THE ASEAN JOURNAL OF RADIOLOGY
ISSN 2672-9393

Original Article

Findings of abdominal computed tomography in COVID-19 patients with abnormal abdominal symptoms In Siriraj Hospital

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Received 8 Octorber 2023; revised 1 June 2024; accepted 1 June 2024
doi:10.46475/asean-jr.v25i2.886

Abstract

Background: The coronavirus (COVID-19) is caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). Chest imaging findings of COVID-19 disease have been widely published. Only a few studies of abdominal imaging findings have been documented. The majority of these studies demonstrate thrombotic events associated with COVID-19. Previous studies were mainly conducted in the USA, Europe and China which limited the applicability in Southeast Asia (SEA) including Thailand.

Objective: To provide a summary of various abdominal imaging findings of COVID-19 patients admitted to xxx Hospital with findings associated with clinical outcomes.

Materials and methods: All CT abdominal imaging of adult patients who tested positive for COVID-19 performed from January 1st, 2020 to August 31st, 2022 were retrospectively reviewed. We collected clinical data, abdominal signs and symptoms, laboratory data and various CT findings, for example; bowel-wall thickening, bowel ischemia, fluid-filled colon and bleeding manifestations. The clinical outcomes were gathered as death confirmation, invasive mechanical ventilation, days of invasive mechanical ventilation and days of hospitalization.

Results: A large number of patients who had stage 3-5 chronic kidney disease (CKD), abdominal distension, abnormal bowel findings and longer days of hospitalization were significantly observed in a group with worse clinical outcomes. Abnormal intestinal imaging findings were related to a higher risk of worse outcomes, invasive mechanical ventilation, death and days of hospitalization without statistical significance.

Conclusion: Abdominal CT scans performed on COVID-19 patients frequently revealed abnormal bowel findings, which were strongly associated with poor clinical outcomes. Radiologists need to be concerned about abnormal bowel findings and point them out to clinicians and surgeons.

Keywords: Abdominal imaging, Abdominal symptoms, Coronavirus, COVID-19.

THE ASEAN JOURNAL OF RADIOLOGY
ISSN 2672-9393

Introduction

The coronavirus (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), was originally identified in China in 2019. By July 29, 2020, around 17 million people were diagnosed with coronavirus, and more than half a million people died as a consequence of this infection. Non-specific common clinical signs included flu-like symptoms like fever, coughing, exhaustion, and dyspnea [1-3]. As the number of cases expanded globally, gastrointestinal (GI) symptoms such as nausea, vomiting, diarrhea, abdominal discomfort, and lack of appetite were also noticed [4-7]. The pathophysiology of SARS-CoV-2 is well known by accessing cells via surface expression of angiotensin-converting enzyme 2 (ACE-2) [8]. ACE-2 has been found mostly in alveolar epithelial cells and the enterocytes of the small intestine and hepatobiliary cells [4, 9-11].

Chest imaging findings of COVID-19 disease have been widely published. Only a few studies of abdominal imaging findings have been documented [12-15]. The majority of these studies demonstrate thrombotic events associated with the disease, including bowel wall involvement, hepatitis, pancreatitis, gallbladder sludge, portal and upper mesenteric vein thrombosis [12-16]. Limitations of previous studies were mainly conducted in the USA, Europe and China which limited the applicability in Southeast Asia (SEA) including Thailand. The objective of this retrospective study is to provide a summary of the abdominal imaging findings of COVID-19 patients with the associated clinical outcomes.

Materials and methods

Study population

The ethics committee of Siriraj Hospital accepted our retrospective study, and the institutional review board approved it (797/2564) (IRB3). All data were collected in Siriraj Hospital which is a large quaternary care academic institution. The patient databases at the institutions relevant to COVID-19 were eventually maintained.

The inclusion criteria were adult patients, not younger than 18 years old who tested positive for COVID-19 (PCR). The patients underwent abdominal CT imaging from January 1st, 2020 to August 31st, 2022. The exclusion criteria were duplicated data and abdominal findings were associated with alternative comorbidities. The final research population consisted of fifty-nine patients.

Data collection (demographic, clinical and laboratory)

The clinical and laboratory data were collected from medical record reviews using a standardized data form. The clinical data were reviewed: age, gender and, a presence of comorbidities including diabetes, hypertension, dyslipidemia, stage 3-5 chronic kidney disease (CKD), obesity (BMI>25kg/m2), cancer and chronic lung disease (COPD, asthma). Abdominal signs and symptoms on performed abdominal CT imaging included abdominal pain, diarrhea, nausea and vomiting, abdominal distension, GI bleeding, fever with chills, hematuria, an anticoagulant drug for venous thromboembolism (VTE) prophylaxis or treatment and bleeding manifestations.

