Cyanobacterial Detection in Human Kidney Formalin-Fixed Paraffin Embedded Specimens from Cancer and Non-Cancer Populations

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Introduction: Harmful algal blooms (HABs) are uncontrolled outbreaks of cyanobacterial growth that thrive in warm waters. HABs pose a serious health risk to humans due to the release of cyanotoxins produced by cyanobacteria. We and others have demonstrated that the kidney is a key target organ for cyanotoxin induced injury and that these cyanotoxins are capable of activating key oncogenic genes in renal cells in vitro. However, the effects of cyanotoxin exposure in humans with renal cancer is poorly understood.

Objectives: We sought to identify the presence of cyanobacteria in Formalin-Fixed Paraffin Embedded (FFPE) kidney tissue obtained from patients residing in the Great Lakes region. We hypothesized that the levels of cyanobacteria correlate with markers of tumor severity in renal cell carcinoma (RCC).

Methods: DNA and RNA were extracted using an optimized extraction/purification protocol designed for Formalin-fixed paraffin-embedded (FFPE) kidney tissues from RCC (n=13) and age and sex matched non-RCC controls (n=3). Presence of cyanobacteria and markers of tumor severity were determined using quantitative PCR analysis.

Results: Cyanobacteria levels were elevated in RCC compared to non-RCC (1.0 ± 0.34 vs $1.3\pm.26$) although this was not statistically significant. Interestingly, while markers of inflammation and angiogenesis were not significantly correlated with cyanobacterial load overall in both cancer and non-

cancer samples, cyanobacterial load was positively correlated with Transforming Growth Factor-beta in all patients (r=0.5452, p=0.0013) as well as within the RCC cohort (r=0.5320, p=0.0052).

Conclusion: Our results suggest that cyanobacteria may be increased in the setting of RCC and impact the expression of key tissue remodeling genes within these tumors. This data is in agreement with clinical and experimental evidence suggesting an association between cyanobacteria and cancer progression in other settings and supports the need to investigate the potential role of cyanobacteria in renal cancer progression. Analysis of additional samples is ongoing to establish this relationship in an expanded cohort.