Using Light to Improve the Diagnosis and Treatment of Patients with Kidney Cancer

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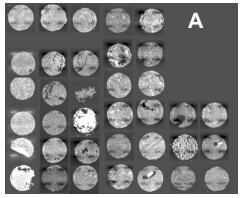
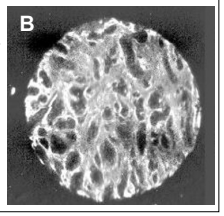
Introduction

- Renal Cell Carcinoma (RCC) is the deadliest urological cancer (1)
  - Chromophobe RCC makes up approximately 5% of all renal tumors (2)
  - Leads to improper filtration of the blood which causes symptoms such as blood in the urine, back or side pain, loss of appetite, weight loss, fatigue, and fever
- Renal Oncocytoma is a common benign renal neoplasm but shares many characteristics with Chromophobe RCC making them difficult to distinguish from one another (2)
- Use of Fourier Transform Infrared (FTIR) Spectroscopy and Quantum Cascade Laser (QCL) technology have been shown to be accurate at identifying a neoplasm and determining the malignancy of it (3,4)



A) TMA map of Biopsy of 2 types of Renal Cell Carcinoma (Chromophobe and Oncocytoma), 36 cores.
B) Single RCC Oncocytoma core.

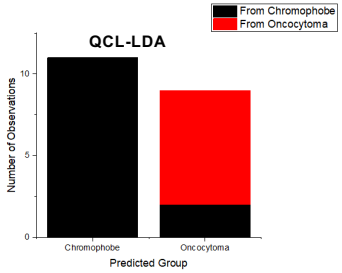


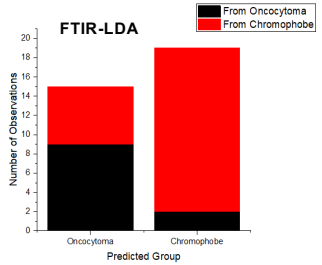
Purpose

- Use IR imaging and multivariate analysis to identify unique signatures of oncocytoma and chromophobe cancer.
- Compare the efficacy of FTIR imaging and QCL technology in their ability to differentiate between renal oncocytoma and chromophobe renal cell carcinoma.

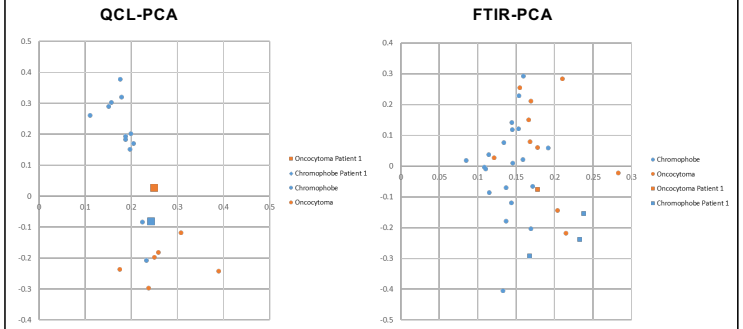
Results

Linear Discriminate Analysis of the QCL and FTIR Data





Principle Component Analysis of the QCL and FTIR Data



Discussion

- Discrimination between chromophobe and oncocytoma remains a serious challenge for the renal pathologist.
- Accurate diagnosis is critical for treatment and prognosis of the patient
- IR spectroscopy offers a unique approach to derive a biochemical signature from tissues that are unique to the different cancers
- QCL technology appears to provide better differentiation between chromophobe RCC and oncocytoma.
- New advances in QCL technologies also allows much faster data acquisition over FTIR based imaging.

Future directions

- In this study, we took a straightforward approach to derive a signature across the entire tissue, we next will determine whether targeting specific cell types or tissue structures can improve classification
- We will develop automated cancer classifiers for clinical implementation.

References

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