Patient outcome

Following a standardized form, a medical record review was used to obtain the clinical and laboratory data, including death confirmation, invasive mechanical ventilation and days of invasive mechanical ventilation and hospitalization. There were two groups of patients: good clinical outcomes and worse clinical outcomes. Patients who needed an intensive care unit (ICU) or died were classified as having worse clinical outcomes.

Image acquisition

A 64-slice or 256-slice CT scanner was used in all CT scans. Two patients underwent upper abdomen contrast-enhanced CT and 57 patients underwent whole abdomen contrast-enhanced CT. Images were acquired in the arterial phase (35-40 seconds following intravenous contrast injection), the portovenous phase (70–80 seconds following intravenous contrast injection). Intravenous contrast injection of 1.5-2 ml/kg of iodinated contrast (concentration 300-370 mgI/ml, Iopromide (Ultravist™), Iopamidol (Iopamiro™), Iodixanol (Visipaque™)

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ISSN 2672-9393

adopted a power injector with a rate of 2–4 ml/second followed by 30 ml saline flush. Axial images were generated using a thickness of 1.25 mm and 5 mm. Five mm-thickness of sagittal and coronal reconstructions was obtained.

Imaging analysis

Independently reviewing the abdominal CT, two board-certified abdominal radiologists reached a consensus after discussing different opinions on some cases. The radiologists were blinded to clinical, treatment and outcome data. The intestinal findings were reviewed: bowel-wall thickening (small bowel, large bowel, described as a single wall thickness greater than 3 mm in distended bowel loops and greater than 5 mm in collapsed bowel loops), bowel ischemia (decreased bowel wall enhancement, vessel occlusion, and pneumatosis intestinalis/portal vein gas), intestinal perforation (a presence of peritoneal or retroperitoneal air), intestinal distension (>3 cm for small bowel and >6 cm for large bowel), a fluid-filled colon (homogeneous, low-attenuation fluid-filled bowel), solid organ infarction (hypoattenuation of organ parenchyma), pancreatitis (pancreatic edema and peripancreatic fluid), hepatitis (gallbladder wall thickening and heterogeneous liver parenchyma) and submucosal edema of the stomach. The manifestation of bleeding included intra-abdominal bleeding, retroperitoneal bleeding and abdominal wall hematoma.

Statistical analysis

SPSS (IBM SPSS Statistics for Windows, Version 28.0. Armonk, NY: IBM Corp) was employed for all statistical analyses.

Demographic and imaging data (such categorical variables as sex, comorbidities, abdominal signs and symptoms, and bleeding complications) were presented by the frequency and the percentage. Continuous variables like age, invasive mechanical days (days of invasive mechanical ventilation) and the length of stay were presented by the median and the range.

Clinical outcomes were reported as good outcomes and worse outcomes (including ICU admission and death).

The association between clinical outcomes and categorical variables (demographic, imaging data and complications) was performed by Chi-square or Fisher' Exact test and significant difference testing between clinical outcomes in continuous data such as age, invasive mechanical days (days of invasive mechanical ventilation) and the length of stay, were analyzed by Mann Whitney U-test, respectively.

For the multivariate analysis, logistic regression analysis was measured to figure out the factors for intestinal imaging findings which reported Adjusted Odd Ratio (95%CI). In case of time to event analysis, Kaplan Meier and Cox-Regression analysis were analyzed to obtain factors for an invasive mechanical ventilator, ICU admission and death events which were reported by crude and Adjusted Hazard Ratio (95%CI) and we selected the enter selection method of univariate analysis with $p<0.1$. The selection of variables for the final models is based on predetermined variables associated with COVID-19 prognosis. Statistically significant difference was regarded as a P- value lower than 0.05.

Results

All 59 patients with 59 studies were included, 34/59 (58%) were male. The average age was 65 years (ranging from 19 to 92), 59/59 (100%) were inpatients. The most frequent comorbidities were hypertension (37/59, 63%), dyslipidemia (24/59, 41%) and diabetes (21/59, 36%). For comorbidities, stage 3-5 chronic kidney disease (CKD) significantly associated with patients with worse outcomes [12/42 (29%) vs 1/17 (6%), p=0.040]. The rest of the comorbidities were not significantly different in both groups.

