Small bowel obstruction caused by dried apple

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A B S T R A C T

INTRODUCTION: Small bowel obstruction in a virgin abdomen is an uncommon surgical condition. While malignancy, inflammatory bowel disease and foreign body are the main reported causes, undigested food bezoar causing bowel obstruction is a rare entity. We report a case of small bowel obstruction secondary to dried preserved apple having re-expanded within the gastrointestinal tract.

PRESENTATION OF CASE: A 69 year old male presented with severe abdominal distension, generalized abdominal tenderness and obstipation for 1 week. Small bowel obstruction (SBO) was confirmed on plain abdominal X-ray and CT imaging. An emergency explorative laparatomy identified a sausage-shaped intra-luminal foreign body obstructing the distal ileum. An enterotomy was performed which revealed a rehydrated, donut-shaped piece of dried apple.

DISCUSSION: Swallowed items that pass through the pylorus rarely cause obstruction as they are usually small enough to pass through the rest of the bowel without difficulty. We postulate that in our patient that the dried apple was originally small enough to pass through the pylorus. However during small bowel, its’ highly absorbable nature resulted in an increase in size that prevented its’ passage through the ileocecal valve. A simple in-vitro experiment discovered that dried apple has a potential to reabsorb fluid and expand up to 35% of its initial size within 72 h.

CONCLUSION: This report illustrates the potential for dried food substances to cause intra-luminal SBO after significant expansion with rehydration.

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1. Introduction

Bowel obstruction in a virgin abdomen is uncommon. The main causes of obstruction in a virgin abdomen are malignancy, inflammatory bowel disease and ingested foreign bodies. Ingested foreign body may be non-edible objects or food items. Incidents of ingesting non-edible items occur in children, elderly, mentally impaired and intoxicated patients [1,2]. These non-edible items may be as bizarre as plastics, metal, plants, soil, hair, insects and highly absorbable items [3]. Bowel obstruction from food items usually happen in people with poor gastrointestinal motility, Guillain-Barre syndrome, hypothyroidism and fast eaters [4,5,6]. Food items that have been reported to cause obstruction include dried fruits, apricot, persimmon, coconut and raw banana [5,7,10]. We present a case of bowel obstruction due to dried apple.

2. Presentation of case

A 69 years old male presented to our emergency department with severe abdominal distension and generalized abdominal tenderness. He had one week of obstipation, 3 days of offensive smelling vomits and was unable to tolerate any food intake. Past medical history included coronary arteries bypass, diabetes and hypertension. His previous endoscopy was normal. Importantly, he had no history of any abdominal surgery.

At presentation, he was haemodynamically stable and afebrile. Patient did not appear to have significant discomfort. Examination revealed severe abdominal distension with mild tenderness but no peritonism and absent bowel sounds. Per rectal examination showed an empty rectum.

Blood tests revealed raised inflammatory markers with WCC of $29.3 \times 10^9/L$ and CRP $51 \text{mg/L}$. Blood lactate was $1.9 \text{mmol/L}$. Abdominal X-ray showed dilated small bowel loops with multiple air-fluid levels but no free gas. CT confirmed a SBO extending from proximal small bowel to the terminal ileum with a low density filling defect just proximal to ileocecal valve.

Given the diagnosis of SBO in a virgin abdomen, the patient underwent an emergency explorative laparotomy. Distended small bowel and a moderate amount of ascites were identified. In the distal ileum, at about 50 cm proximal to ileocecal junction, the bowel was adherent to itself forming a tight hairpin loop (Image 1).
A sausage-shaped luminal obstructing foreign body was palpable proximal to the hairpin loop. A 4 cm anti-mesenteric enterotomy was performed to deliver the foreign body. Small bowel run to duodenjejunal flexure did not identify any other abnormality. The foreign body extracted appeared to be a donut-shaped dried apple that had rehydrated, and folded in half into the shape of a sausage. It was approximately 7 cm in length and 2 cm in diameter when folded like a sausage (Image 2).

Interestingly, the patient reported that he had no teeth and had not used dentures for past 10 years. He was able to chew solid food including chunks of meat with his gums but admitted to swallowing food in whole occasionally. The patient had an unremarkable recovery and was discharged from the hospital after 11 days with the advice to obtain a set of dentures and chew his food thoroughly before swallowing (Images 3 and 4).

3. Discussion

A bezoar is a mass of undigested material which accumulates in the gastrointestinal tract, most often in the stomach. Bezoars can be classified according to the type of undigested material and include food bolus bezoar, phytobezoar (non-digestible particles from fruits and vegetables), lactobezoar (solidified milk), diospyrobezoar (unripe persimmons), pharmacobezoar (pills and medications) and trichobezoar (hairballs) [2,6,8]. Although bezoars are well documented, the diagnosis and treatment remains a challenge [6].

