

Follow up results of a prospective study to evaluate the impact of FDG-PET on CT-based radiotherapy treatment planning for oesophageal cancer



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ABSTRACT

Background: This prospective study aims to determine the impact of PET/CT on radiotherapy planning and outcomes in patients with oesophageal cancer.

Methods: All patients underwent PET/CT scanning in the radiotherapy treatment position, and received treatment planned using the PET/CT dataset. GTV was defined separately on PET/CT (GTV-PET) and CT (GTV-CT) datasets. A corresponding PTV was generated for each patient. Volumetric and spatial analysis quantified the proportion of FDG-avid disease not included in CT-based volumes. Clinical data was collected to determine locoregional control and overall survival rates.

Results: 13 (24.1%) of 57 accrued patients had metastatic disease detected on PET. Median follow up was 4 years. FDG-avid disease would have been excluded from GTV-CT in 29 of 38 patients (76%). In 5 patients, FDG-avid disease would have been completely excluded from the PTV-CT. GTV-CT underestimated the cranial and caudal extent of FDG-avid tumour in 14 (36%) and 10 (26%) patients. 4-Year overall survival and locoregional failure free survival were 37% and 65%.

Conclusions: PET/CT altered the delineation of tumour volumes when compared to CT alone, and should be considered standard for treatment planning. Although clinical outcomes were not improved with PET/CT planning, it did allow the use of smaller radiotherapy volumes.

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Introduction

Oesophageal cancer is often treated with radiotherapy (RT), both in the radical and palliative settings. Accurate localisation of the tumour is imperative to ensure optimal radiation field design and avoid geographic miss. Currently there is no universally accepted method to accurately define the cranial and caudal limits of the primary oesophageal tumour when delineating the gross

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tumour volume (GTV) for radiotherapy planning. Oesophagography was once routinely used to determine the cranial and caudal extent of the tumour; however it does not define the radial extent of disease [1]. With computed tomography (CT) planning, it is possible to better define the radial extent of the primary tumour but it is less accurate in defining the cranial and caudal extent of the tumour than oesophagography [2]. Furthermore, oesophagography provides no assessment of regional nodal status, while the sensitivity of CT imaging for detecting lymph node involvement is low compared to surgical pathology [3,4].

The role and potential value of positron emission tomography (PET) scanning in certain tumours, including oesophageal cancer, has been widely investigated in recent years [5–14]. Most of these

studies have investigated the role of PET in cancer staging, evaluating treatment response, monitoring disease status and estimating prognosis. Our study aims to evaluate the contribution of PET/CT imaging in radiotherapy treatment planning and its impact on outcomes. In 2006 we reported preliminary results of the first 16 patients recruited to the study, which demonstrated that FDG-avid disease was excluded from the GTV in 11 of 16 patients (69%) when the GTV was based on CT alone [15]. Modifications based on PET were mainly seen in the longitudinal direction in keeping with the known limitations of soft tissue definition on CT imaging alone. In this article, we report final results for the full cohort of patients who completed the study protocol. In addition to evaluating the contribution of PET/CT to radiotherapy treatment planning, we also determined treatment outcomes for patients treated according to PET/CT planning.

Materials and methods

Study participants

From June 2003–May 2008, patients with localised oesophageal cancer suitable for definitive chemoradiotherapy were recruited, following ethics approval from the Peter MacCallum Cancer Centre Human Research and Ethics Committee. Exclusion criteria were metastatic disease detected on conventional imaging or clinically, significant comorbidities that might be exacerbated by or impacting the planned delivery of chemotherapy and/or radiotherapy. All patients were discussed at the institutional multidisciplinary meeting and were considered suitable for definitive radiotherapy. Informed consent was obtained from all participants in this study.

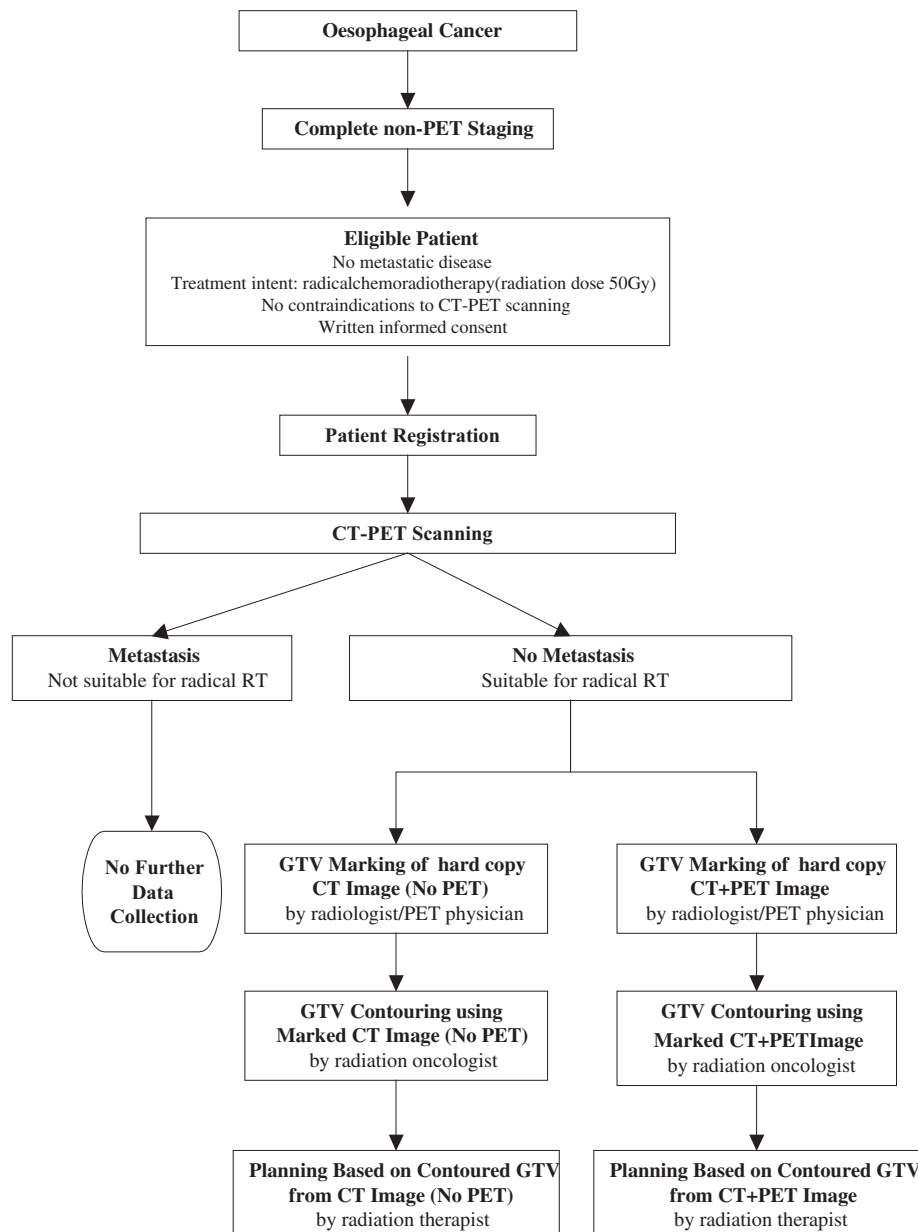


Fig. 1. Study schema.

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