For abdominal signs and symptoms, the majority of the patients had fever with chills (41/59, 70%), abdominal pain (36/59, 61%) and abdominal distension (22/59, 37%). Fourteen patients (14/59, 24%) had gastrointestinal bleeding. Ten patients (10/59, 17%) had nausea and vomiting, and eight patients had hematuria (8/59, 14%). Abdominal distension was significantly associated with patients with worse outcomes. [21/42 (50%) vs 1/17 (6%), p=0.002]. Only nausea and vomiting

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were significantly found in patients with good outcomes. [2/42 (5%) vs 8/17 (47%), p<0.001]. Table 1 summarizes the abdominal signs and symptoms of the included patients.

Thirty-four patients (34/59, 58%) also received anticoagulant drugs for venous thromboembolism prophylaxis and treatment including enoxaparin (28/59, 47%), warfarin (3/59, 5%), fondaparinux (1/59, 2%) and bemiparin (2/59, 3%). Regarding bleeding manifestations, patients had intra-abdominal bleeding (11/59, 19%), retroperitoneal bleeding (6/59, 10%) and abdominal wall hematoma (4/59, 7%). Between good and worse outcomes, there was no significant difference in bleeding manifestations. Table 2 summarizes bleeding manifestations.

For abdominal findings on CT, the majority of patients had abnormal bowel findings (32/59, 54%) including a fluid-filled colon (27/59, 46%), colitis (14/59, 24%), small bowel thickening (4/59, 7%), intestinal perforation (3/59, 5%), bowel ischemia (2/59, 3%) and intestinal distension (2/59, 3%). Other abdominal CT findings were hepatitis (9/59, 15%), submucosal edema of the stomach (9/59, 15%), solid organ infarction (6/59, 10%) and pancreatitis (4/59, 7%). A higher proportion of patients who had abnormal bowel findings [28/42 (67%) vs 4/17 (24%), p=0.029), fluid-filled colon [25/42 (60%) vs 2/17 (12%), p=0.001] and submucosal edema of the stomach [9/42 (21%) vs 0/17 (0%), p=0.048] were significantly found in the group with worse clinical outcomes. Other abdominal findings on CT were not significantly different in both groups. Table 2 summarizes abdominal imaging features.

Considering the groups of clinical outcomes, forty-two patients had worse outcomes (42/59, 71%), including death (17/59, 29%) or being admitted to intensive care units (42/59, 71%). Thirty-four patients (34/42, 81%) with the worse outcome group were on invasive mechanical ventilators. Seventeen patients (17/59, 29%) had good clinical outcomes. Additionally, the overall days of hospitalization rate increased among patients with worse outcomes with a statistical difference [32 (3-186) vs 8 (3-74), p=0.010). Table 2 summarizes clinical outcomes of the included patients.

Table 1. *Patients' characteristics on performed abdominal CT imaging and comparison between patients with good clinical outcomes and worse clinical outcomes (intensive care unit (ICU) admission or death).*

	Number of patients N(%)	Good clinical outcome N(%)	Worse clinical outcome N(%)	P-value
Number of patients	59	17 (29%)	42 (71%)	-
Age years (range)	65	60 (19-90)	67 (28-92)	-
Male	34 (58%)	10 (59%)	24 (57%)	0.900
Female	25 (42%)	7 (41%)	18 (43%)	
Comorbidities	**Number of patients N(%)**	**Good clinical outcome N(%)**	**Worse clinical outcome N(%)**	**P-value**
Diabetes	21 (36%)	4 (23.5%)	17 (40.5%)	0.200
Hypertension	37 (63%)	8 (47%)	29 (69%)	0.100
Dyslipidemia	24 (41%)	5 (29%)	19 (45%)	0.260
Stage 3-5 chronic kidney disease (CKD)	13 (22%)	1 (6%)	12 (29%)	0.040
Obesity	8 (14%)	1 (6%)	7 (17%)	0.400
Cancer	4 (7%)	1 (6%)	3 (7%)	1
Chronic lung disease (COPD, Asthma)	7 (12%)	3 (18%)	4 (10%)	0.400

Table 1 (Continued). *Patients' characteristics on performed abdominal CT imaging and comparison between patients with good clinical outcomes and worse clinical outcomes (intensive care unit (ICU) admission or death).*

