Abdominal and pelvic imaging findings in COVID-19

Patologie w badaniach obrazowych jamy brzusznej i miednicy u pacjentów zakażonych SARS-CoV-2

Anna Laskus[*1], Monika Kamińska[1], Robert Wysocki[1]*

[1] *Department of Radiology, Centre of Postgraduate Medical Education, Central Clinical Hospital of the Ministry of Interior and Administration in Warsaw, Poland*

KEYWORDS:

- COVID-19
- abdomen
- imaging
- gastrointestinal system
- vascular system

ABSTRACT

Pulmonary imaging findings of Coronavirus disease 2019 (COVID-19) has been widely described, but recently few studies have been published about abdominal and pelvic radiological presentation. The aim of this study was to provide an overview of abdominal imaging findings in patients with COVID-19. After investigation of recent published literature we came to conclusion that most common findings are associated with gastrointestinal abnormalities with mural thickening of part of gastrointestinal tract being the most common, followed by vascular and less frequently described solid organ and gallbladder abnormalities. It is important to be familiar with abdominal COVID-19 manifestations, since they're often implicated with the development of poor clinical outcomes.

SŁOWA KLUCZOWE:

- COVID-19
- jama brzuszna
- obrazowanie
- układ żołądkowo-jelitowy
- układ naczyniowy

STRESZCZENIE

Objawy płucne COVID-19 były szeroko opisywane od początku pandemii. Na przestrzeni ostatnich kilku miesięcy pojawiły się również doniesienia dotyczące brzusznych manifestacji choroby. Celem pracy jest przedstawienie patologii jamy brzusznej i miednicy w badaniach obrazowych u chorych z COVID-19. Przegląd aktualnego piśmiennictwa wykazał, że najczęściej występującymi patologiami są odcinkowe pogrubienie ściany jelita, następnie nieprawidłowości w obrębie naczyń, pęcherzyka żółciowego oraz innych organów. Obrazowanie jamy brzusznej i miednicy uwidocznia niekiedy zagrażające życiu nieprawidłowości, co przemawia za zasadnością wykonywania badań obrazowych i ich wnikliwej oceny.

Introduction

Coronavirus disease 2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has presented a global threat for over one year.

Symptoms of infection are variable and nonspecific but most patients present with fever and flu-like symptoms. Gastrointestinal manifestations have also been recognized, including diarrhea, nausea, abdominal pain and loss of appetite (1, 2).

Angiotensin-converting enzyme 2 (ACE2) receptor, which is identified as a functional receptor for the virus is found predominately in type II pneumocytes but not only, it is expressed broadly in the human body viscera. The receptor is also common in vascular endothelium, enterocytes of small intestine and hepatobiliary cells (several tissue tropism), what makes abdominal viscera and vasculature susceptible to injury (2, 3).

The number of studies and case reports of abdominal radiological presentations increases constantly. The aim of this study is to provide an overview of abdominal imaging findings collected over last few months in patients presenting with COVID-19.

Gastrointestinal abnormalities

Gastrointestinal abnormalities are most common abdominal imaging finding in patients with SARS-CoV-2 infection. Goldberg-Stelin et al., made retrospective study included adult COVID-positive patients with abdominopelvic CT (computed tomography) performed within 14 days of their COVID PCR (Polymerase Chain Reaction) nasal swab assay. Of 141 COVID+ patients, 80 (57%) had positive abdominopelvic findings. They found abnormality of GI (gastrointestinal) tract in 25 (31%) patients (4).

*Address for correspondence: *Anna Laskus, Department of Radiology, Centre of Postgraduate Medical Education, Central Clinical Hospital of the Ministry of Interior and Administration in Warsaw, Wołoska 137 Street, 02-507 Warsaw, Poland, e-mail: alaskus@vp.pl.*
ISSN 2657-9669/
Published and financed by Centre of Postgraduate Medical Education; https://doi.org/10.36553/wm.89.

GI symptoms remain very common in COVID+ patients. The prevalence of GI symptoms is roughly 18% and includes loss of appetite, nausea, vomiting, diarrhea, and abdominal pain. Abdominal pain is most common symptom reported in 33% of patients – Bhayana et al.

Large study by Luo et al. found that of 1141 confirmed cases of COVID-19, 16% presented with only GI symptoms (5).

Most common GI imaging finding is mural thickening in any location (12/25 patients with abnormality of GI tract) (7). Guo Y., Hu X., Yu F., et al. described a case of COVID-19 demonstrating intestinal symptoms. The main abdominal CT features in this case included the following three aspects: segmental wall thickening involving jejunum in the left upper quadrant, mesenteric vascular enlargement and lack of inflammatory exudative changes around the swollen intestine. They found these features nonspecific, which were similar to some other inflammatory bowel diseases such as Crohn's disease (6).

