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Cardiothoracic Imaging

Incidental CT findings in the lungs in COVID-19 patients presenting with abdominal pain

Nicholas Voutsinas*, Danielle Toussie, Adam Jacobi, Adam Bernheim, Michael Chung

Icahn School of Medicine, Department of Diagnostic, Molecular, and Interventional Radiology, 1 Gustave Levy Place, Box 1234, NY, New York 10029, United States of America

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ABSTRACT

As the 2019 novel coronavirus disease (COVID-19) continues to spread, some patients are presenting with abdominal symptoms without respiratory complaints. Our case series documents four patients who presented with abdominal symptoms whose abdominopelvic CT revealed incidental pulmonary parenchymal findings in the imaged lung bases and were subsequently confirmed positive for COVID-19 via laboratory testing. It remains to be seen whether these patients will eventually develop respiratory symptoms. While it is possible that the patients' abdominal complaints are coincidental with CT findings, it is interesting that patients can have such extensive incidental disease in the lungs on CT without respiratory symptoms.

1. Case series

1.1. Case 1

A 31-year-old female with a history of hypertension presented to the emergency department complaining of right lower quadrant abdominal pain and right costovertebral angle tenderness for two weeks, which worsened over the previous two days. She endorsed hematuria and dysuria as additional symptoms. She denied chest pain, shortness of breath, cough, and fever. Vital signs were normal and blood laboratory tests were normal except for leukopenia (3.1×10^9 cells per Liter). The patient received a non-contrast computed tomography (CT) scan of the abdomen and pelvis, which showed no acute abdominal abnormalities but demonstrated hazy ground-glass opacities in the dependent portions of both lung bases (Fig. 1). She subsequently received a nasopharyngeal swab for COVID-19, which was positive on real-time reverse transcriptase polymerase chain reaction (rRT-PCR) nasopharyngeal swab. Urinalysis was also performed, which showed leukocytes in the urine; the patient was subsequently discharged on antibiotics for a presumptive urinary tract infection (UTI) and was instructed to self-quarantine.

1.2. Case 2

A 46-year-old male with a history of type 2 diabetes mellitus and hypertension presented to the emergency department with four days of

diffuse abdominal pain, which localized to both flanks on physical examination. He was febrile to 38.3 °C, but vital signs were otherwise normal. Review of symptoms was positive for nausea, vomiting, and decreased appetite, but negative for diarrhea, chest pain, shortness of breath, and cough. Blood laboratory tests were also normal except for mild leukopenia (3.9×10^9 cells per Liter). CT of the abdomen and pelvis was performed, with both intravenous and oral contrast, and demonstrated no acute abdominal abnormalities, but instead showed large, confluent peripheral ground-glass opacities with associated increased interstitial markings in both lung bases (Figs. 2 and 3). He received a nasopharyngeal swab for COVID-19, which was positive. He was subsequently admitted for management of his infection for 5 days, before being discharged.

1.3. Case 3

A 20-year-old male with no significant past medical history presented to the emergency department with abdominal pain, diarrhea, and bloody stool for the past day. He was mildly tachycardic with otherwise normal vital signs and laboratory tests. CT of the abdomen and pelvis was performed, demonstrating mild sigmoid colitis; however, incidentally noted was a focal area of ground-glass opacification with a rounded morphology in the periphery of the right lung base (Fig. 4). He denied chest pain, shortness of breath, and cough. He subsequently received a nasopharyngeal swab for COVID-19, which was positive, and was prescribed oral antibiotics for his colitis. The patient

* Corresponding author at: 1 Gustave Levy Place, Box 1234, NY, New York 10029, United States of America.

E-mail address: nicholas.voutsinas@mountsinai.org (N. Voutsinas).

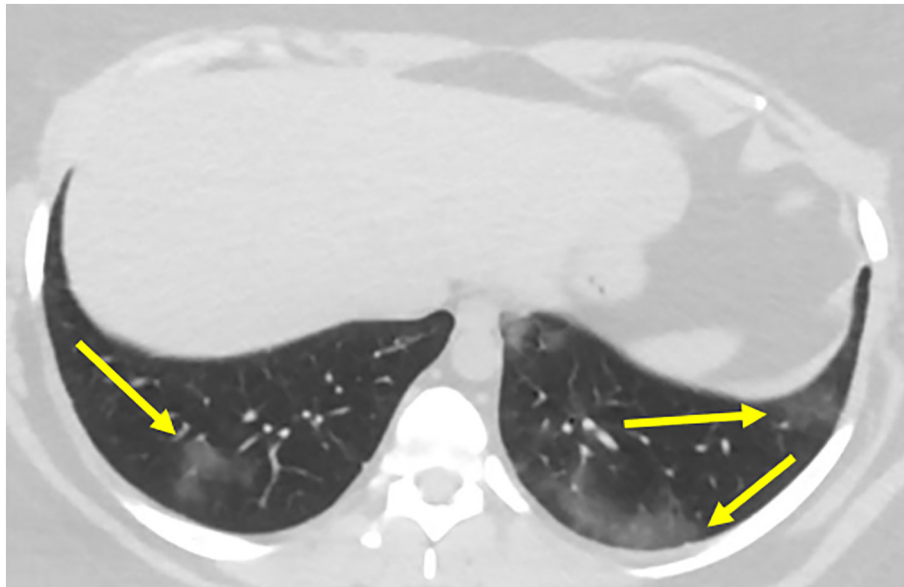


Fig. 1. (Case 1): peripheral ground-glass opacities in the lung bases (arrows) in a 31-year-old female, incidentally noted on axial abdominopelvic CT imaging performed for abdominal pain. The patient tested positive for COVID-19 without respiratory symptoms.