	All patients N(%)	Good clinical outcome N(%)	Worse clinical outcome N(%)	P-value
Abdominal signs and symptoms				
Abdominal pain	36 (61%)	12 (70%)	24 (57%)	0.340
Diarrhea	7 (12%)	3 (18%)	4 (10%)	0.390
Nausea and vomiting	10 (17%)	8 (47%)	2 (5%)	<0.001*
Abdominal distension	22 (37%)	1 (6%)	21 (50%)	0.002*
GI bleeding	14 (24%)	2 (12%)	12 (29%)	0.300
Fever with chills	41 (70%)	11 (64%)	30 (71%)	0.600
Hematuria	8 (14%)	2 (12%)	6 (14%)	1
On anticoagulant (Enoxaparin, Bemiparin, Warfarin, Fondaparinux)	34 (58%)	6 (35%)	28 (67%)	0.027

Table 2. *Abdominal findings on computed tomography among all patients, patients with good clinical outcomes and worse clinical outcomes (intensive care unit admission (ICU) or death).*

	Number of patients N(%)	Good clinical outcome N(%)	Worse clinical outcome N(%)	P-value
Abnormal bowel findings (included colitis, small bowel thickening, bowel ischemia, intestinal perforation, intestinal distension and a fluid-filled colon)	32 (54%)	4 (24%)	28 (67%)	0.029
• Colitis (colonic and rectal abnormalities)	14 (24%)	2 (12%)	12 (29%)	0.300
• Small bowel thickening	4 (7%)	1 (6%)	3 (7%)	1
• Bowel ischemia (decreased bowel wall enhancement, vessel occlusion, Pneumatosis intestinalis/Portal vein gas)	2 (3%)	0 (0%)	2 (5%)	1
• Intestinal perforation (presence of free peritoneal or retroperitoneal air)	3 (5%)	1 (6%)	2 (5%)	1
• Intestinal distension	2 (3%)	0 (0%)	2 (5%)	1
• Fluid-filled colon	27 (46%)	2 (12%)	25 (60%)	0.001*
Solid organ infarction	6 (10%)	1 (6%)	5 (12%)	0.660
Pancreatitis	4 (7%)	1 (6%)	3 (7%)	1
Hepatitis (GB wall thickening, heterogeneous liver parenchyma)	9 (15%)	4 (24%)	5 (12%)	0.420
Submucosal edema of stomach	9 (15%)	0 (0%)	9 (21%)	0.048
Bleeding manifestations	16 (27%)	2 (12%)	14 (33%)	0.120
Intra-abdominal bleeding	11 (19%)	2 (12%)	9 (21%)	0.500
Retroperitoneal bleeding	6 (10%)	0	6 (14%)	0.170
Abdominal wall hematoma	4 (7%)	0	4 (10%)	0.300

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Regarding the association between anticoagulants for VTE prophylaxis or treatment and bleeding manifestations, anticoagulants significantly increased the incidence of all bleeding manifestations (P=0.025) and retroperitoneal bleeding (P=0.034) but not significantly associated with intra-abdominal bleeding and abdominal wall hematoma. Table 3 summarizes the association between anticoagulant use for VTE prophylaxis or treatment and bleeding manifestations.

Table 3. *Association between anticoagulants for VTE prophylaxis or treatment and bleeding manifestations. The number of patients on anticoagulant for VTE prophylaxis and treatment (Enoxaparin, Bemiparin, Warfarin, Fondaparinux) = 34/59 (58%).*

	No	Yes	P-value
All bleeding manifestations	21 (49%)	13 (81%)	0.025
Intra-abdominal bleeding	26 (54%)	8 (73%)	0.300
Retroperitoneal bleeding	28 (53%)	6 (100%)	0.034
Abdominal wall hematoma	30 (55%)	4 (100%)	0.130

In regard to multivariate analysis, abnormal intestinal imaging findings were associated with a higher risk of worse outcomes without a statistical significance. (RR=1.17, p=0.646), and also longer days of hospitalization were also observed (adjusted difference: +14.3 days, p=0.103). Table 4 summarizes the association between abnormal intestinal findings on CT scan and patients' outcomes.

Additionally, ventilator free time was higher (RR=1.86, p=0.140), and survival free time was longer (RR=2.08, p=0.218) in patients without abnormal intestinal imaging findings (blue line) compared to patients with abnormal intestinal imaging findings (red line), but no statistical significance (Figure 1).

