Case Report

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SARS-COV-2-related superior mesenteric artery thrombosis resulting in pneumatosis intestinalis complicated by pneumatosis portalis in a young male: a case report

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Abstract

The novel coronavirus disease-2019 (COVID-19) caused by the severe acute respiratory syndrome coronavirus 2 is a highly contagious disease that has rapidly spread throughout the world. In addition to respiratory complications, the virus has also been linked to damage other organ systems as well as coagulopathy. The features and clinical spectrum of COVID-19 are continually emerging, with growing evidence of its connection to thrombosis in various systems. In this case report, the authors present a case of COVID-19 infection in a young male patient who had superior mesenteric artery thrombosis with pneumatosis intestinalis complicated by hepatic portal venous gas.

Keywords: acute mesenteric ischemia, COVID-19, pneumatosis intestinalis, portal venous gas, SARS-COV-2, superior mesenteric artery, thrombosis

Introduction and importance

Coronavirus disease-2019 (COVID-19) is a viral illness caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), and now has been declared a pandemic by the WHO[1,2]. Patients with COVID-19 frequently have constitutional, febrile, and respiratory symptoms. However, unusual presentations – particularly arterial or venous occlusion are widely established. These include stroke, myocardial infarction, acute limb ischemia, mesenteric ischemia, deep venous thrombosis, and pulmonary embolism[3].

Since the advent of the new coronavirus spreading very quickly, evidence of its connection to thrombosis has also been presented[4]. Although various works of literature have documented isolated mesenteric arterial occlusion linked to COVID-19, superior mesenteric arterial thrombosis leading to pneumatosis intestinalis and pneumatosis portalis is a unique instance.

Herein, we present a case of a young male patient with thrombosis of the superior mesenteric artery (SMA) with complications as a consequence of COVID-19 infection that was successfully treated by surgical intervention.

The work has been reported in line with the Surgical CAse REport (SCARE) criteria[5].

HIGHLIGHTS

- The novel coronavirus disease-2019 (COVID-19) caused by the severe acute respiratory syndrome coronavirus 2 is a highly contagious disease that has rapidly spread throughout the world.
- In addition to respiratory complications, the virus has also been linked to damage other organ systems as well as coagulopathy.
- The features and clinical spectrum of COVID-19 are continually emerging, with growing evidence of its connection to thrombosis in various systems.
- In this case report, we present a case of COVID-19 infection in a young male patient who had superior mesenteric artery thrombosis with pneumatosis intestinalis complicated by hepatic portal venous gas.

Case presentation

An otherwise healthy male in his early 20s presented to the emergency room of our hospital with complaints of acute abdominal pain which was severe and diffusely distributed in all abdominal quadrants. The pain was associated with two episodes of nonprojectile bilious vomiting. No accompanying fever or abdominal distension was noted. Physical examination revealed diffuse abdominal tenderness more severe in the lower quadrants associated with guarding. Vitals at the time of presentation were within normal limits (blood pressure – 132/78 mmHg, heart

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Sponsorships or competing interests that may be relevant to content are disclosed at the end of this article.

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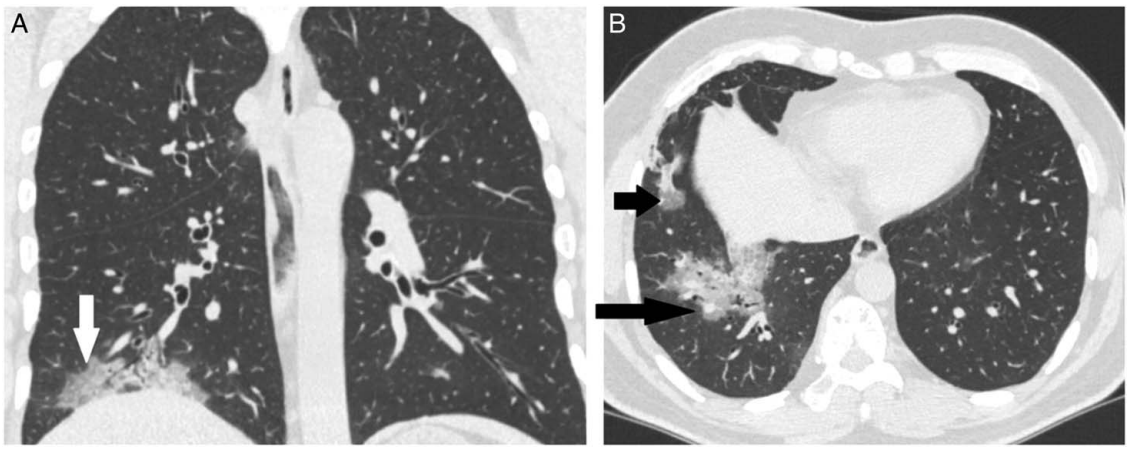

