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ORIGINAL ARTICLE

Diagnostic Accuracy of Magnetic Resonance Imaging for Detection of Metastatic Cervical Nodes at Level I and II in Patients with Oral Squamous Cell Carcinoma Taking Postoperative Histopathology as Gold Standard

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ABSTRACT

Background: Head and neck carcinoma is the malignant lesions which develops on lips, oral cavity, nasal mucosa, paranasal sinuses, inside or outside the throat or parotid glands. Magnetic resonance imaging can be a good alternative to invasive procedures for detection of metastatic disease in cases of head and neck tumors.

Objective: To evaluate diagnostic accuracy of magnetic resonance imaging in detecting metastasis in neck nodes of oral squamous cell carcinoma with reference to postoperative neck histopathology.

Study Design: Cross sectional study

Place and Duration of Study: Department of Oral and Maxillofacial Surgery, Mayo Hospital Lahore from 1st January 2014 to 30th June 2014.

Methodology: Eighty seven patients with biopsy proven squamous cell carcinoma of orofacial origin were enrolled who had single malignant tumor at the time of diagnosis.

Results: The mean age of the patients was 50.44±12.44 years. There were 58 (66.67%) males and 29 (33.33%) females. In terms of sensitivity, specificity, and diagnostic accuracy, magnetic resonance imaging was 94.12%, 61.11%, and 80.46% respectively taking histopathology as gold standard.

Conclusion: For the detection of cervical nodal metastases in oral squamous cell carcinoma, MRI is a useful and trustworthy method with a high sensitivity and specificity, especially when compared to postoperative neck histopathology.

Keywords: Histopathology, Carcinoma, Magnetic resonance imaging (MRI),Metastasis

INTRODUCTION

Oral and maxillofacial carcinoma is the 6th most prevalent cause of carcinoma related mortality all over the world.[1,2] The most significant factor, which also effects the outcome of the treatment is the stage of carcinoma at the time of presentation or diagnosis.[2,3] Staging and the localization of the pathologic lymph nodes are perilous to choose better treatment and are very important factor for the prognosis of patients diagnosed with head and neck carcinoma.[3]

The metastasis of even one lymph node (stage: N1) reduces the better prognosis of patients by 50%.[4] However, bilateral metastatic reduces the prognosis or survival by additional 25%.[5] Nodal metastasis can invade adjacent muscle, bone, neural or vascular structure,[4] if left untreated disease in neck may be associated with higher incidence of distant metastasis.[6] So, the detection of metastasis is important step at initial level and then the prevention of lymph node metastasis is very important features for the successful management and good prognosis of head and neck carcinoma.[7]

The presence of the less or non-intrusive diagnostic tool, which also have high accuracy rate to determine the metastasis of cervical lymph nodes can streamline the decision for neck dissection,[8]and it is also possible to lessen the hazard of the undetermined metastasis with some imaging tool of high detection accuracy.[1] Numerous technique are available for staging of lymph nodes. Among these are fine-needle aspiration cytology, ultrasonography, fine-needle palpation, and computed tomography,[1,8,9] lymphoscintigraphy, Doppler sonography, and sonography guided fine needle aspiration cytology (FNAC).[3] The ability of the imaging modality to detect the presence or absence of metastatic disease is crucial in head and neck cancer.[3]

Mayo Hospital Lahore has a high volume of patients with oral cancer who are seeking treatment. In conjunction to clinical examination we can use different imaging modalities such as; conventional US, CT, CECT, MRI, PET/CT etc for metastatic workup, yet we don't know accuracy of each of these modalities. MRI has acceptable accuracy for detection of metastasis of cervical lymph nodes.[2,3]

Combination of F18-FDG-PET with CECT has been reported to be more accurate, but its use in routine for screening of cervical metastasis is virtually unfeasible and is beyond financial approach of patients.[2]MRI has high accuracy to differentiate the metastatic nodes from the reactive nodes.[3] CT has risk of ionizing radiation and is of almost same cost as MRI. Ultrasound has low specificity (25%).[1]

Recent studies demonstrate that around 25% of mouth and 35% of throat tumors are connected with HPV. The 5 year ailment free survival rate for HPV positive disease is altogether higher when properly treated with surgery, radiation and chemotherapy when contrasted with non-HPV positive tumor.[10]

Metastasis at cervical nodes in patients with oral SCC is a sign of worse disease. Hence detection of neck node metastasis is necessary for knowing the prognosis and the treatment planning. This study is carried out as to find out appropriate cost effective tool for accurate detection of metastatic neck nodes in patients with oral SCC in existing economic condition in Pakistan. Reported sensitivity of MRI in one study is 65% and specificity 81%,[7] while another study shows higher values that MRI yielded, 83% sensitivity and 89% spacificity.[3] We did this study to assess the diagnostic accuracy of MRI in detecting lymph nodes with typical features suggestive of malignancy, as the diagnostic accuracy of MRI varies among published studies and hence cannot be declared as gold standard staging examination.