Other GI abnormalities included: retained colonic stool (5/25), acute appendicitis (2/25), acute colonic diverticulitis (2/25), small bowel obstruction (1/25), small bowel ileus (1/25), other (2/25) (4).

Kevin Lui, Mitchell P. Wilson and Gavin Low found a rare ultrasound finding reported in pediatric cases of SARS-CoV-2 infection is ileocolic intussusception (5).

The positive detection of SARS-CoV-2 in the stool was a breakthrough, which suggested that the virus can replicate and exist in the digestive tract. Some COVID-19 patients still present with nucleic acid-positive stool after the virus in pharyngeal swab turns negative. Detection of SARS-CoV-2 in fecal samples is essential for clinical practice, particularly

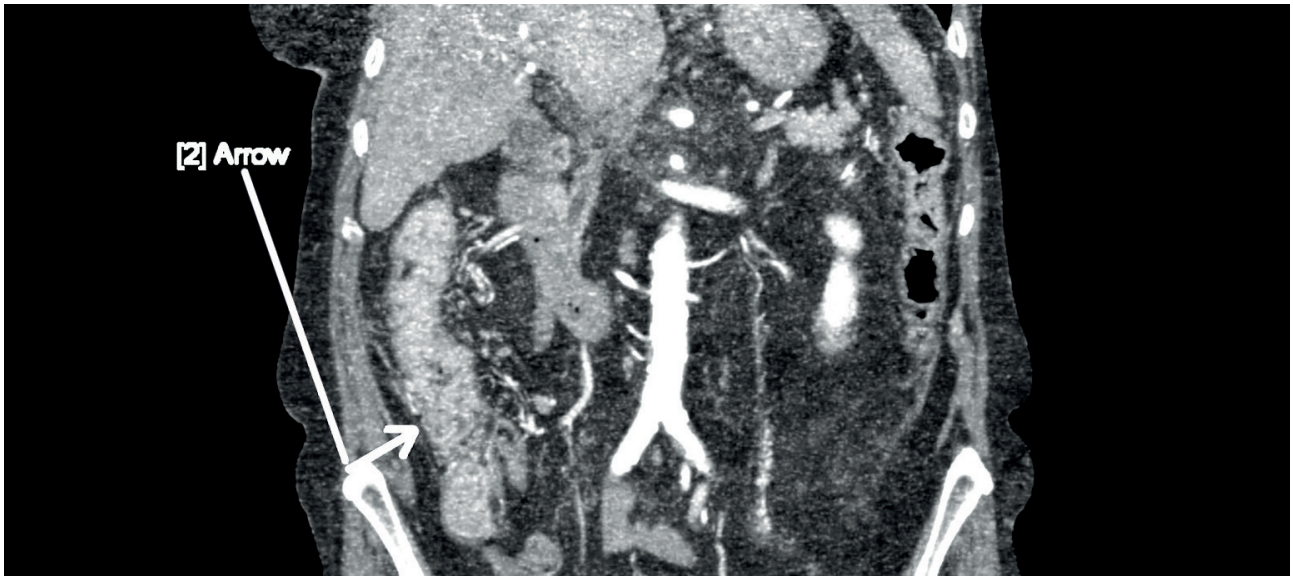

Figure 1. A 65 years old, COVID positive woman with abdominal pain. Enhanced CT in coronal plane showing ascending colon wall thickening (arrow).

Source: own elaboration.