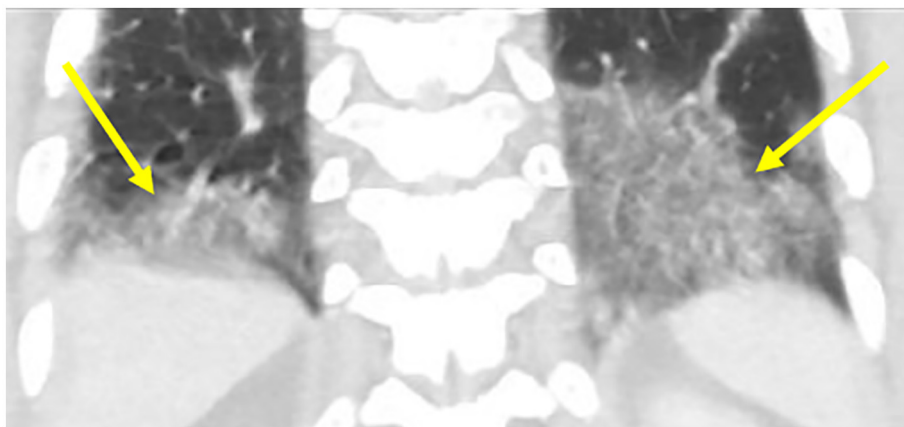


Fig. 2. (Case 2): coronal reformatted CT image of a 46-year-old male with multiple hazy and patchy coalescent ground-glass pulmonary opacities with interstitial thickening in the imaged lung bases who tested positive for COVID-19 despite the absence of respiratory symptoms.

was discharged home and instructed to self-quarantine.

1.4. Case 4

A 27-year-old female with no significant past medical history presented to the emergency department with two days of right flank pain, epigastric pain, chills, and nausea. She denied fever, chest pain, shortness of breath, and cough. CT of the abdomen and pelvis with intravenous contrast was performed demonstrating heterogeneous enhancement of the right kidney, suggestive of pyelonephritis (confirmed with urinalysis), with multiple incidental peripheral rounded ground-glass opacities in the periphery of the imaged right lower lobe (Fig. 5). She was admitted for intravenous antibiotic administration for her pyelonephritis, and her leukocyte count was observed to decrease throughout her admission (from 5.3 to 2.9×10^9 cells per Liter). She was discharged after four days and instructed to self-quarantine.

2. Discussion

This case series describes four patients who presented to our health system with only abdominal symptomatology but notably without respiratory or thoracic symptoms, which triggered abdominopelvic CT

imaging. This imaging incidentally detected pulmonary findings, prompting RT-PCR testing for COVID-19. All patients subsequently tested positive. Each of these patients had ground-glass opacities in the lung bases, and many with characteristic features (such as rounded morphology, peripheral distribution, and basilar predominance) that have been widely described in COVID-19 [1–3]. Consolidative opacities can also be seen in the setting of COVID-19 pneumonia, particularly when there is more severe lung disease or with longer infection duration (Fig. 5) [1–3]. Patients 2 and 4 subsequently underwent an additional non-contrast chest CT, which did not reveal any additional sites of disease in the upper lungs.

Non-productive cough, shortness of breath, and fever are the most common clinical presenting symptoms of patients with COVID-19 [4,5]. As the pandemic continues to progress, additional symptoms related to the disease have been identified including headache, abdominal pain, flank pain, myalgia, nausea, vomiting, and diarrhea [4–7]. None of these patients had respiratory symptoms, which is an uncommon presentation for COVID-19. In two of our patients (patient 1 and patient 4), a UTI was treated at the same time that COVID-19 was diagnosed, confounding interpretation of the patient's abdominal pain being related to COVID-19; however, urine cultures were negative in both of these patients. While imaging of the right kidney was abnormal in

