



# Portal Vein Thrombosis—a Rare Complication of SARS-CoV-2 Infection

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## Abstract

The SARS-CoV-2 is the causative organism for COVID-19 disease. It primarily affects the respiratory system. With time, some new extra-pulmonary manifestations of COVID-19 disease have been identified. Recent studies have shown that patients with SARS-CoV-2 infection may have a hypercoagulable state which explains the increased incidence of thrombotic events in these patients without any known risk factors. The most common thrombotic event described in these patients is pulmonary embolism. Intra-abdominal thrombosis is a rare thrombotic complication of COVID-19 disease. Here, we report a case of COVID-19 disease associated with acute portal vein thrombosis.

**Keywords** SARS-CoV-2 · COVID-19 · Thromboembolism · Portal vein thrombosis

## Introduction

The SARS-CoV-2 is the causative organism for COVID-19 disease. It primarily affects the respiratory system. The clinical presentation of this disease varies from a mild flu-like syndrome to a severe viral pneumonia with acute respiratory insufficiency [1]. With time, some new extra-pulmonary manifestations of COVID-19 disease have been identified. Recent studies have shown that patients with SARS-CoV-2 infection may have a hypercoagulable state which explains the

increased incidence of thrombotic events in these patients without any known risk factors. The most common thrombotic event described in these patients is pulmonary embolism [2]. Intra-abdominal thrombosis is a rare thrombotic complication of COVID-19 disease. Here, we report a case of COVID-19 disease associated with portal vein thrombosis.

## Case Presentation

The patient was a 28-year-old male with no known comorbidities. He was admitted with chief complaint of worsening colicky abdominal pain over epigastric and umbilical region of 3 days duration. It was associated with nausea, vomiting, and constipation. He was a non-smoker and used to consume alcohol occasionally (twice a month). He denied history of abdominal trauma and similar complaints in past. On examination, he appeared dehydrated. He had tachycardia (110/min) with normal oxygen saturation of 98% on room air and normal respiratory rate. Abdominal examination revealed severe epigastric and umbilical tenderness with guarding. Laboratory workup on admission is summarized in Table 1. It showed total white blood cell count (WBC) 10,400  $\mu$ /L with predominant neutrophils, urea 16 mg/dl, creatinine 1.0 mg/dl, aspartate aminotransferase (AST) 38 U/L, alanine aminotransferase (ALT) 86 U/L, serum lipase 313 U/L, serum amylase 75 U/L, and total bilirubin of 0.8 mg/dl (Table 1). During hospital stay, his nasopharyngeal swab test for COVID-19 RT-PCR was

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**Table 1** Laboratory workup on admission

Total leucocyte count (per mm <sup>3</sup> )	10,400
Differential leucocyte count	N-85%, L-12%, M-1%, E-2%
Platelet count (per mm <sup>3</sup> )	3.12 lakh
Hemoglobin (g/dl)	13.6
Hematocrit	43.5%
Total bilirubin (mg/dl)	0.8
ALT (U/L)	86
AST (U/L)	38
Lactate dehydrogenase (U/liter)	421
Urea (mg/dl)	16
Creatinine (mg/dl)	1.0
Amylase (U/L)	75
Lipase (U/L)	313
CRP	Positive
D-dimer (ng/ml)	1533 (0–500)
Ferritin (ng/ml)	410 (0–322)
SARS-CoV-2 (nasopharyngeal swab)	RT-PCR positive
Procalcitonin (ng/ml)	0.46
Protein C	92 (70–106%)
Protein S	64 (55–160%)
Antithrombin III (g/l)	0.33 (0.22–0.39)
Cardiolipin antibodies (IgG)	7.21 (<10)
Factor VIII	95 (70–150%)
ANA	Negative
P ANCA/C ANCA	Negative

