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Multidetector CT Evaluation of Oral Cavity and Oropharynx Malignant Tumours

Dr. Amish P George[1], Dr. Shrikrishna .U[2]

[1]Post Graduate, Department of Radiodiagnosis, K.S Hegde Medical Academy, NITTE University, Mangalore-575018, India

[2]Professor and Head, Department of Radiodiagnosis, K.S Hegde Medical Academy, NITTE University, Mangalore-575018, India

Abstract: ***Squamous cell carcinoma is the most frequent malignancy of oral cavity and oropharyngeal region, accounting for 5% of all malignant tumors worldwide. Geographic variations in incidence and mortality have been observed due to prevalence of known aetiological riskfactors, such as tobacco and alcohol use. By mapping out the extent of disease, cross-sectional imaging completes the picture given by clinical examination and also evaluate lymph node involvement and bone invasion in oral cavity and oropharynx malignancy. CT and MR imaging are the imaging modalities useful in the evaluation of the oral cavity and oropharynx malignant tumours. CT is useful to look for bony erosions and also to assess lymph node metastasis in the neck using contrast CT with 5-mm axial sections. The aim of the study was to compare the sensitivity of CT with clinical staging in tumor extent, lymph node involvement and bone erosion in oral cavity and oropharyngeal malignant tumors. Over a period of 24 months, 67 patients histopathologically proven to have carcinoma of oral cavity and oropharynx and underwent contrast enhanced computed tomography scan of neck in Department of Radio-diagnosis, K.S Hegde Medical Hospital were included in the study. All patients with oral cavity tumours underwent ''Puffed-cheek'' technique at the time of image acquisition. The clinical examination findings were obtained from patients records. Correlation of clinical examination and CT findings with histopathology findings with respect to tumor extent, nodal involvement and bone invasion was done by sensitivity, specificity, PPV, NPV and by overall accuracy. Out of 67 patients studied, 52 were males and 15 were females and the mean age of the study population was 55 years. The most common primary site of malignancy was found to be buccal mucosa (52%). The sensitivity of clinical examination for tumor extension was 82%, for lymph nodal involvement 50% and for bone invasion 50% . The sensitivity of CT for tumor extension was 96% , for lymph nodal involvement 92% and for bone invasion 89%. When compared to clinical examination CT was found to be more sensitive in predicting lymph nodal involvement and bone invasion. CT performed slightly better than clinical examination to assess tumor extension. The CT scan showed high efficiency in excluding bone involvement when compared to clinical examination and this provides a good guidance for surgery.***

Keywords: Computed tomography, oral cavity and oropharynx malignant tumours

1. Introduction

Oral cavity and oropharynx carcinomas together is the sixth most common cancer in the world[1]. Tobacco chewing, alcohol abuse are the predisposing factors for the development of the oral cavity and oropharynx malignant tumors[2]. CT and MR imaging are the imaging modalities useful in the evaluation of the oral cavity and oropharynx malignant tumors. CT is useful to look for bony erosions and also to assess lymph node metastasis in the neck using contrast CT with 5-mm axial sections. Some malignant lesions can mimic a benign tumor, therefore histopathological diagnosis is required before the commencement of the treatment. PET scanning is required to look for an unknown primary tumor with a nodal mass in neck due to unknown primary, when there is recurrence of carcinoma or when CT is indecisive for metastatic lymph nodes in the neck.

Half of the carcinomas in the upper aero digestive tract are squamous cell carcinomas[3]. with increased chance of developing carcinomas in tobacco chewing and excessive alcohol abuse patients. The Carcinoma develops in oral cavity at the site of chewing and up to 90% of carcinomas in oral cavity are SCC[4]. The carcinomas has to be staged in order to assess prognosis and deciding appropriate treatment regimen.

2. Aims and objectives of the study

To compare the sensitivity of CT with clinical staging in tumor extent, lymph node involvement and bone erosion in oral cavity and oropharyngeal malignant tumors.

