Cocaine use and splenic rupture: a rare yet serious association

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Abstract

Cocaine abuse is frequent in patients visiting the emergency department. The knowledge of the cardiovascular complications of cocaine is excellent among physicians. However the awareness regarding its abdominal complications, the most important of which include gastroduodenal perforation, bowel ischemia and splenic rupture is less adequate. We report a 58-year-old with cocaine use who presents with upper abdominal pain and a rapidly worsening clinical status. He was found to have atraumatic splenic rupture causing a hemoperitoneum that was managed by intervention radiology guided splenic artery embolization. Splenic hemorrhage and rupture need timely recognition, as they are difficult to diagnose clinically and can be potentially fatal. In the encounter of patients with cocaine use who present with chest or upper abdominal pain, clinicians should consider imaging to look for splenic rupture as it is often masked or overlooked due to the complicated clinical picture.

Introduction

Substance abuse is a common cause of visit to the hospital and cocaine is among the most commonly encountered drug. Cocaine intoxication has a vast spectrum of presentation and can affect various organ systems. The abdominal complications related to cocaine are less often recognized as they are less often considered. However a patient with cocaine use presenting with acute abdominal pain could be harboring a life-threatening emergency that warrants prompt recognition and treatment. The important differentials that need to be considered are bowel ischemia, bowel perforation and splenic hematomas or rupture. We discuss a case of spontaneous splenic rupture causing hemoperitoneum in a patient with cocaine use.

Case Report

A 58-year-old male with history of polysubstance abuse and HIV infection on antiretroviral therapy presented to the emergency department with complaints of shortness of breath and coughing for 2 days. He also reported a vague pain in the left chest and upper abdomen that was aggravated by deep inspiration. Though he initially denied recent substance use, after specific questioning he admitted to smoking crack cocaine two days prior. On examination, he had sinus tachycardia with a heart rate of 115 per min, a respiratory rate of 22 per min and blood pressure of 115/66 mm Hg. Chest examination revealed equal breath sounds and he exhibited vague tenderness in the epigastric region and left upper quadrant of the abdomen. Laboratory testing showed a total leukocyte count of 16,200 with 88% neutrophils, hemoglobin of 13.9 g/dL, creatinine of 4.1 mg/dL, lactate of 2.2 mmol/L and total CK of 41,000 U/L. Urine toxicology was positive for cocaine metabolites. Chest radiograph showed bilateral basal opacities that were suspicious for early consolidation. He was diagnosed with sepsis from pneumonia and acute kidney injury from rhabdomyolysis, likely due to cocaine use. He was given broad-spectrum antibiotics, started on aggressive intravenous hydration and transferred to the medical step-down unit.

In a few hours after his arrival, his abdominal pain acutely worsened and was also radiating to his back. On repeat examination, the abdomen was tender diffusely, with diffuse guarding and rigidity. Sinus tachycardia persisted and there was a drop in his blood pressures to 86/62 mm Hg. He was started on intravenous fluid bolus and repeat labs were drawn. There was a drop in the hemoglobin to 10.7 g/dL, leukocyte count increased to 25,400 and lactate to 7.8 mmol/L. His clinical condition continued to deteriorate, as his blood pressures were further dropping and not responding to fluid resuscitation. His respirations were getting irregular, the pain in his abdomen was worsening and he was developing confusion. Given the clinical and laboratory picture, a possibility of bleeding in the abdomen was considered. He was intubated due to poor respiratory effort and given fluid boluses. Following initial stabilization he underwent a computerized tomography (CT) of the abdomen and pelvis that revealed a perisplenic hemorrhage, moderate hemoperitoneum in the abdomen tracking down to the pelvis (Figure 1) and ill-defined hypodense splenic lesions (Figure 2). Following this, he was taken for splenic angiography that demonstrated multiple foci of active extravasation in the mid and lower region of the spleen (Figure 3). Successful occlusion of the distal splenic artery was carried out with gelfoam and embolization coils, with follow up angiography not showing any further extravasation (Figure 4). The cause of his deterioration was determined as atraumatic splenic rupture leading to hemoperitoneum. After the procedure, he remained hemodynamically stable. Surgical opinion was obtained and no further surgical intervention was advised. Repeat CT imaging in four days showed decrease in hemoperitoneum and residual splenic lesions, which were most likely hemorrhages.

