Original scientific paper
UDC 616.61-003.7:628.124

SOFT DRINKING WATER AND UROLITHIASIS

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Abstract

It is well known that soft drinking water has an influence on urolithiasis and areas with soft drinking water have a high rate of urolithiasis. The area where our study was carried out has extremely soft drinking water with a mineral content of less than one German grade. Because of this, we did a biochemical investigation on 21 stone-formers (12 males and 9 females) and 6 male volunteers. 24 hour urines were collected, and the excretion of Na, K, Ca, Mg, phosphates, and chlorides, were measured.

Our investigation showed that stone-formers had an urinary excretion of: Na, 321,7+134,9 mmol; K, 39,4+16,2 mmol; Ca, 4,8+2,2 mmol; Mg, 4,1+1,7 mmol; phosphates, 22,6+22,6 mmol; chlorides, 180,2+69,7 mmol. The same investigation was carried out in the volunteers, all of them medical doctors, and showed a urinary excretion of: Na 352,0+85,5 mmol; K, 44,2+8,2 mmol; Ca, 4,2+0,4 mmol; Mg, 3,1+1 mmol; phosphates, 19,9+7,2 mmol; chlorides, 205,7+39,8 mmol. Our results are very interesting because we found hypercalciuria in only 5 (19%) of stone-formers; however, there was a very high rate of hypernatriuria and moderate hyperchloriuria in 90% of stone-formers and 100% of volunteers.

The significant high level of sodium excretion by stone-formers and volunteers in our area with extremely soft drinking water is the result of salt in their food, which is probably added the food. Hypernatriuria is probably a risk factor associated with hypercalciuria or normocalciuria in stone-formers in our area.

Key words: *Soft drinking water, urolithiasis, hypernatriuria, hyperchloriuria*

1. Introduction

Although stone disease is one of the most common afflictions of modern society it has been described since antiquity. With Westernization of global culture, however, the site of stone formation has migrated from the lower to the upper urinary tract and the disease once limited to men is increasingly gender bind. The lifetime prevalence of kidney stone disease is estimated at 1% to 15%, with probability of having a varying according to age, gender-adult men affects more commonly than adult women, genetic predisposition (intrinsic factor), race-whites have the highest incidence compared with Asians, Hispanics and African Americans, geographic location, climate-seasonal variation is likely related to temperature, occupation-heat exposure and dehydration, body mass index and weight, water intake-high water intake has beneficial effect on stone formation. Geographic differences in the incidence of stone disease have been ascribed in some cases to differences in the mineral and electrolyte content of water in different areas. Although several investigators reported a lower incidence of stone disease in geographic regions with a "hard" water supply compared with a "soft" water supply, where water "hardness" is determined by content of calcium carbonate (Churchill *et al*. [1], Sierakowski *et al*. [2]), others found no differences. Schwartz and co-workers [3] found no association between water hardness and incidence of stone episodes, although they did observe a correlation between water hardness and urinary magnesium, calcium, and citrate level.

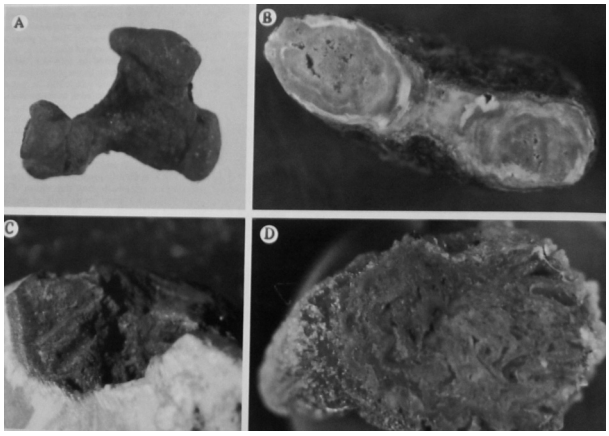

Figure 1. A. Struvite calculus (infection stone). B. Cross section shows intensive stain C. Higher magnification. D. Calcium oxalate calculus (uninfected)

The most common component of urinary calculi is calcium, which is a major constituent in nearly 75% of stones. Calcium oxalate makes up about 60% of all stones; mixed calcium oxalate and hydroxyapatite 20% and brushite stones, 2%. Both uric acid and struvite (magnesium ammonium phosphate) stones occur approximately 10% of time, whereas cystine stones are rare (1%).

