



Fig. 1: Titration lines obtained from the urine of a diagnosed kidney stone patient (PU) and from urine donated by a healthy person (HU). Titrated with 0.1 M  $\text{CaCl}_2$  solution, temperature  $37 \pm 0.5^\circ\text{C}$ .

The above results indicate that the slope of the line obtained by titration of a donor's first morning urine may be a reliable criterion for discrimination of calcium stone-formers from healthy people. The tests show good correlation with the clinical situation and with the previously developed D.I. test (4). Because of its simplicity the new method seems to be suitable for routine examinations in clinical laboratories.

Pilot experiments to ascertain its value for routine tests are being considered.

**Acknowledgements.** It is a pleasure to thank Dr. Edna Schechtman, consultant at the Weizman Institute of Science for her help with the statistical analysis as well as Prof. Erno Pungor and Dr. Klara Toth of the Technical University of Budapest for their valuable consultations concerning the PVC-matrix membrane electrode. The financial support given to one of the authors (H.F.M.) by the Commission of the European Communities, Directorate General XII, and by the Ministry of Science of the Republic of Croatia is greatly acknowledged.

## References

1. Nancollas GH and Mohan MS (1970) The growth of hydroxyapatite crystals. *Arch Oral Biol* 15:731
2. Bisaz S, Felix R, Neuman WF and Fleisch H (1978) Quantitative determination of inhibitors of calcium phosphate precipitation in whole urine. *Mineral Electrolyte Metab* 1:74
3. Achilles W (1987) Crystallization in gel matrices: a new experimental model of calcium stone formation. *Contrib Nephrol* 58:59
4. Sarig S, Garti N, Azoury R, Wax Y, Perlberg S (1982) A method for discrimination between calcium oxalate kidney stone formers and normals. *J Urol* 128:645
5. Garti N, Sarig S and Tibika F (1980) Retardation of calcium oxalate formation by polyacidic peptides. *Invest Urol* 18:149
6. Sarig S, Garti N, Azoury R, Perlberg S and Wax Y (1983) Follow-up of drug therapy efficacy to prevent recurrence of calcium oxalate kidney stone formation. *J Urol* 129:1258
7. Füredi-Milhofer H, Kiss K, Kahana F and Sarig S. A new method for the discrimination between calcium stone formers and healthy persons. To be published

Prof. H. Füredi-Milhofer,  
"Rudjer Boskovic" Institute,  
Zagreb, Croatia, Yugoslavia

## Importance of the Mineral Metabolic Study and Calculi Analysis in Urolithiasis Patients

L. Rodriguez Vela, C. Rioja Sanz, J. M. Ibarz Navarro, J. Lazaro Castillo, T. Abadia Bayona and L. A. Rioja Sanz  
Dept. Urology, "Miguel Servet" Hospital, Zaragoza, Spain

We have performed a metabolic mineral study in 1600 urolithiasis patients. We did a complete blood, 24 hours and 2 hours urine analysis. Indeed with the microscope stereoscopic lens and infrared spectrophotometry we study the gravels and calculi eliminated by these patients. 1436 patients completed properly the protocol.

Overall, 647 patients (45.1%) showed changes in calcium-

oxalate metabolism. In 582 (40.1%) uric acid metabolism changes were detected. 251 (17.5%) had alkalinuria and 4 cystinuria. The mineral metabolism was normal in 173 (12.1%). The chemical composition of the calculi were: Calcium oxalate and phosphate + calcium oxalate (68.2%), uric acid 12.6%, struvite 14.1%, calcium phosphate 5.1% and cystine 0.3%. From the 974 patients (67.8%) with calcium-oxalate calculi, 686 (70.4%) had metabolic anomalies. Upon then the most frequent were: hypercalciuria (29.1%), hyperuricosuria and/or hyperuricemia (18.8%), hyperoxaluria (11.4%), hypercalcemia with secondary hypercalciuria (2.1%). In this group, 288 (29.6%) no changes were detected.

From the 182 patients (12.7%) with uric acid calculi: 15.4%

were type I (hyperuricemia), 38.8% type II (hyperuricosuria), 2.2% type III (decrease in uric acid clearance), 20.3% type IV (urine pH < 5.4) and the sum of different alterations 23.6%. In 50 patients of this group (27.5%) mild hypercalciuria and/or hyperoxaluria were detected.

From the 203 patients (14.1%) with struvite calculi, alkalineuria produced by ureolytic microorganisms was detected in 165 (81.3%) and alkalineuria plus metabolic mineral alterations in 38 (18.7%). Due to the great tendency to relapse of the lithiasis disease and the severity of the damage on the kidney, it is appropriate that prophylactic medical treatment based on calculi analysis and the metabolic changes that have produced the calculi, takes place.

### Influence of Menstrual Cycle on Fractional Excretion of Citrate and Lithogenic Compounds in Healthy Women

H. H. Knispel<sup>1</sup>, R. Fitzner<sup>2</sup>, M. Bulitta<sup>3</sup>, M. Butz<sup>4</sup>

<sup>1</sup> Dep. Urology, <sup>2</sup> Dep. Lab. Med, FU Berlin Steglitz,

<sup>3</sup> Fa. Madaus, Köln, <sup>4</sup> St. Josefskrankenhaus, Paderborn, FRG

Urinary citrate is an important determinant for crystallisation of calcium salts. Women excrete more citrate than men and seem to be less prone to stone formation. Citrate excretion has been suggested to vary during the menstrual cycle. It is unknown whether there is an intraindividual correlation between the clearance of citrate and the menstrual cycle.

In 10 healthy women with normal ovulatory menstrual cycle (age range, 23-41 years), calcium and citrate were analyzed in serum and 24h urine samples during the follicular phase (F) and the luteal phase (L). Estradiol, progesterone, electrolytes and parathormone were determined in serum.

The mean serum concentration of citrate was  $97.7 \pm 38.3$  mmol/l, concentration of calcium  $2.47 \pm 0.19$  mmol/l. Clearance parameters of creatinine were measured at 90.1 ml/min (F) and 88.3 ml/min (L). There was no significant difference in urinary citrate excretion ( $x_F = 3.81$  vs  $x_L = 4.23$  mmol/l) or calcium excretion ( $x_F = 3.59$  vs  $x_L = 3.05$  mmol/l). Filtered load of citrate was 22.6 (F) and 26.5 (L) in mean, and parathormone in serum was determined at 3.81 (F) and 4.23 (L). Both parameters did not correlate with the ovulatory cycle. Furthermore, there was no detectable direct correlation between the daily hormone levels and the clearance of calcium and citrate.

