

# The impact of metabolic risk management on recurrence of urinary stones

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## Abstract

**Introduction:** Urinary stone disease is a common urologic problem and recurrence in stone formation is a very familiar issue to urologists. Although recurrence in stone formation has been linked to metabolic abnormalities, it can be accessible by metabolic risk analysis studies.

**Methods:** Herein, we present our experience in metabolic risk management on recurrence of urinary stones for 10 years in Akdeniz University School of Medicine department of Urology. We retrospectively analyzed Akdeniz University Urinary Stone Database between dates of January 2000 and December 2010. We found over 3500 patients who were managed by SWL (shock wave lithotripsy) or PCNL (percutaneous nephrolithotripsy) or URS (Ureterorenoscopic lithotripsy) or open surgery.

**Results:** 525 patients' metabolic risk analysis was ordered due to recurrent urinary stone disease. Only 134 (25.5 %) current metabolic analysis were returned. Mean patient age was 32.2 years (range: 19-82 years). Patients were 103 male and 31 female. Stone analysis results were CaOx monohydrate in 48 (35.8 %), CaOx dihydrate in 8 (5.9 %), CaOx mono and dihydrate in 70 (52.2 %), uric acid in 3, CaOx monohydrate and uric acid in 2, cystine in 2, and struvite in 1 patient, respectively. The metabolic risk analysis showed some abnormality in 54 (40.2 %) patients.

**Conclusion:** Although compliance to metabolic risk analysis studies is low among recurrent urinary stone formers, some significant metabolic abnormalities could be detected in those who are effectively screened. Recurrence of urinary stones in patients who are started on appropriate metabolic management can be prevented.

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*Keywords: Metabolic analysis, PCNL, Stone management, SWL, URS.*

## Introduction

Urinary stone disease is a common urologic problem and recurrence in stone formation is a very familiar issue to urologists. Distinct genetic, congenital, metabolic, and nutritional mechanisms have been found to underlie this common disorder and account for the wide variation in the geographical prevalence and stone patterns in different populations (1). Epidemiologically, urinary stone disease is more common in males (male/female = 3/1), hot climatic zone, fair-skinned people, people with metabolic disorders (primary hypocitraturia, primary hyperoxaluria, cystinuria, xantinuria), dietary habits (nutrition of mainly

protein, carbohydrate or oxalate) (2, 3). 15 % of the population will develop urinary stone disease over life time (4). Daily life in a western affluent society provides a bundle of factors which impair urine composition and thereby increase the stone formation risk: generally people do not drink enough and only twice or thrice a day, they eat food that is too rich in calories and table salt, but have deficiencies in fiber and alkali. Despite the highly developed health care systems in the western world, the stone disease itself seems to be an unresolved issue (5). Diagnostic tools (especially the high availability of ultrasound and computerized tomography-scans in routine practice) allow today the diagnosis of clinically dumb urinary calculi. Although, it is important to diagnose and treat urinary stone disease, prevention of recurrence is very important (6). Metabolic evaluations have allowed the identification of physiological or environmental causes of urinary cal-

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culi in more than 97 % of patients (7). Although recurrence in stone formation has been linked to metabolic abnormalities which can be accessible by metabolic risk analysis studies, only few data is present proving the management of metabolic risks may effectively decrease the recurrence. In this retrospective study, we analyzed our 10-year urinary stone database to search the effect of metabolic management of risk factors detected by risk analysis studies on recurrent stone formers.

## Methods

### *Patients*

We retrospectively analyzed Akdeniz University Urinary Stone Database between dates of January 2000 and December 2010. We found over 3500 patients who were managed by SWL (shock wave lithotripsy) or PCNL (percutaneous nephrolithotomy) or URS (Ureterorenoscopic lithotripsy) or open surgery. All patients were recorded according to their age, sex, previous urinary stone disease, previous and current stone analysis, previous and current metabolic analysis, previous and current metabolic management, current stone burden, current stone location, modality of intervention, results of intervention and current stone status on the last visit date.