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Discussion

Cocaine is an addictive stimulant drug extract from the leaves of *Erythroxylon coca* plant native to South America. Chemically it is an alkaloid (benzoylmethylecgonine) that is available in two forms. One is cocaine hydrochloride that is in powder or granule form and can be taken orally, intravenously or intranasally (snorting). The other form, widely known as crack cocaine or the free-base cocaine is heat-stable and hence it can be smoked. Crack cocaine is the most addictive formulation as it has a rapid onset of euphoria (3-5 s) and an easy administration route.[1] Cocaine is a triple reuptake inhibitor that acts by inhibiting the reuptake of three neurotransmitters - dopamine, norepinephrine and serotonin. Blocking the reuptake of dopamine and norepinephrine increases the availability of these transmitters in the synaptic cleft, thereby making cocaine a powerful sympathomimetic agent. Cocaine's nervous system stimulant effects and abuse potential are considered primarily secondary to its enhancement of brain dopamine activity, particularly in the mesolimbic dopamine reward pathway.[2] Majority of cocaine is metabolized by hydrolysis of its ester bonds in the liver and plasma to benzoylecgonine (BE) and ecgonine

methylester (EME), which are excreted in the urine along with some minor metabolites. Since BE, EME and cocaine are the major urinary analytes after cocaine use, they are recommended as screening tests for urine toxicology.[3] BE is the most widely used in laboratories worldwide. Cocaine is generally detectable in the urine only for 8 h, BE can be detected from 48 to 144 h depending on the assay used. Due to its long elimination half-life, EME has the longest detection time for up to 164 h.[3]

The adverse effects of cocaine have been described and studied in various organ systems. Cardiopulmonary symptoms are the most common reason for cocaine users seeking medical help, with chest pain being the most frequent presentation. Cocaine acutely increases heart rate, blood pressure and systemic vascular resistance, mainly by increasing adrenergic activity in the heart. It has been shown to increase heart rate by 30 beats per minute and blood pressure by 20/10 mm of Hg.[4] Acute cocaine intoxication can present as coronary ischemia (including acute myocardial infarction), elevated blood pressures, dysrhythmias and sudden cardiac death. Central nervous system effects include seizures, ischemic and hemorrhagic strokes. In the respiratory system, cocaine snorting is associated with rhinitis, perforation of septum and sinusitis. Smoking of crack cocaine can cause chest pain, wheezing, coughing and hemoptysis. Acute pulmonary edema, pulmonary hemorrhage and pneumothorax have all been described, but less commonly.[5] *Crack lung* is an acute pulmonary syndrome of unknown pathogenesis that manifests with fever, hypoxia, hemoptysis and alveolar infiltrates after smoking cocaine. In the kidneys, it can cause acute kidney injury from rhabdomyolysis and contribute to progression of chronic kidney disease, especially in patients with hypertension.

The effects of acute cocaine intoxication in the gastro-intestinal system are not as common as the cardiac and nervous system ones, however they are potentially life threatening. The major ones are gastro-duodenal perforations and bowel ischemia, and the others include delayed gastric emptying and peptic ulceration. Perforations are more common with crack cocaine and are mostly in the jux-

