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ORIGINAL ARTICLE

ROLE OF PET-CT SCAN IN LOCALLY ADVANCED HEAD & NECK CANCER: A Prospective Study

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ABSTRACT:

Aim: To find the role of PET-CT scan in management of locally advanced head & neck cancers.

Materials & Methods: A prospective study was performed in 21 patients suffering from locally advanced head & neck cancers reporting to our centre from January 2014 to December 2015. All the patients who had T3- T4 lesions with metastatic lymph node disease were included in the study. They underwent PET-CT scan and the results were tabulated to check whether there was distant metastasis thereby altering the clinical staging of the disease.

Results: Out of 21 patients, who under PET-CT scan, 9(42.8%) patients had distant metastasis to various organs. 8(38%) patients had more than one metastatic lymph nodes and 4(19%) patients had locally advanced disease with only one metastatic lymph nodal involvement.

Conclusion: Though incidence of distant metastasis is less than 10 % in head and neck cancers, sometimes the clinician fail to identify the distant metastasis due to non-availability of PET-CT scan equipment or due its financial cost when the patient is not affordable. But appropirate steps must be taken based on the clinical symptoms of the patients which must not be ignore by the surgeon and PET-CT scan needs to be done which can change the whole treatment management of the patient.

INTRODUCTION:

The clinical usefulness and role of FDG-PET CT for detection of lymph node involvement and recurrences in patients with head and neck cancer is very well-established[1]. It has been found to be superior to conventional imaging work-ups in the evaluation of patients with head and neck malignancies[2]. FDG PET is also found to be more accurate than CT/MRI imaging in

oral cavity cancer[3] . However, potential clinical applications include pre-treatment staging, treatment monitoring and evaluation of the previously treated patients. The current practice is not in favour of utilizing CT-PET for staging of all newly diagnosed squamous cell carcinomas. However, PET can detect metastatic cervical lymph nodes, which may be clinically occult and may not be detected by CT or MR imaging. It can also detect primary head and neck squamous cell carcinomas greater than 1 cm in size. PET-CT may be performed in squamous cell carcinoma to evaluate for possible occult distant metastases to the lungs or bones[4,5].

MATERIALS & METHODS:

This was a prospective study in 21 patients suffering from locally advanced head & neck cancers reporting to our cancer centre from January 2014 to December 2015. All the patients who had T3-T4 lesions with metastatic lymph node disease were included in the study. All these patients underwent PET-CT scan and the results were tabulated to check whether there was distant metastasis thereby altering the clinical staging of the disease. (Table 1).

TABLE I: PATIENTS WITH DISTANT METASTASIS IN PET-CT SCAN

S.NO	DIAGNOSIS	PET-CT FINDINGS
1.	Buccal mucosa	vertebral column, bilateral supraclavicular and mediastinal nodes and other organs like lung, liver and long bones
2.	Tongue	bilateral supraclavicular, right pectoral and mediastinal nodes, increased metabolic activity of necrotic nodule in superior segment of right lower lobe of lung
3.	Buccal mucosa	Vertebral column, Para tracheal nodes, Lung
4.	Floor of mouth	Lung, Parahilar nodes
5.	Buccal mucosa	increased metabolic activity of necrotic nodule in superior segment of left upper lobe of lung
6.	Larynx	Parahilar nodes, mediastinal nodes, lung
7.	Tongue	Lung and bones, left pectoral and mediastinal nodes,
8.	Alveolus	lung
9.	Alveolus	Vertebral column

CASE 1:

A 48 year old male reported to the Department of head & neck oncology with a lesion measuring 2 x 1 cm in left buccal mucosa. Clinical examination of neck was N2a on left side. cTNM staging was T1N2aMx. Since patient complained about back pain from 4 days PET-CT scan was recommended to check for occult distant metastasis. The report shows an increased FDG uptake with extensive metastasis to vertebral column, bilateral supraclavicular and mediastinal nodes and other organs like lung, liver and long bones. The TNM staging was upgraded to T1N2bM1. (Fig 1).