### *Management of urinary stones*

We have been using "Siemens lithostar" for SWL (stones in kidney, ureter or bladder) standard PCNL techniques (for kidney stones), semirigid or flexible ureterorenoscopy (for stones in ureter and kidney), and classic open surgery procedures in urinary stones (pyelolithotomy, nephrolithotomy, uretherolithotomy, open surgical procedures for bladder stones) (8-10). We used pneumatic lithotripter or ND-YAG laser for endoscopic procedures.

### *Urine and metabolic analysis*

Subjects were given an order for a metabolic stone evaluation to be performed at home. Two 24-hour urine collections were collected at home and brought to our central laboratory. The evaluation included standard urinary indexes, such as volume, level of creatinine, magnesium, phosphate, albumin, calcium, oxalate, citrate, uric acid and pH, as well as urinary calcium oxalate,

calciumphosphate and uric acid supersaturation. Urine chemistry studies, such as calcium, citrate, uric acid and oxalate, were adjusted for urine creatinine. Urine pH, calcium oxalate, calciumphosphate and uric acid supersaturation were assessed but did not require correction using creatinine excretion. As well as urinary analysis, blood analysis was performed to urinary stone disease patients. We analyzed levels of sodium, calcium, potassium, parathormone, albumin, magnesium, phosphate, creatinine, and blood urea nitrogen in the blood.

### *Stone analysis*

We gave a urinary stone analysis form of MTA (Maden tetkik arama enstitüsü – governmental mineral etude institute) to all urinary stone disease patients after they reduced urinary stone or after PCNL or URS operation. Patients have posted MTA form and as least 3 cm<sup>3</sup> stone burden to MTA research laboratory. Urinary stones analyzed with electrospectrally (X-ray defraction methods) in MTA, according to its quality and quantity.

### *Statistical analysis*

Descriptive statistical methods were used.

## Results

525 patients' metabolic risk analysis was ordered due to recurrent urinary stone disease. Only 134 (25.5 %) current metabolic analysis were returned. Mean patient age was 32.2 years (range: 19-82 years). Patients were 103 male and 31 female. PCNL procedure was used for 92 (68 %) patients, URS was used for 7 patients (6 %), and SWL was used for 35 patients (26 %). Stone analysis results were CaOx monohydrate in 48 (35.8 %), CaOx dihydrate in 8 (5.9 %), CaOx mono and dihydrate in 70 (52.2 %), uric acid in 3, CaOx monohydrate and uric acid in 2, cystine in 2, and struvite in 1 patient, respectively. The metabolic risk analysis showed some abnormality in 54 (40.2 %) patients. The most common abnormality was hypocitraturia in 31 (57.4 %) patients. The second and third most common abnormalities were hyperoxaluria in 21 (38.8 %) and hypercalciuria in 19 (35.1 %) patients, respectively (Table 1). No primary hyperoxaluria was noted. In 2 hypercalciuric patients primary hyperparathyroidism was found and referred to adenoma removal. In other 2 hypercalci-

**TABLE 1.** Patient and stone disturbance.

	Hypocitraturia	Hyperoxaluria	Hypercalciuria	Hypocitraturia and hyperoxaluria	Hypercalciuria and hyperoxaluria	Hypocitraturia and hypercalciuria	Hypocitraturia and hyperuricosuria	Hypercalciuria and hyperuricosuria	Hypocitraturia and hypomagnesiuria	Hypocitraturia and hyperphosphatemia
Patient number: 54	16	8	7	7	6	4	2	2	1	1
Patient numbers of recurrent urinary stones		1	3	1			1			
Patient number: 6										