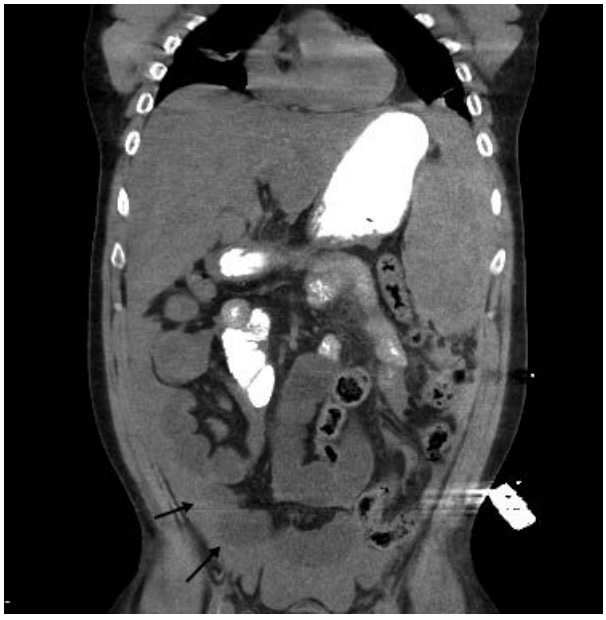

Figure 1. Computed tomography of abdomen and pelvis (coronal plane) showing hemoperitoneum with blood tracking down into the pelvic cavity (arrows).

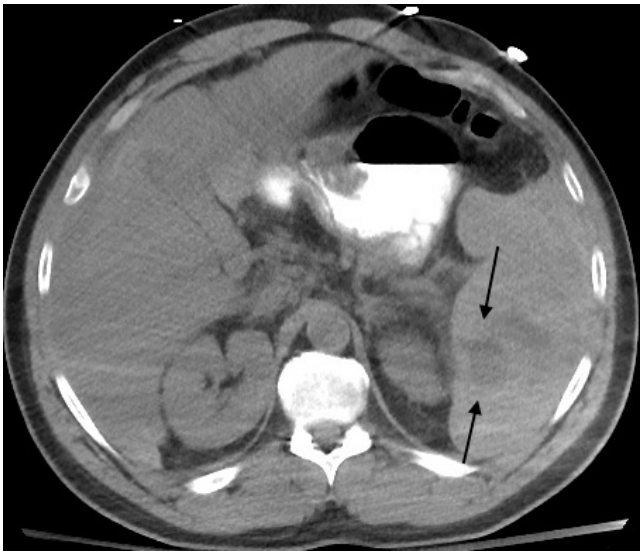

Figure 2. Computed tomography of abdomen (axial plane) demonstrates ill-defined hypodense lesions (arrows) in the spleen that could represent infarcts or hemorrhages.

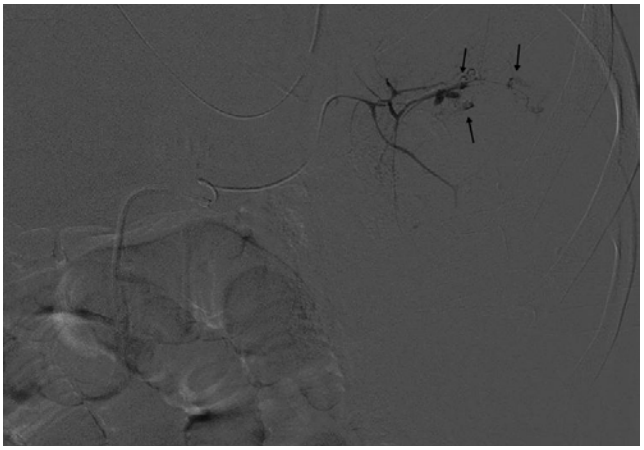

Figure 3. Splenic angiography shows multiple foci of extravasation (arrows) within the spleen.

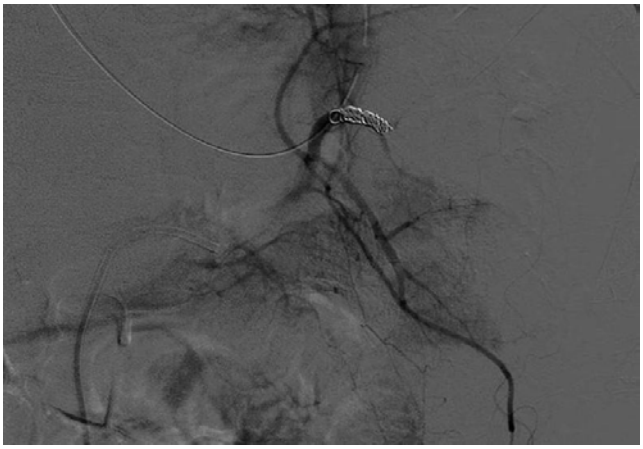

Figure 4. Embolization with coil and gel foam at the distal portion of splenic artery resulting in resolution of the bleeding.