In healthy women, urinary citrate and calcium excretion failed to demonstrate any significant correlation with the ovulatory cycle. Substantial influence of gestagens on serum citrate concentrations and citrate clearance seems to be unlikely. In analysis of urinary risk factors, the phase of ovulatory cycle may be neglected.

### Distribution of Risk Factors in Renal Stone Patients Treated by ESWL

F. Di Silverio, A. R. D'Angelo, G. Alpi, M. Gallucci, L. Misiti, G. Laudani

Department of Urology, University of Rome "La Sapienza", Rome, Italy

We have concluded a retrospective study on 782 patients, of both sexes, previously treated by lithotripsy for calcium urolithiasis and with well established clinical criteria. A careful description is reported regarding family history of renal stone, diet, drug, other disease, frequency and age of stone formation, and risk-oriented laboratory parameters. An univariate statistical analysis of these intended risk factors and some correlations have been performed. It has been done an age and sex standardization and the found differences have been evaluated by proportion Remington's Z test and Student's test. This case report contains a large number of informations. Particularly, the data examination shows significant differences between the two sexes, high and significant incidence of re-

currence and of family history of stone disease, high incidence of some abnormal laboratory parameters (for example urinary levels of calcium, magnesium and uric acid). It is not possible, at the moment, to establish if these patterns are real statistical risk factors. But this analysis permits a matching with literature's data and is the propositus for a longitudinal study, already in progress, that will allow to create a statistical model for the prediction of recurrences.

### Recurrent Kidney Calculi: Possibility of Identifying some Predictive Risk Factors

F. Di Silverio<sup>1</sup>, A. R. D'Angelo<sup>1</sup>, A. Cassanelli<sup>1</sup>, G. Alpi<sup>1</sup>, A. Menotti<sup>2</sup>

<sup>1</sup> Department of Urology-University of Rome "La Sapienza"

<sup>2</sup> Epidemiological Laboratory-I.S.S.-Rome, Italy

782 patients of both sexes, ranging in age from 14 to 79 years, previously treated for urinary tract calculi by lithotripsy and with well established clinical criteria, were studied in our outpatient stone clinic. A careful history has been taken regarding family history of renal stone, diet, drug, other diseases, frequency of stone formation and risk-oriented laboratory parameters. Monovariate statistical analyses have been performed to evaluate the correspondence between intended risk factors in patients with and without stone recurrence. It has been done on age and sex standardization and the found differences have been evaluated by proportion Remington Z test. Then patients had a follow-up in order to detect early recurrences. During a mean follow-up time slightly less than two years (a.v.g. 23 months) 68 of a subgroup of 400 patients showed stone recurrence (8-9% for year). These patients have been tested using Cox's "proportional hazard" statistic model: end point was recurrence, while co-variation factors were eight parameters determined when entering the protocol (age, sex, familial trend for urolithiasis, past history of stone recurrence, suppression test as well as urinary levels of calcium, magnesium and uric acid). Among these, only urinary calcium showed both a significant and a positive coefficient, whereas among the others only past history of stone recurrence was to some extent significant. It is likely that, at the moment, the limited number of patients of our series had prevented other parameters from appearing as predictive factors.

### Diets and Calcium Oxalate Urolithiasis

F. Grases, R. Prieto, J. A. Tur, A. Conte, A. Costa-Bauzá

University of Illes Balears, Palma de Mallorca, Spain

An animal model involving rats fed with different diets (high protein diet, high carbohydrate diet, high lipid diet, high fiber diet and control balanced diet) was used to evaluate the dietary effects on the main oxalocalcic urolithogenic parameters. It was found that the inhibitory factors that prevent calcium oxalate stone formation (citrate and magnesium) were clearly more favourable in the group of rats fed with a balanced diet. However, factors favouring the heterogeneous calcium phosphate nucleation were also found in the balanced diet. On the other hand, factors facilitating the heterogeneous uric acid nucleation were found in the rats treated with high protein, high lipid, high carbohydrate and fiber-rich diets.

In conclusion it seems that by putting together promoting and inhibiting factors, the balanced diet appears to be the less lithogenic one, in spite of presenting some favouring factors. In fact, the lithogenic role of a specific diet will also depend on the particular metabolic conditions of each individual. On the other hand, when planning dietary therapies in urolithiasis disease, knowledge of the causes that provoked the renal stone formation is necessary. Thus, the recommended diet must avoid and correct such causes, i.e. when the oxalocalcic stone is promoted through heterogeneous nucleation on uric acid due to the low urinary pH values, a controlled basifying poor purine diet would be probably the most adequate one.

## Effects of Three Different Diets on Urinary Excretion of Glycosaminoglycans (GAG) in Healthy Men

R. Siener, A. Jähnen, A. Hesse

Experimentelle Urologie, Urologische Universitätsklinik Bonn, FRG

Several *in vitro* investigations have suggested that glycosaminoglycans are inhibitors of calcium oxalate crystal growth and aggregation. The aim of this study was to examine the influence of various forms of diet on urinary GAG excretion.

Ten healthy men were kept on three different standard diets for the duration of 5 days each. DIET I was close to the average German dietary habits which is 95 g of protein, 132 g of fat, 509 mg of purines, 50 g of alcohol with a high energy level, and 1.5 l of beverages. DIET II and III were established according to the dietary recommendations to calcium oxalate stone patients. DIET II contained meat whereas DIET III represented a balanced ovo-lacto-vegetable meal plan. DIET II and III were isoenergetic with equal amounts of the main nutrients and 2.5 l of fluid intake, but differed somewhat in other nutrients, particularly in purines, animal protein, magnesium and potassium.

In the course of the test series the GAG excretion tended to decrease continuously. The GAG excretion was highest under DIET I (21.6  $\mu\text{mol/d}$  glucuronic acid), declined significantly under DIET II (12.4  $\mu\text{mol/d}$ ) and was lowest under the ovo-lacto-vegetable DIET III (10.2  $\mu\text{mol/d}$ ). The decrease in GAG excretion corresponded with the decline in urine supersaturation with calcium oxalate, estimated by the computer program EQUIL of FINLAYSON.

The role of GAG in calcium oxalate stone formation is not finally cleared. Supposing an inhibitory effect of GAG, an increase in renal excretion would be desired. However, DIET II and III, which are prophylactic diets for calcium oxalate stone patients, cause a reduction in renal GAG excretion.

## Effects of Dietary Composition on Cystine Excretion

H. Birwé, R. Siener, A. Hesse

Experimentelle Urologie, Urologische Universitätsklinik Bonn, FRG

The effect of changes of dietary composition on cystine excretion has received limited attention in the treatment of cystinuria.