Figure 1. High-resolution computed tomography images in the coronal plane (A) and the axial plane (B) show consolidative changes and ground glass opacities in the right lung, predominantly toward the periphery [white arrow in (A) and black arrows in (B)].

rate – 79/min, respiratory rate – 18/min, temperature – 97°F, and SpO_2 96% in room air). The patient suffered from fever and cough 15 days prior to this presentation and was tested positive for COVID-19 infection. He also underwent high-resolution computed tomography chest, which revealed ground glass opacities and consolidative changes in the right lung predominantly toward the periphery, consistent with COVID-19 infection (CO-RADS 6) (Fig. 1)

The patient was recovering at home after a hospital stay of 10 days when he suddenly experienced new abdominal symptoms.

Laboratory tests revealed elevated D-dimer levels (640 ng/ml); however, other parameters including complete blood count, renal/liver function tests, arterial blood glass analysis were within normal limits. Laboratory results showed normal factor levels and negative results for rheumatoid factor antibody. The coagulation parameters including homocysteine, antithrombin III, antiphospholipid antibody, and anticardiolipin antibody levels were assessed and returned normal. The patient was advised for a contrast-enhanced computed tomography scan of the abdomen in suspicion of ischemic bowel pathology.

Computed tomography findings revealed multiple air attenuating areas along the walls of the small bowel predominantly in the lower abdomen (Fig. 1B) identified by corresponding dark areas in lung window computed tomography image (Fig. 2C) confirming the presence of intramural gas, i.e. 'pneumatosis