3. Methodology

This was a hospital based prospective study conducted in 67 patients between October 2015 to October 2017 in Department of Radiodiagnosis, Justice K. S. Hegde Hospital, Deralakatte, Mangalore who were clinically diagnosed and histopathologically proven to have oral cavity or oropharyngeal malignant tumours.

All scans will be done using GE Bright speed 16 - slice MDCT with 120 kVp and 250 mAs in supine position. After injection of non ionic contrast media(90 ml bolus at 1.5 ml/sec) and an injection to scan delay of 50 to 60 sec contiguous slices of thickness 5mm was obtained in axial plane, from base of skull to upper chest, taken parallel to infraorbital- meatal line. All patients with oral cavity tumours underwent ''Puffed-cheek'' technique at the time of image acquisition. Images were retro reconstructed with 1.25 mm slice thickness,1.25mm interval and reformatted in sagittal and coronal planes for analysis. All images were analysed in bone and soft tissue algorithm.Tumor extension on CT was defined based on the presence of enhancement in the soft tissue adjacent to primary site of malignancy. Nodal metastasis on CT was defined as lymph nodes with

maximum short axis diameter more than or equal to 10 mm. The criteria for bone invasion in CT was absence of cortex of bone adjacent to malignancy. The clinical examination findings were obtained from patients records. Both CT and clinical examination findings were compared with postoperative histopathology. The cases were staged according to the seventh edition of American Joint Committee on Cancer (TNM) staging. Collected data was summarized for assessment by frequency and percentage. Correlation of clinical examination with histopathology and CT with histopathology with respect to tumor extent, nodal involvement and bone invasion was done by sensitivity, specificity, PPV, NPV and by overall accuracy.

4. Results

Mean age of our sample was 55 years and majority [52 (77.6%)] were males belonging to rural [62 (91.2%)] domicile. The most common primary site for malignancy was buccal mucosa(52%).

Table 1: Clinical tumor extension * HPE tumor extension

		HPE- Tumor extension	
		Present n(%)	Absent n(%)
Clinical – Tumor extension	Present n (%)	41 (78.8%) (82%)	11(21.1%) (64.7%)
	Absent n (%)	9 (60%) (18%)	6 (40%) (35.2%)

Sensitivity: 82%, Specificity: 35.2%, PPV: 78.8%, NPV: 40%, Overall accuracy:70%

Table 2: CT tumor extension*HPE tumor extension

		HPE- Tumor extension	
		Present n(%)	Absent n(%)
CT – Tumor extension	Present n (%)	48 (78.6%) (96%)	13 (21.3%) (76.4%)
	Absent n (%)	2 (33.3%) (4%)	4 (66.6%) (23.5%)

Sensitivity: 96%, Specificity: 23.5%, PPV: 78.6%, NPV: 66.6%, Overall accuracy:77.6%

Table 3: Clinical nodal involvement*HPE nodal involvement

		HPE- Node	
		Present n(%)	Absent n(%)
Clinical Node	Present n (%)	14 (48.3%) (50%)	15 (51.7%) (24%)
	Absent n (%)	14 (36.8%) (50%)	24 (63.2%) (61.5%)

Sensitivity: 50%, Specificity: 61.5%, PPV: 48.2%, NPV: 63.1%, Overall accuracy: 56.7%

Table 4: CT nodal involvement*HPE nodal involvement

		HPE- Node	
		Present n(%)	Absent n(%)
CT Node	Present n (%)	26(56.5%) (92.9%)	20(43.5%) (51.3%)
	Absent n (%)	2 (9.5%) (7.1%)	19(90.5%) (48.7%)

Sensitivity: 92.8%, Specificity: 48.7%, PPV: 56.5%, NPV: 90.4%, Overall accuracy: 67.1%

For bone invasion out of 67 patients in the case study only in 25 cases bone has been removed surgically and this cases were compared with clinical and CT data for bone invasion.

