

Received: 2022.03.24

Accepted: 2022.11.09

Available online: 2022.11.29

Published: 2022.12.20

Failure of Computed Tomography (CT) in Detecting an Aspirin Pharmacobezoar: A Case Report

Authors' Contribution:

Study Design A
Data Collection B
Statistical Analysis C
Data Interpretation D
Manuscript Preparation E
Literature Search F
Funds Collection G

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Patient:	Female, 64-year-old
Final Diagnosis:	Salicylate overdose with bezoar • salicylate toxicity
Symptoms:	Altered mental state • metabolic acidosis • renal failure • respiratory alkalosis • respiratory failure • salicylate toxicity
Medication:	—
Clinical Procedure:	CT abdomen and pelvis • hemodialysis • whole bowel irrigation
Specialty:	Critical Care Medicine • Gastroenterology and Hepatology • Toxicology
Objective:	Unusual clinical course
Background:	Prior studies suggest CT can identify bezoars under certain circumstances. Endoscopy provides diagnostic and therapeutic benefit in the setting of suspected aspirin bezoar. Does the absence of findings on CT scan exclude the presence of an aspirin bezoar?
Case Report:	A 64-year-old woman called the police and stated she ingested a bottle of aspirin to harm herself. Upon arrival to the Emergency Department, she was tachypneic with a GCS of 15. Initial laboratory results were: salicylate level of 1143 mcg/mL, respiratory alkalosis, bicarbonate of 9 meq/L, anion gap of 23, and normal renal function. Initial therapeutic intervention included infusions of glucose and bicarbonate, multiple doses of activated charcoal, intubation, and emergent hemodialysis. After hemodialysis, the salicylate level rebounded, and a Gastroenterology (GI) consultation was requested to rule out bezoar. On day 2, GI requested an abdominal CT scan with Gastrografin in place of endoscopy due to hemodynamic instability. A CT scan was negative for bezoar. After multiple hemodialysis sessions and whole-bowel irrigation with rebounding salicylate levels, GI was consulted again for reevaluation for endoscopy. On day 5, an endoscopy discovered a concretion containing pill fragments. Another endoscopy performed on day 7 removed further fragments. Salicylate levels began to consistently decline. Unfortunately, the patient's neurologic status did not improve, and on day 11 she was switched to palliative care and died.
Conclusions:	Endoscopy with direct visualization is diagnostic and therapeutic in the setting of a possible bezoar. The absence of pharmacobezoar on imaging should not delay endoscopy in a clinical setting suggesting bezoar.
Keywords:	Aspirin • Bezoar
Full-text PDF:	https://www.amjcaserep.com/abstract/index/idArt/936752

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Background

A complication of acute salicylate overdose is the formation of a pharmacobezoar, which is a formation of adherent masses that can delay or prolong absorption of pharmaceuticals [1]. Investigation for a pharmacobezoar should occur with ingestions of enteric-coated tablets (salicylates), extended-release preparations, and medications that delay gastric emptying or cause pylorospasm [1]. After an aspirin overdose, the diagnosis of a bezoar should be aggressively pursued when salicylate levels fail to decline or rebound repeatedly, despite maximizing clearance, to prevent continued absorption, worsening acidosis, and potential cerebral edema [2]. Endoscopy provides diagnostic and therapeutic benefits for the treatment of a possible bezoar. Computed tomography (CT) can potentially identify phytobezoars (from fruits and vegetables with high fiber content) and pharmacobezoars (from pharmaceuticals), and it can be an adjunct in management if an obstruction is suspected [3,4].

This report discusses a case of failure of CT to identify a pharmacobezoar after massive aspirin ingestion, and reinforces the necessity of emergent endoscopy. We performed a scoping review of the literature to assess the ability of CT to detect bezoars.

Case Report

A 64-year-old woman was brought to the Emergency Department by Emergency Medical Services (EMS) after a reported intentional ingestion of aspirin. The patient called and reported she had ingested an unknown quantity of aspirin to harm herself, but first responders did not find any empty pill bottles.

On arrival to the Emergency Department, she denied ingestion and intentions to harm herself. She reported dyspnea but denied any other concerns such as abdominal pain, vomiting, or nausea. Her initial respiratory rate was 22 breaths per minute, heart rate was 99 beats per minute, blood pressure of 109/84 mmHg, and her temperature was 37.4°C. She had a Glasgow Coma Scale (GCS) of 15 but demonstrated inattentive behavior with a blunted affect. She was oriented to place, month, and year, but did not understand why she was at the hospital. She had a significant medical history of schizoaffective disorder, generalized anxiety disorder, deep venous thrombosis, and delusional disorder. Her medications included olanzapine and alprazolam.

