Case Report

An unusual type of crystalluria
(appearing only once every 130 years?)

Giovanni B. Fogazzi1, Silvia Baroni2, Giuseppe Garigali1 and Michel Daudon3

1Research Laboratory on Urine, Divisione di Nefrologia, Ospedale Maggiore, IRCCS, Milano,
2Laboratorio di Chimica Clinica, Università Cattolica del Sacro Cuore Policlinico ‘A. Gemelli’,
Roma, Italy and 3Laboratoire de Biochimie A, Hôpital Necker, Paris, France

Keywords: calcium carbonate crystals; crystalluria; infrared spectroscopy; urinary sediment

Introduction

The correct approach for the identification of urinary crystals is based on the knowledge of: (i) the morphological features of the crystals; (ii) the pH of the urine in which the crystals are found; and (iii) the birefringence features under polarized light. Only for selected cases, more sophisticated techniques such as infrared spectroscopy are required [1,2].

Herein we describe a very unusual crystalluria and the steps we took to identify the nature of such crystals.

Case

On March 25, 2003 a very unusual crystalluria was found in the laboratory of Clinical Chemistry of Policlinico ‘A.Gemelli’ of Rome.

Crystals, which were in a moderate amount (+++), were colourless with a shape that reminded one somewhat of daisies. In fact, they were made up of a combination of six to thirteen triangles of different width which were separated by clear spaces and whose apexes converged toward a central structure. This was roundish, with two dark concentric lines and a dark central dot (Figure 1A and B). The contours of the crystals were very well defined, and were dark under bright field microscopy. The crystals were small, with a diameter ranging from 15 to 37.5 mm (mean ± SD on 50 crystals measured: 28.5 ± 6.7), and under polarized light did not show any birefringence.

The sample did not contain other particles but a few amorphous phosphates. Urine pH and specific gravity were 7.5 and 1.025, respectively. By dipstick, albumin, haemoglobin, leukocyte esterase, glucose, and nitrites were all negative.

The urine belonged to a 30-year-old woman who was in the eighth week of her first pregnancy, and had normal serum creatinin and normal blood pressure. The patient was under medication with folic acid 5 mg/day, iron sulphate 525 mg/day, and levotyroxin 100 μg mg/day. The day before urinalysis she had eaten large amounts of vegetables, especially spinach and salad.

After the first sample another eight urine specimens from the same patient were analysed over the subsequent 2 months, whose pH ranged from 6.0 to 6.5 and specific gravity from 1.020 to 1.025. Urinary calcium, phosphates, and uric acid were always within the normal ranges. A few crystals of calcium oxalate bi-hydrated or amorphous phosphates with or without a few leukocytes and/or bacteria were occasionally found. However, the unusual crystals described could no longer be seen. This situation did not change also when the patient was asked to ingest large amounts of vegetables as she had done on the previous occasion of the first urine examination.

Steps undertaken to identify the nature of the unknown crystals

The crystals described are very unusual and differ from those reported in textbooks and atlases.

In order to identify the nature of such crystals we both (i) looked for images similar to our own in a large number of textbooks and atlases and (ii) performed infrared spectroscopy of the sample.

Altogether we revised more than 1530 images of crystals contained in 58 books devoted to urinalysis, urine sediments, or clinical microscopy: 43 historic books covering the period 1844–1960 and 15 recent books covering the years from 1974 to 1999 (a full list...
Fig. 1. (A) Two crystals as seen by bright field microscopy (original magnification 1000×). (B) The same types of crystals by phase contrast microscopy (original magnification 400×). (C) Some details of table V of [4]. (D) A detail of table XV, figure 1 of [5].
can be supplied by the authors upon request). The list of books consulted will be sent on request.

Our historical collection, which belongs to one of us (G.B.F.), starts with [3] (which is the first monograph ever published on urine sediments) and includes the major works published on the subject in 19th and early 20th century in Austria (n = 2), France (n = 5), Germany (n = 12), Italy (n = 8), Switzerland (n = 2), the UK (n = 9), and the USA (n = 5).

In our historical library the first work which showed crystals morphologically very similar to those we had found was the Atlas of Frenchmen Charles Robin (1821–1885) and François Verdeil, which was published in 1852–1853 as part of a treatise on anatomical and physiological chemistry [4] (Figure 1C). However, the crystals shown had not been observed in the urine but as ‘a spontaneous deposit of the parotid gland saliva’ of dogs, and were considered to be made up of calcium carbonate.

The only work in which crystals similar to ours were found in the urine is the Atlas of Austrian Robert Ultzman (1842–1889) and Karl Berthold Hofmann (1842–1922), which was published in 1871 [5,6] (Figure 1D). Interestingly, in this case the crystals were considered to be made up of a combination of creatin and zinc chloride, the latter being a reagent used in the laboratory to extract creatin.

Of note, no crystals resembling ours were found in the textbooks and atlases published from 1974 to 1999.

Taking into account the above information, one of us (M.D.) performed infrared microscopy. This showed that our crystals were composed of a carbonate salt. Although elemental analysis revealed the presence of calcium, the infrared spectrum (Figure 2) did not correspond to calcium carbonate salts commonly found in biological fluids, namely calcite, aragonite, or vaterite. In addition, no traces of creatin were found. Because of the very small amount of sediment available for further investigation, other techniques such as X-ray fluorescence analysis could not be used.

In conclusion, our investigation has confirmed that the crystalluria we have described is very unusual and rare, and this might be the first time that it has been shown in images since 1871. However, the nature of the crystals remains partially unknown. For this reason also the causes of this crystalluria remain unclear.

Acknowledgements. The authors are grateful to Dr Gina Zini (Policlinico ‘A. Gemelli’, Rome) for supplying the beautiful photographs of crystals obtained with bright field microscopy.

Conflict of interest statement. None declared.

References

Received for publication: 16.12.03 Accepted in revised form: 14.1.04