

Acute kidney injury associated with ingestion of star fruit: Acute oxalate nephropathy: a report of two cases

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Abstract

There are few case reports regarding star fruit's nephrotoxicity and neurotoxicity in chronic kidney disease patients. Star fruit (*Averrhoa carambola*) is commonly consumed as a herbal remedy for various ailments in tropical countries. However, the dangers associated with consumption of star fruit are not commonly known. Although star fruit induced oxalate nephrotoxicity in those with existing renal impairment is well documented, reports on its effect on those with normal renal function are infrequent. We report two unique clinical presentation patterns of star fruit nephrotoxicity following consumption of the fruit. The first patient is a 52 year-old male diabetic patient who had normal renal function prior to developing acute kidney injury (AKI) after consuming large amount of star fruit juice at once for remedy of diabetes. The second patient, a 27 years old young male who developed acute kidney injury following star fruit ingestion in empty stomach. One case needed 4 sessions of hemodialysis another case recovered over 2 weeks without the need for haemodialysis. Consumption of star fruit, especially on an empty stomach or in a state of dehydration may precipitate acute kidney injury. A history of star fruit ingestion must be actively looked for in patients presenting with unexplained acute kidney injury. The use of star fruit as a therapy for diabetes should be discouraged.

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Introduction

Carambola, also known as star fruit, is the fruit of *Averrhoa carambola* species of tree native to the Philippines, Indonesia, Malaysia, India, Bangladesh and Sri Lanka. It is valued for its medicinal and nutritional properties.¹ Its hypoglycemic effects are considered to be particularly beneficial in patients with diabetes mellitus, and it has been promoted as a traditional remedy for diabetes.²

However, excessive consumption of star fruit has been associated with the development of oxalate nephropathy in patients with both normal and abnormal baseline renal function.^{3,4} Star fruit induced oxalate nephropathy remains an under recognized cause for both acute and chronic kidney disease. We report two cases of acute kidney injury following ingestion of star fruit and discuss the literature related to star fruit toxicity and renal disease.

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Figure 1: Star fruits (*Averrhoa carambola*).

Case presentation

Case 1

A 52-year-old male hailing from Bhaluka, Mymensingh was admitted on 29/12/2013 in Community Based Medical College Hospital suffering with type 2 diabetes mellitus from five years, presented along with loose stools, abdominal pain and reduced urine output for two days. He had ingested of 200 ml of homemade star fruit juice made from four whole star fruits a few hours prior to the onset of symptoms. Notably he complained of intractable hiccoughs. His serum creatinine three months prior to the presentation had been 0.7 mg/dl. On admission he was mildly dehydrated and had a blood pressure of 140/ 90 mmHg. There was no evidence of diabetic retinopathy. Investigations revealed the following: haemoglobin- 13.5 g/dl, white cell count - 17, 840/ cumm (Neutrophils 79%, Lymphocytes- 10%, Eosinophils-0%), platelets 345,000/ cumm, serum creatinine 8.5 mg/dl, serum potassium 6.2 mmol/l, serum sodium 131/mmol/l, C reactive protein- 164 mg/l. The urine sediment was bland with no proteinuria. His Antinuclear antibody (ANA) titre, Anti streptolysin O titre

(ASOT), Hepatitis B, C serology, Antineutrophil cytoplasm antibody (ANCA) titre, and Complement 3 (C₃) and Complement 4 (C₄) levels were normal. Renal ultrasound showed normal kidneys with preserved cortico-medullary demarcation. Urine and blood cultures were sterile. He was commenced on intravenous cefotaxime for suspected sepsis. By day 5 of illness serum creatinine rose to 11.3 mg/dl leading to the initiation of haemodialysis.

Renal biopsy was done on the sixth day. This showed eight glomeruli, one of which was sclerosed, the others being normal. Some of the tubules showed oxalate crystals associated with acute tubular epithelial injury and evidence of regeneration. Patchy tubular atrophy was seen. The interstitium was oedematous and infiltrated by moderate inflammatory infiltrate comprising of lymphocytes, plasma cells, eosinophils and neutrophils. Mild interstitial fibrosis was seen. A diagnosis of star fruit induced oxalate nephropathy was made.

He required four sessions of hemodialysis and was discharged after two weeks with a falling serum creatinine. Serum creatinine three months later had stabilized at baseline levels.



Figure 2: case 1

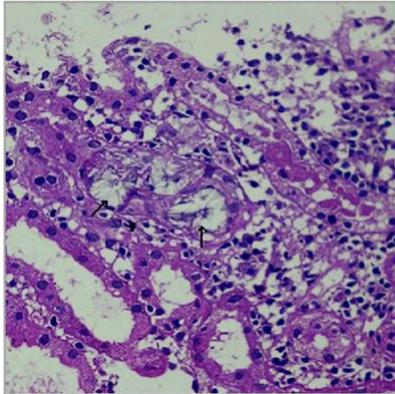


Figure 3: Histology (haematoxylin and eosin stain) of the renal biopsy of case 1 showing acute oxalate induced tubulo-interstitial nephritis. Tubules are blocked by oxalate crystals (black arrows).

