


## CASE REPORT

# Abdominal compartment syndrome secondary to a large retroperitoneal hematoma caused by ruptured gastroduodenal artery pseudoaneurysms in a patient with severe acute pancreatitis

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## Abstract

**Background:** Abdominal compartment syndrome (ACS) is a known complication of severe acute pancreatitis. It is typically secondary to visceral edema and aggressive fluid resuscitation, but rarely caused by a retroperitoneal hematoma due to ruptured visceral pseudoaneurysms.

**Case Presentation:** A 49-year-old man presented in shock with a history of heavy alcohol use and was transferred to the intensive care unit with a diagnosis of severe acute pancreatitis. Computed tomography scan on hospital day 2 revealed a large retroperitoneal hematoma due to ruptured gastroduodenal artery pseudoaneurysms. Despite adequate resuscitation, the patient developed ACS, which required decompressive laparotomy on hospital day 10. Open abdominal management was continued until multiorgan failure resolved. He was eventually discharged to a rehabilitation hospital 3 months after presenting.

**Conclusion:** We report a patient with severe acute pancreatitis who underwent decompressive laparotomy for ACS secondary to a large retroperitoneal hematoma due to ruptured gastroduodenal artery pseudoaneurysms.

## KEYWORDS

abdominal compartment syndrome, acute pancreatitis, retroperitoneal hematoma, visceral artery pseudoaneurysm

## BACKGROUND

In patients with severe acute pancreatitis (SAP), acute inflammation of the pancreas results in local or systemic complications with persistent failure of one or more organs. Increased microvascular permeability due to inflammation results in edema of various organs. In addition, aggressive fluid resuscitation further contributes to edema formation.<sup>1,2</sup> If the resulting intra-abdominal pressure rises above 20 mmHg and organ failure occurs, the diagnosis of abdominal compartment syndrome (ACS) is established, and decompression laparotomy is indicated.<sup>3</sup> This is a severe complication associated with a mortality rate as high as 50%.

Other pancreatitis-related complications include visceral artery pseudoaneurysms. Inflammation caused by pancreatitis can damage surrounding blood vessels leading to pseudoaneurysm formation. The frequency of visceral artery pseudoaneurysms complicating SAP is reported to be 3.5%–10%, making it a relatively rare complication. Rupture of a pseudoaneurysm can be fatal, with a mortality rate of 25.0%–50.0%.<sup>4</sup>

In this report, we describe a patient with SAP who underwent decompressive laparotomy for ACS caused by a large retroperitoneal hematoma due to rupture of gastroduodenal artery (GDA) pseudoaneurysms along with severe interstitial edema of the pancreas.