CASE 2:

A 43 year old male reported to the department with proliferative lesion 4 x 5 cm in floor of mouth and ventral surface of tongue. There was bilateral cervical lymphadenopathy. cTNM staging was T2N2bMx. Since he had persistent cough for 9 days, PET-CT scan was recommended. The report showed increased FDG uptake in bilateral supraclavicular right pectoral and mediastinal nodes, increased metabolic activity of necrotic nodule in superior segment of right lower lobe of lung. (Fig 2)

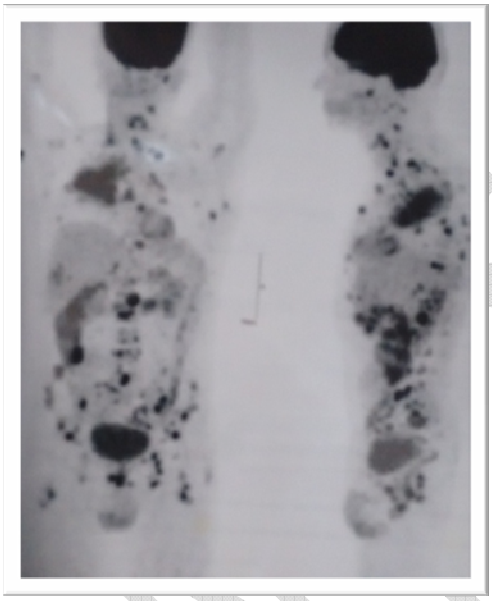


Fig 1- FDG uptake with extensive metastasis to vertebral column, bilateral supraclavicular and mediastinal nodes & other organs like lung, liver and long bones

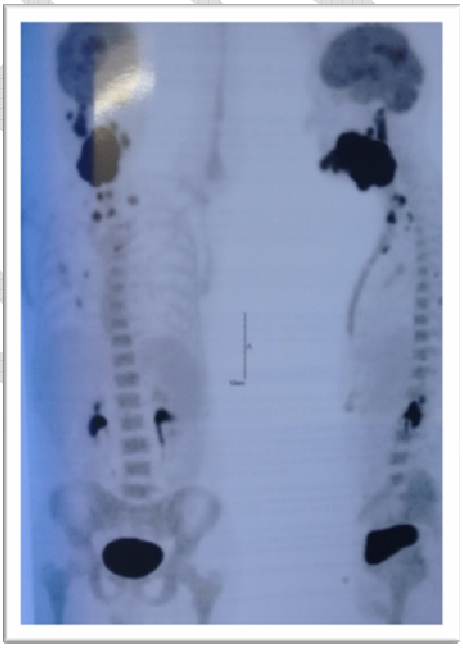


Fig 2- Increased FDG uptake in bilateral supraclavicular right pectoral and mediastinal nodes, increased metabolic activity of necrotic nodule in superior segment of right lower lobe of lung.