Case 2

A young farmer of 27 years hailing from Jamalpur was admitted on 24/08/2014 in Community Based Medical College Hospital, Mymensingh with the history of abdominal pain, back pain, vomiting, hiccup and reduced urine volume following ingestion of 3-4 medium to large sized star fruits in empty stomach. There were no history of acute watery diarrhea, blood loss and ingestion of any nephrotoxic drugs. The time between ingestion and development of symptoms was about 4-5 hours. He had no history of renal disease. On admission he was confused and mildly edematous. Vital parameters were within normal range. Serum creatinine was raised. He was diagnosed as a case of acute kidney injury probably due to star fruit intoxication. After admission he was followed up closely and treated conservatively. He recovered completely. Dialysis was not required. Investigation reveals initial serum creatinine as 2.9 mg/dl. USG showed right kidney (BPL-11.4 cm), left kidney (BPL-11.7cm). Renal parenchyma was hypoechoic. Complete blood count, liver function test was normal. During discharge his serum creatinine was 1.2 mg/dl. Kidney biopsy was done and histopathology report was in light microscopy: most of the glomeruli reveals

segmental increase of mesangial cells and matrix. Diffuse interstitial infiltration of lymphocytes, eosinophils and neutrophils was present. There was marked edema in the interstitium. Some renal tubules contain pus casts in the lumen with shedding and necrosis of the tubular epithelium in some renal tubules. No crystal of any form was present in the lumen. Blood vessels were normal. In direct immunofluorescence study no deposit of IgA, IgG, IgM, or C3 was present. Histological diagnosis was acute tubulointerstitial nephritis with mild tubular necrosis.



Figure 2 : case 4

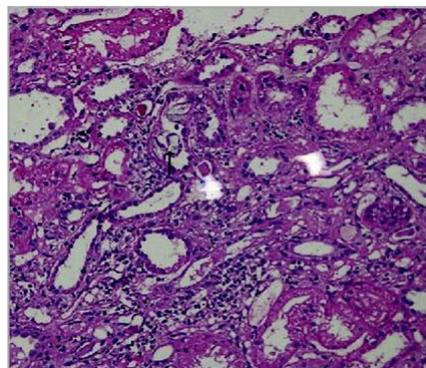


Fig. 5: Histology (haematoxylin and eosin stain) of renal biopsy of case 2 showing oxalate induced tubulo-interstitial nephritis. One tubule contains oxalate crystals (black arrow)

Discussion:

Averrhoa carambola (star fruit), a member of the Oxalidaceae family, is rich in oxalic acid. The content of oxalate varies according to the type of star fruit, being higher in the sour type than in the sweet.⁵

Total consumption is often higher when consumed as a juice than as a single whole fruit. The oxalic acid content of fresh juice was measured by Chen et al. as 202 mg/dl in fresh sweet juice and 829 mg/dl in fresh sour juice.⁶ Commercial preparations of star fruit juice are processed by pickling and diluting procedures which lower oxalate concentrations. In comparison homemade and medicinal preparations of pure sour star fruit juice often have high concentrations of oxalate.⁶

Table 1: Oxalate content of star fruit from different preparations

Star fruit preparations	Oxalate content (mg/100mL)
Fresh sour carambola juice	820
Sour carambola juice from venders	308
Pure pickled sour carambola juice from venders	261.2±169.1
Fresh sweet carambola	202
Diluted pickled sour carambola juice from venders	53.7±36.8
Commercial canned carambola juice	54.6±39.7

Many studies from different countries of the world had done on star fruit intoxication. Star fruit is commonly found in tropical countries and is popular fruit in Brazil.⁷ In 1993, Martin et al were the first to report clinical observations on the intake of this fruit.⁷

The neurotoxic effect of star fruit ranges from mild to severe, include hiccups, vomiting, insomnia, psychomotor agitation, numbness, paraesthesia, mental confusion, coma, seizure, and hemodynamic instability resulting in mortality.^{8,9} The velocity of progression of symptom varies in different patient. Some manifest only with hiccups and others may develop seizure. These variations depend on individual biological response, the amount of toxin content in each fruit and the detoxification, excretion, or both, of this toxin from bloodstream and also on various star fruit subspecies. Some patient with mild intoxication may recover

spontaneously. But others without proper treatment mild intoxication may become more severe.⁸

This condition is uncommon in patient with normal renal function. Only two cases of oxalate nephropathy were reported in patient with normal renal function.^{9,10} Young patient (Case 2) showed acute kidney injury and neurotoxic symptoms (persistent hiccups and mild confusional state) following ingestion of star fruits in empty stomach. Patient was treated conservatively without dialysis and recovered completely. This feature is similar to the findings of MoysesNeto et al. who described case series of 5 patients with previously normal renal function.¹¹ The patients with normal renal function developed acute nephrotoxic and neurotoxic feature after ingestion of Star Fruits or its juice. In three of five patients kidney biopsy was not done. The diagnosis was done on the basis of history, clinical finding and biochemical parameters. Initially it is observed that only haemodialysis improves this symptom by removing unknown neurotoxin. Patient presenting with severe intoxication who are not treated, that are treated by peritoneal method, or by late haemodialysis, will die with most of them in status epilepticus.¹² In several studies and case reports, it is found that haemoperfusion is superior to haemodialysis in removing star fruit toxin. Our first case needed 4 session of hemodialysis and was discharged on the two weeks with a falling serum creatinine. Serum creatinine three months later had stabilized at baseline levels.

Conclusion

Star fruit nephrotoxicity must be considered in any individual developing unexplained acute kidney injury. The history is the key to reach a diagnosis early. As yet, there are no proven specific therapies and management is supportive. It is essential to prevent star fruit nephrotoxicity by educating the public and especially diabetics to avoid consuming star fruit, especially on an empty stomach or in a dehydrated state.

Further studies need to be done to identify the dose and type of star fruit, which could lead to nephrotoxicity. In the interim the use of star fruit, specifically as a therapy to achieve better glycaemic control in diabetes, should be discouraged.

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