JACC: CASE REPORTS VOL. 13, 2023

CASE REPORT

INTERMEDIATE

CLINICAL CASE: ACC.23

Spontaneous Cholesterol Embolism Leading to Small Bowel Obstruction and Perforation

Arun Umesh Mahtani, MD, MS,[a] Muhammad Khalid Tahir, MD,[b] Inderbir Padda, MD,[a] Muhammad Haider, MD,[a] Farhang Ebrahimi, MD,[b] Philip Otterbeck, MD,[c] Jay Nfonoyim, MD[a]

ABSTRACT

A spontaneous occurrence of cholesterol embolization syndrome causing small bowel obstruction and perforation is a highly scarce event. In this article, we report a case of spontaneous cholesterol embolism resulting in small bowel obstruction and perforation in a 52-year-old male with multiple cardiovascular and medical comorbidities. In our patient, the source was an eccentric left lateral atherosclerotic plaque from the abdominal aorta that was identified using computed tomography. A distal occlusion in numerous small intestinal arteries due to cholesterol embolism was confirmed on biopsy after surgical resection. (**Level of Difficulty: Intermediate.**) (J Am Coll Cardiol Case Rep 2023;13:101780) © 2023 The Authors. Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

Cholesterol embolization syndrome (CES) transpires following showers of numerous microemboli (cholesterol crystals) in circulation from a proximal large artery source to mid- and small-sized vessels located distally, causing occlusion and inflammatory response, resulting in end-organ damage. In contemporary literature, the incidence CES is reported to be 0.79%-3.4%, occurring most typically in elderly male patients aged above 60 years.[1,2] The pathophysiology and fundamental characteristics of CES include the existence of a large artery plaque, typically the aorta, internal carotid, or iliac arteries, a rupture of the plaque, or embolization of cholesterol crystals causing downstream mechanical occlusion in mid- to small-sized vessels. This further causes an inflammatory reaction resulting in end-organ damage.[1,3]

LEARNING OBJECTIVES

- To identify cholesterol emboli as a source of bowel obstruction in patients with multiple cardiovascular comorbidities.
- To differentiate it from conditions like mesenteric ischemia and ulcerative colitis using multiple imaging and laboratory modalities.
- To assess condition of the patient as cases can be a medical emergency requiring collaboration with medicine, gastroenterology, surgery, and vascular teams.

HISTORY OF PRESENTATION

A 52-year-old male with a past medical history of abdominal aortic aneurysm status post endovascular

From the [a]Department of Medicine, Richmond University Medical Center/Mount Sinai, Staten Island, New York, USA; [b]Department of Nephrology, Richmond University Medical Center/Mount Sinai, Staten Island, New York, USA; and the [c]Department of Endocrinology, Richmond University Medical Center/Mount Sinai, Staten Island, New York, USA.

The authors attest they are in compliance with human studies committees and animal welfare regulations of the authors' institutions and Food and Drug Administration guidelines, including patient consent where appropriate. For more information, visit the Author Center.

Manuscript received December 5, 2022; revised manuscript received January 4, 2023, accepted January 19, 2023.