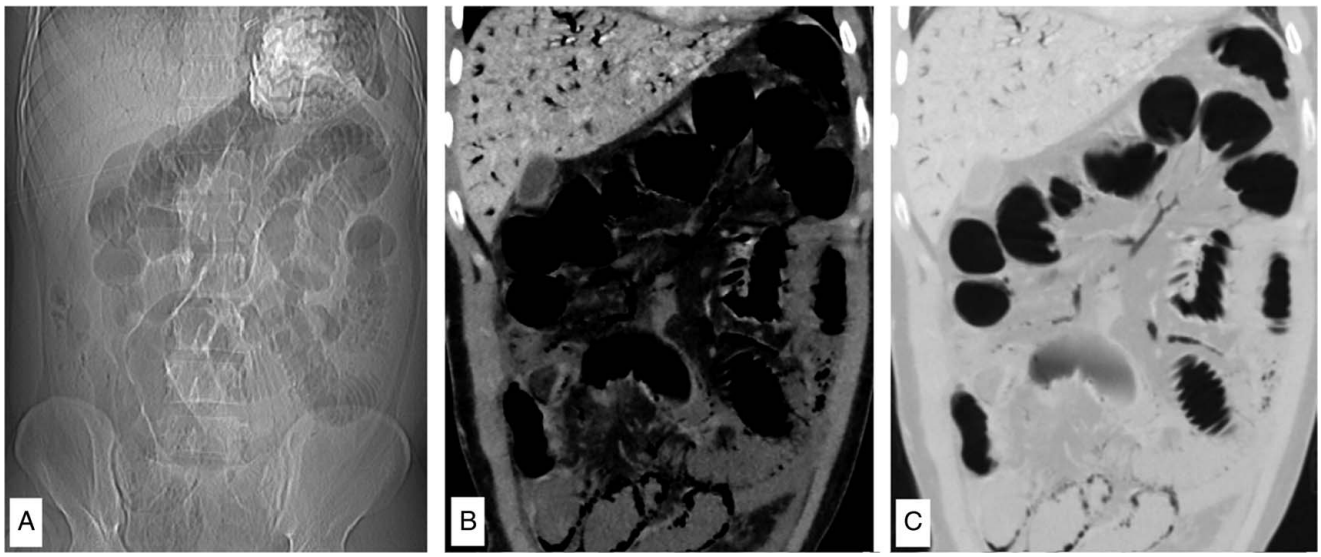

Figure 2. Computed tomography scout image of the abdomen (A) shows multiple linear branching lucent areas along the liver shadow, which is suspicious for 'portal venous gas'; multiple linear dark foci are also noted along the contour of small bowel loops in the lower abdominal region which is suspicious for 'pneumatosis intestinalis.' Coronal contrast-enhanced computed tomography image of the abdomen in soft tissue window (B) shows the presence of air attenuating areas along the contour of the small bowel wall in the lower abdominal region, which is ascertained by corresponding dark areas in the lung window computed tomography image (C) confirming the presence of mural gas, i.e. 'pneumatosis intestinalis'; (B, C) also demonstrate linear air attenuating areas in liver extending up to the periphery which is suggestive of 'portal venous gas'; coronal lung window image (C) also shows linear dark areas in the region of small bowel mesentery consistent with the presence of 'gas in mesenteric veins.'

