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# Urolithiasis Associated with Urogenital Tuberculosis

## Clinical and Mineralogical Aspects

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**Summary.** Of 628 patients with bacteriologicaly or histologicaly proven urogenital tuberculosis (UGT) treated from 1960 to 1985. 126 patients (20.1%) had additional urinary tract infection and 66 patients (10.5%) developed urolithiasis. In these 66 patients a simultaneous urinary tract infection occured in 29 cases (43.9%). Twenty-eight calculi were analyzed by a combined crystal-optical and x-ray-diffraction method. A high incidence of struvite/carbonate apatite calculi (11/28) as well as of calcium phosphate calculi (6/28) was found. The texture of 15 calculi was investigated on thin sections by polarization microscopy and a high concentration of organic material was found in both calcium oxalate and struvite/carbonate apatite calculi probably due to the specific and nonspecific infection with deposition of cell and protein degradation products.

**Key words:** Urogenital tuberculosis – Urolithiasis – Texture of calculi

## Introduction

The decline of pulmonary tuberculosis has caused a marked decrease of UGT as a known late manifestation of the primary infection. In 1985 only 141 new cases of UGT were registered in our country, representing an incidence rate of 0.83 per 100,000 inhabitants [7]. Through the application of a highly effective antituberculous drug regimen treatment has been reduced to 6–9 months [6, 12].

Nonspecific bacterial urinary tract infection and urolithiasis are two important complications in UGT. The frequency of urolithiasis in patients with UGT was reported to range from 3.8 to 9.4% [3, 7, 11, 13, 14], but detailed studies on this subject have been published only rarely in the literature [3, 13]. The aim of the present paper is to describe our experience with urolithiasis in UGT with special reference to the morbidity, treatment and pathogenic aspects of calculi formation, including mineralogical investigations. Crystaloptical and x-ray-diffraction studies as well as scanning electron microscopy have contributed to the interpretation of the constituents and texture of the calculi and of the aetiological factors, respectively [5, 10].

## Material and Methods

Among 628 patients with bacteriologically or histologically proven UGT treated from 1960 to 1985 at the Urological Clinic of the Hospital Friedrichshain, 66 patients have had additional urolithiasis (10.5%). In these cases the frequency of simultaneous nonspecific bacterial urinary tract infection, the localization of the calculi at the time of diagnosis, the treatment methods and the morbidity and nephrectomy rate, due to urolithiasis associated with UGT were analyzed.

The analysis of stone composition in 28 cases was performed with a combined crystal-optical-x-ray-diffraction method as described by Bick and Brien [1]. In addition, the texture of 15 calculi was investigated on thin sections by polarization microscopy and in 4 cases by scanning electron microscopy as reported previously [9, 10].

## Results

### *Clinical Findings*

Among 628 patients with UGT, 126 patients (20.1%) had an additional urinary tract infection, mainly caused by E. coli, proteus or pseudomonas bacteria. However, the frequency was more than twice as high (43,9%; 29/66 cases) in patients with urolithiasis.

The treatment of urolithiasis was conservative in 22 patients. Fifty-seven operations were performed in 44 patients (Table 1).

In 21 out of 66 patients (32%) with urolithiasis a nephrectomy was performed because of extensive loss of functional parenchyma, pyonephrosis and other complications of urosepsis.

The recurrence rate of lithiasis in patients with UGT was 22.7% (14/66 cases).

**Table 1.** Summary of operative treatment in UGT

| Operative Technique | Number of Operation |
|---|---|
| Pyelotomy/Nephrotomy | 24 |
| Partial Kidney resection | 1 |
| Ureterolithotomy | 4 |
| Sectio alta | 3 |
| Endourologic procedures | 4 |
| Nephrectomy | 21 |
| Total | 57 |

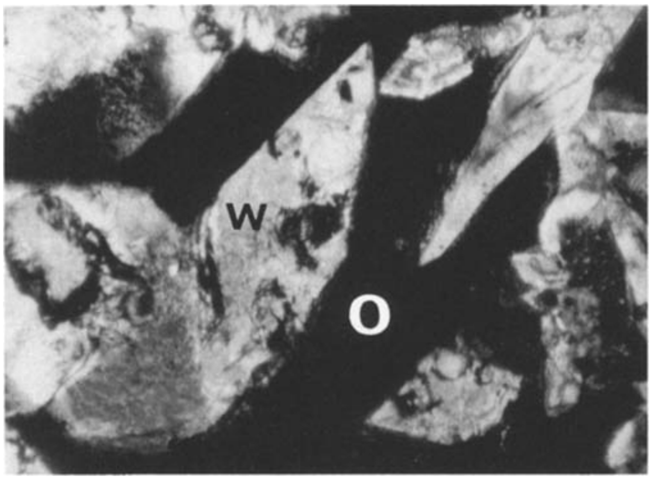


**Fig. 1.** Different stages of weddellite transformation into whewellite. Deposition in isotropic organic material (x 72, crossed polarizers). *W* = Weddellite/Whewellite crystals, *O* = Organic material