MATERIALS AND METHODS

This cross-sectional study was conducted at the Oral & Maxillofacial Surgery Department, Mayo Hospital Lahore from from 1st January 2014 to 30th June 2014 and 87 patients were enrolled. All patients with biopsy proven squamous cell carcinoma of orofacial origin were included, who had single malignant tumor at the time of diagnosis. Patients between 15-75 years of age, either gender, fit for surgery according to ASA grade I or II were included. Patients with distant metastasis, received Neo-Adjuvant Chemotherapy or Radiotherapy, primary tumor previously operated upon, or with other causes of lymphadenopathy e.g. lymphomas, granulomatous disease, Tuberculosis, existing infection were excluded.

Patients with a history of oral squamous cell carcinoma matching the inclusion criteria selected. Every patient was evaluated by physical examination of primary tumor and neck. Informed consent was taken for inclusion in study. Performa filled regarding demographic details and staging of the condition. Topographical correlation between histopathologic examination of dissected nodes and MRI performed. Suspected cases were sent for incisional biopsy. After signing the informed consent by patients suspected cases of squamous cell carcinoma of orofacial origin from outpatient department was sent for incisional biopsy, Biopsy proven cases were sent to anesthetist for declaring of fitness for anesthesia. Biopsy proven carcinoma patients was sent to anesthetist for clinical examination and lab investigations to rule out any systemic disease, and categorization in ASA grading. Patients were further investigated for distant metastasis by Ultrasound Abdomen & Chest X-Ray. Patients were included in study according to inclusion criteria. Patients were sent for MRI of neck, where reporting of imaging was done by same center and same radiologist, to minimize variations. Patients were declared positive for nodal metastatic disease on MRI according to criteria given. Ablative surgery was performed. At surgery, the lymph nodes were excised enblock along with primary tumor; levels of lymph nodes were marked by silk sutures, one long thread at level-I and two long threads at level-II. Specimen was collected and sent in laboratory for histopathologic evaluation. MRI report of neck nodes at level I and II was compared with histopathalogic results.

Level-I neck nodes: Nodes below mylohyoid muscle and above hyoid bone, between anterior and posterior belly of digastrics muscle.

Level-II neck nodes: Nodes from base of skull to inferior border of hyoid bone, deep to sternoclidomastoid muscle.

All the data was analyzed by using SPSS-20. A 2X2 contingency table was generated for sensitivity, specificity, positive predictive value, negative predictive value and accuracy of MRI.

RESULTS

The mean age of the patients was 50.44±12.44 years. There were 58 (66.67%) males and 29(33.33%) females with male to female ratio was 2:1. Alveolus was noted in 13(14.9%) patients, buccal mucosa noted in 38(43.7%) patients, lower lip noted in 2(2.3%) patients, masticator space noted in 1%, maxillary sinus noted in 2(2.3%) patients, palate diagnosis noted in 4(4.6%) patients and tongue diagnosis found in 27(31%) patients (Table1).

The sensitivity and specificity of MRI were 94% and 61.16%, while PPV and NPV were 77.05% and 88.46% and diagnostic accuracy was 80.46% respectively taking histopathology as gold standard (Table 2).

The size on MRI for recognition of lymph node involvement at level 1 for size ≥8mm, the sensitivity and specificity were 96.77% and 0.0%, PPV and NPV were 76.92% and 0.0% and diagnostic accuracy was 75% taking histopathology as gold standard. For size <8mm, diagnostic accuracy, as well as sensitivity, specificity, PPV, NPV, and PPV of MRI in level 1 patients was 89.47%, 82.14%, 77.27%, 92% and 85.11% taking histopathology as gold standard (Table 3).

Table 1: Characteristics of patients (n=87)

Variable	No.	%
Age (years)	50.44±12.44	
Gender		
Male	58	66.7%
Female	29	33.3
Diagnosis		
SCC Alveolus	13	
SCC Buccal Mucosa	38	
SCC Lower lip	2	
SCC Masticator space	1	
SCC Maxillary sinus	2	
SCC Palate	4	
SCC Tongue	27	

The data of size on MRI for detection of lymph node involvement at level II for size ≥8mm, MRI's diagnostic accuracy, sensitivity, specificity, PPV, and NPV were100%, 0.0%, 81.25%, 0.0% and 81.25% taking histopathology as gold standard. At level II for size <8mm, MRI's sensitivity, specificity, PPV, and NPV in level II patients were72.73%, 82.14%, 61.54%, 88.46% & 79.49% taking histopathology as gold standard (Table 4).