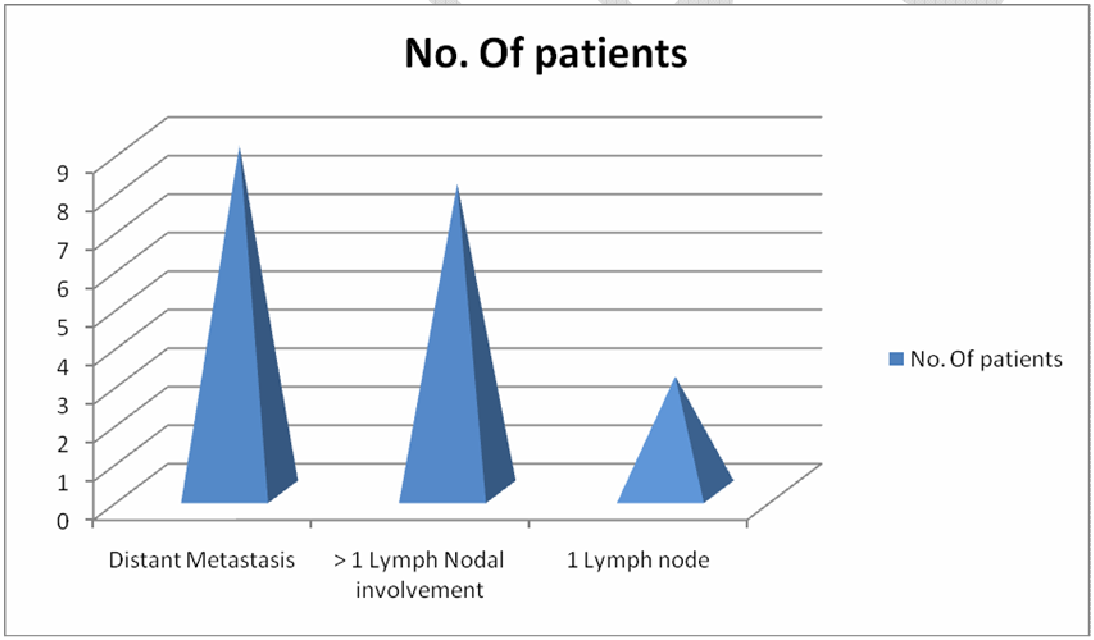
RESULTS:

Out of 21 patients who under PET-CT scan, 9(42.8%) patients had distant metastasis to various organs, 8(38%) patients had more than one metastatic lymph nodes and 4(19%) patients had locally advanced disease with only one metastatic lymph nodal involvement. **(Graph 1).**

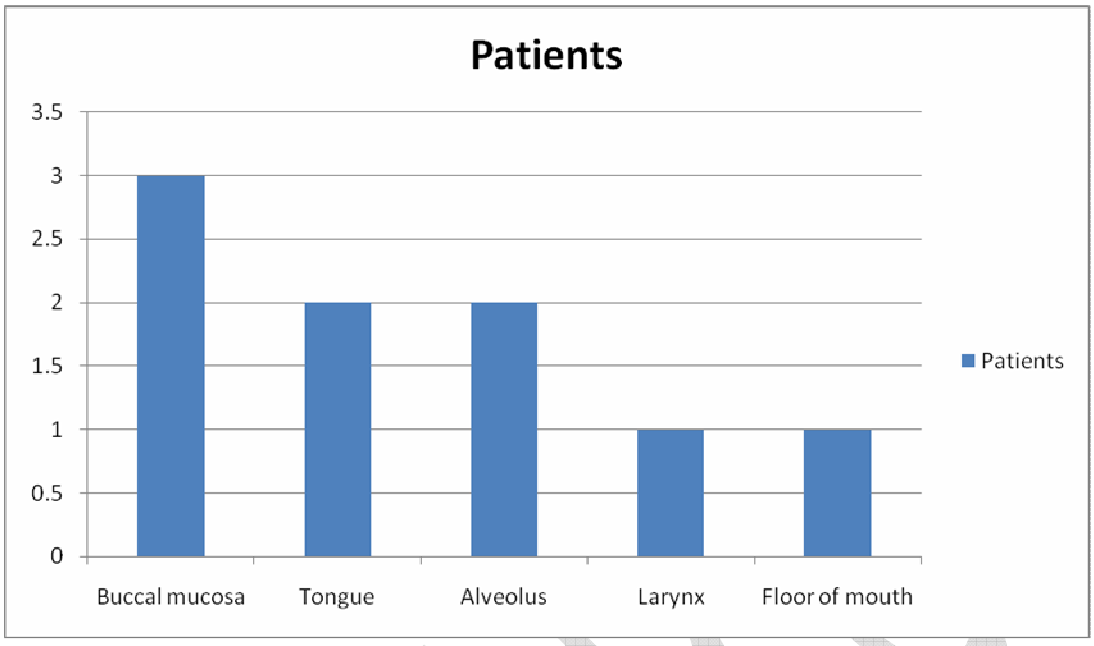
Graph 2 shows 3 patients with metastasis were carcinoma buccal mucosa, 2 patients were carcinoma tongue, 2 patients were carcinoma alveolus, 1 patient was carcinoma larynx and 1 patient was carcinoma floor of mouth.

