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Acute kidney injury due to oxalate nephropathy after star fruit ingestion

Hugo Abensur¹, Karina dos Santos Falani¹, Roberto Buessio¹, Fabiana Toledo Bueno², Dino Martini Filho², Maria Regina Teixeira Araújo¹, João Egidio Romão Junior^{1*}

¹Clínica de Nefrologia e Transplantes, Hospital da Beneficência Portuguesa, São Paulo, Brazil

²Serviço de Patologia, Hospital da Beneficência Portuguesa, São Paulo, Brazil

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ABSTRACT

Background: Great quantity of star fruit (*Averrhoa carambola*) ingestion, or even smaller amounts in a patient with an empty stomach, may induce acute kidney injury (AKI).

Case Presentation: We report a 65-year-old male patient with underlying multiple myeloma and normal kidney function, who developed alterations of consciousness and rapid increase in serum creatinine due to oxalate nephropathy after large ingestion of star fruit on an empty stomach. Kidney biopsy revealed the diagnosis of oxalate nephropathy.

Conclusions: AKI due to oxalate nephropathy after star fruit ingestion is relatively uncommon (only eight other reported cases) but there is an increasing evidence of AKI associated with intoxication by star fruit. This case alerts health professionals, nephrologists in particular, to a new disease that is increasingly better known and diagnosed more frequently.

Implication for health policy/practice/research/medical education:

Star fruit (*carambola*) is cultivated in many tropical and subtropical areas, especially in Southeast Asia and South and Central America. Star fruit nephrotoxicity in people with normal renal function is rarely reported. However, this case reported of acute oxalate nephropathy induced by large ingestion of star fruit. Along with those previously reported, confirm the existence of this disease, and is a reason to alert health professionals in these regions.

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1. Background

Plant toxins are an important cause of tropical acute kidney injury (AKI) (1). Star fruit (*Averrhoa carambola*) is a plant with a high content of oxalic acid, which could contribute to acute nephrotoxicity (2). Frequently, star fruit is reported as a cause of neurotoxicity in patients with moderate to severe chronic kidney disease (3,4). However, there are few reports of individuals with previously normal renal function who developed AKI due to ingestion of a large amount of fresh star fruit or star fruit juice (2,5-7). Kidneys are the primary organ for oxalate excretion, and AKI can occur due to acute oxalate nephropathy, with calcium oxalate crystals deposition within renal tubules. We report the case of AKI related

to oxalate nephropathy following star fruit ingestion.

2. Case Presentation

A 65-year-old Caucasian male patient with past medical history of multiple myeloma was admitted to the hospital with mild mental confusion, drowsiness, asthenia, lethargy and abdominal discomfort for three days, after ingestion a large amount of carambola with an empty stomach. There was no history of oliguria, hematuria, or other urine abnormality. He did not have fever, dysuria, and shortness of breath, dehydration or other neurologic symptoms. He was taking valganciclovir hydrochloride, bromopride, pantoprazole, vitamin D and azithromycin. On clinical examination, the patient was conscious and

*Corresponding author: João Egidio Romão Junior, Ph.D, E-mail; joao.egidio@uol.com.br

oriented, and blood pressure was 130/70 mm Hg. The patient had no edema, and his systems were normal. Laboratory investigations at time of admission showed serum creatinine; 1.20 mg/dL (eGFR = 89 ml/min/1.73 m²), urea; 71 mg/dL, potassium; 3.6 mEq/L, ion calcium; 1.14 mg/dL, magnesium; 2.3 mg/dL, and uric acid; 5.6 mg/dL, with normal CBC and liver enzymes. Urine analysis showed no albuminuria, and protein/creatinine ratio was 0.15. Ultrasonogram of kidneys and urinary tract was normal. There was no evidence of calculi or hydronephrosis. After supportive treatment, neurologic symptoms were reverted, and he remained hemodynamically stable. However, on day fourth post-admission, the serum creatinine level increased to 4.8 mg/dL, associated with a reduction in urine output. He underwent a percutaneous kidney biopsy. A total of 15 glomeruli were present, of which 5 were globally sclerosed. Light microscopy revealed widespread tubular degenerative changes typical of acute tubular necrosis and intra-tubular oxalate crystals deposition. Arterioles showed moderate age-consistent fibrointimal thickening, there was marked interstitial edema, and mild interstitial fibrosis. There are neither immunoglobulins nor complement fractions deposition in renal tissue. When reviewed under polarized light, the tubular oxalate deposits appeared birefringent. Overall, the biopsy showed acute tubular necrosis and oxalate nephropathy (Figure 1). Based on the unremarkable laboratory test results and findings on kidney biopsy, a diagnosis of secondary oxalosis was made. Within one week, there was an increase in urinary flow, with a corresponding decrease in serum creatinine concentration. At the time, the patient was discharged from the hospital, and serum creatinine concentration was 2.52 mg/dL. On further outpatient follow-up (75th day), the serum creatinine concentration was 1.2 mg/dL.