As bezoars can occur at any point in the gastrointestinal tract, and can be formed from a variety of substances, the presentation, investigation and management can vary greatly. Bezoar usually does not cause symptom and hence has been under reported. Even at presentation, the signs and symptoms remained non-specific [1,6]. Symptoms commonly reported are abdominal bloating, diffuse abdominal pain, nausea and vomiting, early satiety, anorexia and dysphagia. Investigations may include plain abdominal X-ray, barium swallow, CT imaging and endoscopy [6]. Plain abdominal X-ray may reveal filling defect outlined with gas or bowel dilatation. Barium studies may also reveal motting or streaks of filling defect as the contrast infiltrate the bezoar. Abdominal CT is the most useful imaging modality because it not only reveals the filling defect, it also shows the approximate level where the bezoar is lodged and the complications such as obstruction or perforation [2,10]. Endoscopy on the other hand can be diagnostic and therapeutic. Small bezoar that can easily be missed in imaging could be visualized during endoscopy. The aim of treatment for a symptomatic bezoar is to remove the mass and treat the underlying cause [6,8,9]. Certain organic bezoar can be managed non-invasively through dissolution with enzymatic therapy, but any bezoar causing acute bowel obstruction will require endoscopic or surgical extraction [1]. During surgery, the bezoar can either be milked through the ileocecal valve into the cecum or it can be extracted via enterotomy if it is too large [2,4].

This case illustrates a unique incident of SBO in a virgin abdomen caused by an undigested dried apple that has rehydrated and expanded within the lumen. Although there are occasional incidents of bezoar causing bowel obstruction, it is still relatively rare. Swallowed items that pass through the pylorus rarely cause an obstruction as it usually passes through the rest of the bowel without difficulty [5]. It is postulated that the dried apple that was swallowed in this case was originally small enough to pass through the pylorus, however with slow transit time, its highly absorbable nature resulted in a much larger dimension for it to progress through the ileocecal valve. The position of obstruction at 50 cm from ileocecal valve is consistent with documented cases of small bowel obstruction secondary to bezoar [8,9].

To the best of our knowledge, there is no record of the capacity of dried apple to re-expand when rehydrated. A simple in-vitro experiment was carried out to establish the growing potential. Two apple slices (A and B) in the shape of a donut were used for this experiment. Each apple slice was marked and measured at the longest

| Diameter of re-hydrated apple slices at different time interval. Percentage growth calculated based on original diameter at start of experiment. | A (cm) | % Growth | B (cm) | % Growth |
| --- | --- | --- | --- | --- |
| Start | 4.5 | - | 5.5 | - |
| 15min | 4.8 | 7 | 6 | 9 |
| 30min | 4.9 | 9 | 6.1 | 11 |
| 1h | 5.2 | 16 | 6.6 | 20 |
| 2h | 5.4 | 20 | 6.7 | 22 |
| 4h | 6 | 33 | 6.9 | 25 |
| 8h | 5.8 | 29 | 7.2 | 31 |
| 16h | 5.8 | 29 | 7.2 | 31 |
| 24h | 5.8 | 29 | 7.2 | 31 |
| 36h | 5.8 | 29 | 7.4 | 35 |
| 72h | 5.8 | 29 | 7.4 | 35 |

### Table 1

![Image 2](left to right): the extracted foreign body was folded into the shape of a sausage. When unfolded, it appeared to be a donut-shaped dried apple that had rehydrated.
Image 3. Slice A at start, 4 h and 72 h (from left to right). Growth of 1.3 cm by 29% after 72 h.

Image 4. Slice B at start, 4 h and 72 h (from left to right). Growth of 1.4 cm by 35% after 72 h.

diameter at the start of the experiment. They were then soaked in water at room temperature in separate containers. The apple slices were measured at the same markings at 15 min, 30 min, 1h, 2h, 4h, 8h, 16h, 24h, 36h and 72h. Percentage growth was calculated based on original size (Table 1). From this simple experiment, dried apple has a potential to reabsorb fluid and expand up to 35%. It is postulated that the dried apple has similar trend of growth within the gastrointestinal tract when not digested. In this reported case, the diameter of the folded up bezoar was approximately 7 cm, it is likely to have expanded by 35% from an original size of 5.2 cm. This swallowed item which was originally small enough to pass through the distal esophageal sphincter and pyloric sphincter had expanded substantially to 7 cm during transit to obstruct the small bowel.

4. Conclusion

SBO due to rehydrated dried apple as the source of bezoar is very rare. A simple in-vitro experiment identified that dried apple has a re-expansion capability up to 35%. This report serves to raise the awareness that rehydrated food can be a potential source of SBO. Bowel obstruction caused by bezoar not only requires immediate treatment but also recognition and treatment of underlying cause of bezoar formation.

Conflict of interest

The author declares that there is no conflict of interests regarding the publication of this paper.

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Consent

Written consent was obtained from patient regarding the publication of this case.

Author contribution

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