Graph 3 shows the results of number of lymhnodes involved in 8 patients. Out of 8 patients 4 patients had level Ib-III involvement, 2 Patients had Level II-IV involvement and 2 patients had Level Ia-II lymph node involvement. The management of these 21 patients was done as follows:- Out of 12 patients with M0 disease, 5 patients underwent Neoadjuvant chemotherapy and 7 patients underwent surgery. 9 patients with M1 disease underwent 3-6# of chemotherapy.

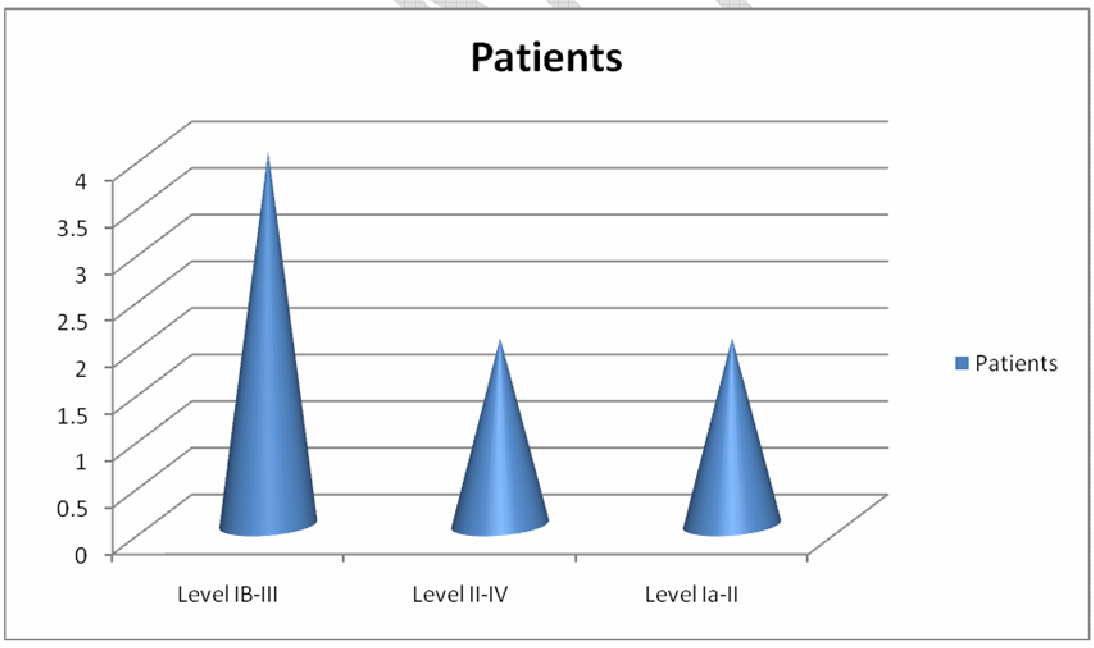
Graph 1: Number of patients with PET-CT scan



Graph 2: Diagnosis of metastatic disease patients



Graph 3: Lymph nodal Involvement



DISCUSSION:

PET -CT scan is used to diagnose and stage**:** by determining the location of the cancer and where the cancer has spread in the body; patients with head and neck cancer are scanned from the top of the head to the thighs, plan treatment**:** be determining a site that is appropriate for biopsy and in research studies, by helping to select the best therapy based on the unique biology of the cancer and of the patient**,** evaluate: how the cancer responds to treatment and distinguish changes due to radiation therapy from a cancer recurrence, which can be difficult to determine with CT alone, manage ongoing care: through early detection of cancer recurrences[6,7,8].

