Determining Urinary Calculi Composition

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Technology description

Background

Accurate determination of urinary stone composition has significant bearing on understanding pathophysiology, choosing treatment modalities and preventing recurrence. Several modalities to determine stone composition exist (e.g., chemical analysis, X-ray diffraction and infrared spectroscopy); however, all of these methods require direct access to the stone. This necessitates either surgical sampling of the stone or collection of the calculi after passing it through the urinary tract. As a non-invasive alternative, urine samples tested for metabolic abnormalities may hint at the underlying stone type; however, these techniques have been identified as inaccurate and misleading. Therefore, there is a need for a non-invasive, inexpensive and high-throughput method to accurately determine stone composition.

Technology Overview

The present technology provides the first accurate, non-invasive method to determine the composition of urinary stones. This was achieved by examining nanocrystals that are present within urine samples of individuals with urinary stones. More specifically, using nanoscale flow cytometry, the inventors have demonstrated that analyzing the composition of the nanocrystals found in the urine provides a reliable means to estimate the composition of the primary stone. To characterize the nanocrystals in the urine, fluorescently labelled bisphosphonate probes (Alendronate-fluorescein/Alendronate-Cy5) were developed to enumerate nanocrystals that bound the fluorescent probes. Petrographic thin sectioning analysis results correlated to alendronate positive nanocrystal counts in the corresponding urine samples tested. Importantly, the present technology provides a quick, reliable and non-invasive means to estimate urinary stone composition, which can be used by clinicians to select better treatments and prevent recurrence.

Keywords

Petrographic thin sectioning, urinary calculi, nanoscale flow cytometry, alendronate, nanocrystals, nephrolithiasis

Advantages

- Provides a reliable, non-invasive method of determining urinary stone composition.
- Shortens sample analysis time: the average time between acquisition of a urine sample and generation of results is only 5–10 minutes.

• Improves the clinician's understanding of the urinary stone composition which betters treatment selection and lowers the chance of recurrence.

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