Effect of creatine supplementation on kidney stones recurrence in an athlete: a case report

Effet de la supplémentation en créatine sur la récurrence des calculs rénaux chez un athlète : un cas clinique

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Abstract

Introduction: Several studies examined the effects of creatine monohydrate supplementation on renal function, but no previous study has investigated its effects on kidney stones in humans.

Observation: A renal ultrasound in a healthy young athlete (without a known renal morphological anomaly, normal kidney function, normal phospholipid and uric acid data) revealed a kidney stone of 11 mm in the lower right calyx. Extracorporeal shock wave lithotripsy was applied in order to break the down stone. Twenty-one days later, a follow-up renal ultrasound showed the absence of stones in the kidney. One week later, the athlete started creatine monohydrate supplementation for two months. Fourteen months after stopping creatine monohydrate supplementation, a third renal ultrasound confirmed the absence of stones in the kidney.

Conclusion. Two months of creatine monohydrate supplementation in an athlete with a history of kidney stones could not be associated with kidney stone recurrence in the long run.

Keywords : Creatine Monohydrate, Kidney Stone, Prostate Enlargement, Renal Function

Résumé

Introduction: Plusieurs études ont examiné les effets de la supplémentation en créatine monohydrate sur la fonction rénale, mais aucune étude n'a évalué ses effets sur les calculs rénaux chez l'homme.

Observation: Une échographie rénale chez un jeune athlète en bonne santé (sans anomalie morphologique rénale connue, fonction rénale normale, bilan phospholipidique normal, acide urique normal) a révélé un calcul rénal de 11 mm dans le calice inférieur droit. Une lithotripsie extracorporelle par ondes de choc a été appliquée afin de briser le calcul. Vingt et un jours plus tard, une échographie rénale de suivi a montré l'absence de calculs dans le rein. Une semaine plus tard, l'athlète a commencé une supplémentation en créatine monohydrate pendant deux mois. Quatorze mois après l'arrêt de la supplémentation en créatine monohydrate, une troisième échographie rénale a confirmé l'absence de calculs dans le rein.

Conclusion: Deux mois de supplémentation en créatine monohydrate chez un athlète ayant des antécédents de calculs rénaux n'ont pas pu être associés à la récurrence des calculs rénaux à long terme.

Mots clés : Calcul rénal, Élargissement de la prostate, Fonction rénale, Monohydrate de créatine.

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INTRODUCTION

Creatine monohydrate supplementation (CMS) is an effective way to increase sports performance, especially in short duration and high intensity exercises, and it is one of the most commonly used dietary supplements worldwide [1, 2]. Decades of research have consistently shown that short- and long-term CMS is safe in healthy individuals and in a number of patient populations [3].

Several studies examined the effects of CMS on renal function [4-6], but to the best of the authors' knowledge, no previous study has investigated the effects of CMS on kidney stones in humans.

In the present study, we investigated the case of an athlete with kidney stones where CMS in recommended doses did not cause new kidney stones.

CASE REPORT

The present case was reported according to the "CAse REports" (CARE) guidelines [7]. A healthy muscular resistance-trained 28-year-old man without renal morphological anomaly (weight = 110 kg; height = 184 cm; body mass index = 29.5 kg/m2; experience in bodybuilding ≈ 12 years; training frequency ≈ 6 days/week; training intensity = high; with a well-balanced diet and no supplement consumption for 5 years; and no history of illegal drug use), with a history of a kidney stone excretion (18 years, right kidney, diameter of 0.6 mm), consulted because of severe pain in the right flank and lower right abdomen. The kidney function, the phospholipid and the uric acid data were normal. Painkillers were prescribed, and based on the patient's history, a kidney stone was suspected. A urine test revealed a high number of erythrocytes of 878.00 elements/high power field (normal range: 0-5 elements/high power field). A renal ultrasound revealed a kidney stone (diameter: 11 mm) in the lower right calyx (Figure 1A). In order to break the stone down, and because it was too big to cross the ureter, an extracorporeal shock wave lithotripsy (ESWL) was applied. Twenty-one days after the ESWL, the athlete's kidneys were examined with a second renal ultrasound confirming the absence of the kidney stone (Figure 1B).