Table 4. *Association between presences of intestinal finding on computed tomography and patients' outcomes.*

	No intestinal imaging findings N(%)	Abnormal intestinal imaging findings N(%)	Crude Hazard Ratio (95% CI)	Fully adjusted Hazard Ratio* (95% CI)
Worse clinical outcome	14/27 (51.9%)	28/32 (87.5%)	RR=1.22 (0.64-2.33) P=0.553	RR=1.17 (0.60-2.26) P=0.646
Death	4/27 (15.0%)	13/32 (41.0%)	RR=1.81 (0.58-5.60) P=0.305	RR=2.08 (0.65-6.70) P=0.218
Invasive mechanical ventilation	10/27 (37.0%)	24/32 (75.0%)	RR=1.46 (0.69-3.09) P=0.318	RR=1.86 (0.82-4.24) P=0.140
	No intestinal imaging findings N(%)	**13/32 (41.0%)**	**RR=1.81 (0.58-5.60)**	**P-value**
Hospital length (days)	28.7 (28.6%)	43 (36.3%)	+14.30 (-2.98-31.56) P=0.103	1.03 (0.97-1.10) P=0.289
Invasive mechanical ventilations length (days)	33.2 (35.8%)	28.7 (31.4%)	4.53 (-29.59-20.52) P=0.715	0.96 (0.89-1.04) P=0.287

**Adjusted Odd Ratio variables associated intestinal imaging findings with p<0.1 in univariate analysis by any abdominal bleeding, GI bleeding, abdominal distension, abdominal pain, stage 3-5 CKD, respectively.*