We have checked the effect of protein ingestion on cystine excretion by a study with 10 healthy control persons. The study lasted 17 days. During three periods the following diets were given: diet I (94.7 g protein per day, 59 % animal protein), diet II (65.5 g protein per day, 57 % animal protein) and diet III, an ovo-lacto-vegetable diet (65.5 g protein per day, 43 % animal protein). All test persons collected 24 h-urines. Urinary cystine was determined by HPLC.

During ingestion of diet I the mean excretion of cystine was 132.2  $\mu\text{mol/d}$ . The mean excretion of cystine under diet II was 108.0  $\mu\text{mol/d}$ . Ingesting diet III the excretion of cystine was 112.5  $\mu\text{mol/d}$ .

Thus, a reduction of the total protein ingestion of 30 % (diet II vs diet I) results in a reduction of cystine excretion of 18 %. Under the conditions described here an exchange of animal protein against plant protein (diet III vs diet II) seems to have no additional effect on the excretion of cystine.

## The Bonn Urolithiasis Post-Episode Care Program

A. Nolde, A. Hesse, O. Scharrel, W. Vahlensieck

Experimentelle Urologie, Universitätsklinik Bonn, FRG

For more than 2 years a total of 849 patients with recurrent stone formation have participated in the Bonn urolithiasis post-episode care program.

In 4 months intervals, check-ups were made and general as well as specific recommendations were given concerning diet,

fluid intake and drugs, depending on the analysis of urine and stone composition, serum parameters and nutrition record. Stone analyses have shown that calcium oxalate stones were the most frequent type of stone (69%). First urine tests have indicated that 82% of all patients had three and more abnormal findings. In more than 90% of all cases at least one cause of stone formation was identified. No difference in the pattern of the age of first manifestation between male (34.1 years) and female (34.7 years) patients could be found. The average stone passage rate amounted to 7.13 in men and 5.67 in women. 24% of all patients had more than 10 stones passages before they participated in the study.

On patients' fourth check-up a decrease in calcium, uric acid, oxalic acid and an increase in citric acid excretion and urine volume was found. The rate of stone passage decreased from 1.6 stones per patient per year to 0.89 stones per patient per year.

A basic diagnostic program involving all stone patients, especially those with recurrent stone formation, should be carried out. Recurrent stone formation can positively be prevented through consequent metaphylaxis.

## Variation of Stone Analysis after ESWL

S. Korn, M. Kalchthaler, N. Balk, W. L. Strohmaier, D. M. Wilbert, K. H. Bichler

Department of Urology, Tübingen University, Tübingen, FRG

In approximately 70 % of ESWL patients it is possible to collect fragments during the time in hospital or in the follow-up period. Further management of patients with recurrent stone formation relies to a great extent on the stone analysis. In 31 patients multiple (3 and more) stone examinations (polarisation microscopy and X-ray diffractometry) were available. In 9 of 31 patients (29 %) every stone analysis revealed the same stone composition. In 7 patients (22.6 %) stone analysis revealed a varying percentage of the same component. In 15 patients (48.4 %) a variation of stone components was found, however in a range of less than 20 %. In 50 % of the patients multiple stones analyses showed different stone components with one leading component and the others in variation of less than 20 %. Therefore in ESWL patients one can rely on a single stone analysis.

## Microscopic-Microchemical Analysis of Components of Uroliths (Harzolith<sup>®</sup>) in Comparison to X-Ray Diffraction and Polarisation Microscopy

S. Korn<sup>1</sup>, K. H. Bichler<sup>1</sup>, E. Eipper<sup>1</sup>, B. Henzler<sup>1</sup>, M. Schreiber<sup>1</sup>, W. Bayh<sup>2</sup>

<sup>1</sup> Department of Urology, <sup>2</sup> Institute of Mineralogy, Eberhard-Karls-University Tübingen, FRG

The Harzolith<sup>®</sup>-method presented by Mecconti company was tested and the results compared with those of X-ray diffraction and polarisation microscopy. N = 30 different uroliths (one or multiple component calculi) were analyzed qualitatively and quantitatively by three methods. There was no qualitative difference found between X-ray diffraction and polarisation microscopy, differences were seen however with the Harzolith<sup>®</sup>-method. With increasing number of components there was hardly an agreement compared with the other methods. When applying the Harzolith<sup>®</sup>-method, too many components were determined. Analysis of the samples was made by 3 laboratory assistants working independently of each other. We found that the Harzolith<sup>®</sup>-method as a quantitative test is not sufficiently correct. Slight optical differences and indistinct colour changes of the various crystals are the cause of it. It is difficult, particularly with multiple-component calculi to interpret the components' reactions to addition of the reagents. Extraordinary ability to differentiate the morphology of the crystals is required to carry out the test. After successful training by an analyst experienced in the method better results will surely be obtained. This has to be noted in the instructions.

### Clinical Results with the MFL 5000 Lithotripter

N. Balk, D. M. Wilbert, W. L. Strohmaier, K. H. Bichler  
Tübingen, FRG

Since April 1989 the lithotripter Dornier HM 5 (= MFL 5000) is in clinical use and has replaced the previous HM 4 model. Local shock wave coupling, low energy generator, single movable X-ray-unit and conventional X-ray table are the main features of this unit. So far 176 patients are evaluable with a total of 288 treatments.

Results: The patients average age was 49.8 years. There were 34 % calyceal, 25 % renal pelvic, 23 % upper ureteral and 18 % lower ureteral stones. Multiple treatments were necessary in 30.5 % of the patients. The average impulse rate was 1600 shocks per session. 133 treatments (46 %) required analgesia or other forms (6 %) of anesthesia. In 38 % of all treatments either ureteral stents or double-J-stents were placed. On 3 months follow up 70.8 % of the patients were free of stones.

Discussion: With low energy more than 50 % of patients can be treated without anesthesia, however in 30 % repeated ESWL therapy is necessary due to incomplete stone desintegration.

### Determination of Stone Free Rate after ESWL

N. Balk, D. M. Wilbert, K. H. Bichler

Department of Urology, Eberhard-Karls-University,  
W-7400 Tübingen, FRG

Methods: After ESWL with a Dornier HM 4 Lithotripter 141 patients were followed up until stone free or at least for 6 months. Follow up examinations included a KUB, renal sonography, plain tomography when necessary, urine culture and urinalysis. Patients were stratified according to stone location, size and stone composition.

Results: Of 141 patients after one month 56.9 %, after 3 months 74.5 % and after 6 months 83.0 % were stone free. Concerning stone location the highest stone free rate was found in patients with upper and lower ureteral stones: 95.7 % and 100 %, respectively. Concerning stone composition the stone free rate was equal except for cystine stones which showed only 66 % stone free rate. All stones larger than 15 mm had a significantly lower stone free rate.

