PET-CT Imaging In Non-Small Cell Lung Carcinoma – A Review of Cases from A Northern Malaysia Referral Centre

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Background: Positron Emission Tomography and Computed Tomography (PET-CT) imaging is shown to influence a decision change in managing non-small cell lung carcinoma (NSCLC). The introduction of such a facility in Malaysia is relatively recent, and its impact from its utility is currently being assessed.

Aim: In a tertiary referral centre possessing the only PET-CT facility in northern Peninsular Malaysia, we evaluated the potential roles of PET-CT in referred patients with non-small cell lung carcinoma.

Methodology: Sixty eligible adult cases with NSCLC, between September 2005 and December 2007, were retrospectively reviewed. Relevant data was collected using standard questionnaire for indications, staging of disease, and outcomes in terms of recurrence and response to prescribed cancer-specific therapy.

Results: The indications for PET-CT were: staging of a newly diagnosed non-small cell lung carcinoma (25.0%); post-operative restaging (21.7%); exclusion of recurrence or metastasis (18.3%); establishing diagnosis of carcinoma (13.3%); assessment of response to treatment (11.7%), and for surveillance (10.0%). The use of PET-CT was shown to induce a change in the staging, compared with non-PET conventional means in 69.2% of patients with newly diagnosed lung carcinoma (upstaged in 55.5%; downstaged in 44.5%) and in 65.0% of patients who underwent cancer-specific treatments (upstaged in 38.5%; downstaged in 61.5%). PET-CT detected recurrence in 62.5% who underwent the imaging to exclude a recurrence or metastasis.

Conclusion: PET-CT has affected the staging of a large proportion of our local Malaysian patients. Like elsewhere, the availability of such a facility is likely to have important influence in overall management of NSCLC in Malaysia.

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Background

Lung carcinoma is the most common cancer and the leading cause of cancer-related mortality among men. Tumour staging is the most important prognostic factor as well as the determining factor in deciding the most appropriate treatment modality. It has been well established that the FDG-labelled positron emission tomography (FDG-PET) imaging is a useful tool in both the staging and management of lung carcinoma, particularly non-small cell lung carcinoma (NSCLC), and better diagnostic validity than CT imaging alone.[1,2,3] More recently, PET-CT imaging is shown to have a superior diagnostic value than the CT or FDG-PET imaging alone in that it is more sensitive and specific, particularly in detecting tumor involvement in the mediastinal and hilar lymph nodes as it provides a precise localisation of hypermetabolic lesions.[4] By permitting fusion of anatomic and functional information, the PET-CT imaging can similarly provides a more accurate staging of many cancers, thus enabling a better decision in the management of the disease.[5]

While the evidence for PET-CT imaging in influencing a change in the decision on clinical staging or the management of NSCLC is still being gathered[6], the PET-CT imaging have only been recently made available in Malaysia with services accessible only in four health centres in the whole of Malaysia including two government hospitals. One of these government hospital is in Penang Hospital and represents the sole available centre in northern peninsular Malaysia, The utility as well as its present role in the area of non-small cell lung carcinoma, however, is still unclear in this part of the world due to its relatively recent introduction. The objectives of this current study, thus, are to evaluate the indications of the use of PET-CT and its role in influencing the staging and management of non-small cell carcinoma in the local setting of northern Peninsular Malaysia.

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Patients and Methods

From 14 September 2005 to 4 December 2007, sixty adult cases of non-small cell lung carcinoma, who had undergone PET-CT imaging at the Penang Hospital, the only regional tertiary centre in Northern Malaysia where PET-CT is currently available, were retrospectively reviewed. Data were collected using standard questionnaires, based on PET-CT request forms submitted to the Nuclear Medicine Department. Included were patients with confirmed primary non-small cell lung carcinoma either by suspicion of non-small cell lung carcinoma on chest X-ray by a chest physician, followed by a contrast-enhanced chest CT scan, a fibreoptic bronchoscopy with biopsy or any other biopsy procedures.

The indications of the use of PET-CT imaging were assessed, while the staging of newly-diagnosed lung carcinoma based on PET-CT imaging was compared to that of conventional imaging. The role of PET-CT in post-treatment restaging, exclusion of recurrence as well as assessment of response towards treatment were also evaluated.

Results

The mean age of studied cohort was 61 yrs (range: 34 to 77 yrs), consisting mostly of male (68.3%). The majority were Chinese (68.3%), followed equally by Malays and Indians (11.7% each).

The majority of the indications for PET-CT were for staging of a newly-diagnosed NSCLC (25.0%), followed by post-operative restaging (21.7%), and to exclude recurrence or metastasis (18.3%). A smaller proportion of patients underwent PET-CT for the purposes of diagnosis of non-small cell lung carcinoma (13.3%), to assess response towards treatment (11.7%), and for surveillance (10.0%) [Figure 1].