Initial laboratory results in the Emergency Department included a salicylate level of 1143 mcg/mL, with an anion gap of 23, and serum bicarbonate was 9 mEq/L, with a venous blood gas

(VBG) consistent with respiratory alkalosis and metabolic acidosis (pH=7.44, pCO₂=16). Subsequent arterial blood gases coincided with the VBG demonstrating a mixed respiratory acidosis and metabolic acidosis (pH=7.45, pCO₂=23, pO₂=250, bicarbonate=19). She had normal renal function and liver enzymes on the initial comprehensive metabolic panel. Ethanol and acetaminophen levels were undetectable, initial lactic acid was normal, ammonia level was 17 mcumol/L, and the urine drug screen was positive for benzodiazepines. Her initial electrocardiogram was normal sinus rhythm with normal QRS and QTc intervals. The laboratory results for the VBG came back prior to the salicylate level, and the team started treatment with a bicarbonate and glucose infusion prior to obtaining salicylate level results due to concerns of massive salicylate ingestion in the setting of altered mental status and tachypnea.

The patient declined further intubation and placement of emergent dialysis vascular access. Ventilator settings matched pre-intubation tachypnea and we increased tidal volume to match intrinsic minute ventilation. An initial chest X-ray was normal. Nasogastric tube contents returned dark-brown gastric contents, but no pill fragments. The Emergency Department gave the first dose of activated charcoal through the nasogastric tube. The initial head CT scan was without acute intracranial abnormalities. The Inpatient Toxicology Consult Service recommended emergent dialysis, continuing alkalinization, and activated charcoal. The Intensive Care Team admitted the patient and contacted Nephrology for emergent dialysis.

She received 3 more doses of activated charcoal 50 mg every 4 h. Approximately 6 h after arrival, dialysis was initiated. The patient required vasopressors. The salicylate level after initial dialysis was 400 mcg/mL, but 6 h after dialysis the level rebounded to 694 mcg/mL. Continuous renal replacement therapy was initiated after the first session of dialysis.

Clinically, the patient was able to open her eyes spontaneously and withdraw to pain, and her blood gases correlated with an uncompensated respiratory alkalosis. Despite remaining on continuous renal replacement therapy, salicylate levels rebounded to 1005 mcg/mL. Nephrology transitioned the patient back to hemodialysis for a second 4-h session. The patient's hypotension worsened, requiring vasopressin to support her blood pressure. Episodes of hypoglycemia required dextrose infusion, which was started along with the continuation of 150 mEq of sodium bicarbonate in dextrose 5% in water with 20 mEq of potassium chloride at 200 mL/h. The Toxicology Team recommended repeat activated charcoal and recommended a Gastroenterology consult to the Primary Team for a possible concretion. Nephrology decided to complete a third session of intermittent hemodialysis due to level >500 mcg/mL on day 1 of hospitalization.

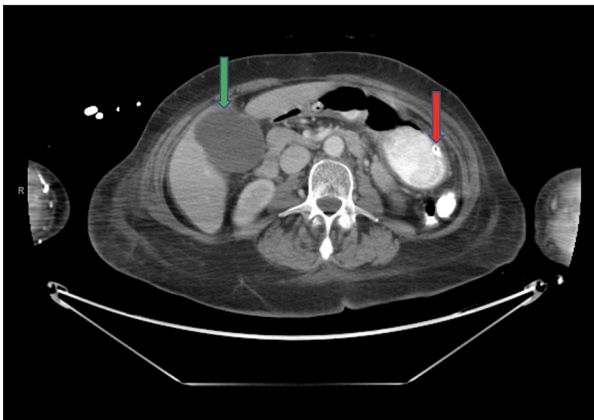


Figure 1. CT abdomen and pelvis with i.v. contrast and oral Gastrografin (GE Lightspeed RT 16). A CT obtained on day 3 of hospitalization demonstrated a nasogastric tube with its tip in the stomach (red arrow), moderately distended gallbladder with mild biliary ductal distention (green arrow), and no bezoar identified.