Discussion: Only careful follow up of patients after ESWL leads to reliable information about the status of the patients. We recommend plain film and sonography as appropriate examinations and a time of up to 6 months, as another 10 % of the patients become free of stones after the 3 months follow up.

### Beneficial Effects of Fosfomycin on Shock-Wave-Induced Tubular Damage - in Vitro Examination in the MDCK-Cell Modell

W. L. Strohmaier, K. H. Bichler, M. Pedro, D. M. Wilbert

Department of Urology, Eberhard-Karls-University,  
Tübingen, FRG

Several investigations have shown that shock-wave lithotripsy (ESWL) can cause impairment of renal tubule function. Recently we have established an in vitro model using cultured Madine-Darby-Canine-Kidney (MDCK)-cells. Using this model an increase of LDH and GOT concentrations in the culture medium after shock wave exposure could be demonstrated as an indication of tubular damage. In the present study we examined the influence of fosfomycin on shock-wave-induced tubular damage. Fosfomycin is known as a protective substance against drug-induced nephrotoxicity. Suspensions of MDCK cells (70x10 E6/ml) filled in small containers were exposed to shock waves (Dornier HM 4, 18 kV). Two series were investigated: 1. fosfomycin added to culture medium (100 µg/ml), 2. control (without fosfomycin). Each series consisted of 4 groups of 128, 64 and 0 impulses respectively. In the control series LDH and GOT concentrations increased after ESWL in a dose-dependent

way. Whereas the GOT increase could not be influenced by fosfomycin, the LDH rise was significantly lower in the fosfomycin group. Our results indicate a protective effect of fosfomycin from shock-wave-induced lesions like permeability disorders as indicated by LDH-leakage in vitro. More severe disorders (e.g. cell rupture) as indicated by GOT-leakage was not influenced. Further studies must show whether fosfomycin is capable of reducing shock wave damage in-vivo as well.

### Protective Effect of Calcium Antagonist GÖ 6070 in PTH-Induced Renal Insufficiency

W. L. Strohmaier<sup>1</sup>, K. H. Bichler<sup>1</sup>, D. Seeger<sup>1</sup>, H. Oßwald<sup>2</sup>

<sup>1</sup> Department of Urology, <sup>2</sup> Institute of Pharmacology, Eberhard-Karls-University, W-7400 Tübingen, FRG

Renal function is frequently impaired in patients with primary hyperparathyroidism (HPT). In secondary HPT preexisting renal insufficiency can deteriorate. This may be due to hypercalcemia, renal calcifications, urolithiasis or direct "toxic" effects of parathyroid hormone (PTH). In an animal model the pathogenesis of PTH-induced renal insufficiency and the influence of the new calcium antagonist GÖ 6070 was studied. Male rats were randomly assigned to three groups: 1. control (n = 8) 2. PTH (n = 8) 3. PTH + GÖ 6070 (n = 8). PTH (30 µg/24 h, non-hypercalcemic dose) and GÖ 6070 (1 mg/kg/24 h) were given for 5 days. Urine was obtained at day 5 for determination of calcium and phosphate. Day 6 an inulin clearance was performed, the animals were sacrificed and kidneys taken for histological examination and measurement of calcium tissue levels. PTH deteriorated the glomerular filtration rate (GFR) significantly (10.3 vs 4.9 ml/min/kg). Concomitant application of GÖ 6070 significantly improved GFR (6.2 ml/min/kg). As expected from the PTH dose used here, all animals were normocalcemic. Nephrocalcinosis was not observed. Our results demonstrate that hypercalcemia, hypercalciuria or nephrocalcinosis are not prerequisites for PTH-induced renal insufficiency. The calcium antagonist GÖ 6070 could inhibit the deterioration of GFR significantly. Possible mechanisms are discussed.

### Treatment of Hypercalciuria as Prophylaxis of Calcium Nephrolithiasis

C. Reina, M. Arrabal, P. Campoy, E. Camacho, J. Reguera, M. Garcia

Servicio de Urologia, Hosp. Univ. de Valme, Sevilla, Spain

Hypercalciuria is the most common metabolic derangement in nephrolithiasis. The effectiveness of its treatment has been evaluated under clinical and biochemical approaches. We accomplished metabolic evaluation in 1200 patients; 88 % showed only one physiologic disturbance whereas 27 % had some of them. Hypercalciuria was present in 32 % of evaluated patients followed by hypocitraturia (21 %), hyperuricosuria (19 %), hypomagnesuria (17 %), and hyperoxaluria (12 %). We appreciated persistent urinary infection in 25 %. A 60 % incidence of the absorptive form was encountered among the hypercalciuric group the renal type was observed in 27 % and resorptive type in 13 %. We have applied the next therapeutic regime: 1) Absorptive hypercalciuria type I: low calcium diet and cellulose phosphate. 2) Absorptive hypercalciuria type II: low calcium diet. 3) Absorptive hypercalciuria type III: low calcium diet and orthophosphates. 4) Renal hypercalciuria: thiazides. 5) Resorptive hypercalciuria (hyperparathyroidism): with hypercalcemia, surgery; with normocalcemia, low calcium diet, cellulose phosphate and thiazides. Follow up was 12 months at least. Hypercalciuria decreased in 80 % of patients with absorptive and renal types as well as in 100 % of resorptive type. Likewise we studied the stone formation rate during follow up and pretreatment period, obtaining statistically significant reduction. These results support the effectiveness of hypercalciuria treatment as prophylaxis of calcium nephrolithiasis.

## Urolithiasis Etiopathogenia. Computerized Study over 1200 Patients

M. Arrabal, J. Castillo, C. Reina, C. Gonzalez, P. Campoy, F. Recio  
S. Urología y Bioquímica, Hospital Univ. de Valme, Sevilla, Spain

**Introduction:** Urolithiasis has been associated to lithogenic predisposition factor that justify the performance of a basic metabolic study to all lithiasic population. The society requests every day a better fluency and effectiveness in diagnostic-therapeutic protocols, so we propose and study in 3 phases: phase I, II, III in a progressive selection.

**Material:** We studied 1200 patients with urolithiasis who previously had been treated with open or endoscopic surgery and ESWL.

**Methods:** In phase I we have measured: glucose, urea, creatinine, uric acid, total protein, calcium, phosphorus, magnesium, urinary calcium, uric acid, oxalate, citrate, magnesium, urinary pH, acidity citration, amonium, citologic and bacteriological study that allow us to calculate CCR, TPR, TCaR, uric acid clearance, Ca/Cr, Brand reaction, oral calcium load, etc. Phase II, just in selective cases, we divided into:

IIA - differential diagnosis in hypercalciuria.