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## CASE

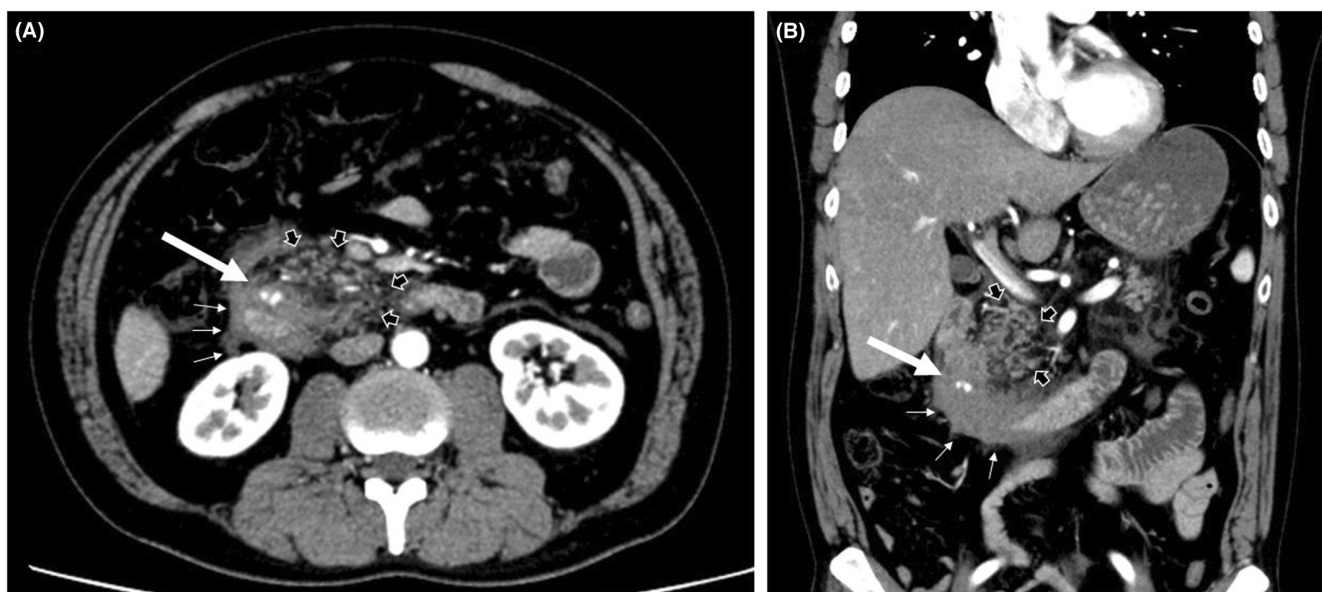
A 49-year-old man presented to the emergency department with upper abdominal pain. His regular alcohol intake was 2–3 L daily. On admission, Glasgow Coma Scale was 15, heart rate 92 b.p.m., blood pressure 185/124 mmHg, respiratory rate 20 breaths/min, SpO<sub>2</sub> 96% on room air, and body temperature 35.0°C. Physical examination revealed a moderately distended abdomen with epigastric tenderness. Laboratory tests showed a white blood cell count of 25,200/ $\mu$ L, hemoglobin 21.9 g/L, hematocrit 62.5%, platelet count  $44.7 \times 10^4/\mu$ L, blood urea nitrogen 13.6 mg/dL, creatinine 0.94 mg/dL, lactic dehydrogenase 303 IU/L, and amylase 1325 IU/L. Contrast-enhanced computed tomography (CT) scan of the abdomen was consistent with acute pancreatitis with intact GDA pseudoaneurysms surrounded by a small hematoma (Figure 1). He was admitted to a regular ward and received 3 L of intravenous fluid.

On hospital day 2, he became tachycardic (heart rate 122 b.p.m.), febrile (body temperature 38.9°C), and hypoxemic (SpO<sub>2</sub> 91% on 10 L/min O<sub>2</sub>). The abdomen was more distended and diffusely tender. Laboratory tests were significant for leukocytosis (11,000/ $\mu$ L), anemia (hemoglobin 8.9 g/dL, hematocrit 42.0%), renal dysfunction (blood urea nitrogen 39.9 mg/dL, creatinine 2.1 mg/dL) and lactic acid 2.1 mmol/L. A contrast-enhanced CT scan was repeated and revealed a huge right-sided retroperitoneal hematoma. The GDA pseudoaneurysms seen on the previous CT scan had resolved. (Figure 2). There were no signs of active bleeding nor worsening of anemia. After discussion with the interventional radiology team, it was concluded not to perform angioembolization because the target to be embolized was