Traditionally, imaging modalities such as CT and PET have been applied sequentially in the diagnosis and staging of disease and in monitoring the effects of therapy. Indeed, in many cases anatomic imaging is used exclusively, although functional imaging with PET is fulfilling an increasingly important role in the staging and therapy monitoring processes, particularly when the CT scan is equivocal[9-11]. Visual fusion of the anatomic and functional image sets has often been considered sufficient to extract additional information, particularly with the perception that only a small fraction of PET studies benefits from access to corresponding CT scans. In cases in which more accurate localization is required, software fusion can be used to align the two sets of images.

This situation changed dramatically with the recent introduction of the combined PET/CT scanner, an approach that solves the fusion problem through hardware rather than software. Such a device provides a medical imaging department with the capability to acquire accurately aligned anatomic and functional images for a patient from a single scanning session[12-14]. Additionally, since the patient remains positioned on the same bed for both imaging modalities, temporal and spatial differences between the two sets of images are minimized.

The advantages of PET scanning are the most significant advance in the staging of head and neck cancers in recent years. It is a powerful tool for diagnosing and determining the stage of many types of head and neck cancers. It scans prompt changes in the treatment of more than one-third of patients registered in the National Oncologic PET Registry (NOPR)[15]. The National Comprehensive Cancer Network (NCCN) has incorporated PET-CT into the practice guidelines for most malignancies. By detecting whether lesions are benign or malignant, PET scans may eliminate the need for surgical biopsy or, if biopsy is necessary, identify the optimal biopsy location. PET scans help physicians choose the most appropriate treatment plan and assess whether chemotherapy or other treatments are working as intended. This scan is currently the most effective means of detecting a recurrence of cancer.

In addition to increasing our understanding of the underlying causes of disease, molecular imaging is improving the way disease is detected and treated[16]. Molecular imaging technologies are also playing an important role in the development of: screening tools, by providing a non-invasive and highly accurate way to assess at-risk populations, new and more effective drugs, by helping researchers quickly understand and assess new drug therapies,

personalized medicine, in which medical treatment is based on a patient's unique genetic profile

Since the introduction of the first PET/CT prototype in 1998, a number of different designs have been offered by the major vendors of medical imaging equipment. All designs comprise a CT scanner placed in tandem with a PET scanner with little or no mechanical integration of the two modalities[17]. A common patient couch, however, enables combined PET/CT imaging to be performed with an axial translation of the bed. Since patient movement is minimal and the CT and PET scans are acquired within a short time span, accurate alignment of the two image sets is automatic. Even though combined PET/CT scanners have been in clinical operation for less than 3 years, they have already evolved through several generations with performance enhancements in both CT and PET components. The principal features of current PET/CT scanners will be reviewed, and the strengths and weaknesses of the different aspects emphasized. Particular consideration will be given to a discussion of CT-based attenuation correction. From the rapid progress seen in the past 3 years, it is evident that PET/CT technology will continue to evolve in the future[17].

The presence of pulmonary metastases upstages a patient from M0 to M1 and alters the treatment regimen[2]. Routine imaging work-up for the patient with pulmonary squamous cell carcinoma includes conventional radiography of the chest at most institutions. Chest CT is performed in patients with advanced stage disease. A solitary nodule on CT scan may represent a metastasis or a granuloma. The presence of pulmonary metastases upstages a patient from M0 to M1 and alters the treatment regimen[17,18] . Routine imaging work-up for the patient with pulmonary squamous cell carcinoma includes conventional radiography of the chest at most institutions.

In the future, molecular imaging will include an increased use of: fusion or hybrid imaging, in which two imaging technologies are combined to produce one image, optical imaging, new probes for imaging critical cancer processes, reporter-probe pairs that will facilitate molecular-genetic imaging, PET-CT to help administer more targeted radiation treatments

CONCLUSION:

Though incidence of distant metastasis is less than 10 % in head and neck cancers, sometimes the clinician fail to identify the distant metastasis due to non-availability of PET-CT scan equipment or due its financial cost when the patient is not affordable. But appropriate steps must be taken based on the clinical symptoms of the patients which must not be ignore by the surgeon and PET-CT scan needs to be done which can change the whole treatment management of the patient.

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