5 to 2 cm margins from the visible and the palpable tumor [70]

Despite improved protocol and technical advances in adjuvant therapy, there has been no significant improvement in the local control rate of 50-60 % and an overall survival rate of 40%. Many centers have reported a high percent-

age of close pathological margins 30-40-% hence most head and neck surgeons and guidelines in this era by consensus recommends resection margins of 1.2 to 2 cm.. SCC of the tongue spreads locally by radial infiltrative growth (as for any other sub site in the oral cavity) and vertically along the planes of least resistance between the muscle fibers. This is the reason why many oncosurgeons believe that the compartmental resection of the tongue lesions may give a better oncological clearance especially for tumors which involve the extrinsic muscles of the tongue From July 1999 to July 2009, at the European Institute of Oncology in Milano, Italy, 155 patients were treated, while defining and refining the concept of compartmental tongue surgery (CTS

In 2007 a small sector probe was used to visualize the depth of tumor before resection and post resection sonography was performed in gelatin embedded specimen to confirm clearance but with no preoperative marking for resection margins[66].

Baek C et alIn 2008 small intracavitory probes was used to place 25 gauge spinal needle at the depth of resection with a high chance of canula displacement during resection[67] while the mucosal safety margins were not different.\nCONCLUSION: Intraoral sonography-assisted resection provides a more adequate deep resection margin for early T-stage tongue

Kodama et al study In 2010 depth was indicated with an IV canula and then post resection the specimen was embedded in gelatin for sonographic confirmation of adequate resection   margins[68]"page":"1746-1752","volume":"68","issue":"8","source":"NCBI   PubMed","abstract":"PURPOSE: Exact estimation of tumor thickness and the status of the resection margin in tongue carcinoma are important prognostic factors for local recurrence, subclinical nodal metastasis, and survival. This study aims to evaluate the accuracy of intraoral ultrasonography-guided measurement of tumor thickness and define an adequate intraoperative resection margin in squamous cell carcinomas of the tongue.\RESULTS: Very fine ultrasonographic images of the resected specimen could be easily obtained without any special skills, and surgical clearance could be verified intraoperatively. The ultrasonographic tumor thickness measurements corresponded well with those of histologic sections, with a consistency ratio of 91.4% to 98.2% (Pearson correlation coefficient = 0.981, P < .05.

In our study we used a large curved round body needle 8 to 10 cm diameter needle which followed the natural curvature of three dimentional resection with reconfirmation of the margins on the ultrasound table for adequacy of the margins.

Conclusions

Intraoperative sonography real-time estimation of deep soft tissue margins and using sonography to mark the margins of 1.5 cm did ensure that no patients had a close resection margin which certainly does help in avoiding unnecessary adjuvant treatment for patients with not very aggressive tumors and without risk factors. This perhaps helped in reducing added morbidity from radiation therapy and also reduces cost of treatment and emotional trauma to the patient and the family.

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