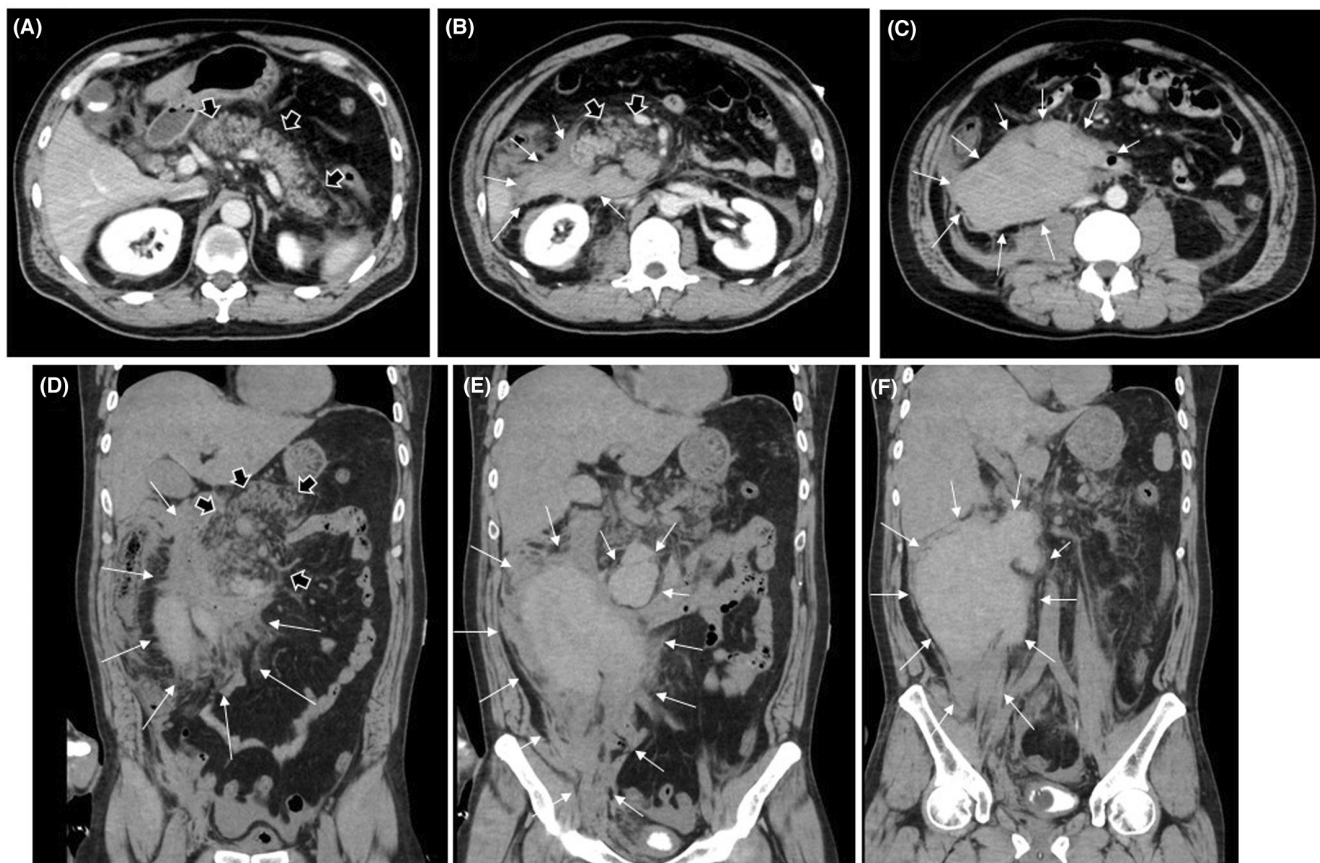
no longer apparent on imaging. This patient did not require blood transfusions throughout this episode.

The patient developed respiratory failure and underwent an endotracheal intubation with mechanical ventilatory support and was transferred to the intensive care unit. Intra-abdominal pressure (IAP) monitoring was started by urinary catheter and was initially 20 mmHg. Intravenous continuous sedation, analgesia, and muscle relaxants were given. A nasogastric tube was inserted for gastric drainage. Intra-abdominal pressure then decreased to less than 20 mmHg and urine output was maintained at 1 mL/kg/h. On hospital day 8, the patient became oliguric. Serum creatinine level was 4.6 mg/L and IAP elevated to 30 mmHg. After initiating continuous hemodialysis and filtration, IAP temporarily decreased. On hospital day 10, IAP increased again to 30 mmHg. Respiratory failure worsened, and he became anuric. Repeat CT scan showed that the large hematoma still occupied the right retroperitoneal space, although there were no signs of active bleeding.