3. Discussion

This case suggests that star fruit ingestion may cause acute deterioration in kidney function and oxalate nephropathy. AKI can occur as a result of acute oxalate nephropathy due to the deposition of calcium oxalate crystals within the renal tubules (8,9). In developed countries, commercial star fruit juices usually are prepared by industrial processes that markedly reduce oxalate content. However, pure fresh juice or ingestion of in nature star fruit, as observed in developing countries, contain high quantities of oxalate. Oxalate is the ionic form of oxalic acid and is derived from various animal and plant sources (8). Oxalate is excreted mainly through the kidneys, and secondary oxalosis could be the result of

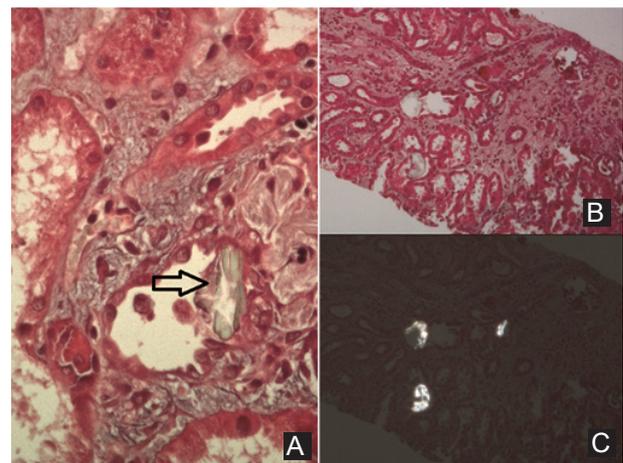


Figure 1. Microscopic views of renal biopsy. Light microscopy showing (A/B) oxalate crystals (arrow) within the tubular lumina and walls surrounded by inflammatory infiltration (Hematoxylin and eosin stain, original magnification $\times 400$), and (C) tubular oxalate deposits appear birefringent under polarized light.

excessive oxalate accumulation due to increased ingestion, increased production and/or decreased excretion (10). Several substances are related to secondary oxalosis, such as ascorbic acid, methoxyflurane, ethylene glycol, xylitol, and consumption of a large amount of oxalate-rich fruit and vegetable (8,9). An empty stomach and dehydrated state may be an additional risk for development of AKI (5). A study suggested that star fruit ingestion produces AKI, not only through the obstructive effect of calcium oxalate crystals, but also by inducing apoptosis of renal epithelial cells, which may be induced by the amount of oxalate in the fruit (11).

Acute oxalate nephropathy is a severe cause of AKI characterized by tubulointerstitial oxalate deposits with a diffuse inflammatory infiltrate. When viewed under polarized light, these oxalate deposits appeared birefringent (12). Its prognosis remains dismal and rapid recognition by renal biopsy and determination of the cause of hyperoxaluria is important in order to avoid the risk for developing chronic kidney disease. This diagnosis should be suspected in patients with non-resolving AKI.

Star fruit is recognized as a high source of oxalate (5,8), and there is an increasing evidence of AKI associated with intoxication by star fruit (Table 1). In 2001, Chen et al (5) reported two cases of AKI in patients with previous normal renal function after ingesting large quantities of sour carambola juice. Both patients needed hemodialysis for oliguric AKI, and kidney biopsy examination showed typical changes of acute oxalate nephropathy. The renal function recovered a few weeks later without specific treatment. Niticharoenpong et al (12) reported

a patient with previously chronic kidney disease, who developed a rapid increase in serum creatinine and acute oxalate nephropathy after chronic ingestion of star fruit juice, and the recovery of renal function was not fully observed after 12 weeks. Moyses Neto et al (2) presented five patients with normal renal function, who developed simultaneously nephrotoxic and neurotoxic symptoms after star fruit ingestion (ingesting fresh fruit or drinking star fruit juice), and all patients had good outcomes without dialysis. More recently, Scaranello et al, report on a case of star fruit poisoning suggestive of AKI by oxalate nephropathy; the patient was submitted to two sessions of hemodialysis, and had good outcome, as did other patients in cases described in the literature. The absorption of free oxalate triggered the onset of AKI, and the authors did not mention manifestations consistent with neurotoxicity (13).

4. Conclusions

We conclude that an ingestion of large quantities of star fruit (carambola), or even smaller amounts in a patient with empty stomach, is a potential cause of AKI associated with acute oxalate nephropathy. This case draws the attention of physicians and nephrologists in particular to a condition that is increasingly better known and therefore diagnosed more frequently.

Authors' contribution

KSF, RB, and MRTA conducted the clinical procedures and helped to prepare the first draft of article. FTB and DMF analyzed the histopathology data. JERJ and HA designed, supervised and analyzed the research and completed the manuscript. All authors read and signed the paper.

Conflicts of interest

The authors declare no conflict of interest.

Ethical considerations

Ethical issues (including plagiarism, data fabrication, double publication) have been completely observed by the authors. All the investigators observed the patient confidentiality and privacy before using the data set. Patient's consent was obtained to report this case.

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