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Significant pain alleviation, cease of hematuria, and renal stone removal after extracorporeal shock wave lithotripsy with adjuvant boron therapy – Case Report

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Objective. Stone disease is an increasingly common form of renal disease. Therapy to prevent stones rests in lowering supersaturation uses both diet and medication. Environmental factors, especially diet, play an important role in the expression of the tendency to stone formation. Effective treatment decreases stone recurrence and need to use procedures to stone removal. Considering the nutrients, boron as an ultratrace element of the plant food is assumed to have an impact on the stone removal.

Method. Female patient with a 10.0 mm stone in the lower pole underwent an extracorporeal shock wave lithotripsy (ESWL) and received 10 mg of boron supplement/day for two weeks.

Results. Ultrasonography assessment revealed complete stone removal or disposal without hydronephrosis with a significant pain alleviation and significant reduction in ureter bleeding or hematuria along with a little burning sensation in the genital region. The expulsion was confirmed by the collection of the lithiasic residues.

Conclusions. Successful and comfortable kidney stone repulsion with a minor pain and bleeding indicates that the impact of boron in this issue deserves further study and clarification.

Keywords: lithotripsy, pain alleviation, cease of hematuria, renal stone removal, boron

Urolithiasis is a multifactorial disorder influenced by both intrinsic and extrinsic (environmental) factors. The incidence of urolithiasis has been increasing throughout the past three decades. To reduce the incidence of renal lithiasis a number of important etiologic factors can be adequately modified through diet, since it must be considered that the urine composition is directly related to the diet. In fact, the change of inappropriate habitual diet patterns should be the main measure to prevent kidney stones (Scales et al. 2007). Considering the nutrients, the biological, medical, and environmental roles of trace elements have attracted a considerable attention over the years in prevention of chronic or acute diseases, including renal diseases. Recently, boron has attracted a lot of attentions

with a widespread role in the biochemistry and nutrition. It is a non-metal trace element which possesses properties which are intermediate between the metals and non metals (Nielsen 2009). After establishing the essentiality, understanding the role(s) of boron became the major task in the boron biology. Foods of plant origin, especially fruits, leafy vegetables, nuts, and legumes are rich in boron, as are wine, cider, and beer (Gropper et al. 2004).

To initiate a link between the boron and urolithiasis, a male individual (age 27), who voluntarily participated in a study, have reported an easy discard and collection of a 2.0 mm urinary stone after consuming 10.0 mg boron for three days. Later, this finding has been also reported by some other patients who consumed boron.

The aim of this preliminary study was to evaluate the effect of a boron supplementation in the removal of kidney stones in a female subject and to confirm the result by ultrasonography.

Method

Female patient (70 year old) whose urolithiasis was confirmed by ultrasonography, participated in this study as a volunteer. Two ultrasonography reports confirmed the presence of a 10.0 mm large renal calculus located in the lower pole (calyx) of the left kidney. The patient decided to undergo one session of the extracorporeal shock wave lithotripsy (ESWL). Three hours prior to the ESWL, she admitted to receive 10.0 mg boron supplement in the form of capsule. The capsules were formulated and provided by a pharmacist colleague, using sodium tetraborate, as the source of the boron. After ESWL treatment she continued to receive one capsule per day for the next two weeks. She was asked to consume enough of the serving dairy products to meet daily calcium requirement plus adequate liquids and allowed to withdraw any time she wishes. She was instructed how to collect the stone residuals.

Results

The patient cooperated and completed the course of treatment and performed pre- and post-ultrasonography assessments in the same center. After ESWL session, the complete disintegration of the stone was confirmed. The first stone clearance started one hr after lithotripsy accompanied by bleeding. She was discharged after two hours. During the course of treatment, she reported pain alleviation and cease of hematuria within hours to one day after consumption, mostly at the time of discarding the stone residuals. She successfully collected the residuals from the urine.

The last report of the ultrasonography assessment revealed complete treatment and clearance of the disintegrated calculi after two weeks. She became free of stone within 14 days. No side effects were reported for supplement intake. The patient expressed a sense of satisfaction and continued in a normal daily life activity.

Discussion

Boron is a mineral that has been recognized as essential for plants. There is also evidence that it may be required by human and animals. Foods particularly

rich in boron include avocado, peanuts, pecans, grapes, raisins, legumes, nuts, and wine (Groppe et al. 2004). Boron in food and the compounds sodium borate and boric acid are rapidly absorbed and largely excreted by the urine. Absorption appears to be virtually complete (95% in humans and rats), and boron after ingestion appears rapidly in the blood and body tissues as observed in several mammalian species (Nielsen 1988; Naghii and Samman 1997).

