

Type 2 diabetes and uric acid stones: A powder neutron diffraction investigation

Michel Daudon ^{a,b,*}, Emmanuel Letavernier ^{a,b}, Raphael Weil ^c, Emmanuel Véron ^d, Guy Matzen ^d, Gilles André ^e, Dominique Bazin ^{c,f}

^a AP-HP, Hôpital Tenon, Service des Explorations Fonctionnelles, 75020 Paris, France

^b Unité INSERM UMR S 1155, UPMC, Hôpital Tenon, 75020 Paris, France

^c Laboratoire de Physique des Solides, UMR 8502, Université de Paris-Sud, Bât 510, 91405 Orsay cedex, France

^d CNRS-CEMHTI, 1D, avenue de la Recherche-Scientifique, 45071 Orléans cedex 2, France

^e Laboratoire Léon-Brillouin, (CEA-CNRS) Saclay, Gif-sur-Yvette cedex 91191, France

^f CNRS, LCMCP-UPMC, Collège de France, 11, place Marcellin-Berthelot, 75231 Paris cedex 05, France

Background: Recent epidemiologic investigations have identified an association between type 2 diabetes and uric acid kidney stones. This association was more apparent in women than in men. However, male patients are more prone than women to form uric acid stones in upper and lower urinary tract. In addition, uric acid stone morphology may be different according to stone location. Finally, it was shown that uric acid stone prevalence is increasing with the patient's age.

Aim of the study: To compare uric acid crystal size as determined by powder neutron diffraction with clinical data and the gender of patients.

Material and methods: Uric acid stones from 43 patients (24 males, 19 females) identified by Fourier transform infrared spectroscopy were investigated using Environmental Scanning Electron Microscopy and Powder neutron diffraction.

Results: Uric acid anhydrous was the main crystalline form of the stones. The mean size of the crystals was 91.3 ± 28.5 nm. No significant differences were found regarding uric acid crystal size in the stones by comparison to the stone location or the patient's age. However, particle sizes of uric acid kidney stones were significantly different between male and female patients (84.7 ± 5.3 vs. 140.2 ± 6.7 nm, $p < 0.000003$) in the absence of diabetes mellitus. Interestingly, when type 2 diabetes appeared, this structural difference between male and female vanished (76.1 ± 3.9 vs. 78.8 ± 4.2 nm, not significant). Thus, the complete set of structural data is in line with observations regarding epidemiological data. Some explanations based on supersaturation are discussed.