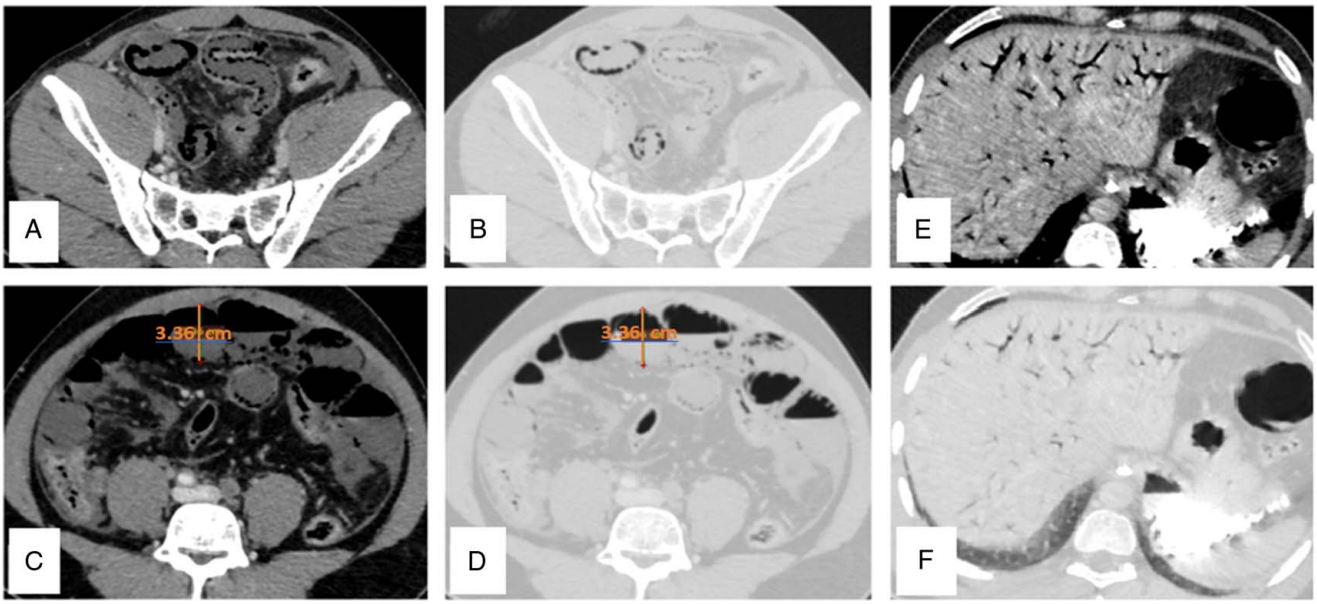

Figure 3. Axial contrast-enhanced computed tomography images in soft tissue window (A, B) show the presence of air attenuating areas along the small bowel walls confirmed by corresponding dark areas in lung window images (C, D) confirming the diagnosis of 'pneumatosis intestinalis.' Axial contrast-enhanced computed tomography images in soft tissue and lung windows (E, F) demonstrate the presence of fine linear branching air attenuating areas in the liver in continuation with portal veins and extending up to the periphery of the liver, suggestive of 'portal venous gas.'

intestinalis.' Multiple linear air attenuating areas were also noted in the liver along the branches of the portal vein and extending up to the periphery, suggestive of 'portal venous gas' (Fig. 3E, F). In addition, there was a nonenhancing filling defect starting approximately 2.2 cm distal to the origin of SMA in keeping with 'SMA thrombosis' (Fig. 4A–C). Similar nonenhancing filling defect was also identified in the proximal part of the left common iliac artery, suggestive of 'thrombosis,' starting just distal to the aortic bifurcation (Fig. 5A, B). With the above imaging findings, a diagnosis of acute mesenteric ischemia as a consequence of SMA thrombosis was made, which was complicated by pneumatosis intestinalis and pneumatosis portalis. He was administered low molecular weight heparin for 5 days for the underlying cause identified on the CECT scan.

The patient underwent emergency exploratory laparotomy with resection of nonviable bowel loops and end-to-end bowel anastomosis. Approximately 2.5 m length of small bowel was resected and jejuno-jejunal side-to-side anastomosis was done. On the 15th postoperative day, there was the separation of all layers of incision (burst abdomen, shown in Fig. 6B) for which he