IIB - differential diagnosis in hyperoxaluria.

IIC - differential diagnosis in hyperuricosuria.

IID - quantification of a COLA.

Phase III include functional and specific tests. In order to make easier the interpretation of the results, this protocol has been computerized.

**Results:** Of the 1200 patients, 88 % had lithogenic disease; in 32 % there was hypercalciuria, 12 % had hyperoxaluria, 19.5 % had hyperuricosuria, 21 % had hypocitraturia, 17 % had hypomagnesuria, 0.7 % had cystinuria and the last 25 % had urinary tract infection; 27 % had several lithogenic disease. We have chosen 200 patients with recurrent urolithiasis; 98 % had lithogenic disease and in 43 % of cases there was several lithogenic disease.

**Conclusions:** The computerized UMS has to be made in all patients and this study simplifies the etiopathogenic diagnosis of urolithiasis.

## Usefulness of a Urinary Lithiasis New Clinic Classification

M. Arrabal, A. Lancina, E. Camacho, C. Reina, E. Vilches,  
R. Salazar, M. Garcia

Servicio de Urología, Hospital Univ. de Valme, Sevilla, Spain

**Introduction:** Since 1980 therapeutic possibilities widen (endoscopic surgery, ESWL), and the modern lithiasis classifications appear: Rocco proposes a classification similar to TNMCEP, Griffith and Valiquette report their own classification PICA-Burden, Arrabal and Rioja (1990) accomplish a clinical-therapeutical classification based on CEP/LTS-X: renal lithiasis types I-II-III-IV; ureteral lithiasis types I-II-III; vesical lithiasis types I-II and urethral lithiasis types I-II.

**Material and methods:** Over 700 patients and the CEP/LTS-X features we define renal lithiasis type I all calyceal and renal pelvic calculi less than 2-3 cm with normal renal function and urinary tract whose indication is ESWL monotherapy. The renal lithiasis type II are calculi bigger than 2-4 cm or less (2-3 cm) with some of these features: hard consistence and only one functioning kidney, it must be treated with ESWL associated to simple endourologic techniques. In renal lithiasis type III we approach PNL monotherapy; these are about 3-4 cm, hard consistence calculi with chronic renal dilatation. Renal lithiasis type IV comprises large calculi, bigger than 4 cm or associated to an altered kidney; treatment include PNL + ESWL or surgery. Ureteral lithiasis type I are calculi less than 2 cm, soft or moderate consistence with normal kidney and ureter; indicated therapy: ESWL "in situ". Ureteral lithiasis type II include lumbar ureteral calculi > 2 cm and all those lumbar ureteral calculi that are obstructive or hard consistence: the elected treatment is simple endourology (diversion-mobilisation and irrigation) and ESWL as first option. Ureteral lithiasis type III has indication of ureteroscopy; comprise calculi in iliac-

abdominal and pelvic portion or ureter that are 2 cm or less but hard and obstructive.

**Results-Conclusions:** This clinical-therapeutical classification point up a protocol with a prediction of good results above 90 % as well as complications and therapeutic failures have decreased.

## Treatment of Ureteral Lithiasis. Analysis of 3 Series

E. Camacho, R. Salazar, M. Arrabal, C. Reina, M. Garcia

Servicio de Urología, Hospital Univ. de Valme, Sevilla, Spain

**Introduction:** We show our experience on integral treatment of ureteral lithiasis studying 3 chronological and methodological different series. We evaluate results and set up our present approach, following a selective therapeutic protocol for each type of lithiasis.

**Material and methods:** In the 1986/90 period we have treated 3804 urinary calculi of which 860 were ureteral. Initially (first series, 1986/88) we used a Dornier HM3 lithotripter and treated 396 ureteral stones, we accomplished ESWL + irrigating catheter on lumbar location and URS on ilio pelvic zone. From July 1988 we used a Siemens Lithostar lithotripter and have treated 265 calculi (second series) with ESWL only, whatever the location was. The third series included the treatment of 199 ureteral stones following the next protocol that divides the ureteral calculi into 3 types (I, II, III) in terms of size, location, consistence, etc. Type I: ESWL "in situ", Type II: ESWL + simple endourology and type III: ureteroscopy.

**Results:** First series 79 % lumbar ureteral lithiasis (ESWL + irrigating catheter) was resolved successfully (mean 1.28 sessions, 1830 sw and 52 % locoregional anaesthesia); good results in 88.9 % ilio pelvic lithiasis (URS). Second series: good results on 72 % lumbar calculi, 59 % iliac calculi and 79 % on pelvic portion (mean 1.6 sessions, 4750 sw and no anaesthesia). Third series: Type I, 89 % succesfull outcome with ESWL "in situ"; type II, 85 % good results with ESWL + simple endourology and type III, 90 % complete resolution with URS.

**Conclusions:** From analysis of our results we deduce: 1) ESWL "in situ" is the treatment of choice for simple ureteral lithiasis (type I). 2) Simple endourologic techniques improve results and URS is resolutive in complex ureteral calculi (type II and III). 3) An accurate selection secures a greater degree of therapeutic success.

## Renal Lymphatics, Polycystic Disease of the Renal Sinus and Renal Lithiasis

R. Vela-Navarrete, E. Garcia de la Pena, C. Rodriguez Minon,  
A. Lopez de Alda, C. Gonzalez Enguita, F. J. y Calahorra

Servicio de Urología, Fundacion Jimenez Diaz, Madrid, Spain

Renal lymphatics has been considered to participate in the genesis of renal stone and renal cyst. Correlation between cysts of the renal sinus and renal lithiasis have been examined in 67 patients with polycystic disease of the renal sinus (J Urol (1983) 129:700-703). Incidence of lithiasis in this group of patients was of 41.8 %. Most common presentation forms were renal colic and elimination of small concretions. Composition of stones was as following: calcium oxalate 72 %, uric acid 21 %, calcium phosphate 7 %. Six patients were operated because of stone complications and in three there was small calculi localized in the renal papilla, as in the sponge kidney. In 70 % of patients with lithiasis there was a metabolic abnormality, such as increased elimination of uric acid (75 %), hypercalciuria (14 %) or both (11 %). However, 25 % of patients with cysts but no lithiasis had also increased elimination of uric acid. It is concluded that both conditions may be the consequence of high elimination of uric acid.

## Evaluation of Crystal Agglomeration of Calcium Oxalate in Urine of Stone Formers and Normal Controls Using a Flow Model of Crystallization

W. Achilles and H. Bröden

Urologische Universitätsklinik, Klin. Forschung,  
W-3550 Marburg/Lahn, FRG

A special dynamic crystallization model has been developed in order to evaluate agglomeration and adhesion of calcium oxalate (Caox) crystals on gel surfaces.