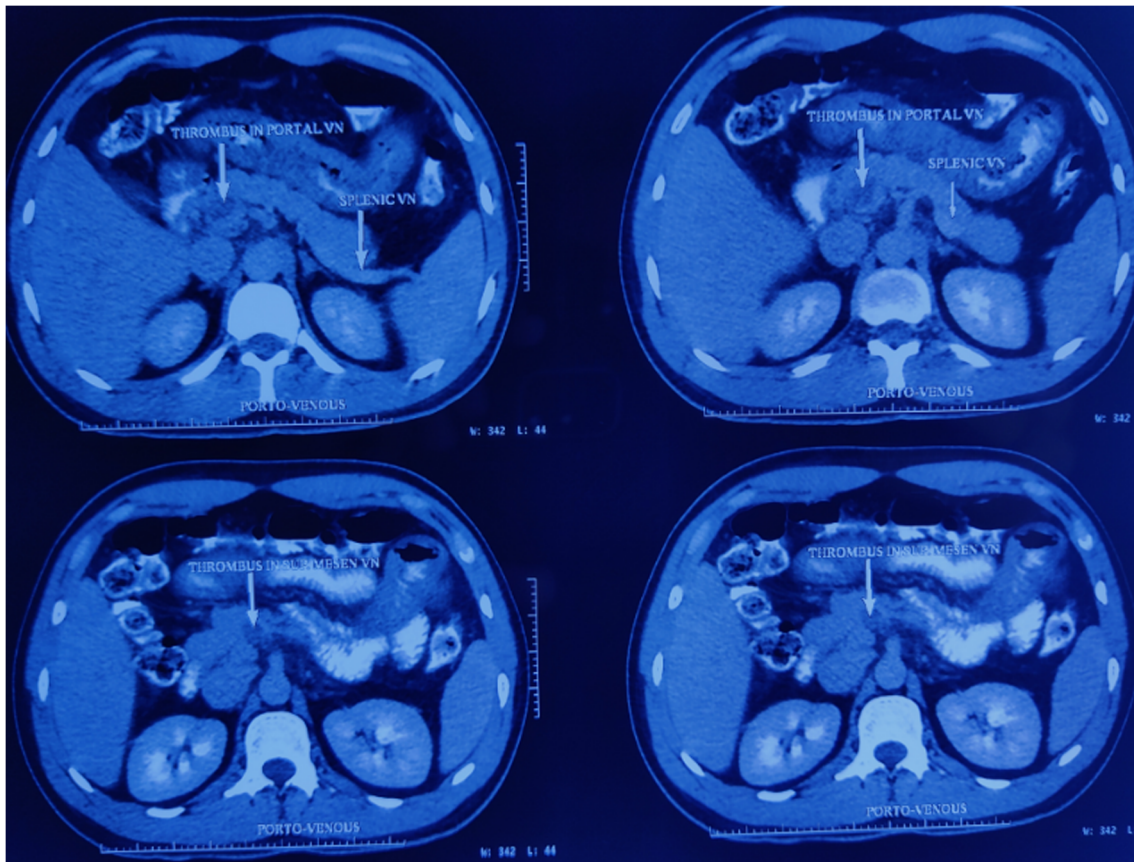
done (hospital protocol due to ongoing COVID-19 pandemic) which came out to be positive. The chest radiograph was normal. He underwent ultrasound of the abdomen which showed echogenic debris in right and left branches of portal vein consistent with thrombus and mild hepatosplenomegaly with ascites. He was subjected to contrast-enhanced computed tomography (CECT) of abdomen which showed portal and superior mesenteric vein thrombosis with mild hepatomegaly with minimal ascites (Fig. 1). His inflammatory markers (CRP, LDH, ferritin) were also raised. He was subjected to thrombophilia workup (antithrombin III, lupus anticoagulant, protein C, protein S, anti-nuclear antibody (ANA), anti-neutrophil cytoplasmic antibody (ANCA), factor V Leiden, and prothrombin G20210A mutations) which came out to be normal. Flow cytometric testing for paroxysmal nocturnal hemoglobinuria was also negative. Hence after ruling out inherited/acquired causes of thrombophilia and the local predisposing factors (liver cirrhosis, pancreatitis, diverticulitis, and cholecystitis), his final diagnosis was acute portal vein thrombosis secondary to COVID-19 disease. He was managed in intensive care unit with parenteral empirical antibiotics, inj low molecular weight heparin (LMWH), IV fluids,

and bowel rest. He responded well to the therapy and was later switched to oral novel anticoagulant agent (apixaban, 5 mg BD). He underwent upper gastrointestinal endoscopy (UGIE) later to rule out varices and was found to be normal (Fig. 2). He will remain anticoagulated for a minimum of 6 months and was advised to review after 3 months of anticoagulation therapy.

## Discussion

The clinical presentation of SARS-CoV-2 infection seems to be variable, including asymptomatic infection, mild upper respiratory infection, and severe pneumonia with respiratory failure [3]. The involvement of gastrointestinal system in COVID-19 disease has been reported in an increasing number of patients with symptoms such as vomiting, diarrhea, nausea, and abdominal pain. The largest meta-analysis of gastrointestinal symptoms associated with COVID-19 infection found 18% of patients presented with gastrointestinal symptoms, with around 9.2% developing abdominal pain [4].