ISSN 2666-0849 https://doi.org/10.1016/j.jaccas.2023.101780

ABBREVIATIONS AND ACRONYMS

CES = cholesterol embolization syndrome

CT = computed tomography

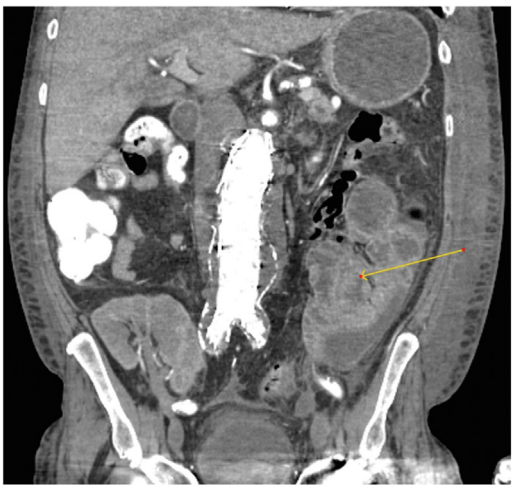
ED = emergency department

aneurysm repair, hypertension, hyperlipidemia, atrial flutter status post-radiofrequency ablation, coronary artery disease, cerebrovascular accident, previous myocardial infarction with coronary artery bypass graft, chronic kidney disease with an unsuccessful renal transplant, and ulcerative colitis presented to the emergency department (ED) with abdominal pain that awoke him from his sleep early in the morning. He reports waking up once overnight due to the pain and then at 6 am when he experienced a sudden onset of sharp pain. He reported the pain to spike intermittently being 10/10 intensity exacerbated by movement and relieved after belching. The pain was also associated with nausea and nonbilious, non-bloody vomiting. He had about 6 episodes of vomiting and 1 non-bloody bowel movement before coming to the hospital. He also experienced shortness of breath due to the pain but denied any diarrhea, constipation, melena, fever, chest pain, dysuria, or decreased appetite. His list of medications included apixaban 2.5 mg twice a day, diltiazem 60 mg thrice a day, epoetin alfa 10,000 U subcutaneous once a week, ferrous sulfate 325 mg twice a day, hydralazine 50 mg thrice a day, icosapent ethyl 4 g daily, mesalamine 400 mg daily, metoprolol tartrate 75 mg twice a day, and potassium chloride 10 milliequivalents daily. On physical examination the patient's vital signs were stable, and he was noted to be in severe distress; guarding and rebound tenderness were prominent in the hypogastric area along with diffuse tenderness. His extremities showed cyanosis of the right 1st and 5th toe with edema and 2+ pulses. The left foot also showed cyanosis and edema over the 3rd toe with 2+ pulses. Ulcerative colitis flare-up and mesenteric ischemia were suspected as a differential diagnosis.

INVESTIGATIONS

Further work-up for *Clostridium difficile*, stool leukocyte, and culture with sensitivity was ordered and reported to be negative. A computed tomography (CT) of the abdomen with contrast showed abnormally dilated loops of jejunum with a transition point in the left mid abdomen in addition to adjacent free fluid and free air suspicious for small bowel obstruction with perforation (Figures 1 and 2). It also showed an eccentric left lateral atherosclerotic plaque

FIGURE 1 Computed Tomography Angiogram of the Abdomen and Pelvis

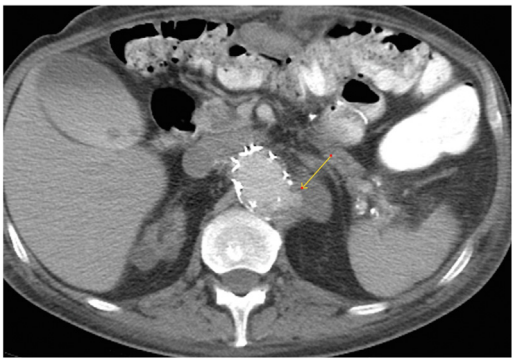


Dilated loops of stomach, duodenum, and jejunum with a transition point in the left mid abdomen along with a change in caliber at this level. Decompressed small bowel distal to this is seen **(orange arrow)**. Contrast is seen flowing to the terminal ileum and cecum. Courtesy of Dr Mahmoud, Department of Radiology, Richmond University Medical Center/Mount Sinai, Staten Island, New York. CT = computed tomography.

FIGURE 2 Computed Tomography Angiogram of the Abdomen and Pelvis

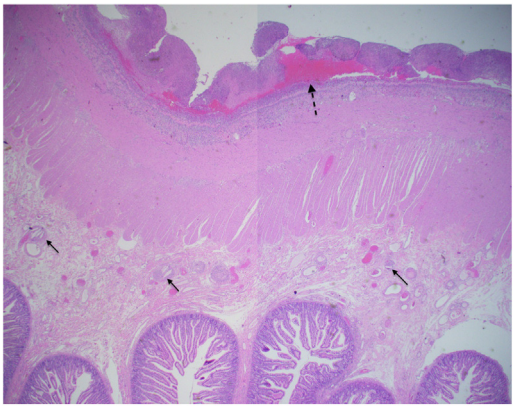
Free air and fluid are seen in the intraperitoneal space, which is concerning for bowel perforation **(green arrow)**. Courtesy of Dr Mahmoud, Department of Radiology, Richmond University Medical Center/Mount Sinai, Staten Island, New York. Abbreviation as in Figure 1.