Method: Whole urine and a 6 mM solution of sodium oxalate were mixed 1:15 in a flow system. The resulting solution, which was supersaturated with respect to Caox, was conducted through a special chamber containing a gel (1% agar-agar) as a matrix for crystal growth and adhesion. A flow of solution of 0.5 ml/min was maintained for 6 hours by a 16-channel peristaltic pump. Crystals adhered on the gel surface were pictured by microphotography and were semiquantitatively evaluated.

Results: In a pilot study, corresponding crystal images of Caox were produced from 24 h-urines of 20 Caox stone formers (SF) and 21 normal controls (NC). A highly significant appearance of agglomerates of Caox crystals in the group of SF compared to NC ( $p < 0.001$ ) could be observed. However, no significant correlations could be demonstrated between the order of crystal images and those of other parameters of urine (like crystal growth rate, Ca and citrate).

Conclusion: Using a flow model of crystallization of Caox from whole urine which simulates physiological conditions as well as possible, crystal agglomeration and/or adhesion can be demonstrated to play a significant role in Caox stone formation.

## Crystal Growth of Calcium Oxalate in Urine of Stone Formers and Normal Controls

W. Achilles<sup>1</sup>, D. Dekanic<sup>2</sup>, M. Burk<sup>1</sup>, C. Schalk<sup>1</sup>, A. Tucak<sup>2</sup>, I. Karner<sup>2</sup>

<sup>1</sup> Urologische Universitätsklinik, Klin. Forschung,  
W-3550 Marburg/Lahn, FRG

<sup>2</sup> Inst. Med. Res. Occup. Health, YU-41001 Zagreb, and  
General Hospital, YU-54 Osijek, Yugoslavia

In this study, the relative crystal growth rate (Vcr) of calcium oxalate (Caox) and a number of other parameters were determined in 17h daily (d) and 7h nocturnal fractions (n) of whole urine from 20 male recurrent Caox stone formers (SF) and 29 matched normal controls (NC).

Vcr, which was determined by the Gel Crystallization Method (GCM), showed the largest difference between SF and NC among all parameters under investigation. Mean values  $\pm$  SD of Vcr were:  $0.73 \pm 0.58$  (SF-d) /  $0.21 \pm 0.22$  (NC-d) ( $p < 0.001$ ) and  $0.63 \pm 0.58$  (SF-n) /  $0.24 \pm 0.25$  (NC-n) ( $p < 0.01$ ).

Supersaturations of Caox between both groups were much less distinguished.

Significantly higher concentrations of Ca and lower concentrations of thermodynamic and kinetic effectors of Caox crystal growth in SF (Na, K, Mg, Cl, citrate, ammonium, isocitrate, sulfate, phosphate) were responsible for the higher crystal growth rates in SF compared to NC, i. e., they should be partially causative in Caox urolithiasis.

However, it may be concluded from the results that other additional properties of urine or the urinary tract (potentially crystal agglomeration and adhesion) must be accounted for the genesis of Caox stones. Thus, the "crystallization theory" of stone genesis can only in part be supported by our results.

## Quantification of Mineral Deposits on Urinary Catheters Produced in an Invitro Flow Model of Crystallization

W. Achilles, P. Kollenbach, J. Bewernick, C. Haacke, H. Feiber

Urologische Universitätsklinik, Klin. Forschung,  
W-3550 Marburg/Lahn, FRG

Deposition of mineral phases on urinary catheters during long-term use is a common problem in urological patients. It has been the aim of this study to quantify the properties of catheter materials in resisting mineral encrustation using a new flow model of crystallization.

Method: Depositions of calcium phosphates and struvite were produced by pumping supersaturated urinary solutions through catheter tubes (37 °C; reaction time: 4 h; flow rate: 0.5 ml/min). Supersaturation was performed within the tubes by mixing of two different solutions (native urine with ammonia) from flows of a multi-channel peristaltic pump. The crystalline material was quantified by determination of Ca, Mg and P after elution using ICP-AES.

Results: From the materials under investigation, PVC, PE and silicon were similar at resisting encrustation in-vitro. Tubes made of polyurethane showed the lowest rate of deposition in the model applied. Amounts of calcium phosphates and struvite precipitated were by 20-30% smaller than those deposited in a standard PVC tube.

Conclusion: The flow crystallization model could be shown to be useful in differentiating between different materials with respect to their ability to deposit minerals from urine. It may be successfully applied to optimize those materials in resisting natural encrustation in patients.

## Hypocitraturia: Main Risk Factor for Recurrent Calcium Oxalate Urolithiasis in Males

A. Cupisti, S. Lupetti, M. Meola, A. Guidi, F. De Finis, S. Sanguineti, E. Morelli and G. Barsotti

Clinica Medica I, Università di Pisa, Italy

Male gender represent a true risk factor for calcium urolithiasis probably because of the higher urinary excretion of calcium (uCa), oxalate (uOx), uric acid (uUa) and the lower urine citrate (uCit) than females. To define the relative role of metabolic factors as the cause of the recurrence of stone formation in males with primitive calcium-oxalate urolithiasis, we studied the 24 h urinary excretion of uCa, uOx, uUa, uCit and creatinine (uCr) in 73 male patients divided in two groups: 51 recurrent stone formers (RSF) and 22 single stone formers (SSF). 20 normal males were controls (C). uOx and uCit were measured by enzymatic assays. Results are expressed as mg/24 h (Mean  $\pm$  SD):

	uCa	uOx	uUa	uCit
RSF	262 $\pm$ 113*	27.8 $\pm$ 8.4*	605 $\pm$ 165	433 $\pm$ 218**a
SSF	272 $\pm$ 109*	25.5 $\pm$ 6.9	535 $\pm$ 136	676 $\pm$ 249
C	207 $\pm$ 71	22.7 $\pm$ 8.6	580 $\pm$ 116	718 $\pm$ 279

\*  $p < 0.05$ , \*\*  $p < 0.001$  vs C; <sup>a</sup>  $p < 0.001$  vs SSF

Hypocitraturia (uCit  $< 320$  mg/24 h) was detected in 16 out of 51 RSF (29.4%) and in 1 out of 22 SSF (4.5%), whereas hypercalciuria (uCa  $> 300$  mg/24h) was similar in RSF (31.4%) and in SSF (27.6%); hyperoxaluria (uOx  $> 45$  mg/24 h) was present only in a small number of RSF (7.8%). These data confirm that high levels of uCa and uOx represent risk factors for lithogenesis, but also strongly indicate that low urine citrate excretion as the most important urinary abnormality accounting for the recurrence of calcium oxalate stones.