One week after the last renal ultrasound examination, the athlete decided to start taking CMS. For this purpose, the patient reportedly purchased the CMS approved by the Iranian ministry of health (300 grams CMS produced by Z-KONZEPT company, Germany). The patient reported the consumption of five grams/day of the supplement (just before training) for two months. During this period, the athlete reported to drink enough water (by his own account the color of his urine was bright) and performed high-intensity bodybuilding training (six days/week, one-day rest), without any modifications to his diet.

Fourteen months after ending his CMS cycle, the third renal ultrasound showed no new kidney stone formations (Figure 1C). In addition, the ultrasound showed no increase in prostate size as compared with pre-CMS examination (Figure 2). In addition, the size of the liver, gall bladder, spleen, bladder, and kidneys did not change after CMS.

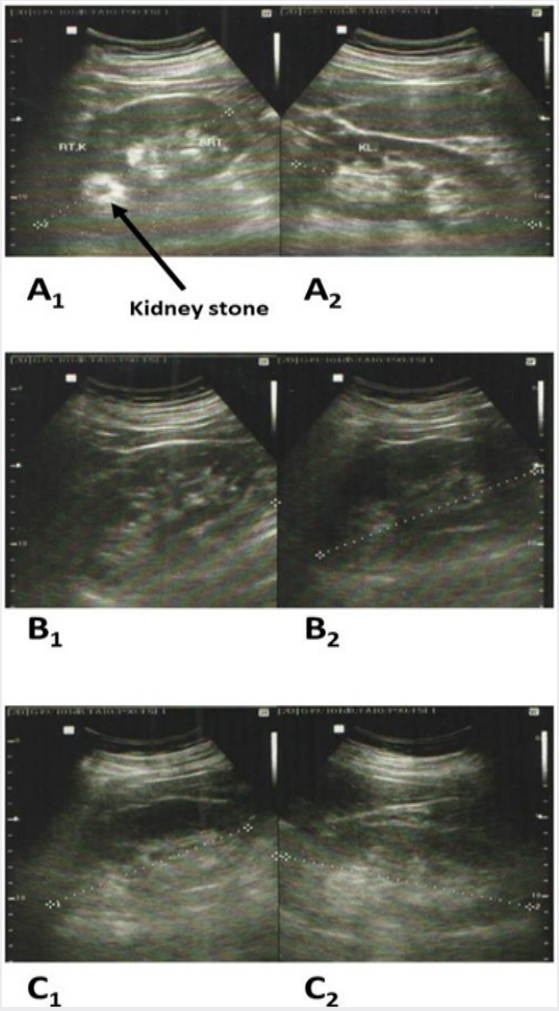

Figure 1. Renal ultrasound examination of right (A1, B1, and C1) and left (A2, B2, and C2) kidneys.

(A) First renal ultrasound: 11 mm kidney stone in the lower right calyx (A1) of the athlete.
(B) Second ultrasound (21 days after extracorporeal shock wave lithotripsy): no kidney stone.
C) Third renal ultrasound (14 months after the last day of creatine monohydrate supplementation): no kidney stone.

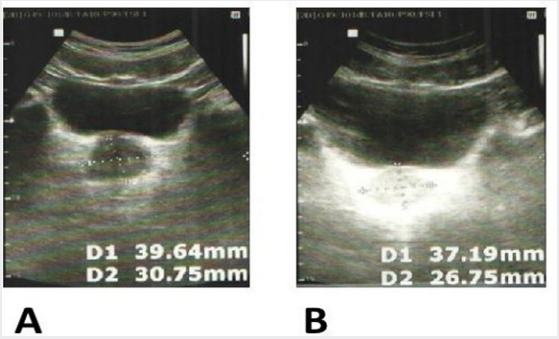

Figure 2. Renal ultrasound examination of prostate.
(A) Pre creatine monohydrate supplementation (21 days after extracorporeal shock wave lithotripsy).
(B) Fourteen months after stopping creatine monohydrate supplementation.
Note: prostate size was normal in the 2 conditions.