tapyloric region and the first part of duodenum. They can present anywhere between an hour to three days after crack cocaine use.[6] Hence if the clinical suspicion for perforation is high in a patient with cocaine use, immediate exploration should be considered. A retrospective study observed that most of these gastric perforations are treated with omental patch repair, though anti-ulcer surgery had a slightly lower recurrence rate.[7] The pathogenesis of perforation is vasoconstriction causing tissue ischemia and necrosis, predisposing to perforation. There are two postulated mechanisms for cocaine-induced vasoconstriction. First is the direct vasoconstrictive effect mediated via increased influx of calcium across the vascular endothelium as has been proven in animal studies.[8] The other is vasospasm and poor blood flow in the mucosal vessels due to the sympathomimetic effects of cocaine in the gut vasculature. Apart from vasoconstriction, cocaine can cause ischemia by promoting intramural thrombus formation. Increased platelet activation and aggregation and elevated concentrations of plasminogen-activator inhibitor contribute to the thrombogenicity of cocaine.[9] Intestinal ischemia after cocaine use is also well known and presents with acute abdominal pain with or without bloody stools. Both mesenteric ischemia and ischemic colitis have been described. In the small bowel, the distal ileum is most commonly involved.[10] In cocaine induced ischemic colitis, the time interval between drug use and onset of symptoms varies from one hour to two days.[11] Some of these cases are self-resolving with conservative management, while others need surgical intervention especially if complicated by perforation or peritonitis. The underlying pathology is vasoconstriction causing ischemia or direct toxic effect of cocaine on the gut mucosa.

Another intra-abdominal organ that is affected by cocaine but is less commonly recognized is the spleen. We performed a literature search relating to papers on cocaine use and splenic pathology. There are two case reports that have described splenic infarction following cocaine use in sickle cell trait patients presenting as acute onset abdominal pain.[12,13] There is another report of autopsy findings in a patient with cocaine abuse that describes multiple splenic infarcts, some with necrosis and abscess formation.[14] Homler and colleagues described a patient with cocaine *snorting* who presented with left upper quadrant pain and was found to have a subcapsular splenic hematoma on CT imaging.[15] Azar and colleagues reported a case of atraumatic splenic rupture and hemoperitoneum following intranasal cocaine use where the patient was managed supportively and improved.[16] There is one other report of hemoperitoneum following intravenous cocaine use, in which an exploratory laparotomy did not reveal the source of bleeding.[17] None of the cases had a splenic angiogram performed that would have better demonstrated the bleeding in the spleen.

Though vasoconstriction and thrombus formation can explain the cases of splenic infarct, there is no clear explanation for the splenic rupture, hematomas or bleeding. Cocaine has been shown to transiently reduce splenic volume by approximately 20% in human subjects, which is believed to be from splenic constriction.[18] It is possible that the initial insult on the spleen could be ischemic; with hemorrhage occurring in the ischemic area later after the vasoconstriction is resolved. Despite the evidence that cocaine promotes platelet aggregation, some studies have proven that cocaine inhibits platelet aggregation and interferes with the process of thrombus formation by activated platelets.[19] It has also been shown to induce expression of platelet-derived growth factor in endothelial cells, thereby increasing vascular permeability.[20] Hence inhibition of platelet aggregation and increased vascular permeability could also be contributing to the bleeding. Another possible mechanism could be splenic arterial or arteriolar rupture from hypertension caused by cocaine. It is unclear whether anatomical factors like a pseudoaneurysm can predispose to splenic hematoma and bleeding. In the case described, the patient may have had a splenic hematoma or ischemia at the time of presentation and the rapid change in clinical status was due to splenic rupture resulting in hemoperitoneum.

