

Precise identification of crystal deposits in the kidney tissue.

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Background

Biopsies of native or transplanted kidneys in patients suffering chronic or acute renal failure are commonly stained for tissue examination and search for possible crystal deposits which are then identified by polarizing microscopy and staining by von Kossa's method revealing mainly calcium deposits.

Aim of the study

Revisiting the nature of crystal deposits in kidney tissue sections by infrared microscopy.

Method

205 renal biopsies presumably containing crystal deposits were analyzed with the Spotlight 400 FTIR imaging System in the mid infrared spectral range to obtain infrared maps of tissue slides at high spatial resolution, down to 10 microns.

Results

Based on infrared analysis, we identified crystals in all biopsies including 78.8% calcium-containing crystals, 15.3% purine crystals of which 90.5% of 2,8-dihydroxyadenine, and 5.9% drugs crystals.

Among birefringent crystals observed under polarized light, we identified 60.2% of calcium oxalate monohydrate, 2.6% of lipids, 13.1% of 2,8-dihydroxyadenine, 7.8% of uric acids and urates, 5.9% of drug crystals (triamterene, N-acetylsulfadiazine, ciprofloxacin, indinavir monohydrate, atazanavir); and among non refringent crystals: 27% of carbapatite, 14.6% of amorphous carbonated calcium phosphate, 3.9% of drug crystals (fosfarnet, vancomycine) and 1.5% of other phosphates. Overall, we identified 26 different types of crystals. Surprisingly, we found mixtures of crystalline phases in a high proportion (23.8%) of biopsy samples.

Discussion

Crystals may be related to various pathological conditions. Identification of dihydroxyadenine prompt to treat the patient with allopurinol. In transplanted patients, we found a negative correlation between the amount of calcium phosphate deposits and the graft survival. The high occurrence of mixed crystals may be a marker for successive episodes of kidney dysfunction related to different mechanisms. We therefore suggest that FTIR microspectroscopy is a major diagnostic tool for crystal identification and should be proposed to any patient with a past history of stone disease and presenting with an unexplained renal failure of the native or grafted kidney.

Conclusion

A precise identification of crystal deposits in the kidney tissue may totally modify the diagnosis of an unexplained kidney dysfunction. Common histological procedures clearly fail to identify accurately crystals deposits and should be completed by infrared analysis.