PET Scan in Head and Neck Tumours in a Developing Country Like India: Is It a Must?

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Received: 26 September 2013 / Accepted: 14 November 2013 / Published online: 28 November 2013
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Abstract To study the impact of Positron emission tomography (PET) and its incremental value in diagnosing an unknown primary tumour with secondaries in the head and neck; recurrent head and neck cancers (confirmation of suspected recurrences and re-staging); and staging of head and neck tumours. This was a prospective observational study where 60 patients of head and neck tumours under the clinical settings as described above were evaluated. Thorough clinical examination and necessary radiological and histopathological investigations were done. All patients underwent a PET scan, the results of which were correlated with histopathological examination. Sensitivities, specificities, positive and negative predictive values, false positives and false negatives of PET scan in the different indications were calculated. The study included 11 patients of unknown primary, 28 patients with suspected recurrent tumours and 21 patients where PET scan was

done for initial staging. PETCT scan was able to detect the primary in 3 out of 11 patients (27.27 %) who presented with cervical metastases with an unknown primary. In 2 of the 8 patients where a primary tumour was not found, PETCT detected distant metastases. For recurrent tumours, PETCT scan showed sensitivity, specificity, positive predictive value and negative predictive value as 100, 72.72, 85 and 100 % respectively. In restaging of recurrent disease, 4 out of 28 patients were detected to have distant metastases. In 7 cases of locoregionally advanced tumors, where PETCT scan was used for pre-treatment staging, it detected distant metastases in 4 of 7 patients. In the patients with N0 neck status PETCT scan showed a sensitivity, specificity, positive predictive value and negative predictive value of 100, 66.67, 50 and 100 % respectively. PETCT scan was able to alter the plan of management in 15 out of 60 patients. Thus, in carefully selected patients PETCT scan can provide incremental information that proves invaluable in these circumstances even in a developing country like India. In all the settings, PETCT scan demonstrated a very high negative predictive value. Hence, negative PETCT scan could be interpreted as absence of disease with reasonable assurance.

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Keywords PETCT scan · Unknown primary tumour · Recurrent head and neck tumour

Introduction

Cancers of the head and neck are the third most common cancers in India and the second most common in males [1]. Imaging has played an important role in head and neck cancer diagnosis and management.

A new development in integrated modalities incorporating morphological and functional imaging is in the form of Positron emission tomography (PETCT) scan. This has contributed significantly and brought about a paradigm shift in the past few years and pioneered the search for newer horizons in the management of head and neck malignancies. This modality has been subjected to critical evaluation both regarding its utility and cost effectiveness. However, there is increasing evidence of utility of Fluoro-deoxy-glucose (FDG)-PETCT technology. The new practice of PETCT–CT integrates anatomical and more uniquely functional imaging within a single modality [2].

The role of PETCT scan is being increasingly realized for unknown primary tumours [3], recurrent tumours [4], and as a staging modality [5].

The aim of this study is to evaluate the utility of PETCT scan in this select group of patients where the addition of PETCT scan is expected to add vital information that could impact on their further management.

In a country like India, where resources are scarce and insurance cover is meagre [7], most patients have to pay “out of their pockets for their healthcare needs” [8]. Thus, it is of utmost importance to use this investigation judiciously. We hope that the results of this study will serve in re-enforcing our present knowledge and provide us with new guidelines in the apt usage of PETCT scans for patients suffering from head and neck malignancies.

Aims and Objectives

To study the impact of PETCT scan and its incremental value in diagnosing an unknown primary tumour with secondaries in the head and neck; recurrent head and neck cancers (confirmation of suspected recurrences and restaging); and staging of head and neck tumours.

Methodology

This was a prospective observational study of 60 patients conducted during the period 2009–2012.

The inclusion criteria included FNAC or Biopsy proven cases of Head and Neck Cancers in the following four disease settings:

- Patients presenting with neck metastasis with no evidence of primary lesion on thorough clinical examination and panendoscopy.
- Patients with clinically suspected recurrent head and neck malignancies.
- Patients with locally advanced/or undifferentiated head and neck malignancies.

- Patients with node negative head and neck cancers.

Patients with uncontrolled diabetes mellitus and those with evidence of active infection at the site to be investigated were excluded.

Pertinent history taking and thorough clinical examination was carried out for these patients. TNM staging was used to stage these tumours. All patients underwent relevant investigations including necessary imaging (USG or CT or MRI), biopsy and/or FNAC, and panendoscopy where merited. All patients underwent a PETCT scan.

The results of PETCT scan were then correlated with histopathological examination of the fine needle aspirate, biopsy or specimen as appropriate.

Incidence and relative frequency of various outcomes/parameters under study were expressed as percentages or proportions. Sensitivities, specificities, positive predictive values, negative predictive values, false positives and false negatives of PETCT scan in the different indications were calculated.

Results

Unknown Primary Tumours

Out of the 11 patients who presented with neck nodal metastases with the primary being unknown, PETCT scan was able to identify the site of primary in 3 patients. Two of these tumours were found to be in the nasopharynx and 1 patient had primary tumour in the tonsil (Fig. 1). Out of the 8 patients where a primary could not be found, 2 patients showed distant metastases on PETCT scan.