Table 2: Accuracy of MRI with histopathology

MRI	Histopathology		Total
	Positive	Negative	
Positive	47	14	61
Negative	3	23	26
Total	50	37	87

Sensitivity=94.00%, Specificity=61.16%, PPV=77.05%, NPV=88.46%, Diagnostic Accuracy=80.46%

Table 3: Accuracy of MRI with histopathology according to level 1 size

MRI		Histopathology		Total
		Positive	Negative	
Yes	Positive	30	9	39
	Negative	1	-	1
No	Positive	17	5	22
	Negative	2	23	25

Level 1	Yes	No
Sensitivity	96.77%	89.47%
Specificity	0.0%	82.14%
PPV	76.92%	77.27%
NPV	-	92%
Diagnostic accuracy	75%	85.11%

Table 4: Accuracy of MRI with histopathology according to level 2 size

MRI		Histopathology		Total
		Positive	Negative	
Yes	Positive	39	9	48
	Negative	-	-	-
No	Positive	8	5	13
	Negative	3	23	26

Level 1	Yes	No
Sensitivity	100%	72.73%
Specificity	-	82.14%
PPV	81.25%	61.54%
NPV	-	88.46%
Diagnostic accuracy	81.25%	79.49%

DISCUSSION

Cervical lymph nodes are frequently involved in the spread of head and neck cancer. A patient's prognosis and treatment options may be impacted by the occurrence of metastases.[11,12] Cervical lymph node metastases in patients of head and neck carcinoma can be detected using a number of different imaging modalities. Localized lesions of mucosa of oral cavity have different frequency of metastasis. Pharyngeal areas and posterior tongue show more nodal disease than gingival, palatal area and anterior tongue.[11-15] Cervical nodal metastasis in patients of oral SCC on same side of primary lesion is about 50% and on opposite side or both sides is 2-35%.[16,17]

In the present investigation, specificity and sensitivity of MRI were 94.12% and 61.11%, PPV and NPV were 77.42% and 88% and diagnostic accuracy was 80.46% taking histopathology as gold standard. Sumi et al[3] proved that MRI yielded the sensitivity of 83%, specificity of 88%, and accuracy of 86%. MRI yielded sensitivity as 100%, specificity 98% and accuracy 99% for larger metastatic nodes. The sensitivity of MRI in our study was 94%, which is almost near to the sensitivity reported by Sumi et al[3] while specificity of our study was low as compared to the present study.

Reported sensitivity of MRI in one study is 65% and specificity 81%[7], while another study shows higher values that MRI yielded 83% sensitivity and 89% specificity.[3] Whereas our study showed lower value of specificity. Probably this difference exists

due to variation of sample size.

Thus studies demonstrated that MRI has a high accuracy to detect the metastatic cervical lymph node.[18,19,] Wide et al found that MRI has sensitivity of 66.7% and specificity of 68% for detection of lymph node metastasis. While few enlarged, positive nodes on histology were not noticed on MRI.[20,] van den Brekel et al[21] defined the evaluation of lymph node metastasis in neck with several imaging modalities and it was concluded that computed tomography and MRI are better than palpation to detect and exclude the metastatic neck disease.

Wide et al.[20] observed that MRI had a sensitivity of 66.7% and a specificity of 68.0% for detecting metastases in lymph nodes. The researchers found that MRI have low accuracy rate and it's not enough to replace the neck dissection for both; staging and prognosis. Regarding MRI's diagnostic criteria, Sun et al.[22] determined that a minimum axial diameter of 10 mm can be considered as optimal size. Metastatic lymph nodes on MRI have diagnostic criteria proposed to be set at 10 mm in size.

We stratified data for one of the major criteria (size) on MRI for detection of lymph node involvement. Using histology as the gold standard, the sensitivity, specificity, PPV, NPV, and diagnostic accuracy of MRI in patients with a tumour size of 8mm were 96.77%, 0%, 76.92%, 0%, and 75% respectively. For size <8mm, the sensitivity, specificity, PPV, NPV and diagnostic accuracy of MRI in level 1 patients was 89.47%, 82.14%, 77.27%, 92% and 85.11% taking histopathology as gold standard. We stratified data for one of the major criteria (size) on MRI for detection of lymph node involvement. At level II for size ≥8mm, the sensitivity, specificity, PPV, NPV and diagnostic accuracy of MRI was 100%, 0%, 81.25%, 0% & 81.25% taking histopathology as gold standard. At level II for size <8mm, the sensitivity, specificity, PPV, NPV and diagnostic accuracy of MRI in level II patients was 72.73%, 82.14%, 61.54%, 88.46% and 79.49% taking histopathology as gold standard.

Magnetic resonance imaging had a sensitivity of 100%, specificity of 66.67%, and diagnostic accuracy of 84.62 in patients with SCC of the alveolus; a sensitivity of 96.3%, specificity of 54.55%, and diagnostic accuracy of 84.21% in patients with SCC of the buccal mucosa; and a sensitivity of 86.67%, specificity of 41.67%, and diagnostic accuracy of 66.67% in patients with SCC of the tongue.

CONCLUSION

With reference to postoperative neck histopathology, magnetic resonance imaging has satisfactory diagnostic accuracy for detecting cervical nodal metastases in oral squamous cell carcinoma. Despite its low specificity, a second method can be employed for confirmation of negative instances.

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