The Acute Care Surgery team was consulted, and decompressive laparotomy was carried out at the bedside in the intensive care unit because the patient was too unstable to transfer to the operating room. When the abdomen was opened, a moderate amount of serous ascites, swollen loops of bowel, as well as a retroperitoneal hematoma without active expansion were observed. Immediately, the patient's oxygenation and ventilation improved and IAP decreased to 13 mmHg. Due to the risk of massive bleeding, the retroperitoneal hematoma was left in situ and open abdominal management initiated. On hospital day 13 (postoperative day 3), tracheostomy was carried out, and mechanical ventilation was weaned off gradually over 2 weeks. On hospital day 33



**FIGURE 1** Contrast-enhanced computed tomography scan of the abdomen on the day of admission of a 49-year-old man with severe acute pancreatitis revealed gastroduodenal artery pseudoaneurysms without extravasation of contrast medium (thick white arrows) in the (A) axial view and (B) coronal view. One was 6 mm in diameter and the other was 4 mm in diameter. The pseudoaneurysms were surrounded by a small hematoma (thin white arrows). The pancreatic parenchyma was significantly swollen and enlarged, but not necrotic (black arrows).



**FIGURE 2** Contrast-enhanced computed tomography (CT) scan of the abdomen of a 49-year-old man with severe acute pancreatitis on hospital day 2 with (A–C) axial and (D–F) coronal views. Pseudoaneurysms of the gastroduodenal artery had resolved, however, the hematoma around the pancreatic head had enlarged (15.6 cm × 12.3 cm × 7.1 cm) occupying the right retroperitoneal space (thin white arrows). Interstitial edema of the pancreas was more evident than on the CT scan from admission (black arrows). There was no necrosis seen.

(postoperative day 23), the abdomen was closed. Renal function gradually improved and hemodialysis was stopped on hospital day 48.

The postoperative course was prolonged because of a fungal infection in the large retroperitoneal hematoma, which was treated with antifungal agents and percutaneous drainage. The patient was discharged to a rehabilitation hospital 3 months later in stable condition.

## DISCUSSION

Acute pancreatitis is inflammation of the pancreas most commonly caused by chronic alcohol consumption or gallstones, and is estimated to occur in 13–45/100,000 people.<sup>2,5</sup> The severity of acute pancreatitis is classified as mild, moderately severe, or severe depending on the presence of organ failure and related complications.<sup>1</sup>

Initial management for acute pancreatitis includes supportive care with fluid resuscitation with close monitoring, pain control, and nutritional support. In patients with severe acute pancreatitis, intensive care unit monitoring and support of pulmonary, renal, circulatory, and hepatobiliary function could minimize systemic sequelae. Nutritional

support is often required in patients with moderately severe pancreatitis if they are unlikely to resume oral intake within 5–7 days. Patients with moderately severe or severe acute pancreatitis, signs of sepsis, or clinical deterioration 72 h after initial presentation should undergo a contrast-enhanced CT scan to assess the presence of pancreatic or extrapancreatic necrosis and local complications.<sup>1,2</sup>

One related local complication is a visceral artery pseudoaneurysm. Visceral artery pseudoaneurysms are relatively rare and can lead to massive hemorrhage associated with mortality as high as 25%–50% if they rupture.<sup>4</sup> These occur in the splenic artery (36%), gastroduodenal artery (24%), gastrotroeploic artery (12%), pancreaticoduodenal artery (12%), and others.<sup>4</sup> Endovascular therapy is reportedly effective for hemostasis of ruptured visceral artery pseudoaneurysms.<sup>4</sup>

Abdominal compartment syndrome is defined as a sustained IAP >20 mmHg associated with new organ dysfunction or intra-abdominal hypertension-induced new organ dysfunction without a strict intra-abdominal pressure threshold.<sup>3</sup> Abdominal compartment syndrome generally occurs in critically ill patients after trauma, burns, liver transplantation, various intraperitoneal conditions (massive ascites, abdominal surgery, or hemorrhage), retroperitoneal conditions (ruptured abdominal aortic aneurysm,

pelvic fracture with bleeding, and pancreatitis), sepsis, and postoperatively.<sup>6</sup> Abdominal compartment syndrome due to SAP occurs when IAP is elevated due to increased vascular permeability, paralytic bowel obstruction, and decreased abdominal wall compliance, leading to organ failure. The incidence of ACS in patients with SAP is reported from 9.1% to 35.6%, and the mortality rate is as high as 50%.<sup>1,2</sup> The World Society of ACS recommends measurement of IAP, medical therapy including sedation, analgesia, muscle relaxants, gastric drainage, and defecation control for intra-abdominal hypertension and surgical decompression if it progresses to ACS.<sup>3</sup>

In the present patient, GDA pseudoaneurysms were seen on the initial CT scan, but not embolized because they were small without signs of rupture. However, these ruptured the following day forming a large retroperitoneal hematoma. As the pseudoaneurysms had resolved without evidence of active bleeding on the second CT scan, the decision was made for close observation. Subsequently, the patient developed ACS, caused not only by tissue edema and massive fluid resuscitation typical in SAP, but also a large space-occupying retroperitoneal lesion caused by a ruptured pseudoaneurysm.