On day 2 of hospitalization, Gastroenterology was consulted and recommended a CT scan of the abdomen and pelvis, but deferred esophagogastroduodenoscopy (EGD) as the patient was hemodynamically unstable, requiring 3 vasopressors to support her blood pressure. On day 3 of hospitalization, a CT scan of the abdomen and pelvis (GE Lightspeed RT 16) with i.v. contrast and oral contrast (Gastrografin) revealed moderate bibasilar pneumonia, concerning for aspiration, a small amount of ascites in the right upper-quadrant abdomen, and distended gallbladder with mild biliary ductal distention, but no gastric foreign body was identified (Figure 1). Furthermore, Gastroenterology advised there was a low likelihood to identify and retrieve any remaining salicylate in the stomach since

the patient was having bowel movements and there was no evidence of obstruction, therefore, recommended a CT abdomen pelvis with Gastrografin.

By hospital day 3 the patient received another 2 sessions of hemodialysis. On day 4, whole-bowel irrigation was given in an attempt to clear any remaining salicylate. Nephrology continued hemodialysis with continuous renal replacement therapy in between intermittent hemodialysis due to levels rising to 491 mcg/mL (Figure 2). Of note, renal function remained within normal limits. Gastroenterology recommended whole-bowel irrigation and reassessment on the next morning because the CT scan of the abdomen and pelvis was negative for bezoar. The patient's hospital course was complicated by MSSA pneumonia.

After whole-bowel irrigation and continuous renal replacement, salicylate levels remained above 400 mcg/mL, and Nephrology completed a sixth hemodialysis treatment. Gastroenterology performed an endoscopy on the fifth day of admission, with significant findings of a moderate quantity of red blood found in the entire stomach, and a packet/paper wrapped around pills, measuring 8-10 cm was found in the body of the stomach (Figure 3A, 3B). They attempted retrieval of pills, with partial success. There was no evidence of ulcers. A large amount of black liquid was also found. The hypopharynx, esophagus, gastroesophageal junction, pylorus, and duodenum were noted to be normal. GI suggested they would possibly repeat endoscopy in 1 day if salicylate levels did not improve.

The patient's mental status continued to decline; an MRI of the brain was unrevealing, and an EEG was consistent with moderate-to-severe encephalopathy without epileptiform discharges or electrographic seizures. Nephrology held hemodialysis

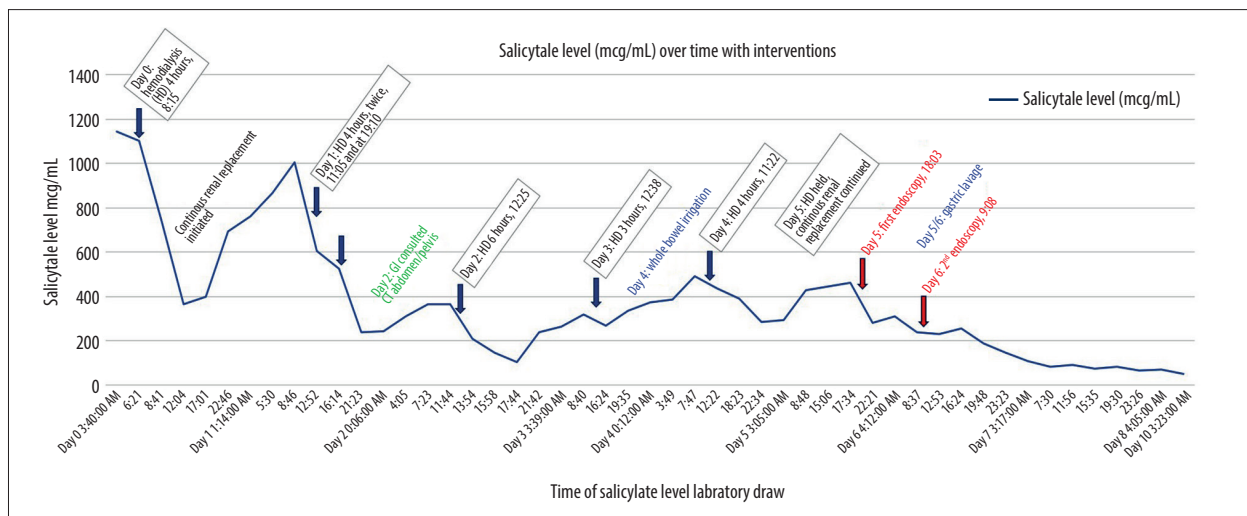


Figure 2. Salicylate levels over time with interventions. Y axis: Salicylate level in mcg/mL. X axis: Time of salicylate level laboratory draw. Blue arrows identify time of hemodialysis with duration and red arrows identify time of endoscopy.