As it is well known that soft drinking water has an influence on urolithiasis and areas with soft drinking water have a high rate of urolithiasis. The area where our research study was carried out (region of Bitola, Republic of Macedonia) has extremely soft drinking water with a mineral content less than one German grade.

2. Materials and Methods

We did a biochemical investigation on 27 people in total, or 21 stone-formers (12 males and 9 females), and 6 male volunteers. Stone formation was established using X ray investigation and stones were extracted with Dormia basket (Figure 1). 24 hours urines from all volunteers were collected, and the excretion of: Sodium, Potassium, Calcium, Magnesium, Phosphates, and Chloride, were measured, by means of Electrolyte AnalyzerAVL.

Table 1. N° of stone-former patients, gender and age

Gender/N° of stone-former patients	Age	Recidive stone
Males/12	35-65 (45)	7
Females/9	33-67 (49)	6
Volunteers/6	35-57 (39)	0

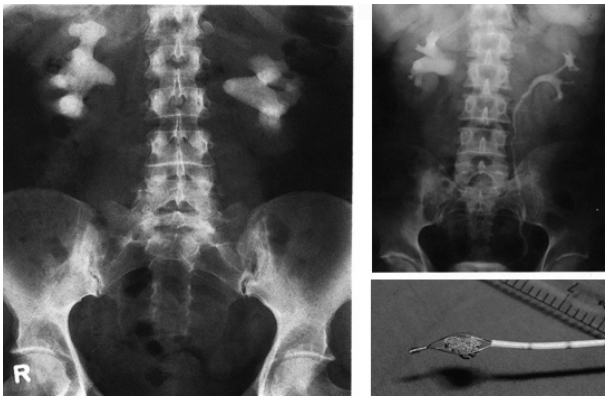

Figure 2. X-ray investigation shows staghorn stone (left), and Dormia basket extraction of the stone (right)

3. Results and Discussions

Our investigation showed that stone-formers had a urinary excretion of:

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- Potassium, 39,4+16,2 mmol;
- Calcium, 4,8+2,2 mmol;
- Magnesium, 4,1+1,7 mmol;
- Phosphates, 22,6+22,6 mmol;
- Chlorides, 180,2+69,7 mmol;

The same investigation was carried out in the volunteers, and all of them medical doctors, and showed a urinary excretion of:

- Sodium, 352,0+85,5 mmol;
- Potassium, 44,2+8,2 mmol;
- Calcium, 4,2+0,4 mmol;
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Results are very interesting because we found hypercalciuria in only 5 (19%) of stone-formers; however, there was a very high rate of hypernatriuria and moderate hyperchloriuria in 90% of stone-formers and 100% of volunteers.

The significant high level of sodium excretion by stone-formers and volunteers in our areas with extremely soft drinking water is results of salt intake in their food, which is probably added in the food.

Hypernatriuria is probably a risk factor associated with hypercalciuria or normocalciuria in stone-formers in our area.

4. Conclusions

- The natural course of the first urinary stone leads to 27-50% recurrence within 5 years, according to two prospective studies available.

- There are few studies available addressing dietary prophylactic therapy in patients with their first urinary stone. Strauss et al. [4] reported 14% recurrence in 58 patients on a low-calcium and low-purine diet after 3 years and other authors detected only a 5% recurrence rate among 29 patients on an individual diet, compared with 74% (from 57 patients) on a fluid-intake regimen only.
- In a prospective, randomized trial assessing the effect of fluid intake on stone recurrence among first-time idiopathic calcium stone formers, urine volume was significantly higher in the group assigned to a high fluid intake compared with control group receiving no recommendations, and, accordingly, stone recurrence rates were significantly lower (12% vs. 27%, respectively; Borghi et al. [5]).
- In a study of Churchill et al. [1] and Sierakowski et al. [2] that in the regions with a "hard" water supply compared with a "soft" water supply determined by content of calcium carbonate showed lower incidence of stone formation. Schwartz and co-workers [3] found no association between water hardness and incidence of stone episodes, although they did observe a correlation between water hardness and urinary magnesium, calcium, and citrate level. Prevention of stone formations in regions with soft drinking water is high water intake of bottled water (with appropriate minerals and electrolytes content).

5. Refrences

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