FIGURE 3 Computed Tomography Angiogram of the Abdomen and Pelvis



Stable eccentric left lateral atherosclerotic plaque involving the abdominal aorta superior to the proximal aspect of the stent **(orange arrow)**. Courtesy of Dr Mahmoud, Department of Radiology, Richmond University Medical Center/Mount Sinai, Staten Island, New York. Abbreviation as in Figure 1.

FIGURE 4 Histology of the Jejunum Postsurgical Resection



Numerous cholesterol emboli are noted in the small arteries resulting in partial or complete luminal stenosis **(solid arrows)**. There is also secondary acute serositis **(dashed arrow)**.

involving the abdominal aorta superior to the proximal aspect of the stent (Figure 3).

MANAGEMENT

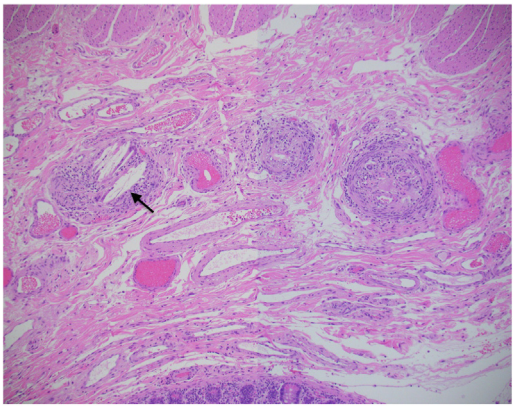
Broad-spectrum antibiotics were initiated with vancomycin and cefepime for suspected peritonitis from microperforation. The gastroenterology, vascular, and surgical teams were consulted. The surgical team performed an exploratory laparotomy, lysis of adhesions, drainage of the intra-abdominal abscess, a small bowel resection of 1 foot in length, and insertion of a Jackson Pratt drain. The surgical pathology report of the small bowel showed segments of the small intestine with multiple foci of punctate ulcers and focal bowel perforation. It also showed secondary acute serositis, which was diffuse and involved the resected margins. The mucosa of the resected margins was viable without any ischemia (Figure 4). Numerous cholesterol emboli were also seen resulting in partial or complete luminal stenosis of the small arteries (Figures 4 and 5). The punctate ulcers and bowel perforation may be the result of localized ischemia due to deposition of cholesterol emboli in small arteries. He was diagnosed with spontaneous cholesterol embolism involving small arteries of the small bowel leading to small bowel obstruction following ischemia and ultimately leading to perforation. His condition improved after surgery and a repeat CT scan of the abdomen did not show any bowel obstruction (Figure 6). Consent was obtained from the patient for publication.

DISCUSSION

Cholesterol crystal embolism frequently occurs following detachment of cholesterol crystals from an atherosclerotic plaque. This usually happens from plaque manipulation during procedures like cardiac catheterization, vascular surgery, or use of anticoagulants.[4,5] However, spontaneous cholesterol crystal embolism remains a rare phenomenon.

The presence of needle-shaped clefts in circulation, primarily the smaller blood vessels, causes occlusion and the development of fibrin thrombi.[6] In our case, the patient has an extensive past medical history, including inflammatory bowel disease, which was a part of our differential diagnosis. The patient also had significant risk factors and underlying cardiovascular comorbidities, suggestive of a vascular etiology. In our case, key distinguishing characteristics for CES were findings on physical examination and imaging. Blue toes were seen on physical examination and a CT angiogram showed an eccentric left lateral atherosclerotic plaque involving the abdominal aorta superior to the proximal aspect of the stent (Figure 3). Confirming a rare case of CES was the numerous cholesterol emboli in the small arteries causing punctate ulcers and bowel perforation on the histology report after surgical resection (Figures 4 and 5).

FIGURE 5 Histology of the Jejunum Postsurgical Resection



Numerous cholesterol emboli are noted in the small arteries resulting in partial or complete luminal stenosis (magnified) **(solid arrow)**.