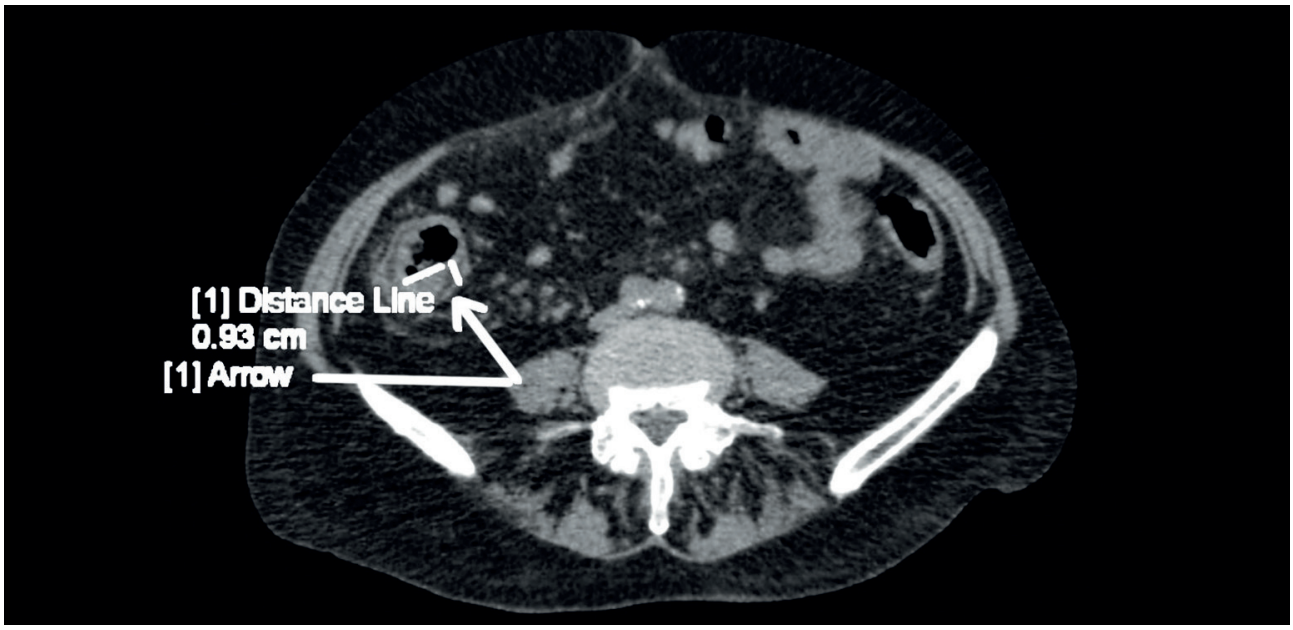

Figure 2. A 65 years old, COVID positive woman with abdominal pain. Enhanced CT in axial plane showing ascending colon wall thickening (arrow).

Source: own elaboration.

for patients with atypical symptoms, and should be performed when COVID-19 patients are leaving the hospital as well to confirm viral clearance (7).

Vascular abnormalities

Coagulopathy is often seen in acute infection due to excessive inflammation, hypoxia, immobilization and diffuse intravascular coagulation. Apart from many cases of pulmonary embolism COVID-19 may predispose to abdominal venous and/or arterial thromboembolism manifesting with abdominal pain.

A Beccara L. et al. provides a case report of 52-year-old man with a 10-day history of cough and fever, positive for SARS-CoV-2 and interstitial pneumonia in a thoracic CT. Four days after successful treatment the patient developed other symptoms such as fever, diarrhea, vomiting and abdominal pain. The abdomen CT scan has been performed twice, after patient clinically got worse, and second abdominal CT scan showed arterial thrombosis of vessels efferent of the superior mesenteric artery and bowel distension. The patient underwent intestinal resection and discharged from the hospital instructed to continue LMWH (low-molecular weight heparin) and aspirin (8).

De Barry O. et al. reports negative for SARS-CoV-2 79-year-old woman with typical symptoms of COVID-19 and abdominal pain in the epigastric area. Chest CT scan displayed typical signs of COVID-19 pneumonia, upper abdominal slices showed a spontaneous hyperdensity in the right portal vein. Further CT scan of the chest, abdomen, and pelvis at the arterial and portal phases, revealed thrombosis of a right portal vein, distal part of the upper mesenteric vein and spleno-mesenteric trunk. Proximal upper mesenteric artery and jejunal artery were also affected with subsequent features of bowel ischemia. During laparotomy necrotic bowel was removed. The patient underwent thrombolysis and thrombectomy. Despite of the treatment he passed away 4 days later (9).

Closed attention payed to indirect signs of thrombosis on unenhanced CT scan can be very important. Enhanced CT scan in case of pulmonary embolism suspicion or abdominal pain should be considered in each symptomatic patient (8, 9).

Other abnormalities

Although intestinal and vascular abnormalities are the most frequent described findings in abdominal and pelvic radiological examinations in patients with COVID-19, other abnormalities have been also described.

In Bhayana R. et al. retrospective study of 412 patients, gallbladder bile stasis was one of the most common findings on abdominal images of patients with Coronavirus disease 2019. Right upper quadrant US examinations were mostly performed because of liver laboratory findings, revealed a dilated sludge-filled gallbladder, suggestive of bile stasis. Patients with a cholecystostomy tube placed had negative bacterial cultures (1).

Goldberg-Stein S. et al. in their retrospective study also emphasized CT findings relating to the gallbladder and biliary system which were found in 25% of patients (in group of 80 patients), including gallbladder distension, mural edema and findings reported as possible or definite acute cholecystitis; 10% of patients had biliary ductal dilation.

Since gallbladder edema is common finding in acute hepatitis, it is possible that gallbladder edema seen in some patients is a reflection of hepatocellular damage, either directly by SARS-CoV-2 or by reactive inflammatory response. Further studies are necessary to determine the implications of the findings of biliary and gallbladder pathology and relationship to COVID-19 positivity is uncertain (4).