Table 5: Clinical bone invasion* HPE bone invasion

		HPE- Bone invasion	
		Present n(%)	*Absent n(%)*
Clinical Bone invasion	Present n (%)	4 (33.3%) (44.4%)	8(66.7%) (50%)
	Absent n (%)	5 (38.5%) (55.6%)	8 (61.5%) (50%)

Sensitivity: 50%, Specificity: 61.5%, PPV: 48.2%, NPV: 63.1%, Overall accuracy: 56.7%

Table 6: CT bone invasion*HPE bone invasion

		HPE- Bone invasion	
		Present n(%)	*Absent n(%)*
CT Bone invasion	Present n (%)	8 (88.9%) (88.9%)	1(11.1%) (6.3%)
	Absent n (%)	1 (6.3%) (11.1%)	15 (93.8%) (93.8%)

Sensitivity: 88.8%, Specificity: 93.7%, PPV: 88.8%, NPV: 93.7%, Overall accuracy: 92%

5. Discussion

For tumor extension to adjacent soft tissue the sensitivity of clinical examination was 82% and CT was 96%. There were 11 false positive and 9 false negative cases in clinical examination and in CT there was 13 false positive and 2 false negative cases. In the study the clinical examination was not able to predict the invasion to deeper structures, particularly in cases of carcinoma tongue. The overall accuracy for clinical examination was 70% and in CT was 76%. Therefore there is no much difference between efficiency of clinical examination and CT for predicting tumor invasion.

For nodal involvement, in clinical examination there were 15 false positive and 14 false negative cases. The sensitivity for nodal involvement in clinical examination was 50% and specificity was 61.5 % and overall accuracy was 56.7%. The positive and negative predictive value for clinical examination was low [PPV-48.2%, NPV-63.1%]. In CT examination there were 20 false positive and 2 false negative cases. The sensitivity for nodal involvement in CT examination was 92.8% and specificity was 48.7 % and overall accuracy was 67.1%. To achieve a high negative predictive value the upper size limit of a normal node was kept as 10mm in short axis diameter. The negative predictive value of CT was 90.4% and positive predictive value was 56.5%. The false negative cases in CT had nodal size less than 10mm.

Out of 25 cases for bone invasion, In clinical examination 12 cases (48%) showed bone invasion, in CT 9 cases(36%) showed bone invasion and in histopathological examination 9 cases(36%) showed bone invasion. The false positive cases in clinical examination was 8(66.7) and false negative were 5(38.5%). In CT there was 1 false positive case and 1 false negative case. When comparing clinical and CT examination with postoperative histopathological data,

clinical examination was found to be less efficient than CT scan to exclude bone involvement, [specificity 44.4% vs 88.8% for CT scan]. Positive predictive value of CT scan was 88.8% (compared to 33.3% for clinical examination).
The study was in concordance with the study done by O. Malard et al[5]. Their study compared the TN stage of patients by clinical and CT examination to postoperative histopathology. Compared to clinical examination CT showed high sensitivity for nodal involvement and bone invasion. For tumor size and extension there was good correlation between CT and clinical examination.

Curtin et al[6]. in their study by keeping the size of nodes more than 1cm or an internal abnormality in the nodes as criteria for metastatic nodes achieved a high NPV(90%). They also found that by keeping a low size criteria to achieve a high NPV there was low PPV.

6. Conclusion

When compared to clinical examination CT was found to be more sensitive in predicting nodal involvement and bone invasion. CT performed slightly better than clinical examination to assess tumor extension. The specificity and sensitivity for nodal involvement was low for clinical examination, whereas CT had high sensitivity and NPV for detecting nodal involvement. The CT scan showed high efficiency in excluding bone involvement when compared to clinical examination and this provides a good guidance for surgery.

CT also provides good spatial resolution, can be performed with faster acquisition times and has the advantage of providing multi planar reformatted images. Therefore, considering the new information CT provides in patients with oral and oropharynx malignancy CT examination should be considered a basic evaluation before treatment planning.

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