**A retrospective comparative analysis of sodium fluoride (NaF-18)-PET/CT and fluorocholine (F-18-CH) PET/CT in the evaluation skeletal metastases of prostate cancer using a volumetric 3-D analysis**

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BACKGROUND: Prostate cancer (PCa is the most common male cancer and bone is the most frequent metastatic site. Fluorocholine-18 (FCH) and sodium fluoride-18 (NaF) are registered radiopharmaceuticals in >15 EU countries that have been used to assess PCa and associated bone metastases in several thousands of patients. In advanced PCa these tracers often demonstrate different distribution due to mechanism of uptake – cell membrane synthesis and bone mineralization. Here we aim to characterize this difference in a more detailed manner.

HYPOTHESIS: Does the distribution of FCH and NaF differ from each other and how is it related to sclerotic skelatal disease?

METHODS: Our study consists so far of 12 patients with advanced disease (>5 lesions) who had had routine PET/CT both with FCH and NaF on consecutive days. Bone regions in CT were used to co-register the two PET/CT scans. Whole skeleton VOI was defined on CT of PET with HU>150, similarly sclerotic/dense bone was defined as HU>600. Additional VOIs were defined on PET uptake with different pathologic threshold values on both FCH (SUV>3.5) and NaF (SUV>10). PET based FCH and NaF VOIs that overlapped with the CT based skeletal and sclerotic VOIs were separately generated and analyzed. We analyzed the pathologic bone volumes in each technique (CT, HU>600), NaF (SUV>10) and FCH (SUV >3.5).

RESULTS: Preliminary results show that, the skeletal VOI volumes varied from 4.36 L to 7.28 L whereas sclerotic bone volumes were from 1.11 L to 2.99 L. In analogue to TLG (total lesion glycolysis), we also analyzed total choline kinase activity (total cell membrane synthesis activity) for FCH (TCA) and total accelerated osteoblastic activity ( total bone demineralization) activity for NaF (TBA). The TCA varied from 0.57 to 4.23 [kg] in patients with skeletal metastases and was 0.0006 [kg] in a PCa control patient with no metastases in all techniques. The TBA varied from 0.94 to 3.9 [kg] in patients with skeletal metastases and was 0.007 [kg] in a PCa control patient. The sclerotic bone volume represented only 1.1%-2.9% of the pathologic FCH volume and 4.6% -6.2% of the TLF10 in patients with multiple metastases. In the control PCa patient pathologic FCH was only 0.01 % of the sclerotic bone volume and pathologic NaF volume 0.46 % of sclerotic bone. There was also a large variation observed in the overlap of FCH and NaF volumes.

Our results suggests that CT can not be used for assessment of the extent of active metastatic skeletal disease in PCa. It also obvious that NaF and FCH give different

information about activity in the skeletal disease, but the active sites differ less from each other than sclerotic bone regions from any PET activity.