

Kidney Anatomy, Stone Type: Is There a Link?

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Abstract

Background: Renal anatomical anomalies are associated with altered urinary drainage and pH, which may influence urinary stone formation and composition. However, limited studies have assessed the stone composition differences in patients with abnormal versus normal renal anatomy.

Methods: This observational study included 100 patients treated between September 2023 and August 2024 in a tertiary academic center in southern Romania. Stone composition was assessed using Fourier-transform infrared spectroscopy and categorized into five major types. Comparative and multivariate analyses were performed to assess associations between renal morphology, comorbidities, and stone type.

Results: Uric acid (39%) and calcium oxalate (32%) were the most common stone types. Patients with horseshoe kidney and ectopic kidneys showed higher proportions of calcium phosphate stones. Diabetes and hyperuricemia were significant predictors of calcium phosphate and uric acid stones, respectively. No statistically significant association was found between renal anatomy and stone composition, though descriptive differences were observed.

Conclusions: While anatomical anomalies did not show statistically significant differences in stone composition, metabolic factors such as diabetes and hyperuricemia strongly influenced stone type. Spectroscopic analysis remains essential in guiding individualized nephrolithiasis management.

Keywords: renal malformations, kidney stone composition, FTIR spectroscopy, metabolic factors, nephrolithiasis