## Side Effects of Piezoelectric Shock Waves on the Renal Parenchyma: Experimental Model

J. Alcover, J. M. Mallafre, R. Gutiérrez, B. Umbert, P. Carretero  
Hospital Clinico S. Urologia, Cátedra Urologia,  
Universidad Barcelona, Spain

Extracorporeal shock wave lithotripsy is an accepted procedure for the treatment of renal lithiasis. Although we have some information about its side effects, there is unanimous acceptance of the need to perform more studies.

We designed an experimental model with 41 rabbits divided

into three groups: 30 bilateral rabbits, 5 unilateral rabbits and 6 rabbits as a control group. All, except the control group, received 5000 impulses on their left kidney. Prior to treatment, blood and urine tests performed 2 hours, 24 h, 72 h, 14 days, 21 days, and 31 days after treatment. Morphologic studies were also made of the treated kidneys.

The results include: 45.7% of blood collections, of which 12.5% are perirenal and 87.5% subcapsular; 45.7% of parenchymatous lesions of between 13x10 mm and 3x2 mm in size. As regards the analytical tests, the most notable are rises in the number of leucocytes, CPK and creatinine in blood, and proteinuria. All figures appear to have returned to normal 14 days after treatment.

Morphological analysis showed the presence of very expressive and variable phenomena of haemorrhage, vascular lesions, lesions of tubular necrosis and, in advanced stages, the presence of focal fibrosis.

### Hormonal Variations in Extracorporeal Shock Wave Lithotripsy (ESWL)

V. Gancedo, L. Ibarz, F. J. Ruiz, M. Ramón, P. Cabré, A. Mauri  
Centro Sanitario de Litiasis Renal, Instituto Dexeus,  
Barcelona, Spain

Sixty-five patients with kidney stones treated with ESWL under epidural anaesthesia were studied.

Plasma levels of human growth hormone (HGH), prolactin (PRL), adrenocorticotrophin (ACTH) and cortisol were determined in each patient by competitive RIA method. The extraction protocol was as follows:

- A. Basal, pre-treatment
- B. 15 minutes post-ESWL
- C. 24 hours post-ESWL
- D. 45 days post-ESWL

The results obtained showed:

1. All basal values of the four hormones studied were within normal limits.
2. HGH values were normal in all extractions studied.
3. PRL concentrations had increased above normal levels at 15 minutes post-ESWL.
4. ACTH values 45 days post-ESWL had increased significantly with respect to basal values.
5. Cortisol levels had increased significantly at 15 minutes and 24 hours post-ESWL with respect to basal values, but remained within normal limits.

Similarly, results showed no significant differences in hormone values studied with regard to the number of shock waves and duration of treatment. In conclusion: slight variations in the levels of the hormones studied occur in ESWL but in the majority of cases remain within normal limits.

### Shock Wave Treatment of Staghorn Stones

L. Ibarz, F. J. Blasco, M. Ramón, F. J. Ruiz-Marcellán  
Centro Sanitario de Litiasis Renal, Instituto Dexeus,  
Barcelona, Spain

We have reviewed 368 patients with 388 staghorn calculi, 318 women with a mean age of 46.37 years (9-74) and 50 men with a mean age of 49.05 years (6-78). Lithiasis were located in 182 cases in the right kidney and in 206 patients in the left one. In 278 patients positive urine culture was obtained, in 78 was negative and in 12 it remains unknown. In the previous renal study we found 238 normal kidneys in spite of their staghorn calculi, 48 had moderate and 14 severe obstruction and 88 cases suffered chronic pyelonephritis.

Patients were treated with ESWL and if necessary with ureteroscopy (URN), ureteral catheterism (C) or double pig-tail catheterism. A single session was enough in 118 stones (118 sessions with 148 procedures), in 170 cases we employed two sessions (340 sessions with 408 procedures), in 86 patients we used three sessions (258 sessions with 326 procedures)

and 14 calculi required four sessions (56 sessions with 88 procedures). A total of 772 sessions were made to treat 388 staghorn stones (an average of 1.98 sessions/stone), performing 970 procedures (a median of 2.5 procedures/stone). In the treatment of the staghorn calculi we used a minimum of 800 waves and a maximum of 10100. We had 108 episodes of asymptomatic obstruction diagnosed by routine ultrasonographic control, four cases of haematoma, four symptomatic obstructions, two perforations due to URN and 24 cases of initial sepsis. Elective placing of a double pigtail catheter was performed in 84 staghorn calculi, with a mean remaining time of 39.73 days (1-150). The average days/patient was 3.1 days. At the end of this follow-up (it ranged from one to 54 months, with a median of 17.88 months) 228 kidneys were stone-free and in 28 cases the history was not clear enough to know the presence of remaining stones. We considered 286 normal function kidneys and two cases without function. The urine culture after treatment was negative in 306 cases, positive in 26 cases and in the other 36 remains unknown.

We evaluate the results of shock wave monotherapy in staghorn stones describing the indications and contraindications of this therapeutic procedure.

### Laser Treatment of Ureteric Lithiasis

F. J. Ruiz-Marcellán, L. Ibarz-Servio, M. Ramón-Dalmau  
Centro Sanitario de Litiasis Renal, Instituto Dexeus,  
Barcelona, Spain

Certain ureteric calculi for its situation, hardness and embedment require intraureteral fragmentation.

The fibre that conduits the laser beam has a fine calibre, it permits it focused for a semirigid ureteroscope of 7.2 French. Since December 1988 until October 1990 we have treated in our Center 350 patients with lasertripsy, 199 men and 151 women. 21 patients suffered bilateral ureteral lithiasis. Both were treated at the same time.

We used a Dye-Laser (Candela<sup>®</sup>) with a semirigid ureteroscope. The number of waves applied was 350 at 60-120 mJ. Situation of the calculi: Upper third 10% (37), middle third 25% (93), lower third 65% (241).

Results: complete fragmentation was obtained in 345 (93%), in 24 patients (6.4%) the calculi moved to the kidney and extracorporeal shock wave lithotripsy was used in the same session, and for 2 (0.6%) it was necessary ultrasonic fragmentation.

No patients required open surgery and there have been no important complications.

The calculi that were analysed by crystallography and infrared spectrography were: Mixed calcic oxalate 55, dihydrate calcic oxalate 47, monohydrate calcic oxalate 31, struvite 20, uric acid 12 and cystine 3. The rest was not analysed.