uric cases renal type hypercalciuria was found and started on thiazide diuretics. Patients were started on metabolic management by urinary alkalization, citrate replacement, Vit B6 replacement, allopurinol and dietary restrictions accordingly. All patients were followed up for a mean of 16 months (range: 2-9 years) with renal ultrasound and KUB (Kidney ureter and bladder x-ray). In 8 (5.9 %) patients, stone recurrence was detected. Recurrent stone formers demonstrated stone types as CaOx monohydrate in 5, cystine in 1, uric acid in 1, CaOx dihydrate and uric acid in 1 patient, respectively. Their metabolic abnormalities were hypercalciuria in 3 (1 rejected parathyroid adenoma removal and 1 stopped thiazides), hyperoxaluria in 1, hypocitraturia and hyperoxaluria in 1, and hyperuricosuria in 1 (stopped allopurinol treatment) patient, respectively (Table 1). Remaining one recurrence was in a cystinuric case while the other recurrence showed no metabolic abnormality.

## Discussion

The diverse manifestations of urolithiasis provide a very interesting epidemiological study from the standpoints of geography, socioeconomic status, nutrition and culture, which ultimately affect the stone structure and composition (11). The past 100 years have produced revolutionary changes in the anatomical and clinical pathology of stone disease in the whole World (12). Improved technology has revolutionized the management of stones: the advent of SWL, fiber-optic, semi-rigid and flexible ureteroscopes, and narrow-caliber endoscopes, and minimally invasive options in addition to prevailing open surgical procedures have expanded. The basic idea is to select the best possible modality to make the treatment better controlled. Addition-

ally, to keep in mind the morbidity and cost-effectiveness of the procedure in today's context. After treatment of urinary stone, it is very important to inform patients about the recurrence of urinary stones. Medical treatment, metaflaxi and modifications in dietary habits can help to prevent recurrence of urinary stones. Medical treatment should be based on assessing 24h urinary metabolic abnormalities (13). Drug treatment is advised after a high fluid intake (>3 L/day). Dietary modifications in the long term fail to correct abnormalities or prevent recurrence. Available trials offer urologists excellent treatment strategies for prevention of calcium stones. Since uric acid stones are a consequence of low urine pH, urologists can treat them confidently despite the lack of prospective trials for additional therapeutics. Although with imperfect treatment, the cystine stones could also be prevented. Although potassium citrate salts are effective along with ESWL, they may promote the formation of calcium phosphate stones, the prevalence of which continues to rise with time. Abnormal urine pH and calcium excretion rate are predominant findings that play a major role in the pathogenesis of stone formation (14). Recent evidence strongly supports the concept that dietary calcium restriction does not protect against calcium stone formation and that a reduced calcium diet is detrimental, leading to bone loss, in hypercalciurias other than absorptive type I (15). In fact, it appears that urinary calcium excretion in most renal stone formers is more dependent on the dietary acid load than on the dietary calcium intake itself (16). The excess acid load in a diet rich in animal protein is mainly buffered by the bone, leading to calcium resorption and consequently to hypercalciuria (17). Conversely, decreasing the

acid load either by dietary modifications or alkali therapy has an impact on decreasing stone recurrence, while preventing bone loss. New evidence associates the decolonization of oxalate degrading intestinal flora with a higher risk of calcium oxalate stone formation, possibly opening the door for biological manipulation as a novel approach for the prevention of urinary stone formation. We must not leave the stones unturned. Roughly 25 % of the stone formers belong to the high risk group and definitively need specific measures to prevent frequent stone recurrences. Patients forming “civilization stones” or suffering from the metabolic syndrome, respectively, benefit from the recommended measures of metaphylaxis in a multifold way. As far as children are concerned, keep in mind that most of the stones formed in childhood have a metabolic basis and hence, early diagnosis is mandatory for the purpose of adequate

treatment (18). It is the best to treat the “cause” of disease instead of removing its “symptom”.

## Conclusion

Although compliance to metabolic risk analysis studies is low among recurrent urinary stone formers, some significant metabolic abnormalities could be detected in those who are effectively screened. Recurrence of urinary stones in patients who are started on appropriate metabolic management can be prevented. Patients should be warned about the close relationship between metabolic risk screening and compliance to management and urinary stone recurrence.

## Competing interests

The author declares that there are no financial and personal relationships with other people or organizations that could inappropriately influence this work.

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