

Severity and type of lymphoma are associated with aortic 18-fluorodeoxyglucose (FDG) positron emission tomographic uptake assessed by FDG PET/CT imaging

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Introduction: There is increasing evidence that metabolic disease burden in lymphoma influence patients' outcome. However, the impact of disease severity on cardiovascular system remains unknown.

Purpose: To assess whether lymphoma is associated with arterial inflammation by examining the relationship between disease metabolic burden and arterial fluorodeoxyglucose (FDG) uptake.

Methods: Sixty-two patients (43 male, mean age 58±18 years) with Hodgkin (n=29) or non-Hodgkin lymphoma (n=33) before chemotherapy and two separate control groups of 14 and 16 healthy individuals for Hodgkin and non-Hodgkin population respectively, with similar age, sex and cardiovascular risk factors, underwent FDG positron emission tomography (FDG-PET/CT) imaging. Disease severity was quantified by metabolic tumor volume (MTV) and total lesion glycolysis (TLG) corresponding to standard uptake values (SUV) $\geq 41\%$ or ≥ 2.5 of maximum SUV within lymphoma regions, and aortic FDG uptake by target-to-background ratio (TBR). Serum high sensitivity-C-reactive protein (hs-CRP), white blood

count (WBC), ratio of neutrophils to lymphocytes (N/L), albumin and lactic acid dehydrogenase (LDH) values were measured for patient group.

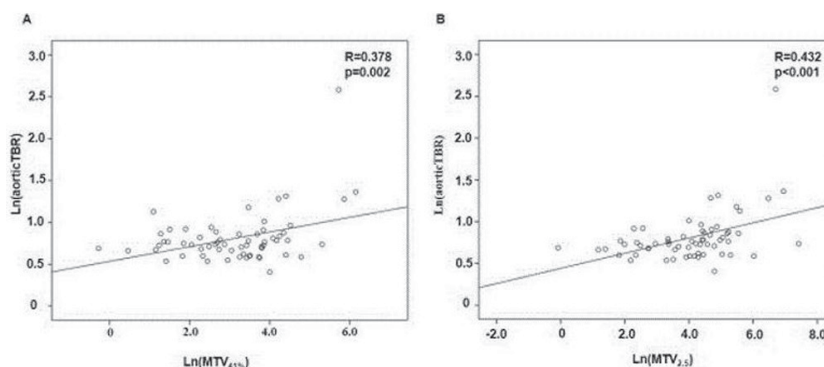
Results: MTV and TLG measurements correlated significantly with hs-CRP, WBC, N/L ratio, albumin and LDH table 1. Patients with non-Hodgkin or Hodgkin lymphoma had increased aortic TBR compared to controls ($p=0.001$ and $p=0.023$, respectively). Aortic TBR was higher in patients with stage III-IV disease compared to those with stage I-I ($p=0.046$). There were significant associations between aortic FDG uptake and MTV values, which remained significant after adjustment for confounders ($\beta=0.353$, $p=0.001$, adjusted $R^2=0.318$ for MTV_{41%}, $\beta=0.442$, $p=0.001$, adjusted $R^2=0.269$ for MTV_{2.5}), Figure 1.

Conclusions: Aortic wall FDG uptake is related with disease severity indicating a vascular effect of lymphoma, as well as a new potential role of molecular imaging in cardio-oncology for evaluating disease severity and its consequences to vascular beds with a single examination.

Table 1. Pearson correlation between disease burden indices and serum biomarkers

PET derived measurements	Hs-CRP	P-value	Neutrophils to lymphocytes ratio	P-value
MTV _{41%}	0.306	0.016	0.317	0.026
MTV _{2.5}	0.312	0.013	0.389	0.006
	Albumin	P-value	LDH	P-value
MTV _{41%}	-0.281	0.044	0.465	<0.001
MTV _{2.5}	-0.419	0.002	0.616	<0.001

PET: Positron Emission Tomography; Hs-CRP: High-sensitivity C-reactive protein; LDH: lactic acid dehydrogenase; MTV: metabolic tumor volume.



Scatterplots of the aortic target to background ratio (TBR) and Metabolic Tumor Volume $\geq 41\%$ (MTV_{41%}) and ≥ 2.5 (MTV_{2.5}) of the maximum SUV (A and B, respectively).

Figure 1