Urinary NMR metabolomics profiles discriminate Inflammatory Bowel Disease from healthy and lead to a commercial test for adenomatous polyps and colon cancer

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Background and Aims: Inflammatory bowel disease, a chronic inflammation of the intestinal tract, presents in two variations, Ulcerative Colitis (UC) and Crohn’s disease (CD). Given that treatment of CD differs from UC, a single test that provided strong diagnostic ability would offer great clinical value. Two previous studies have indicated that CD can be distinguished from UC, and that both can be distinguished from non-IBD-type gastrointestinal disease, based on urinary and faecal metabolite profiling. The aim of this study was to extend these observations into a commercial diagnostic test.

Methods: Analysis of healthy as well as CD and UC patients attending an IBD clinic was performed. IBD patients were classified into two groups (CD or UC) based on chart review of clinical, endoscopic, and histological assessment. Urine samples were obtained and analyzed using nuclear magnetic resonance (NMR) spectroscopy combined with targeted profiling techniques, followed by univariate and multivariate statistical analysis. A sub-study examined 1200 patients undergoing colonoscopy for detection of colonic polyps and cancer.

Results: Based on urinary metabolomics, individuals with IBD could be differentiated from healthy with this urine-based diagnostic test. Major differences between IBD and healthy included TCA cycle intermediates, amino acids, and gut microflora metabolites. Comparison of CD and UC patients revealed discrimination, but removal of patients with the surgical intervention confounder revealed that CD could not be discriminated from UC. In the sub-study, extension of the metabolomic profiling to patients with adenomatous polyps and colon cancer revealed a highly accurate urine-based diagnostic test.

Conclusions: This study highlights the potential for metabolomics to distinguish IBD from the healthy state but shows that careful consideration must be given to establishing disease-representative cohorts that are free of confounding factors. Extending these findings of metabolomic profiling in IBD, a urine-based diagnostic test for detection of adenomatous polyps and cancer was developed and commercialized.