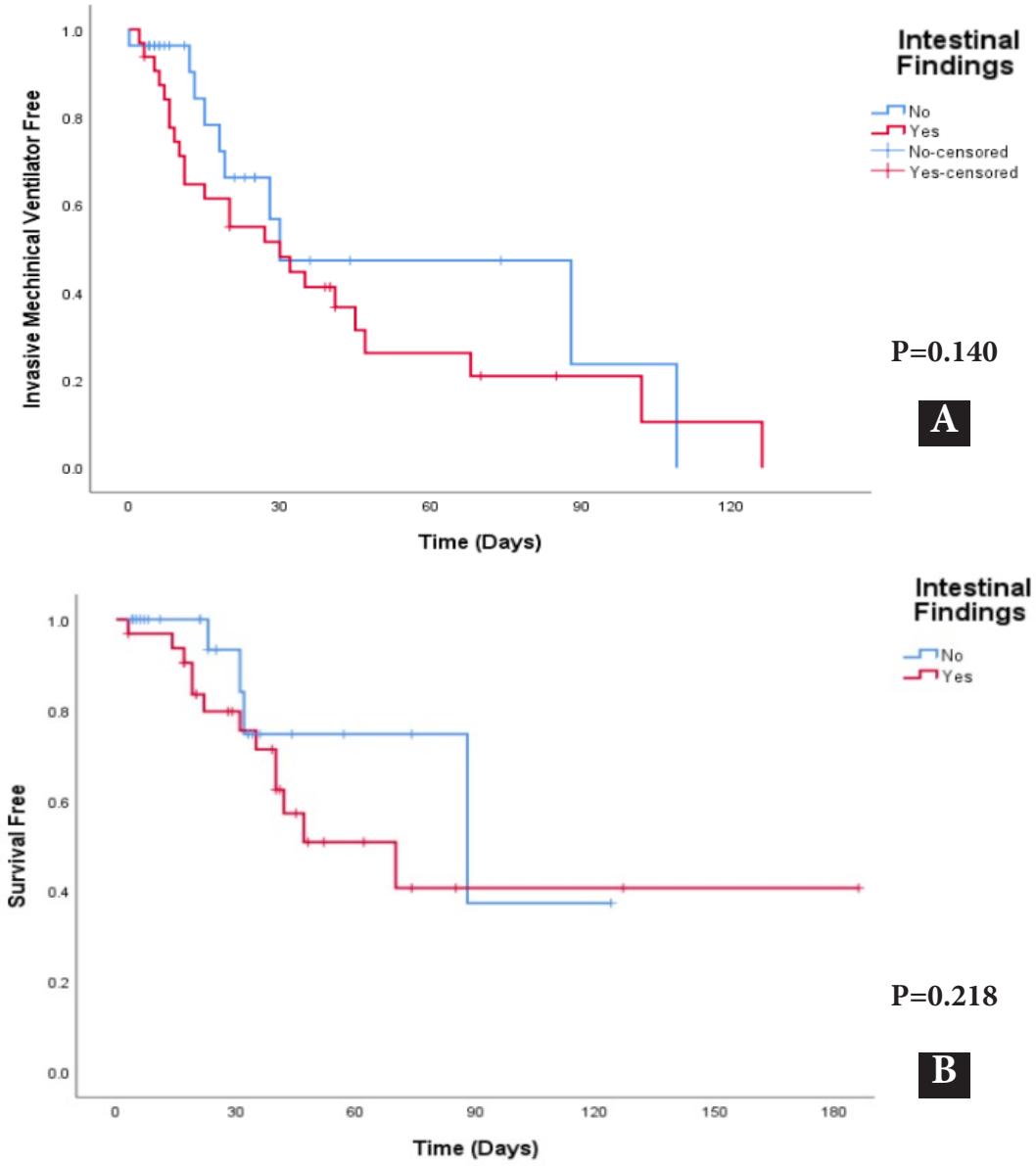

Figure 1. *Kaplan-Meier curves of invasive mechanical ventilation events (Figure A) and combined worse outcomes (Figure B), including death and invasive mechanical ventilation, comparing patients with and without intestinal imaging findings on computed tomography.*

Discussion

Coronaviruses are a group of viruses that mostly manifest with respiratory symptoms and also have extra-pulmonary effects. Involvement in the gastrointestinal tract in COVID-19 was caused by direct tissue damage and also because of inflammation-mediated cytotoxicity attributable to the strong affinity between angiotensin converting enzyme 2 (ACE2) receptor and SARS-CoV-2 [7, 9, 11, 17, 18].

Abdominal symptoms are the primary symptoms of the COVID-19 infection, such as abdominal pain, diarrhea, nausea and vomiting [4, 11, 18] also a hepato-biliary tract injury of an uncertain origin [12].

In previously published studies by Natally et al., fever with chills and abdominal pain were the 1st and 2nd most common clinical symptoms for abdominal CT scanning with 69% and 44%, respectively [9]. Similar to our study, the most common clinical symptoms were fever with chills (70%) followed by abdominal pain (61%). For nausea and vomiting which were significantly associated with good clinical outcomes were discordant with previous studies that found no significant difference in both groups [12, 19, 20]. No previous study considered abdominal distension which was significantly associated with patients with worse outcomes in our study.

In our research, for abdominal CT findings, abnormal bowel findings were significantly observed in patients with worse outcomes (P=0.029) corresponding to two previous published studies by Rajesh et al. (P=0.040) [12] and Natally et al. (P=0.03) [19] A fluid-filled colon, which possibly indicates diarrhea, was the most common CT finding (46%) which was significantly found in patients with worse outcomes (P=0.001) consistent with a previous study by Rajesh et al., which found a fluid-filled colon (43%), significantly evident in ICU patients. (P=0.01) [12]. However, inpatients with COVID-19 commonly develop gastrointestinal symptoms, including diarrhea, which might be unrecognized [5]. Although fluid-filled colons on CT scans are mostly unreported on CT images, this report could be an important clue for COVID-19 patients with abnormal GI symptoms.

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Colonic, rectal abnormalities (29% vs 12%, p=0.3) and small bowel thickening (7% vs 6%, p=0.3) were mostly detected in patients with worse outcomes but not significantly different in both groups, in concordance with the prior studies [12, 19].

COVID-19 is a disease-related consequence that could be deadly due to acute mesenteric ischemia (AMI), results from systemic inflammation, which results in hypercoagulability [21-23]. We encountered one case of acute bowel ischemia. CT imaging reveals non-enhancement of the bowel wall of sigmoid and a descending colon with a filling defect at the proximal inferior mesenteric artery (IMA) which typically indicates acute mesenteric ischemia (AMI) [24] (Figure 2). However, bowel ischemia and intestinal perforation in our study were rare findings, with 3% and 5% line with recent studies [12, 19].