Another frequently reported imagining findings are features of acute pancreatitis. Retrospective cohort studies and case-control studies have detected a higher proportion of idiopathic acute pancreatitis among patients with COVID-19. The COVID PAN study (an international multi-centre retrospective and prospective case-control study) suggests that acute pancreatitis in patients with COVID-19 is more frequently severe than in patients without COVID-19, but this aspect is expected owing to the aggressive behaviour of COVID-19 itself, which is associated with multi-organ failure regardless of the presence of acute pancreatitis.

Severe acute respiratory syndrome coronavirus 2, the causative agent of COVID-19, uses ACE2 receptor to enter human cells. Pancreatic ductal, acinar and islet cells also express ACE2, so infection of the gland is plausible as the virus could spread from the duodenal epithelium to the pancreatic duct and then to acinar and islet cells. In a case report, SARS-CoV-2 has been isolated in samples from a pancreatic pseudocyst from a patient with acute pancreatitis. Notably, SARS-CoV-2 is also able to cause diffuse severe endotheliitis of the submucosal vessels in several anatomical sites, and these changes, in turn, cause diffuse microischaemic disease. Similar ischaemic damage could occur in the pancreas.

Currently, the association between COVID-19 and acute pancreatitis is not based on evidence. The available data are difficult to interpret as, although acute pancreatitis is a relatively frequent disease, its occurrence in patients with COVID-19 seems rare and many questions remain (10).

Other individual cases such as splenic and renal infarcts, ascites, heterogenous liver and liver steatosis have also been described (1, 2, 3, 4).

Conclusion

The most common clinical indication for abdominal imagining is abdominal pain, diarrhea, nausea, vomiting, loss of appetite and fever (2, 4, 5).

According to recent studies, there are several manifestations of COVID-19 in abdominal and pelvic imagining. We divided them into three categories: first group, gastrointestinal pathologies, with mural thickening of part of GI tract being the most common; second group, vascular abnormalities, includes arterial and venous thrombosis, and third group, which we called other abnormalities. We included there gallbladder and solid organ pathologies.

In conclusion, clinicians and surgeons should be familiar with abdominal COVID-19 manifestations, since they're often implicated with the development of poor clinical outcomes. Finally, radiologists should be aware of abdominal imagining findings and all abnormalities should be highlighted in their reports.

References

(1) Bhayana R, Som A, Li MD, et al. Abdominal Imaging Findings in COVID-19: Preliminary Observations. Radiology 2020; 297(1):201908. DOI:10.1148/radiol.2020201908.

(2) Horvat N, Pinto PVA, Araujo-Filho JAB. Abdominal gastrointestinal imaging findings on computed tomography in patients with COVID-19 and correlation with clinical outcomes. Eur J Radiol Open 2021; 8:100326. DOI:10.1016/j.ejro.2021.100326.
(3) Shiralkar K, Chinapuvvula N, Ocazionez D. Cross-sectional abdominal imaging findings in patients with COVID-19. Cureus 2020; 12(8):e9538. DOI:10.7759/cureus.9538.
(4) Goldberg-Stein S, Fink A, Paroder V, et al. Abdominopelvic CT findings in patients with novel coronavirus disease 2019 (COVID-19). Abdom Radiol 2020; 45(9):2613-2623. DOI:10.1007/s00261-020-02669-2.
(5) Lui K, Wilson MP, Low G. Abdominal imaging findings in patients with SARS-CoV-2 infection: a scoping review. Abdom Radiol 2020; 14:1-7. DOI:10.1007/s00261-020-02739-5.
(6) Guo Y, Hu X, Yu F, et el. Abdomen CT findings in a COVID-19 patient with intestinal symptoms and possibly false negative RT-PCR before initial discharge, Quant Imaging Med Surg 2020; 10(5):1158-1161. DOI:10.21037/qims-20-463.
(7) Chunxiang M, Yingzi C, Hu Z. COVID-19 and the Digestive System. Am J Gastroenterol 2020; 115(7):1003-1006 DOI:10.14309/ajg.000000000000069.
(8) Beccara LA, Pacioni C, Ponton S, et al. Arterial Mesenteric Thrombosis as a Complication of SARS-CoV-2 Infection. Eur J Case Rep Intern Med 2020; 7(5):001690. DOI:10.12890/2020_001690.
(9) de Barry O, Mekki A, Diffre C, et al. Arterial and venous abdominal thrombosis in a 79-year-old woman with COVID-19 pneumonia. Radiol Case Rep 2020; 15(7):1054-1057, DOI:10.1016/j.radcr.2020.04.055.
(10) De-Madaria E, Capurso G, COVID-19 and acute pancreatitis: examining the causality. Nat Rev Gastroenterol Hepatol Jan 2021; 18(1):3-4. DOI:10.1038/s41575-020-00389-y.