Guidelines published in 2020 by The Society for Vascular Surgery state that GDA aneurysms should be repaired regardless of size and regardless of true versus false aneurysm in patients who have an acceptable operative or interventional risk.<sup>7</sup> In this current patient, angioembolization should have been carried out when the initial CT revealed the presence of GDA pseudoaneurysms. If angioembolization had been carried out at that time, the rupture of the GDA pseudoaneurysms and the development of ACS due to retroperitoneal hematoma formation could have been prevented.

There are no previous reports of a patient who developed ACS caused by a massive retroperitoneal hematoma due to ruptured visceral artery pseudoaneurysms related to SAP.

## CONCLUSION

When SAP is complicated by ruptured visceral artery pseudoaneurysms, it is important to note that this can cause not only problems due to blood loss but also ACS by forming a hematoma that occupies the retroperitoneum. Once the diagnosis of ACS is suspected, surgical consultation and decompressive laparotomy should be carried out without delay.

## ACKNOWLEDGMENTS

The authors sincerely thank Professor Alan Kawarai Lefor and Marc Ong for their guidance and English editing.

## CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

## DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

## ETHICS STATEMENT

Approval of the research protocol: N/A.

Informed consent: The patient provided written informed consent for publication.

Registry and the registration no. of the study/trial: N/A.

Animal studies: N/A.

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## REFERENCES

1. Leppaniemi A, Tolonen M, Tarasconi A, Segovia-Lohse H, Gamberini E, Kirkpatrick AW, et al. 2019 WSES guidelines for the management of severe acute pancreatitis. *World J Emerg Surg.* 2019;14:27.
2. Working Group IAPAAPAPG. IAP/APA evidence-based guidelines for the management of acute pancreatitis. *Pancreatol.* 2013;13(4 Suppl 2):e1-15.
3. Kirkpatrick AW, Roberts DJ, De Waele J, Jaeschke R, Malbrain ML, De Keulenaer B, et al. Intra-abdominal hypertension and the abdominal compartment syndrome: updated consensus definitions and clinical practice guidelines from the world Society of the Abdominal Compartment Syndrome. *Intensive Care Med.* 2013;39(7):1190-206.
4. Maatman TK, Heimberger MA, Lewellen KA, Roch AM, Colgate CL, House MG, et al. Visceral artery pseudoaneurysm in necrotizing pancreatitis: incidence and outcomes. *Can J Surg.* 2020;63(3):E272-7.
5. Yadav D, Lowenfels AB. The epidemiology of pancreatitis and pancreatic cancer. *Gastroenterology.* 2013;144(6):1252-61.
6. Malbrain ML, Chiumello D, Pelosi P, Bihari D, Innes R, Ranieri VM, et al. Incidence and prognosis of intraabdominal hypertension in a mixed population of critically ill patients: a multiple-center epidemiological study. *Crit Care Med.* 2005;33(2):315-22.
7. Chaer RA, Abularrage CJ, Coleman DM, Eslami MH, Kashyap VS, Rockman C, et al. The Society for Vascular Surgery clinical practice guidelines on the management of visceral aneurysms. *J Vasc Surg.* 2020;72(1S):3S-39S.

**How to cite this article:** Yamazaki M, Nagao T, Kono K, Kanda T, Tomonaga A, Ito K. Abdominal compartment syndrome secondary to a large retroperitoneal hematoma caused by ruptured gastroduodenal artery pseudoaneurysms in a patient with severe acute pancreatitis. *Acute Med Surg.* 2023;10:e866. <https://doi.org/10.1002/ams2.866>