The Food and Nutrition Board of the Institute of Medicine has recently established the Tolerable Upper Intake Level of boron for adults over 18 years old as 20 mg/day (Institute of Medicine, Food and Nutrition Board 2004). Recent findings have reported that boron workers (n=75) with a mean daily boron intake of 31.3 mg B/day, and a subset of 16 of these men, employed at a plant with heavy boron contamination of water supply, having an estimated mean daily intake of 125 mg B/day (Scialli et al. 2010); and a population with average 42 mg boron per day (Naghii and Mofid 2008) showed no clear evidence of male reproductive adverse effects and adverse semen parameters due to high and chronic boron exposure.

Renal lithiasis is a multifactorial disease. An important number of etiologic factors can be adequately modified through diet, since it must be considered that the urine composition is directly related to diet. In fact, the change of inappropriate habitual diet patterns should be the main measure to prevent kidney stones.

Recent findings also indicate that boron and borates have attracted scientific attention due to recent reports indicating that they may possess anti-carcinogenic properties (Cui et al. 2004; Gallardo-Williams et al. 2004). It is also reported that boric acid inhibits human prostate cancer cell proliferation (Gallardo-Williams et al. 2003; Barranco and Eckhart 2004) and ingestion of boron in drinking water decreases the incidence of cervical cancer-related histopathological findings (Korkmaz et al. 2007). Results of the chemical and morphological effects of boric acid on human skin melanoma cells suggest that high concentrations have an anti-proliferative effect and show signs consistent with apoptosis (Acerbo and Miller 2009).

Hormone replacement therapy (HRT) is known to reduce lung cancer and dietary boron may have actions similar to those of HRT. In a study on the joint effects of the boron intake and HRT on lung cancer risk, it has been reported for the first time that boron intake was inversely associated with lung cancer in women, whereas women who consumed low boron and did not

use HRT were at substantial increased odds (Mahabir et al. 2008). Also, evidence exists that boron may have antioxidants and anti-inflammatory properties (Nielsen 2000; Armstrong and Spears 2003).

It has been reported that testosterone is a promoter and estradiol an inhibitor of the kidney crystal deposition (Yoshioka et al. 2010). Since dietary boron has been reported to prevent the urinary excretion of calcium and increase serum 17β -estradiol (E2) level (Nielsen et al. 1987; Naghii and Mofid 2008), these two possible mechanisms of boron might be proposed. It is known that for CaOx, the most important determinants of urinary supersaturation are total daily calcium excretion and urine volume, in other words, urine calcium concentration (Coe et al. 2007). In a large cohort study containing both men and women, relative risk for stone formation strongly correlated with the urine calcium concentration in a continuous manner (Curhan et al. 2001).

The historical shift to less invasive surgical management of kidney stones has likely had a beneficial impact on the risk for CKD. The stone-free rate after extracorporeal shock wave lithotripsy with adjuvant boron therapy is noteworthy. It is evident that stone removal can occur without the use of boron, but usually the symptoms depend on the size, shape, and material of the stone. This patient was experiencing the kidney stone for the first time in her life and no complication occurred during the stone/sludge removal or passing out after shock wave lithotripsy and she successfully discarded the remnants without major pain or bleeding

after boron consumption. It appears that, this aspect of boron is noteworthy, which of course requires further clarification in other subjects suffering from kidney stones. In addition, ten months after treatment she has no sign of recurrency or stone formation.

Recently, we have reported (Naghii et al. 2012) for the first time, about the effect of boron on the treatment of urolithiasis in 14 patients, which further supports the theoretical basis of boron use in the setting for kidney stones. The patients have reported pain alleviation and cease of hematuria (if present) from hours to 2-3 days after consumption mostly at the time of discarding their stone. Most subjects have reported that there was no discard of the stone and therefore it was dissolved or passed out easily. No adverse outcomes have been reported for the boron intake.

The proposed mechanisms along with preliminary presented data requires further investigations, especially with stones of larger size, which recall for the cooperation with urologists to clarify and confirm the above mentioned finding. To initiate a link between the boron and urolithiasis, more placebo-controlled randomized clinical trials are needed to establish the usefulness of the boron in the adjunctive treatment of urolithiasis. This case report may only stand as a starting point on this issue.

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