DISCUSSION

The use of CMS is increasing among athletes. As the kidneys have a significant role in removing creatine consumed from plasma and excrete it in the urine [8], there has been anecdotal concern about the detrimental effects of CMS on the kidneys. In addition, possible increases in creatinine level associated with CMS and the elevated serum of creatinine in stone formers led to speculation that creatine could cause kidney stone formation.

Several studies showed that CMS is safe and does not induce renal damage [1, 9, 10]. However, the efficacy of CMS on kidney function is controversial and it is still unknown how safe CMS is for people with or at risk of kidney disease [5]. Several studies have shown that CMS in healthy individuals [10], athletes [11], bodybuilders [12], and people with type 2 diabetes [13] did not change creatinine levels in urine. Also, a recent systematic review and meta-analysis showed that increases in serum creatinine due to CMS did not indicate kidney damage [1].

On the other hand, some case reports suggested that CMS could affect kidney function in some situations. Nonetheless, these studies have severe limitations that makes it difficult to draw valid conclusions, such as short-term creatine supplementation [5], no evaluation of the patient's condition prior to the supplementation [14], use of other types of supplements [15], and having a history of renal damage [16].

In the present case report, though the athlete has a history of kidney stones, CMS was not associated with the formation of new kidney stones. To the best of the authors' knowledge, no previous study had examined the effects of CMS on kidney stones in humans. However, there is a concern regarding the potential effects of CMS on the kidney function. It has been shown that three months of creatine supplementation can impair renal function in a 19-year old Division I football player [17]. Also, two months of CMS deteriorated renal function in a 25-year-old man with a previous history of renal dysfunction [18]. On the other hand, five grams of CMS for 12 weeks seems to not affect kidney function in a young man with a single kidney, mildly decreased glomerular filtration rate, and ingesting and a high-protein diet [5].

We also showed that creatine consumption did not cause prostate enlargement (Figure 2). CMS has been anecdotally associated with prostate enlargement by increasing dihydrotestosterone levels [19, 20]. Since only one study has suggested that CMS may increase dihydrotestosterone levels, and the lack of evidence for the association between this biochemical finding and prostatic hypertrophy, there is no basis to believe that CMS can cause this condition. One limitation of the present case report is the unknown type of the calculation (radiopaque or radiolucent).

In conclusion, 5 g/day of CMS for two months was not associated with the recurrence of kidney stones in an athlete with a history of this condition. This finding should be confirmed by prospective studies involving a larger number of participants in a well-controlled setting. While creatine users with a history of kidney stones are advised to monitor their condition with the guidance of a professional specialist, there has been no evidence to date to believe that creatine can cause kidney stones.