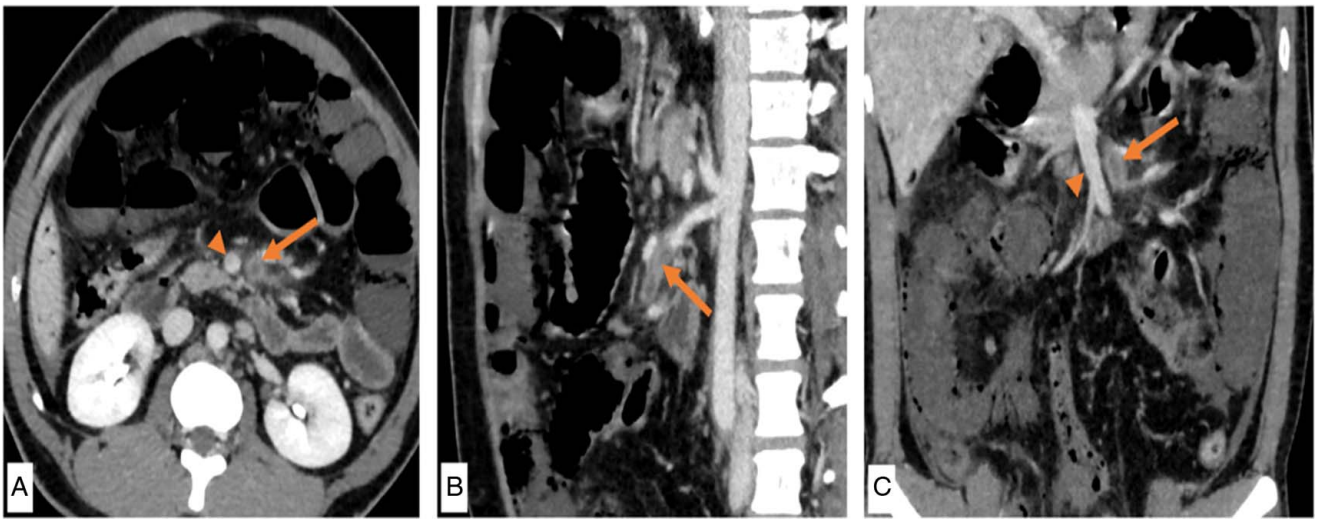

Figure 4. Contrast-enhanced computed tomography images of the abdomen in axial plane (A), oblique sagittal section (B), and coronal plane (C) show normally opacified abdominal aorta with its branches, celiac artery (superiorly), and superior mesenteric artery (SMA) (inferiorly); SMA shows the presence of nonenhancing filling defect (orange arrow) starting ~2.2 cm distal to its origin with mildly thickened enhancing wall in the involved segment in keeping with 'SMA thrombosis. 'Orange arrowhead: superior mesenteric vein. The presence of pneumatosis intestinalis is also demonstrated as described in previous images. Minimal perihepatic ascites is noted (A, C).

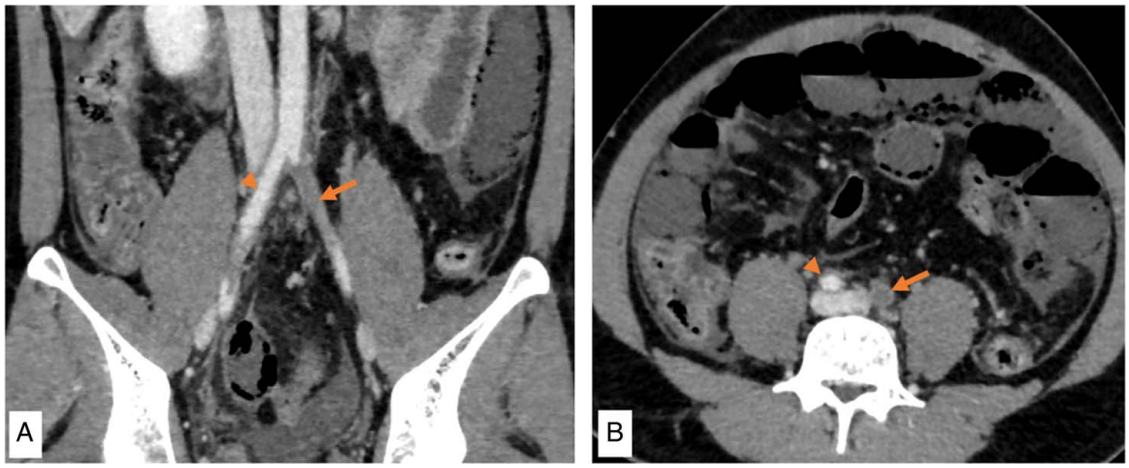

Figure 5. Contrast-enhanced computed tomography images of the abdominopelvic region in coronal plane (A) and axial plane (B) show nonenhancing filling defect in the proximal part of the left common iliac artery (orange arrow) suggestive of 'thrombosis,' starting just distal to the aortic bifurcation. The presence of pneumatosis intestinalis is also demonstrated as described in previous images. Orange arrowhead: normal opacification of the right common iliac artery.

underwent urgent reclosure of the wound. He was discharged on the 35th postoperative day as the patient's condition was stable and there was approximation of the wound margins (Fig. 6C). A COVID-PCR test done on the 7th postoperative day was negative.

He came for a follow-up visit 2 months later when he complained of diarrhea and a weight loss of ~4 kg. His new symptoms were likely to be short bowel syndrome which might have resulted due to resection of a large portion of the small bowel. The patient was advised for dietary consultation for his new symptoms and was also asked to follow up when needed.

Clinical discussion

Acute mesenteric ischemia is characterized by an abrupt interruption in blood flow to the mesenteric circulation with patients exhibiting severe acute abdominal symptoms and has a high mortality rate without prompt treatment. The most common cause of acute mesenteric ischemia is SMA occlusion due to embolism in 70% of the cases and thrombosis in 30% of the cases[6]. After the advent of COVID-19 infection, a connection of the illness with thrombosis has been documented in various literatures.