Suspected Recurrent Tumours

For this indication, PETCT scan demonstrated a sensitivity, specificity, positive predictive value and negative predictive value as 100, 72.72, 85 and 100 % respectively (Table 1).

In restaging of recurrent disease, 4 out of 28 patients were detected to have distant metastases (Fig. 2).

PETCT Scan for Staging Advanced Disease

PETCT scans were done in the pre-treatment scenario to stage advanced disease to rule out/detect regional and distant metastases before formulating the treatment plan. These patients included 2 patients with undifferentiated thyroid cancers and 5 patients with locally advanced head and neck malignancies. PETCT scan demonstrated evidence of distant metastases in 4 out of these 7 patients.

Fig. 1 Detection of unknown primary tumour in the tonsil on PETCT scan

Table 1 PET scan in clinically suspected recurrences

	Histopathology positive	Histopathology negative	Total no. of patients
PET positive	17	3	20
PET negative	0	8	8

PETCT Scan in N0 Neck

Eight patients with proven head and neck malignancy with no nodal metastases underwent a pre-treatment PETCT scan to detect neck nodes and the results were compared with post-op histopathology examination. The sensitivity, specificity, positive predictive value and negative

predictive value of PETCT scan in staging cervical nodal disease in clinically N0 neck node status patients was found to be 100, 66.67, 50 and 100 % respectively.

PETCT in Lymphoma

PETCT scan was also advised in 6 patients who had presented to with cervical lymph nodes where the FNAC suggested lymphoma. An excision biopsy for histopathology and immunohistochemistry was then performed for confirmation. Four patients were found to have Non-Hodgkin's lymphoma whereas 2 were diagnosed with Hodgkin's disease. The role of PETCT scan was paramount in this condition as it provided a one-time whole body imaging. The findings of the PETCT scan and the

results of bone marrow biopsies were then used as a guide to plan treatment. Four patients belonged to stage III and 2 patients to stage II. All patients received chemotherapy under the guidance of a medical oncologist. PETCT scans were also done in the follow-up period to assess response to treatment. 4 patients (2 patients with Hodgkin's disease and 2 patients with Non-Hodgkin's lymphoma) showed excellent response to therapy with no evidence of residual tumour after 12 weeks of treatment completion. Two patients however were lost to follow up.

Discussion

PETCT scan, on account of its functional quality, is able to detect increased metabolic activity of the malignant tissue. This unique quality confers on PETCT scan the utility of providing crucial information over and above routine examination and investigations. It has therefore shown to alter and guide the management plan in patients of head and neck malignancies [6].

In the present study, for unknown primary with neck nodes, PETCT yielded a pick-up of the primary in 3 of 11 cases (27.27 %). This result is in keeping with the results of meta-analysis for this indication [3]. Further, the identification of distant metastases in 2 of the 8 cases where the primary wasn't detected drastically changed their management plan from a neck dissection and post-op adjuvant radiotherapy to a palliative approach in the light of the distant metastases.

PETCT scans are increasingly being used for the confirmation of suspected recurrences. When evaluated for this purpose, PETCT scan in the present study yielded a very high sensitivity and negative predictive value.

Fig. 2 Detection of distant metastases on PET scan in recurrent head and neck tumours

Fig. 3 Alteration in management plan or patients based on PETCT findings

The role of PETCT scan in the initial evaluation of locoregionally advanced head and neck cancers is well established [9]. The purpose of PETCT in this scenario is to identify occult synchronous distant metastases. We found PETCT diagnosed distant metastases at initial evaluation in 4 out of 7 cases of locoregionally advanced head neck cancers. This helped in changing the intent of treatment from a curative to palliative one.

In our study, PETCT scan was able to alter the plan of management in 15 out of 60 patients (Fig. 3) (3 patients of unknown primary tumours where a primary tumour was found, distant metastases in 6 patients at pre-treatment staging and 4 patients at re-staging warranting palliative care, and 2 patients where PETCT scan directed biopsies confirmed recurrent disease). This incremental benefit offered by PETCT is instrumental in clinical decision making and leads to change in management strategy. This has been highlighted by other authors too [6].

In all the settings, PETCT scan demonstrated a very high negative predictive value. Hence, negative PETCT scan could be interpreted as absence of disease with reasonable assurance.

For patients with N0 neck, we found a low specificity and high false positive rates for PETCT scan. This precludes the routine use of PETCT scan for this indication, a view which is supported by other authors [10].

Conclusion

In a developing country like India, PETCT scan has several limitations in routine practice like cost, availability, technical expertise, etc. These limitations hold particularly true to low volume centres. Therefore, the application of this

investigation should be reserved for carefully selected patients. We sought to confirm the utility of PETCT in described clinical scenarios. PETCT was found to be useful and offered incremental information in the settings of unknown primary, suspected recurrences, and the initial evaluation of locoregionally advanced disease. The usefulness of PETCT scan in such carefully selected patients provides information over and above routine investigations that guides the treatment plan. Thus, PETCT scan proves invaluable in these circumstances even in a developing country like India.

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