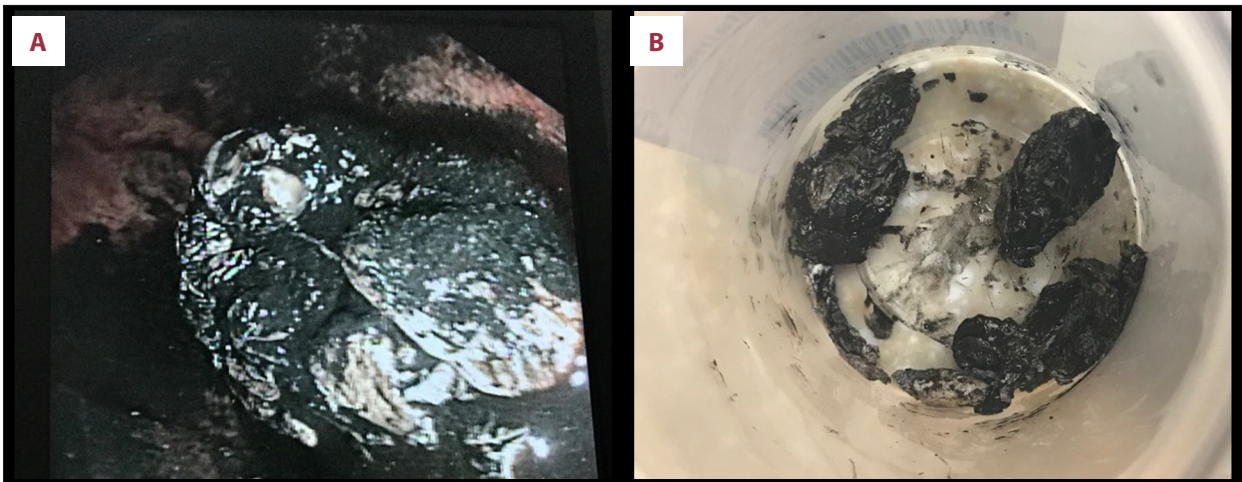


Figure 3. (A) Gastric contents during endoscopy. (B) Packet/paper with pills retrieved by endoscopy.

due to hypophosphatemia and hypocalcemia. Prior to repeating endoscopy, the patient received fresh frozen plasma and vitamin K for coagulopathy. Repeat endoscopy showed a large amount of blood oozing from the gastric mucosa and a large amount of charcoal, along with additional pill remnants. Toxicology recommended gastric lavage to remove pill fragments visualized by endoscopy, but were unable to remove them. The ICU completed gastric lavage with cold saline for a total of 4 liters; the output contained a mixture of activated charcoal and pill fragments.

After the second endoscopy with pill extraction and large-volume gastric lavage, salicylate levels declined continuously by day 7 of hospitalization. Nephrology discontinued hemodialysis, but CRRT was continued for volume overload; as her salicylate levels declined and blood pressure improved, CRRT was discontinued on day 8. She was noted to have waxing and waning of mental status, intermittently opening her eyes to voice and withdrawing to pain. She remained on minimal ventilatory settings. A repeat head CT scan did not show any acute changes.

On day 9, the patient developed oliguria with acute kidney injury in the setting of volume overload, and the ICU team started her on diuretics and albumin 5% bolus. Due to Nephrology findings concerning for toxic tubular necrosis, and with her creatinine peaking after cessation of CRRT, Acetazolamide was given for metabolic alkalosis.

On day 10, Nephrology planned another hemodialysis session, but the patient's family deferred dialysis, and the next day the family decided to pursue palliative care. She was extubated on day 11 and died the next day.

Discussion

We present a case of severe salicylate toxicity with complications of gastric pharmacobezoar that was not evident on abdominal computerized tomography with i.v. and oral Gastrografin contrast.

A focusing review of the medical literature revealed the limited utility of the use of CT to detect pharmacobezoars, with most evaluating efficacy in identifying small-bowel obstruction (SBO) and associated phytobezoar, and not necessarily concurrent gastric bezoars. Most bezoars are formed and discovered in the stomach but can go undetected until they pass to the small intestines, leading to obstruction [5]. Several sources cite the use of CT for differentiating phytobezoar from small-bowel feces in cases of small-bowel obstruction (SBO) [6,7]. Most of these studies were small and retrospective or observational, and further extrapolation is made even more difficult because bezoar causes only 0.4% to 4.8% of SBOs [5].