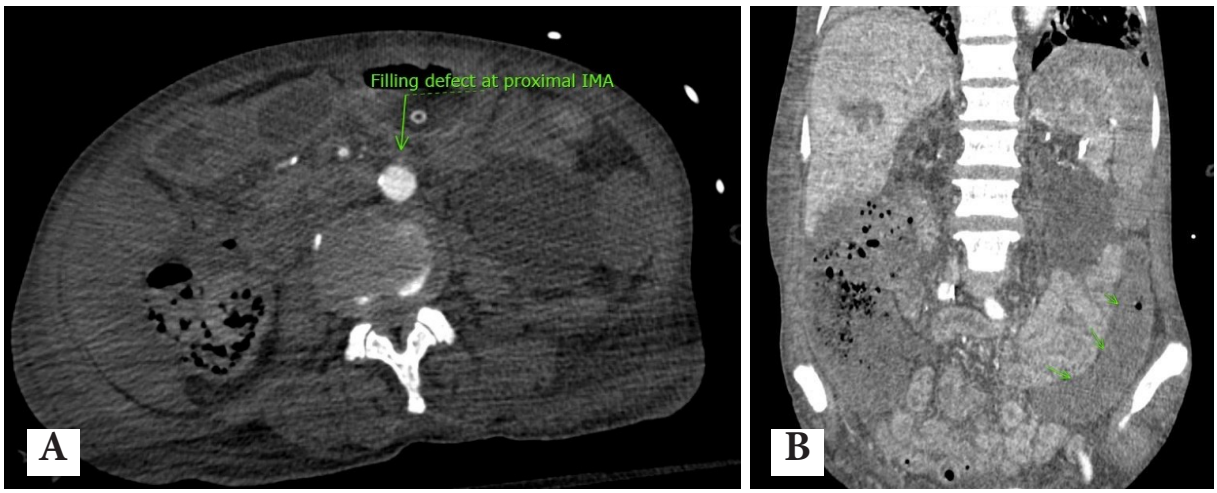

Figure 2. *CT whole abdomen axial view (A) and coronal view (B), a 64-year-old female known case of COVID-19 infection with septic shock, abdominal pain and distension. CT imaging revealed a filling defect at the proximal IMA (A) and non-enhancement of the bowel wall of sigmoid and a descending colon (arrow), which typically indicate acute mesenteric ischemia (AMI) (B).*

A previous study on solid organ infarction showed splenic infarctions in COVID-19, a rare finding in the published literature, as they are frequently accidentally found on contrast-enhanced CT chest (CECT) [25]. In our study, we found about 10% of solid organ infarction. Additional studies are required in order to clarify and correlate with serum biomarkers such as D-dimer levels.

Our study found imaging of hepatitis at 15% which is higher than the previous study [12, 19]. Only a small amount of research has examined the role of abdominal imaging in the assessment and definite imaging features of hepatic involvement in COVID-19, which is still being researched [26]. Further research is needed to establish the significance of COVID-19-related hepatobiliary dysfunction.

The propensity of hypercoagulability in COVID-19 patients increased bleeding manifestations [27]. Regarding the incidence of bleeding in COVID-19 patients, the amount of literature is insufficient, either because of coagulopathy or secondary to anticoagulation treatments [28]. More importantly, the possibility of bleeding complications is increased in anticoagulant treatments with hypercoagulable patients [29]. The majority of studies have reported that the most common bleeding manifestation in seriously ill COVID-19 patients was abdominal hematomas, of which the retroperitoneal compartment was the most common site of bleeding [30-33]. In line with our research, we found all bleeding manifestations up to 27% of which intra-abdominal bleeding was the most common finding (19%) followed by retroperitoneal bleeding (10%) and abdominal wall hematoma (7%). Anticoagulants for venous thromboembolism (VTE) prevention and treatment significantly increased the incidence of all bleeding manifestations (P=0.025) and retroperitoneal bleeding (P=0.034), but did not significantly increase the incidence of intra-abdominal bleeding or abdominal wall hematoma. However, all bleeding manifestations were not significantly associated with worse clinical outcomes. We showed a case of COVID-19 infection on enoxaparin for VTE treatment and developed active bleeding at the left iliacus and left iliopsoas muscles with a large retroperitoneal hematoma. Angiography showed contrast extravasation along the territory of the left L3, L4 lumbar artery and left iliolumbar artery. He underwent gelfoam embolization (Figure 3).