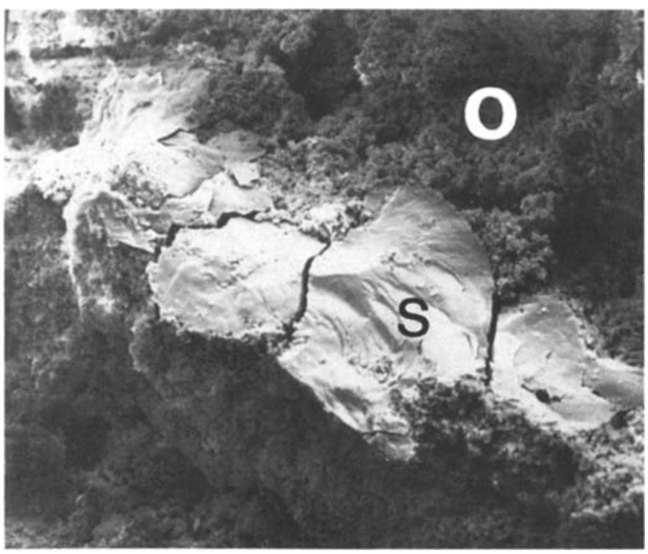


**Fig. 2.** Part of a struvite/carbonate apatite calculus. Deposition of struvite crystal layers in organic substance (x 450). *S* = Struvite crystals, *O* = Organic material

*Mineralogical Findings*

Eleven out of 28 stones (39%) were found to be exclusively composed of struvite and carbonate apatite which are typical of urinary tract infection with urea splitting bacteria and a further 6 (21%) were composed of calcium phosphate. Only 10 calculi (36%) were found to be composed of calcium oxalate and one (4%) was of uric acid.

From the thin sections of 15 calculi investigated by polarization microscopy we found mainly two texture types of struvite/carbonate apatite calculi as observed by Schubert and Brien [8].

*Type 1:* Irregular mosaic texture of isomeric struvite grains; the basic mass was of carbonate apatite and/or organic material.

*Type 2:* Concentric ring texture; isometric struvite grains were pearl-string-like deposits in very thin layers of carbonate apatite and/or isotropic organic material.

In the calcium oxalate calculi we found a *type 4* texture as classified by Schubert et al. [9]: Idiomorphic, irregular weddellite crystal texture in isotrophic basic material, probably of organic origin mostly with different stages of transformation into whewellite (Fig. 1).

The texture types as mentioned above could be confirmed by scanning electron microscopy. The massive inclusion of organic substance could be seen in various parts of the struvite and whewellite texture (Fig. 2).

**Discussion**

The frequency of an additional nonspecific urinary tract infection in patients with UGT ranged from 45% to 79% (11, 14) and in our material 126 out of 628 patients (20.1%) had such a mixed infection. It is striking, that this frequency was much higher in patients with urolithiasis and UGT. Among 66 patients with urolithiasis, 29 patients (43.9%) had a urinary tract infection with common bacteria. Similar observations have been made by other authors [14].

The occurrence of urolithiasis is described in approximately 6% of patients with UGT [4, 11, 13] and we found a frequency of 10.5%. It is also important that nearly 50% (21/44) of the patients operated because of urolithiasis, underwent nephrectomy. The occurrence of urolithiasis in patients with UGT therefore increased their morbidity and reduced full rehabilitation even when the mycobacterial infection had been cured.

The semiquantitative analysis of 28 calculi shows some peculiarities in comparison with the "normal population" of urolithiasis patients, especially the high incidence of both struvite/carbonate apatite (39%) and calcium phosphate stones (21%), respectively and – in contrast – the relatively low frequency of calcium oxalate calculi (36%). This fact is at variance with the findings of other authors [13].

In struvite/carbonate apatite calculi as well as calcium oxalate stones a massive deposition of isotropic non-transparent, probably organic substance, was observed. The deposition of isotropic non-transparent, probably organic substance, was observed. The deposition of organic material occurs during calculus growth and is partially manifested as striation. These phenomena in the texture of calculi in patients with UGT can be explained by the particular pathogenesis. The massive deposition of an isotropic substance is made possible by a high concentration of organic material in the urinary tract due to both specific and nonspecific bacteriuria. This isotropic substance was observed in all parts of the calculus. Therefore, it must be assumed that the organic material is available in abundance during aggregation similar to the development of urolithiasis after kidney transplantation [2]. The tissue damage and the functional impairment of the kidney associated with obstruction due to severe mycobacterial infection lead to an optimal milieu for calculus formation consisting of a massive occurrence of cell degradation products and organic material in the presence of frequent infection with urea-splitting bacteria.

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