SARS-CoV-2 causing COVID-19 infection has spread quickly and now has been declared a pandemic by the WHO. COVID-19 is known to induce a range of organ damage in addition to respiratory illnesses[7]. Studies on COVID-19 patients have revealed that the virus can trigger a cycle of thrombosis and inflammation by binding to angiotensin-converting enzyme 2 receptors on the surface of the alveoli. Since angiotensin-converting enzyme 2 receptor expression occurs in lung alveolar epithelium, enterocytes in the small intestine, and vascular endothelium, the small intestinal vasculature may be vulnerable to SARS-CoV-2 infection. Furthermore, the presence of microthrombi and fibrinogen deposits in the histology of COVID-19 patients indicated a direct impact on the coagulation cascade[4]. These characteristics of COVID-19 patients can offer a tenable

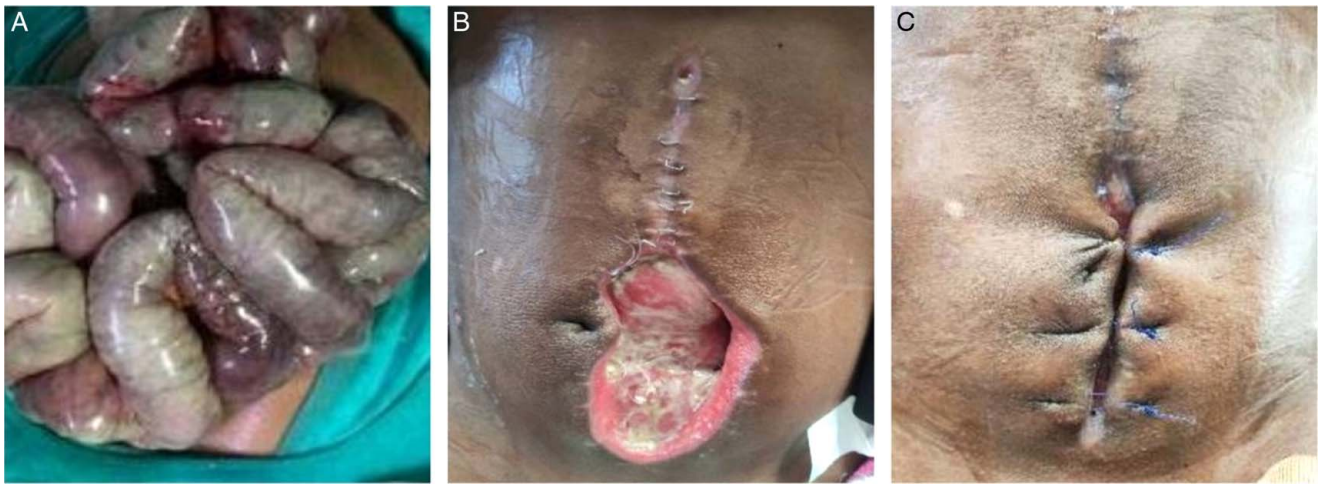

Figure 6. Intraoperative image showing necrotic small bowel loops (A). Burst abdomen which developed 15 days after surgery (B) and approximation of wound margins on 35th post-operative day (C).

justification for the processes causing arterial occlusion, emphasizing the influence of COVID-19 infection on both thrombosis and embolism[8].

The patient presented in this case, who had recently contracted SARS-CoV-2, had imaging findings consistent with thrombosis in SMA with pneumatosis intestinalis complicated by hepatic portal venous gas. The patient presented with acute abdominal symptoms which can be well explained based on the imaging findings. The lack of other significant risk factors for the development of thromboembolism in this patient revealed a direct connection between COVID-19 and hypercoagulability, a potentially fatal side effect of the illness that is still poorly understood[7].

A study conducted in Milan, Italy, demonstrated high prevalence of thromboembolic complications and significant in-hospital mortality among patients admitted with COVID-19 infection. The study also showed that nonsurvivors had rapidly rising D-dimer levels, which emphasized that COVID-19 was an inflammatory and procoagulant condition[9]. According to studies, D-dimer has a sensitivity of 95% for identifying intestinal ischemia and has a tendency to increase early in mesenteric ischemia[3].