Conclusions

Given the increasing abuse of cocaine and its varied presentations, it is important that providers be aware of the various abdominal complications of the same. It can be a challenging task to elicit the history of drug use and perform a good abdominal examination in these patients. Gastroduodenal perforations, bowel ischemia and splenic rupture are all acute and potentially life-threatening conditions that can be associated with cocaine use. Splenic rupture in particular can be easily missed unless an astute clinician looks for it. Also, its association with cocaine use is not widely known. It should be considered in any patient presenting with acute abdominal pain or surgical abdomen without any other obvious cause. A knowledge of these conditions and their association with cocaine can be vital as timely recognition of these emergencies can be life-saving.

References

1. Lange RA, Hillis LD. Cardiovascular complications of cocaine use. N Engl J Med 2001;345:351-8.
2. Dackis CA, O'Brien CP. Cocaine dependence: a disease of the brain's reward centers. J Subst Abuse Treat 2001;21:111-7.
3. Huestis MA, Darwin WD, Shimomura E, et al. Cocaine and metabolites urinary excretion after controlled smoked administration. J Anal Toxicol 2007;31:462-8.
4. Benzaquen BS, Cohen V, Eisenberg MJ. Effects of cocaine on the coronary arteries. Am Heart J 2001;142:402-10.
5. Tseng W, Sutter ME, Albertson TE. Stimulants and the lung : review of literature. Clin Rev Allergy Immunol 2014;46:82-100.
6. Lee HS, LaMaute HR, Pizzi WF, et al. Acute gastroduodenal perforations associated with use of crack. Ann Surg 1990;211:15-7.
7. Schuster KM, Feuer WJ, Barquist ES. Outcomes of cocaine-induced gastric perforations repaired with an omental patch. J Gastrointest Surg 2007;11:1560-3.
8. Summers RJ, Tillman J. Investigation of the role of calcium in the supersensitivity produced by cocaine in cat spleen strips. Br J Pharmacol 1979;65:689-99.
9. Rinder HM, Ault KA, Jatlow PI, et al. Platelet alpha-granule release in cocaine users. Circulation 1994;90:1162-7.
10. Sudhakar CB, Al-Hakeem M, MacArthur JD, Sumpio BE. Mesenteric ischemia secondary to cocaine abuse: case reports and literature review. Am J Gastroenterol 1997;92:1053-4.
11. Linder JD, Mönkemüller KE, Raijman I, et al. Cocaine-associated ischemic colitis. South Med J 2000;93:909-13.
12. Novielli KD, Chambers CV. Splenic infarction after cocaine use. Ann Intern Med 1991;114:251-2.
13. Vaghjimal A. Splenic infarction related to cocaine use. Postgrad Med J 1996;72:768.
14. Dettmeyer R, Schlamann M, Madea B. Cocaine-associated abscesses with lethal sepsis after splenic infarction in an 17-year-old woman. Forensic Sci Int 2004;140:21-3.
15. Homler HJ. Nontraumatic splenic hematoma related to cocaine abuse. West J Med 1995;163:160-2.
16. Azar F, Brownson E, Dechert T. Cocaine-associated hemoperitoneum following atraumatic splenic rupture: a case report and literature review. World J Emerg Surg 2013;8:33.
17. Bellows CF, Raafat AM. The surgical abdomen associated with cocaine abuse. J Emerg Med 2002;23:383-6.
18. Kaufman MJ, Siegel AJ, Mendelson JH, et al. Cocaine administration induces human splenic constriction and altered hematologic parameters. J Appl Physiol 1998;85:1877-83.
19. Heesch CM, Negus BH, Steiner M, et al. Effects of in vivo cocaine administration on human platelet aggregation. Am J Cardiol 1996;78:237-9.
20. Yao H, Duan M, Buch S. Cocaine-mediated induction of platelet-derived growth factor: implication for increased vascular permeability. Blood 2011;117:2538-47.