René Dittrich: Assessing growth rate potential of prostate cancer by HRMAS ^{1}HMRS

INTRODUCTION: In the United States of America, prostate cancer (PCa) has the highest incidence among cancers in men and is one of the leading causes of cancer-associated death. Since the serum prostate specific antigen (PSA) has become the most important biological marker for the detection of prostate cancer, the number of cases diagnosed each year has been increased dramatically. Early cancer detection has saved a lot of patients, suffering from the lethal form of prostate cancer. However, it also lead to a massive increase in overtreatment of patients with slow-progressing or clinically insignificant tumors as pathologists are still unable to predict the potential progression and growth rate of a tumor from biopsy.

Zinc-citrate metabolism:

Studies have suggested that the zinc – citrate metabolism may play a major role in the growth rate potential of PCa. It has been well established that zinc as well as citrate levels in the benign tissue of a prostate are among the highest of any soft tissue in the human body, whereas levels decrease significantly in PCa. Relative citrate concentrations can be quantified by HRMAS ^{1}HMRS.

PSA Velocity (V_{PSA}):

The V_{PSA} is a slope, determined by linear regression of multiple PSA measurements and has been described as a possible indicator for growth rate potentials of PCa.

AIM: The study aimed to contribute to the development of a straight-forward method that allows the differentiation between slow- and fast growing tumors. We intended to measure relative citrate levels of intact PCa tissues by HRMAS ^{1}HMRS in order to correlate them with the V_{PSA} of the tissue specimens.

PROJECT: We selected 21 cases with at least three available PSA values, calculated the V_{PSA}, checked it for statistical significance and prepared the tissue specimens for HRMAS ^{1}HMRS analysis in the 14 T scanner. After scanning the samples, we embedded them into paraffin blocks, followed my microtome cutting into slices of 10 µm. The produced slides were subsequently stained with hematoxylin and eosin.

The computer-aided (Image J) evaluation of the slides with regard to percentage area representing cancer cells, normal epithelial cells and stroma cells in each cross section was supervised by our collaborating pathologist Shulin Wu. Results of each cross section were combined to calculate the total vol% of benign and cancerous sections within the original specimens. We defined an internal control by scanning and evaluating 11 of the 21 cases twice.

In order to determine the relative concentrations of citrate (normalized to vol% of benign epithelium) and to correlate them with V_{PSA}, we will have to process and analyse the metabolomic profiles / spectra of the specimens (acquired by HRMAS ^{1}HMRS). This has not happened yet, as the required software has not been completed so far.

RESULTS: yet to come