

Comparison of individuals consuming natural spring water and tap water in terms of urinary tract stone disease

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Summary *Objectives: To compare individuals consuming natural spring water and tap water in terms of presence of urinary tract stone disease. Patients and methods: Patients were divided into two groups on the basis of the type of water: tap water (Group I) vs natural spring water consumers (Group II). The two groups were compared in terms of presence of urolithiasis. In addition to the type of water consumed, participants were investigated in terms of age, sex, occupation, body mass index (BMI) and presence of hypertension (HT) and diabetes mellitus in order to evaluate if they constituted a risk factor for urolithiasis.*

Results: Two hundred fifty-nine patients consuming tap water and 254 consuming natural spring water were included in this study. Presence of urinary stone disease was determined in 27% of patients in Group I and 26% of Group II (p = 0.794). At multivariate analysis involving all variables that might be correlated with the presence of urolithiasis; male gender, high BMI and presence of HT emerged as being significantly associated with urolithiasis. Conclusions: Although we showed that male gender, presence of HT and high BMI affect stone formation, no difference was demonstrated in terms of presence of stone among patients consuming tap or natural spring water

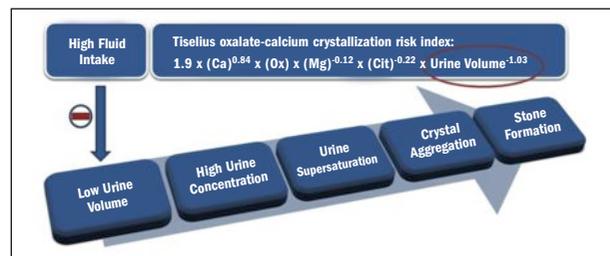
KEY WORDS: Tap water; Natural spring water; Ultrasound; Urolithiasis.

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INTRODUCTION

Urinary system stone disease is a common pathology, with a lifetime prevalence across the world of between 1% and 15% (1). The disease is more common in some geographical regions probably in relation with various genetic and environmental factors. Considering environmental factors alone, stone disease is more common in mountainous areas and in people living in dry and hot climatic conditions, such as deserts and tropical regions (2). Studies have implicated temperature-related fluid loss from the body and rise in vitamin D stimulated by solar rays as the main reasons for this (3,4).

Several studies have proved that increasing daily fluid intake plays a protective role against stone formation by leading to diuresis and preventing supersaturation of stone components in urine (5-7). As much as the amount of fluid consumed, however, several studies have also considered the effect on stone formation of mineral content, electrolyte level, hardness and pH level of water consumed (8-15). However, no studies to date have investigated the widespread popular idea that consumption of chlorinated tap water can lead to stone disease. In order to answer that question, we used renal ultrasound (US) to compare individuals consuming natural spring water or tap water in terms of presence of stone in the urinary system.



MATERIALS AND METHODS

Study population

Five hundred thirteen patients aged over 18 who underwent urinary system US due to abdominal or flank pain and meet study conditions were included in the study following approval of its design by the *Canakkale Onsekiz Mart University Ethical Committee*. Subjects with renal malformation that might constitute a risk factor for urinary stone formation (horseshoe kidney, polycystic renal disease, malrotated or ectopic kidney, ureteropelvic junction obstruction etc.), with known glomerular or tubular renal disease or a family predisposition (with stone first detected in childhood) to stone disease were excluded from the study. Patients were divided into two groups on the basis of the type of water they had principally consumed in the previous 2 years: those consuming tap water (Group I) and those consuming natural spring water (Group II). Patients drinking both types of water or had changed the type of

water consumed over the preceding 2 years or stating to consumed less than 7 glasses of water a day (< 1.5 L/day) were excluded. In addition to the type of water consumed, demographic data such as participants' age, sex, occupation, body mass index (BMI) and presence of chronic diseases such as hypertension (HT) and diabetes mellitus (DM) were recorded. All these variables were investigated in terms of whether or not they constituted a risk factor for presence of stone in the urinary system.

Ultrasound measurements

All examinations were performed by radiologists with experience of ultrasound. Sonographic examinations were performed with gray scale ultrasound machines (Toshiba Aplio XG and General Electric Logiq 9) using two convex transducers with 3.5 MHz, 4.0 MHz frequency. The presence of the stone was defined as presence of an echogenic image with or without posterior acoustic shadowing, clearly located within the urinary tract.

Statistical analysis

All statistical analyses were performed using SPSS, version 16.0. All values are shown as mean ± standard deviation. Comparisons were performed using the chi-square test. Differences between groups were considered statistically significant at $p < 0.05$.

