Hybrid PET/MRI for Evaluation of Nodal Disease in Lymphoma

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Target Audience: Radiologists and physicists interested in hybrid PET/MR imaging or oncologic imaging.

Introduction: Non Hodgkin Lymphoma (NHL) is a common hematologic malignancy accounting for 4% all cancers in United States. It is estimated that nearly 70,000 patients will be diagnosed with NHL in 2013, and 19,000 will die from this disease. 18-F FDG PET combined with anatomic CT imaging has been shown to be superior to contrast enhanced CT examination in staging of lymphoma[1]. Thus PET/CT is routinely performed for initial staging of lymphoma. MR imaging with inclusion of diffusion weighted imaging has also shown considerable promise in evaluation of patients with lymphoma[2]. On morphologic MR imaging, abnormal nodes are identified on the basis of size alone whereas PET identifies abnormal nodes on the basis of FDG uptake. With introduction of integrated PET/MR system simultaneous PET and MR imaging can be performed[3] thus providing a unique opportunity to compare diffusion and PET independently and together for assessment of disease burden. Therefore the **purpose of this study** was to compare accuracy of morphologic MR imaging including diffusion weighted imaging (DWI-MR) to simultaneously acquired PET and radial T1-weighted free-breathing acquisition (PET/MR) for detection of nodal disease in lymphoma patients with PET/CT as a reference.

Materials and Methods: In this prospective study 28 consecutive patient (18M, 10F, mean age 53.6 years) undergoing clinically indicated PET/CT were subsequently imaged with hybrid PET/MR using residual FDG activity. A reader evaluated the MR sequences including DWI (DWI-MR) for the nodal disease with nodal classification as previously described[4]. Any nodal group with lymph node larger than 1 cm in size was considered involved with lymphoma. PET/MR and PET/CT were independently interpreted one month apart by another reader and any node demonstrating FDG avidity above background was considered involved with lymphoma. Each positive nodal station was marked and compared between DWI-MR, PET/MR and PET/CT. PET/MR and PET/CT SUVmax were compared in the FDG avid lesions. In addition ADC values and SUVmax values were also compared for FDG avid nodal groups.

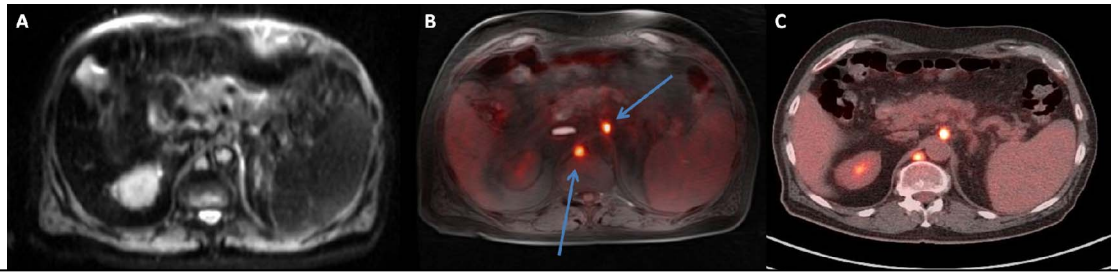

Figure 1: Left paraaortic and right retrocrural nodes (arrows) are sub-centimeter in size and were considered normal based on morphologic size criteria on (A) DWI. However, these nodes were FDG avid (thus involved with lymphoma) and were seen with (B) PET/MR and (C) PET/CT.

Results: 68 abnormal nodal stations were identified on PET/CT, 61 on PET/MR with sensitvity of 90%. DWI-MR identified only 37 stations with sensitivity of 54%. SUVmax measured on PET/MR and PET/CT demonstrated excellent statistically significant correlation ($r = 0.98$, $p < 0.001$) (**Figure 2**). There was a poor negative correlation between ADC and SUVmax ($r = -0.036$, $p = 0.847$).

Conclusion: PET/MR has higher sensitivity compared to DW-MRI in detecting FDG avid nodal disease in lymphoma with excellent correlation in SUVmax between PET/CT and PET/MR. PET/MR maybe a viable alternative to PET/CT in evaluation of lymphoma patients. Furthermore SUVmax and ADC demonstrate poor correlation and thus may provide complimentary information about the tumor biology.

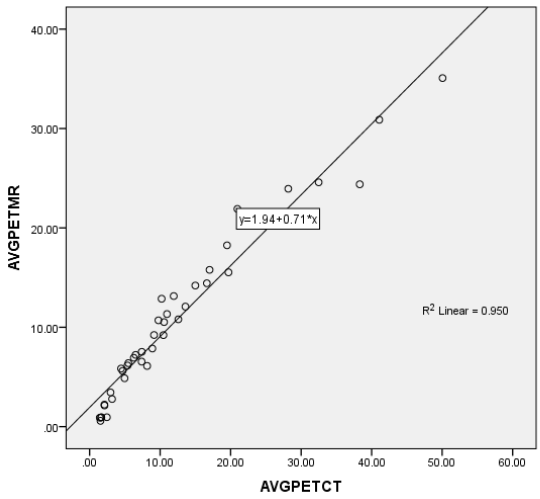

Figure 2: There was excellent correlation between SUVmax measured on PET/MR and PET/CT

References: (1). Cronin CG et al. AJR Am J Roentgenol, 2010. (2). Van Ufford HM et al.AJR Am J Roentgenol, 2011. (3). Punwani S. et al. Eur J Nucl Med Mol Imaging, 2013. (4). Lin C et al. Eur Radiol, 2010.