PET/CT versus CECT in diagnosis and staging of lymphoma

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List of Abbreviations

Abbreviation	
PET	Positron emission tomography
ENL	Extra-nodal lymphoma
FDG	Flouro-deoxyglucose
CECT	Contrast enhanced computed tomography
GLUTs	Glucose transporters
PDGF	Platelet derived growth factor
VEGF	Vascular endothelial growth factor
BFGF	Basic fibroblast growth factor
SUV	Standardized uptake value
BAT	Brown adipose tissue
ROIs	Regions of interest
IASLC	International Association for the Study of Lung Cancer
WHO	World Health Organization
DLBCL	Diffuse large B-cell lymphoma
NHL	Non Hodgkin lymphoma
FL	Follicular lymphoma
MALT	Mucosa associated lymphoid tissue
MCL	Mantle cell lymphoma
HD	Hodgkin Disease
HL	Hodgkin lymphoma
TNM	Tumor Node Metastasis
NK	Natural killer
Mev	Milli electron volt
Kev	Kilo electron volt
HU	Housefield unit
mci	millicurie
MZL	Marginal zone lymphoma
IFRT	Involved field radiotherapy
μ map	attenuation map

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Introduction

Lymphoma comprises a histologically heterogeneous group of cancers derived from the cells of the immune system. The hallmark of the disease is the enlargement and proliferation of lymph nodes or secondary lymphoid tissues. Although rare, both NHL and Hodgkin disease may arise from or involve almost any organ of the human body. **(Paes et al, 2010).**

Lymphoma is generally divided into two groups: Hodgkin's disease (HD) and an inhomogeneous group of conditions called non-Hodgkin's lymphoma (NHL). HD tends to involve a single nodal group and spread in a fixed pattern along the lymphatic chain, with infrequent extra lymph node involvement. NHL is a multifocal disease which often presents late with disseminated extranodal spread **(Drake et al, 2007)**

The extra nodal involvements are compromising in approximately 40% of patients. The term extra-nodal involvement refers to lymphomatous infiltration of anatomic sites other than the lymph nodes. **(Paes et al, 2010).**

It is due to regional spread of nodal disease or hematogenous dissemination. In decreasing order of frequency, the spleen, liver, gastrointestinal tract, pancreas, abdominal wall, genitourinary tract, Waldeyer ring, central nervous system, lung, bone, skin, adrenal, peritoneal cavity and biliary tract are involved **(Lee et al, 2008).**

Differentiation between disseminated lymph nodal disease involving an extranodal site and primary extranodal disease is challenging. Primary extranodal disease usually presents at an early stage; up to 74% in stage II. **(Paes et al, 2010).**

Lymphomas are very sensitive to chemotherapy and radiotherapy. Recent developments in treatment have improved the outcome markedly and are cost-effective. Most patients with Hodgkin's disease (HD) or non-Hodgkin's lymphoma (NHL) can be treated successfully with curative intent. **(Strobel et al, 2007).**

Accurate staging is critical for identifying patients with early-stage (stage I or II) lymphoma, which is treated with involved-field radiation therapy. PET/CT may be of particular value prior to therapy in patients with early-stage lymphoma. Chemotherapy is performed in patients with more advanced stage disease (stage III or IV) **(Okada et al, 2010).**

Thus accurate staging is the basis for the selection of an appropriate therapeutic approach, in order to prevent over or under treatment as well as to minimize morbidity related to the radio-chemotherapy regimens given **(Barrington et al, 2014).**

CT has been the main imaging technique used for the staging and follow-up of lymphoma. The fact that CT assessment of disease is based on anatomic criteria of size and shape and on abnormal contrast enhancement implies limitations in the depiction of pathologic changes in normal-sized lymph nodes and in the assessment of extranodal disease **(Rodrı´guez-Vigil et al., 2006).**

In the last decade, Imaging of tumor metabolism with (FDG-PET) has facilitated the identification of affected nodal and extra-nodal sites, even when CT has demonstrated no lesions. It also plays a role for more correct staging prior to treatment and post treatment follow-up. **(Paes et al, 2010)**

However, detection depends not only on tumor size but also on the degree of FDG avidity, tumor-to-background ratio and effect of motion. A smaller than 1 cm lesion can be detected when conditions are favourable **(Groheux et al., 2013).**

In PET-CT systems the CT portion provides the anatomic information useful for accurate interpretation of PET signal. It also provides a map used for attenuation correction of PET images **(Groheux et al., 2013)**.

Therefore PET-CT systems have replaced PET alone in most nuclear medicine departments. The performance of FDG PET-CT is better than the performance of FDG PET alone in oncology; however the added value might differ according to the clinical situation **(Groheux et al., 2013).**

Basic knowledge of the mechanism of cancer imaging with FDG PET-CT is essential for accurate interpretation of PET-CT images **(Kobayashi et al., 2012).**