Out of a total of 60 patients however, only 33 of these patients were suitable for further evaluation, due to limitations such as incomplete data, unavailable information on previous conventional imaging and inconclusive findings on PET-CT imaging. These patients were indicated for the purpose of post-operative restaging, to rule out recurrence or metastasis, to assess response towards treatment and for surveillance. For analysis on influence on cancer staging, they were all grouped as patients who were newly diagnosed or folowing cancer-specific treatment.

Among the 13 patients who were newly-diagnosed with lung carcinoma, PET-CT was found to induce a change in the staging of 69.2% of these patients: five patients were upstaged (55.5%) and 4 patients were downstaged (44.5%). Among the 20 patients assessed following cancer-specific treatment, PET-CT was shown to induce a change in staging of 65% of these patients: five patients were upstaged (38.5%) and eight patients were downstaged (61.5%) [Figure 2].

In eight patients who underwent PET-CT to exclude a recurrence of metastasis, 5 patients (62.5%) had recurrence detected. In four patients assessed by response to treatment, 2 patients responded while another two did not by PET-CT criteria.

Discussion

This study has demonstrated that the PET-CT imaging, not unlike the FDG-PET, has induced a change in the staging of a significant proportion of patients, in both newly-diagnosed cases of non-small cell lung carcinoma and in the post-treatment restaging of those who had undergone treatment. It thus has an immense potential of influence in the management decision of the physician for the patient, whether an intermodality or intramodality change, or even in the urgency of the treatment. PET-CT has also detected recurrence in a considerable proportion of patients, thus prompting an urgent need for further intervention or management.

Interestingly, our findings show that a significant proportion of cases go either direction, i.e. downstage or upstage, whether in those who newly diagnosed carcinoma or following cancer-specific treatment. Particularly so is the surprising high proportion of newly diagnosed cases who were actually downgraded following PET-CT imaging compared to conventional means of staging. This could indicate good news to

many who might otherwise not provided the opportunity for the appropriate cancer-specific therapy. In our findings of post-treatment cases, accuracy of staging will represent cost-saving in terms of avoiding unnecessary spending of expensive cancer-specific therapy in progressive or refractory disease. In a recently published findings from the US national PET registry of over 22000 all-cancer cases[7], the utility of PET/CT had reduced decision to watching in 37% and induced treatment in 48% of the cases, and following CT/PET, there was a three-fold likelihood of treatment than nontreatment. Overall, physicians changed their intended management in 36.5% of cases after PET. Our figures on NSCLC therefore may seem not overtly unreal.

The degree of validity of this study is however compromised by several limitations, one of which is the inadequate sample size that is a major consideration. There were also incomplete data, unavailable information on previous conventional imaging and inconclusive findings on PET-CT imaging that disallow us to follow on from the initial 60 recruited cases. Despite all these, we believe the accuracy of our collected data has been achieved and therefore our findings provide genuine reflection for the role of PET-CT imaging in the overall management of NSCLC.

To our knowledge, ours is the first ever published case series review in Malaysia to date and provides preliminary data for benchmarking with other centres and justification for further such facility in Malaysia. Clinical oncology is a rapidly progressing specialty and PET-CT imaging is quickly becoming a routine investigation in management of NSCLC and non-NSCLC cancer today in view of the frequency of its use in some centres in the world.[8,9] Larger number of case series conducted on local Malaysian patients will be needed to validate our preliminary findings and promote its wider use when its benefits become obvious.

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Figure 1: Proportion of patients (n=60) for the various indications for PET-CT imaging

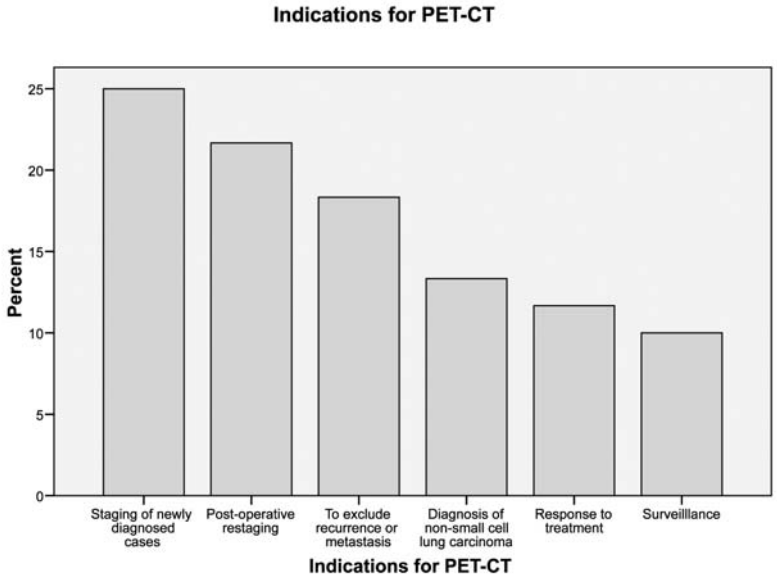

Figure 2: Proportion of cases of non-small cell lung carcinoma in which staging was unchanged, upstaged or downstaged among those who underwent PET-CT imaging for staging of newly-diagnosed cases (n = 13) or for post-treatment restaging (n = 22).