REFERENCES

1. De Souza E Silva A, Pertille A, Reis Barbosa CG, Aparecida de Oliveira Silva J, de Jesus DV, Ribeiro AGSV, et al. Effects of creatine supplementation on renal function: a systematic review and meta-analysis. J Ren Nutr. 2019;29(6):480-489.
2. Butts J, Jacobs B, Silvis M. Creatine use in sports. Sports Health.2018;10(1):31-34.
3. Kreider RB, Kalman DS, Antonio J, Ziegenfuss TN, Wildman R, Collins R, et al International Society of Sports Nutrition position stand: safety and efficacy of creatine supplementation in exercise, sport, and medicine. J Int Soc Sports Nutr. 2017;14(1):18.
4. Cancela P, Ohanian C, Cuitiño E, Hackney AC. Creatine supplementation does not affect clinical health markers in football players. Br J Sports Med. 2008;42(9):731- 5..
5. Gualano B, Ferreira DC, Sapienza MT, Seguro AC, Lancha AH, Jr. Effect of short-term high-dose creatine supplementation on measured GFR in a young man with a single kidney. Am J Kidney Dis. 2010;55(3):e7-9.
6. Gualano B, Ugrinowitsch C, Novaes RB, Artioli GG, Shimizu MH, Seguro AC, et al. Effects of creatine supplementation on renal function: a randomized, double- blind, placebo-controlled clinical trial. Eur J Appl Physiol. 2008;103(1):33-40.
7. Gagnier JJ, Kienle G, Altman DG, Moher D, Sox H, Riley D, et al. The CARE guidelines: consensus-based clinical case reporting guideline development. Glob Adv Health Med. 2013 Sep;2(5):38-43.
8. Farquhar WB, Zambraski EJ. Effects of creatine use on the athlete's kidney. Curr Sports Med Rep. 2002;1(2):103-6.
9. Davani-Davari D, Karimzadeh I, Ezzatzadegan-Jahromi S, Sagheb MM. Potential adverse effects of creatine supplement on the kidney in athletes and bodybuilders. Iran J Kidney Dis. 2018;12(5):253-60.
10. Carvalho APPF, Molina GE, Fontana KE. Creatine supplementation associated with resistance training does not alter renal and hepatic functions. Rev Bras de Medicina do Esporte. 2011;17(4):237-41.
11. Kreider RB, Melton C, Rasmussen CJ, Greenwood M, Lancaster S, Cantler EC, et al. Long-term creatine supplementation does not significantly affect clinical markers of health in athletes. Mol Cell Biochem. 2003;244(1-2):95-104.
12. Lugaresi R, Leme M, de Salles Painelli V, Murai IH, Roschel H, Sapienza MT, et al. Does long-term creatine supplementation impair kidney function in resistance- trained individuals consuming a high-protein diet? J Int Soc Sports Nutr. 2013;10(1):26.
13. Gualano B, de Salles Painelli V, Roschel H, Lugaresi R, Dorea E, Artioli GG, et al. Creatine supplementation does not impair kidney function in type 2 diabetic patients: a randomized, double-blind, placebo-controlled, clinical trial. Eur J Appl Physiol. 2011;111(5):749-56.
14. Taner B, Aysim O, Abdulkadir U. The effects of the recommended dose of creatine monohydrate on kidney function. NDT Plus. 2011;4(1):23-4.
15. Thorsteinsdottir B, Grande JP, Garovic VD. Acute renal failure in a young weight lifter taking multiple food supplements, including creatine monohydrate. J Ren Nutr. 2006;16(4):341-5.

16. Barisic N, Bernert G, Ipsiroglu O, Stromberger C, Muller T, Gruber S, et al. Effects of oral creatine supplementation in a patient with MELAS phenotype and associated nephropathy. Neuropediatrics. 2002;33(3):157-61.
17. Kuehl K, Goldberg L, Elliot D. Renal insufficiency after creatine supplementation in a college football athlete. Med Sci Sports Exerc. 1998;30(5):235.
18. Pritchard NR, Kalra PA. Renal dysfunction accompanying oral creatine supplements. Lancet. 1998;351(9111):1252-3.
19. Van der Merwe J, Brooks NE, Myburgh KH. Three weeks of creatine monohydrate supplementation affects dihydrotestosterone to testosterone ratio in college-aged rugby players. Clin J Sport Med. 2009;19(5):399-404.
20. Andriole G, Bruchovsky N, Chung LW, Matsumoto AM, Rittmaster R, Roehrborn C, et al. Dihydrotestosterone and the prostate: the scientific rationale for 5alpha- reductase inhibitors in the treatment of benign prostatic hyperplasia. J Urol. 2004;172(4 Pt 1):1399-403.