FIGURE 6 Computed Tomography Abdomen and Pelvis With Contrast Postsurgical Resection

Postoperative computed tomography shows resolution of dilated loops of bowel with a surgical staple line seen in the proximal jejunum **(orange arrow)**. Courtesy of Dr Mahmoud, Department of Radiology, Richmond University Medical Center/Mount Sinai, Staten Island, New York. Abbreviation as in Figure 1.

After kidney and skin, gastrointestinal complications are the third most common complication associated with cholesterol embolism.[7-9] Symptoms can include abdominal pain, diarrhea, pancreatitis, splenic infarct, bleeding of a mucosal ulcer, and rarely a perforation as was seen in our patient. There is no specific laboratory test for diagnosing CES, but a complete blood cell count, metabolic panel, and a urinalysis can help. Measurement of free cholesterol crystals has been proposed.[10] Biopsy of various organs including skin, kidney, intestinal mucosa, skeletal muscle, and bone marrow can aid in confirming the diagnosis.[1] In cases of perforation, timely pain management and stabilization of compromised circulation are vital to prevent further damage. Vascular, general surgery, and gastroenterology consultations should be prompted in such a presentation to rule in or out a pathology. A timely diagnostic work-up is crucial; a CT scan of the abdomen and pelvis was done during the ED visit and routinely thereafter during the patient's hospital stay. In our case, the patient's vitals were stable and emergent surgical consultation was not prompted. The patient was treated with broad-spectrum antibiotics and was on opioids for adequate pain control. After diagnostic work-up and identification of the source of ischemia, timely small bowel resection was done, and our patient made a successful recovery.

CONCLUSIONS

A rare occurrence of a spontaneous CES resulting in small bowel obstruction and perforation was reported in a 52-year-old male with multiple cardiovascular and medical comorbidities. This case report highlights considering CES as a potential differential diagnosis in patients presenting to the ED with acute-onset abdominal pain with underlying cardiovascular comorbidities. The case report also further contributes to the medical literature on spontaneous CES, aiding clinicians in diagnostic work-up and timely management using multiple imaging modalities and involving a team based approach by various specialties.

FUNDING SUPPORT AND AUTHOR DISCLOSURES

The authors have reported that they have no relationships relevant to the contents of this paper to disclose.

ADDRESS FOR CORRESPONDENCE: Dr Arun Umesh Mahtani, 1059, 7 Navy Pier Court, Staten Island, New York 10304, USA. E-mail: arun.mahtani@nyu.edu.

REFERENCES

1. Kronzon I, Saric M. Cholesterol embolization syndrome. *Circulation*. 2010;122:631-641.

2. Cross S. How common is cholesterol embolism? *J Clin Pathol*. 1991;44:859-861.

3. Saric M, Kronzon I. Cholesterol embolization syndrome. *Curr Opin Cardiol*. 2011;26:472-479.

4. Shah N, Nagalli S. Cholesterol Emboli. *StatPearls*. StatPearls Publishing Copyright © 2022, StatPearls Publishing LLC.; 2022.

5. Oka H, Kamimura T, Hiramatsu Y, et al. Cholesterol crystal embolism induced by direct factor Xa inhibitor: a first case report. *Intern Med*. 2018;57:71-74.

6. Tian M, Matsukuma KE. Cholesterol crystal embolism to the gastrointestinal tract: a catastrophic case. *Autops Case Rep*. 2019;9:e2018082.

7. Meyrier A. Cholesterol crystal embolism: diagnosis and treatment. *Kidney Int*. 2006;69:1308-1312.

8. Scolari F, Ravani P. Atheroembolic renal disease. *Lancet*. 2010;375:1650-1660.

9. Ben-Horin S, Bardan E, Barshack I, Zaks N, Livneh A. Cholesterol crystal embolization to the digestive system: characterization of a common, yet overlooked presentation of atheroembolism. *Am J Gastroenterol*. 2003;98:1471-1479.

10. Komatsu S, Yutani C, Takewa M, Takahashi S, Kodama K. Detecting free cholesterol crystals in a patient with spontaneous cholesterol embolization syndrome. *J Am Coll Cardiol Case Rep*. 2020;2:615-618.

KEY WORDS **abdominal aorta, aorta, cholesterol, cholesterol emboli, emboli, small bowel, vascular**