### The Fibroscopy in Urology: Results and Programmes for the Nineties

V. Cocimano, D. Griffa, G. Marino, R. Brigato, S. Pastorini,  
R. Marten Perolino

Divisione di Urologia Ospedale Mauriziano "Umberto I" di  
Torino, Largo Turati 62, 10128 Torino, Italy

The use of fibroscopy in urology is not new, in fact is almost routine. At the beginning of the eighties it was considered avant garde to view the upper urinary tract with fibroscopy, now in the hands of an expert is a routine procedure. This article discusses results taken with the flexible endoscope from 1986 to 1990, combining ureterocystoscopy and URS. We have done over 1000 ureterocystoscopies of which 857 were solely diagnostic and 148 diagnostic plus operative. We have taken into consideration the percentage success, patients discomfort and cost/benefit. We have also done 62 URS using Finlayson's technique, 50 diagnostic and 12 operative, comprising lithotripsy with hydroelectric waves, diagnostic



biopsy and diathermy for small papillary neoplasm etc..

In 13 cases the fibroscope was used during conservative operations to explore the upper or lower urinary tract. In conclusion fibroscopy is essential to today's endourology giving a non-traumatic method of follow up for patients with bladder neoplasm, without using any liquid. The operation of fibroscopy depends upon the type used, but it is less operative than Perez-Castro ureteroscope. A urologist's experience is born with specific training in fibroscopic techniques.

Reference: Laser ureterolithotripsy with combined rigid and flexible ureterorenoscopy. Eiji Higashihara, Shigeo Horie, et al. (1990) J Urol 143:273-274

### Calculi Surface Influence in the Results of Extracorporeal Shock Wave Lithotripsy in the Renal Stones

L. Rodriguez Vela, C. Rioja Sanz, J. M. Ibarz Navarro, C. Larumbe Zazu, C. Gonzalez Enguita and L. A. Rioja Sanz  
Dept. Urology, "Miguel Servet" Hospital, Zaragoza, Spain

An essential parameter to consider the therapeutic strategy of one stone is the calculi burden. We have calculated the calculi size in surface units ( $\text{mm}^2$ ). This stone surface is got as a result of the calculus longitudinal diameter by transverse both measured in mm on the simple KUB film. The surface of stones is a more precise approach to the calculi volume than the simple reference in a simple diameter. 1500 renal units treated by ESWL with a HM3 Dornier have been studied, included in a research protocol with 38 variables in a statistical program STAT VIEW 512.

The calculi surface, mentioned in  $\text{mm}^2$ , is an essential measure that has been conditioned meaningfully the therapeutic strategy use ( $p < 0.0001$ ), the applicated shock waves number for the fragmentation ( $r = 0.65$ ), the obstructive complication appeared ( $p < 0.0001$ ), the colic renal incidence post-ESWL ( $p < 0.0001$ ) and general complication ( $p < 0.0002$ ) after ESWL, the rate of residual stones in three months ( $p < 0.0001$ ) and the results obtained by the ESWL treatment ( $p < 0.0001$ ). The lithiasic surface is the most exact evaluation of the stone burden that determines significantly the shock wave number necessary for their fragmentation, the complications and outcomes post-ESWL.

### Stone Chemical Composition Influence in the Resistance to the Fragmentation with Shock Waves Electrohydraulic

L. Rodriguez Vela, C. Rioja Sanz, T. Abadia Bayona, J. M. Ibarz Navarro, C. Larumbe Zazu, C. Gonzales Enguita and L. A. Rioja Sanz

Urology Department, "Miguel Servet" Hospital, Zaragoza, Spain

The urinary calculi fragmentation with shock waves is produced by the pressure strength and tension getting into the stone because to the changes in the acoustic impedance.

With the microscope of stereoscopic lens and infrared spectrophotometry, the gravels removed from 1383 patients treated with ESWL (HM3 Dornier) are analysed.

To value the stone fragmentation resistance there was calculated by polinomic regression the existing big correlation ( $r > 0.60$ ) between the waves number and the stone surface ( $\text{mm}^2$ ) and

there was got the mathematics formulas. Calculi the least resistant to the fragmentation with the electrohydraulic shock waves had been: phosphates+calcium oxalate, dihydrate calcium oxalate and those of phosphates. After these, the infected calculi and in the third place, those of the calcium-oxalate monohydrate and calcium-oxalate monohydrate+dihydrate. And the end with the higher resistance to the fragmentation, we would have the acid uric calculi and cystine stones.

The urinary stone fragmentation resistance depends significantly on lithiasic surface and the calculi composition. This paper shows the mathematics formulas that they permit to us to produce necessary shock wave number to the fragmentation of each kind of stone according to the composition of them. So, they show the different resistance to the fragmentation from the different kinds of calculi.

### Simultaneous Load with Sodium Citrate and Ammonium Chloride

M. Berényi<sup>1</sup>, D. Frang<sup>1</sup>, B. Büki<sup>2</sup>, J. Panovics<sup>1</sup> and J. Nemeth<sup>2</sup>

<sup>1</sup> Dept. of Urology, <sup>2</sup> 1st Dept. of Medicine, Semmelweis Univ. of Med., H-1082 Budapest, Hungary

The favourable effects of oral alkali citrates on chemical composition of urine are attached to the change of pH. It was supposed by us that elimination of alkalinity of sodium citrate (12 mmol sodium citrate + 36 mmol ammonium chloride per 72 kg) would elucidate the real effect of oral citrate ions, independently of pH.

Two hour fasting urines were compared with 2.5 hour after-load urines and controls (Ca, P, creatinine, uric acid, citrate and pH were measured).

No significant changes were found in Ca/citrate, Ca/creatinine, citrate/creatinine or in any other ratio, though favourable alterations were detected in urines after loading with 6 mmol potassium citrate. It is concluded that neutrale citrates or citric acid in usual doses have no prophylactic value in the treatment of oxalate lithiasis, that is the effectiveness of alkali citrates is bound to the alkali ions and not to the citrate ions.

### Extracorporeal Piezoelectric Lithotripsy in Children

D. Neisius, M. F. Netzer, T. J. Davies and M. Ziegler

Urological Clinic, University of Saarland Medical Center, W-6650 Homburg, FRG

Forty-five children up to the age of 14 years with urinary stones have been treated in our clinic with the Wolf-Piezolith. Most stones were caliceal and pelvic stones, but seven partial or total staghorns and five cases of multiple caliceal stones in combination with ureteral stones were also treated.

Thirty children (66%) were treated without sedation or anesthesia. In 32 cases (71%), a sufficient disintegration of stones was possible in one or two sessions. Children with large and/or multiple stones were treated in three or more sessions. At the time of discharge (average stay of 4 days) 58% of all children (26/45) were stone-free and after three months the success rate was 91% (41/45). Post-auxiliary measures because of obstructions or other serious problems were not necessary in any of the children.