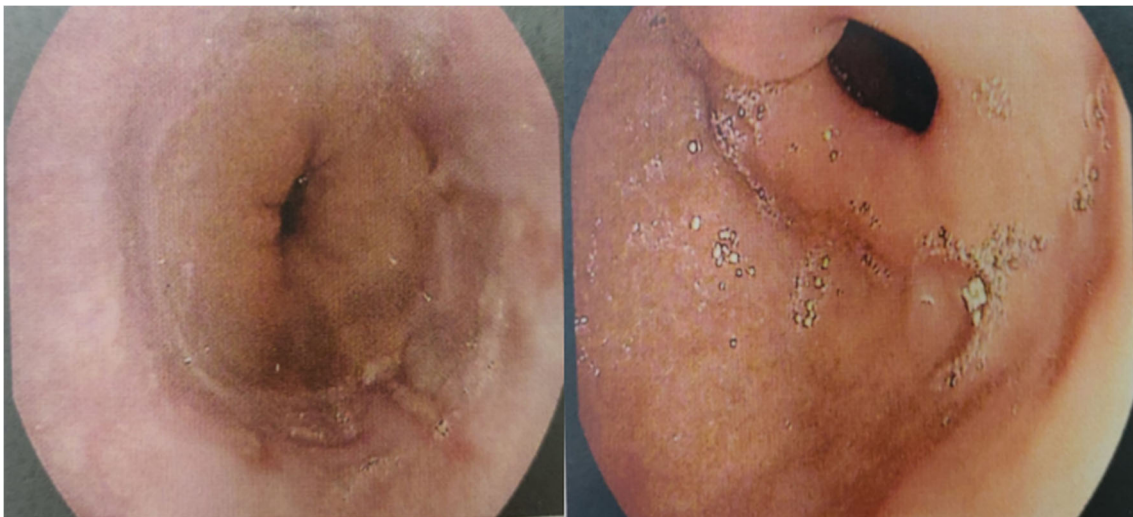
Portal vein thrombosis is a rare cause of acute abdominal pain in both children and adults. It occurs in association with a wide variety of precipitating factors which include diseases such as decompensated liver cirrhosis and/or malignancies, pancreatitis, systemic lupus erythematosus, and other hypercoagulable states [5]. COVID-19 disease has been associated with a hypercoagulable state which can predispose to thrombotic events [6]. The incidence of thromboembolic events in the setting of COVID-19 infection overall is not known. However, in the intensive care setting with critically ill patients, thrombotic complications related to COVID-19 are reported in 25–31% of patients. The majority of thromboembolic events were pulmonary emboli, deep venous thrombosis (DVT), and cerebral infarction usually occurring in the elderly with severe COVID-19 and comorbid diseases such as diabetes and hypertension [7, 8]. In our case, the patient was a young man without any known comorbidities. The intra-abdominal thrombosis is a rare complication related to COVID-19 infection and is sparsely reported in the literature. There are few case reports on acute portal vein thrombosis in COVID-19 patient [9–11]. Jafari et al. reported the abdominal CT findings of a 26-year-old male patient with COVID-19 who had severe abdominal pain during hospitalization and was later diagnosed with portal vein thrombosis [12]. Borazjani et al. also reported a 23-year-old asthmatic male with coronavirus pneumonia who developed acute generalized abdominal pain. Further evaluations revealed a portal vein thrombosis and mild ascites although the patient received proper anticoagulation therapy. Routine lab investigations regarding the secondary causes of portal vein thrombosis were normal [13]. In our patient, inherited and secondary causes for hypercoagulable state and the local



**Fig. 1** Contrast-enhanced computed tomography of abdomen showing portal vein thrombosis

predisposing factors (liver cirrhosis, pancreatitis, diverticulitis, and cholecystitis) which can lead to portal vein thrombosis were excluded before making the diagnosis. Taking into account that venous thromboembolism is the most thrombotic event reported in patients with COVID-19 disease, venous thrombosis at unusual sites like portal vein should be considered.

The exact pathophysiology of the increased prevalence of thromboembolic events in COVID-19 disease still remains unclear. COVID-19 disease shares multiple similarities with other well-defined inflammatory states such as sepsis wherein simultaneous rise in pro and anti-inflammatory cytokines are seen [14]. There is evidence of complement activation in COVID-19 disease by direct endothelial infection. The



**Fig. 2** Upper gastrointestinal endoscopy

attachment of the viruses to the endothelial surfaces via angiotensin-converting enzyme receptor leads to the lymphocytic endotheliitis, which induces the release of anaphylatoxin C5a [15]. This leads to complement activation which further activates the coagulation system and thereby propagating a prothrombotic state. It also causes interferon-1 and prothrombotic genes overexpression [16]. Therefore, it seems that in keeping with Virchow's triad, thrombosis in COVID-19 infection is driven both by the activation of coagulation factors and endothelium involvement. In addition to the factors mentioned above, this thrombotic risk is compounded by hypoxia that typically manifests in severe respiratory COVID-19 cases [17].

The management of these patients involves optimal anticoagulation therapy. Both low molecular weight heparin (LMWH) and unfractionated heparin have been successfully used in these patients both therapeutically and prophylactically [18]. Current strategies of anticoagulation in these patients are heavily influenced by empirical institutional protocols, observational reports, and case series as there is absence of well-conducted clinical trials.

## Conclusion

COVID-19 disease is a markedly prothrombotic state. When reviewing patients with COVID-19 infection presenting with abdominal pain, clinicians should consider portal vein thrombosis in their differential diagnosis. While this is a rare complication of COVID-19 infection, clinical threshold for performing liver imaging must be lower in a proper clinical scenario to avoid missing this reversible and rare complication of COVID-19 infection. Also, one should not expect to see grossly deranged liver function tests with acute portal vein thrombosis.

**Code Availability** Not applicable.

**Author Contribution** All the authors have been involved in the review of the case report.

**Data Availability** Not applicable.

## Declarations

**Ethics Approval** Not applicable.

**Consent to Participate** Not applicable.

**Consent for Publication** Taken from the patient.

**Conflict of Interest** The authors declare no competing interests.

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