RESULTS

Two hundred fifty-nine patients consuming tap water (Group I) and 254 consuming natural spring water (Group II) were included in the study. In terms of gender, 52% of males stated that they used to drink tap water and 48% natural spring water, while 49% of women used to drink tap water and 51% natural spring water. Mean age of patients was 52.2 (18-88) years in group I and 48.6 (18-86) in Group II ($p = 0.75$). Mean BMI values were 25.7 kg/m² in Group I and 26.2 kg/m² in Group II ($p = 0.58$). In terms of chronic diseases, HT was determined in 22% and DM in 17% of patients in group I, and in 16% and 12%, respectively, of those in Group II. Stone was detected in 26% ($n = 145$) of the patients in the study, in 33% of men and 18% of women ($p < 0.001$). Presence of stone in the urinary system was determined in 27% of patients in Group I and 26% of Group II ($p = 0.794$). Mean BMI of the patients with stone in the urinary system was 27.2 kg/m² whereas it was 25.5 kg/m² in those with no stone. DM was observed in 17% and HT in 31% of the patients with stone and in 14% and 15%, respectively, in those with no stone. At multivariate analysis involving all variables that might be correlated with the presence of a stone in the urinary system, male gender and presence of HT emerged as being significantly associated with urolithiasis. Variables such as age, occupation, type of water consumed and presence of DM were not risk factors for development of stone.

CONCLUSIONS

In this study we therefore investigated whether there is any association between consumption of tap or natural spring water and urolithiasis in patients receiving US due to abdominal or flank pain. Although we showed that male gender, presence of HT and high BMI affect the risk of stone formation, no difference was determined in

terms of presence of stone among patients consuming tap versus natural spring water.

REFERENCES

1. Curhan GC. Epidemiology of stone disease. *Urol Clin North Am.* 2007; 34:287-93.
2. Soucie JM, Thun MJ, Coates RJ, et al. Demographics and geographic variability of kidney stones in the United States. *Kidney Int.* 1994; 46:893-9.
3. Curhan GC, Willett WC, Rimm EB, et al. A prospective study of dietary calcium and other nutrients and the risk of symptomatic kidney stones. *N Engl J Med.* 1993; 328:833-8.
4. Urinary volume, water and recurrences in idiopathic calcium nephrolithiasis: a 5-year randomized prospective study. *J Urol.* 1996; 155:839-43.
5. Borghi L, Meschi T, Amato F, et al. Urinary volume, water and recurrences in idiopathic calcium nephrolithiasis: a 5-year randomized prospective study. *J Urol.* 1996; 155:839-43.
6. Lotan Y, Daudon M, Bruye F, et al. Impact of fluid intake in the prevention of urinary system diseases: a brief review. *Curr Opin Nephrol Hypertens.* 2013; 22(Suppl):1-10.
7. Parks JH, Goldfischer ER, Coe FL. Changes in urine volume accomplished by physicians treating nephrolithiasis. *J Urol.* 2003; 169:863-6.
8. Aras B, Kalfazade N, Tugcu V, et al. Can lemon juice be an alternative to potassium citrate in the treatment of urinary calcium stones in patients with hypocitraturia? A prospective randomized study. *Urol Res.* 2008; 36:313-7.
9. Koff SG, Paquette EL, Cullen J, et al. Comparison between lemonade and potassium citrate and impact on urine PH and 24-hour urine parameters in patients with kidney stone formation. *Urology.* 2007; 69:1013-6.
10. Penniston KL, Steele TH, Nakada SY. Lemonade therapy increases urinary citrate and urine volumes in patients with recurrent calcium oxalate stone formation. *Urology.* 2007; 70:856-60.
11. Goldfarb DS, Asplin JR. Effect of grapefruit juice on urinary lithogenicity. *J Urol.* 2001; 166:263-7.
12. Shuster J, Finlayson B, Scheaffer R, et al. Water hardness and urinary stone disease. *J Urol.* 1982; 128:422-5.
13. Bellizi V, De Nicola L, Minutolo R, et al. Effects of water hardness on urinary risk factors for kidney stones in patients with idiopathic nephrolithiasis. *Nephron* 1999; 81(Suppl1):66-70.
14. Rodgers AL. Effect of mineral water containing calcium and magnesium on calcium oxalate urolithiasis risk factors. *Urol Int.* 1997; 58:93-9.
15. Massey LK, Sutton RA. Acute caffeine effects on urine composition and calcium kidney stone risk in calcium stone formers. *J Urol.* 2004; 172:555-8.

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