A retrospective study by Delabrousee et al evaluated the accuracy and differences on CT abdomen pelvis (i.v. contrast only) between food bezoars and small-bowel feces in cases of SBO. They reviewed 27 cases of small-bowel obstruction with 8 confirmed food bezoars after surgery and found that small-bowel food bezoar[s] could be identified as a defined mass, mottled in appearance, with gas bubbles, associated with an encapsulated mass and a similar lesion in the stomach [6]. Ripollés et al reported on the utility of sonography and CT as reliable diagnostic tools to assess for phytobezoar and trichobezoars from 17 confirmed cases of bezoar. Computed tomography confirmed all 17 bezoars, and sonography confirmed 15 out of the 17 cases [7]. Of the CT findings, 15 patients had signs of small-bowel obstruction, with bezoars at the site of the obstruction, with 7 out of the 15 having concurrent gastric bezoar (1 not seen on CT), and 2 patients with isolated gastric bezoars [7]. Variability

in diagnostic accuracy exists: Wang et al reported a diagnostic accuracy of CT of 100% in 35 phytobezoars at the site of impaction, whereas Oh et al reported a diagnostic accuracy of 47% [8,9]. In all the aforementioned studies, most patients had undergone prior gastrointestinal surgeries. In the present case, the patient had a gastric pharmacobezoar and did not have evidence of bowel obstruction on imaging, which may lead clinicians to believe that a bezoar is not present. The absence of findings on radiographic or CT imaging does not necessarily exclude the presence of a pharmacobezoar and should not delay endoscopy.

Pharmacobezoars are rare, but can be formed from extended and immediate release formulations, suspension, and insoluble drug delivery vehicles [4]. In this report, endoscopy found a paper/packet with pills and a large amount of black liquid, possibly activated charcoal. Although massive salicylate toxicity is an indication for multidose activated charcoal (MDAC), there are concerns that MDAC can contribute to the development of a charcoal bezoar and bowel obstruction [4]. From the literature, it is unclear if bowel obstruction or bezoar formation result from decreased gastrointestinal motility from toxic effects of overdose versus concretion formation from activated charcoal, or the cumulation of both. There are reports of bowel obstruction after overdoses of tricyclic antidepressants, opioids, barbiturates, benzodiazepines, bupropion, and theophylline treated with MDAC with and without cathartics [10-14]. Bezoars associated with activated charcoal usually demonstrate GI tract obstruction, which our patient did not have [4]; therefore, it is less likely that MDAC contributed to the patient's retention of pill fragments. A multicenter retrospective chart review reviewed 6258 charts and identified 878 patients in a 5-year timeframe who received MDAC with no occurrence of bowel obstruction [15]. In our patient, whole-bowel irrigation did not produce effluent indicative of

bezoar. The patient underwent endoscopy twice for removal of pill fragments, whole-bowel irrigation with polyethylene glycol prior to endoscopy, and then gastric lavage after endoscopy.

The chemical properties of salicylates could have potentiated the formation of a pharmacobezoar. Specific formulations of salicylates such as enteric-coated aspirin contain a cellulose-acetate-phthalate coating that prevents dissolution in the acidic environment of the stomach [4]. Aspirin bezoars from enteric-coated formulations can develop in chronic long-term ingestions not associated with symptoms of salicylate toxicity, with some cases associated with gastric outlet obstruction [4]. Simpson's review [4] found no case reports of bezoar formation after acute enteric-coated aspirin ingestion.

Conclusions

In this case report, CT did not detect a pharmacobezoar after severe aspirin ingestion, but it was found on subsequent endoscopy. Rising salicylate levels despite maximized gastric decontamination and extracorporeal removal should prompt consideration of pharmacobezoar formation and prompt urgent endoscopy. The absence of bezoar on imaging should not delay endoscopy when salicylate levels are refractory to treatment. CT and radiography with oral contrast can assess larger areas of the GI tract, but may be less reliable, and should not be used to rule out pharmacobezoar or delay endoscopy.

Declaration of Figures' Authenticity

All figures submitted have been created by the authors who confirm that the images are original with no duplication and have not been previously published in whole or in part.

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