Purpose:To investigate the use of non linear dimensionality reduction (NLDR) techniques for integration, segmentation and quantification of multiparametric whole body (WB) radiological imaging methods.

Methods:Twenty subjects were prospectively scanned with WB-MRI and PET/CT, ten patients(age:61±12) and ten normal subjects(age:48±11). WB-MRI of T2WI, T1-STIR and DWI were acquired at 3T. PET/CT using 18FDG or other advanced radiotracers, 11C-acetate, 11C-choline and Na18F was obtained on patients. If present, metastatic disease was confirmed by clinical standards. Whole body trace ADC maps, T1 and T2 were constructed for quantitative analysis and ROIs were drawn in regions of normal and abnormal appearing signal intensity. WB-MRI and PET/CT data were co-registered before application of the NDLR methods using a non-rigid model. NLDR methods used were Isomap, locally linear embedding(LLE) and Diffusion-Maps. The embedded image was constructed by projecting the feature spaces (image intensities) associated with each of the radiological modalities into a one dimensional embedding space (manifold). Dice similarity(DS) indices were calculated and statistical analysis was performed on them.

Results: Integration of multiparametric WB-MRI and PET/CT is feasible. WB-DWI was able to distinguish potential metastatic regions in 7 patients, none were found in the other three with colocalization on WB-MRI and 11C-choline PET, but not in the NAF. These regions had decreased ADC values compared to normal tissue. The ADC values were significantly different($p=0.01$) between patients and normal subjects. The segmented regions were congruent with a mean DS of (90.4+/-2.6)%. The computational load varied with the LLE as the having lowest compared to Isomap and Diffusion-Maps.

Conclusions: The integration of different WB modalities will provide a method to identify “global” tumor burdens and monitor treatment. There were significant differences in the ADC values in areas of metastatic disease compared to normal subjects. Our data suggest the potential of multimodality WB methods for characterization of metastatic disease.