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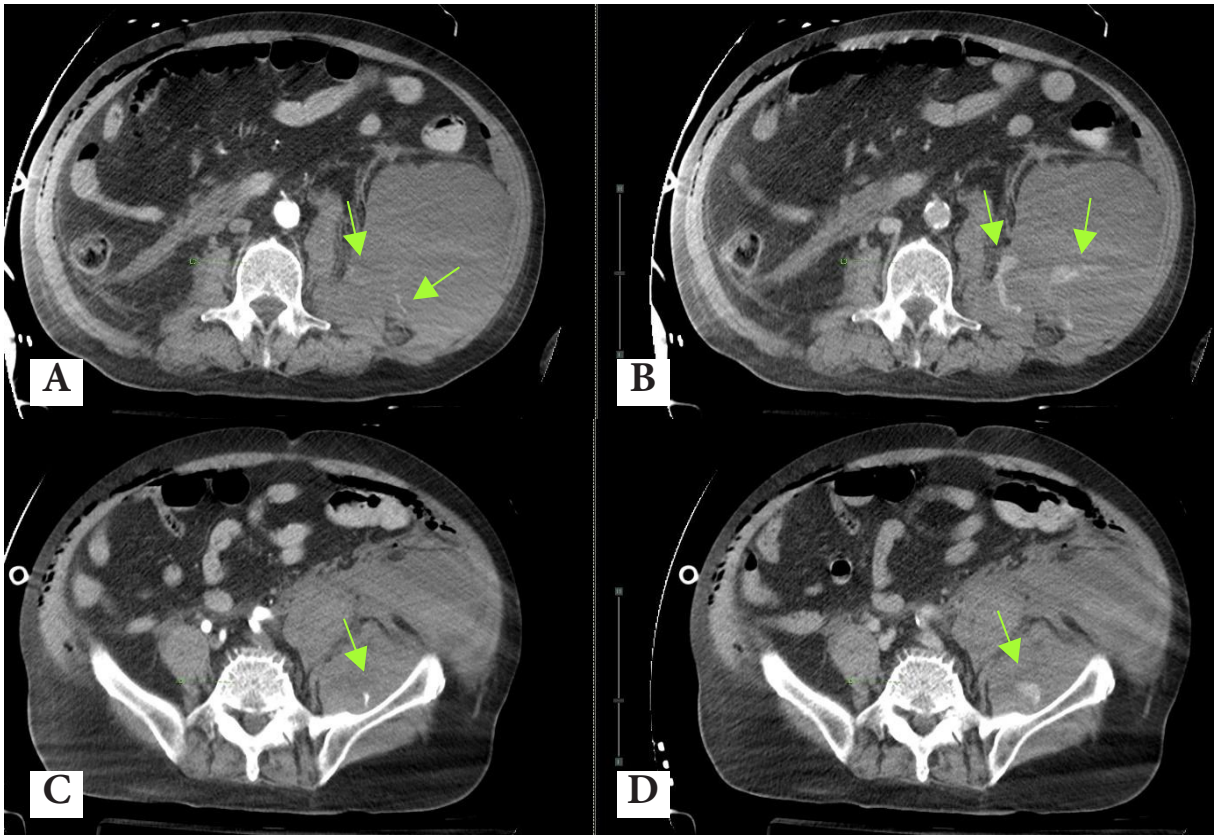

Figure 3. *CT whole abdomen axial view arterial phase (A, C) and portovenous phase (B, D), a 68-year-old male, a known case of COVID-19 infection, given Enoxaparin thromboembolic treatment and developed active bleeding at left iliacus, left iliopsoas muscle (A, B) with large retroperitoneal hematoma (C, D). Angiography showed contrast extravasation along the territory of the left L3 and L4 lumbar arteries, and the left iliolumbar artery (arrow). He underwent gelfoam embolization.*

We also reported patients with abnormal bowel findings would have a higher risk of worse outcomes, invasive mechanical ventilation and death, similar to the result of the previous study [12], but there were no significant statistical correlations. Abnormal bowel findings also indicate higher days of hospitalization but also no significant statistical correlations.

Furthermore, in regard to upcoming research, we believe that multi-center collaborations would produce higher numbers of patient registrations than single-center studies, resulting in a greater data pool and a shorter time to explore topics of concern. Results seem to be statistically significant and represent the entire population.

The limitations of this study included a retrospective study design and a small sample size. Also, there was no inter-reader agreement evaluation and determining imaging findings by consensus. Radiologic-pathologic correlations were not established, and clinical follow-up was not available. Our findings are unable to determine which reported findings are strongly associated with COVID-19. Prospective research with larger samples is needed.

Conclusion

In conclusion, abdominal CT scans performed on COVID-19 patients frequently revealed abnormal bowel findings, which were strongly associated with worse prognosis. Clinicians and surgeons must be concerned about the disease's abdominal signs and symptoms. Finally, radiologists need to be concerned about the abnormal bowel findings and point them out to clinicians and surgeons.

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ISSN 2672-9393

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