In hospitalized patients with COVID-19, the majority of research suggests early heparin treatment owing to its anticoagulant and anti-inflammatory effect. Mesenteric ischemia should be emergently treated with a combination of intravenous fluid resuscitation, intravenous antibiotics, intravenous unfractionated heparin, and prompt intervention for restoration of blood flow in mesenteric vascular trees with/without bowel resection[4,10]. Our case had thrombosis in SMA resulting in pneumatosis intestinalis and portal venous gas; thus, he underwent emergency exploratory laparotomy with resection of nonviable bowel and end-to-end bowel anastomosis.

Conclusion

Since coagulation impairment is one of the leading reasons of mortality in patients with COVID-19 infection, thromboembolic consequences are of utmost significance. When COVID-19 patients experience significant abdominal pain, physicians should be wary of SMA occlusion, which could be the result of microangiopathy secondary to the virus, which directly affects the coagulation cascade. Early diagnosis and treatment is crucial, as the condition can be life threatening.

Ethical approval

Ethical approval was not required since this is a case report.

Patient consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

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No funding was received in the writing of the manuscript; and in the decision to submit the manuscript for publication.

Author contribution

Dr S. Aryal – analyzed and interpreted the patient data and major contributor in writing the manuscript. Dr V. Bhattarai – contributed in writing the manuscript and organization of images in the manuscript. Dr S. Sharma – contributed to writing and editing the manuscript.

Conflicts of interest disclosure

No conflicts of interest among authors to disclose.

Research registration unique identifying number (UIN)

None.

Guarantor

Dr S. Aryal, E-mail: aryal.saji@gmail.com (first author and corresponding author).

Patient perspective

The patient was happy with the treatment he received and the fact that he is still alive after the major health event.

Provenance and peer review

Not commissioned, externally peer reviewed.

References

[1] Coronavirus Disease (COVID-19) Pandemic. World Health Organization; 2021. Accessed August 13, 2021. https://covid19.who.int
[2] Bikdeli B, Madhavan MV, Jimenez D, *et al*. COVID-19 and thrombotic or thromboembolic disease: implications for prevention, antithrombotic therapy, and follow-up. J Am Coll Cardiol 2020;75:2950–73.
[3] Amaravathi U, Balamurugan N, Muthu Pillai V, *et al*. Superior mesenteric arterial and venous thrombosis in COVID-19. J Emerg Med 2021;60:e103–7.
[4] Al Mahruqi G, Stephen E, Abdelhedy I, *et al*. Our early experience with mesenteric ischemia in COVID-19 positive patients. Ann Vasc Surg 2021;73:129.e1–4.
[5] Agha RA, Franchi T, Sohrabi C, *et al*. The SCARE 2020 guideline: updating consensus Surgical CAse REport (SCARE) guidelines. Int J Surg 2020;84:226–30.
[6] Maniar Y, Hashmi H, Silverstein J, *et al*. Superior mesenteric artery thrombosis in a patient with COVID-19 pneumonia and *Clostridium difficile*. J Surg Case Rep 2022;2022:rjac146.
[7] Cheung S, Quiwa JC, Pillai A, *et al*. Superior mesenteric artery thrombosis and acute intestinal ischemia as a consequence of COVID-19 infection. Am J Case Rep 2020;21:e925753-1–3.
[8] Sukegawa M, Nishiwada S, Terai T, *et al*. Acute superior mesenteric artery occlusion associated with COVID-19 pneumonia: a case report. Surg Case Rep 2022;8:6.
[9] Lodigiani C, Iapichino G, Carenzo L, *et al*. Venous and arterial thromboembolic complications in COVID-19 patients admitted to an academic hospital in Milan, Italy. Thromb Res 2020;191:9–14.
[10] Karna ST, Panda R, Maurya AP, *et al*. Superior mesenteric artery thrombosis in COVID-19 pneumonia: an underestimated diagnosis—first case report in Asia. Indian J Surg 2020;82:1235–7.