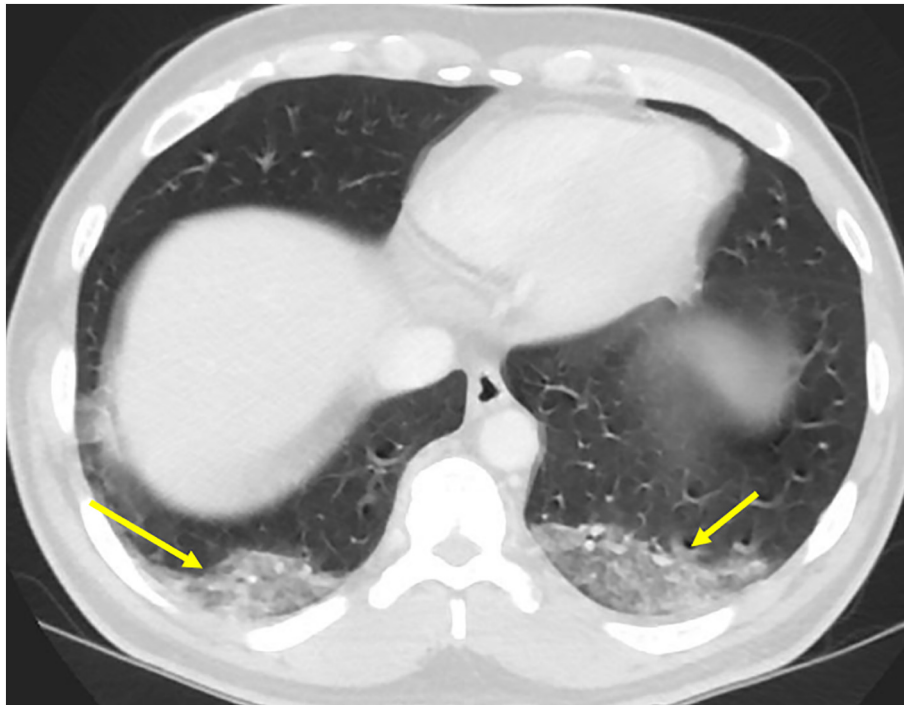


Fig. 3. (Case 2): axial CT image of a 46-year-old male with confluent patchy ground-glass pulmonary opacities with a basilar and peripheral lung distribution who tested positive for COVID-19 without respiratory symptomatology.

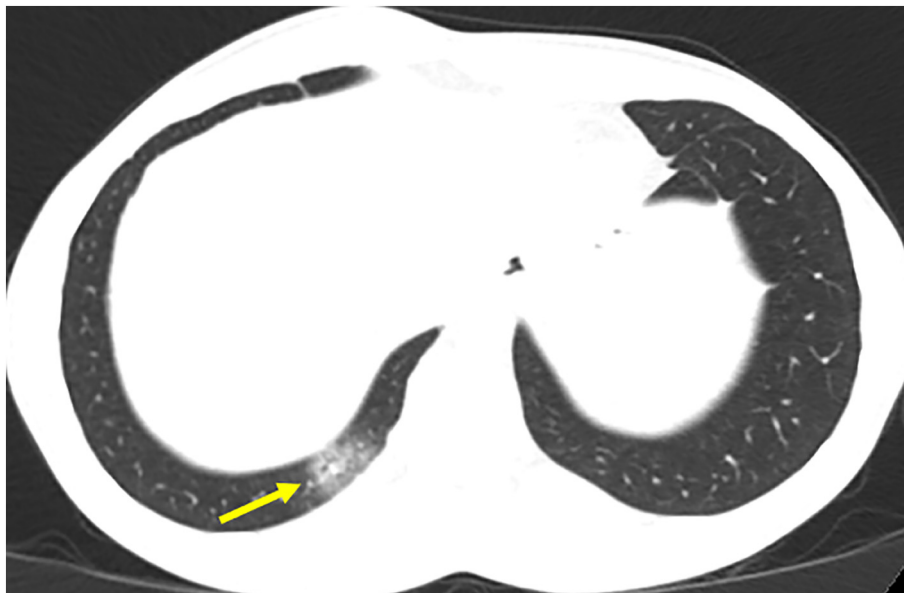


Fig. 4. (Case 3): a solitary small right lower lobe ground-glass pulmonary opacity with a rounded morphology is incidentally noted on this axial CT image of a 20-year-old male with abdominal pain and no respiratory symptoms. He tested positive for COVID-19.

patient 4, there was no evidence of abnormal abdominal findings in patient 1 on reinterpretation of the imaging after knowing there were leukocytes in the patient's urine. It is unclear at this time whether these patients presented with concurrent COVID-19 infection and UTI or if the UTI was a separate process. Further study is needed to determine if there is a relationship between COVID-19 infection and diseases of the renal and urinary systems. Patient 3 was diagnosed with sigmoid colitis, which could be the etiology of the patient's abdominal pain, though a source of colitis was not identified at the time of diagnosis. There are reports that COVID-19 can cause intestinal inflammation, so it is possible active colitis supports may be secondary to patient's COVID-19

diagnosis [7]. Findings of colitis from COVID-19 are non-specific and similar to other potential bacterial, viral and fungal infections, including circumferential wall thickening, mural hyperenhancement, mesenteric hypervascularity, and peri-colonic fat stranding [8]. Patient 2 was discharged after five days without another obvious source for his abdominal pain.

Three of the four patients had leukopenia at some point during their hospital visit, two of them on admission. Leukopenia is a well-described laboratory finding in COVID-19 [4]. It is possible that this impaired immune system due to COVID-19 made these patients more susceptible to other infectious processes; however, further study would be needed

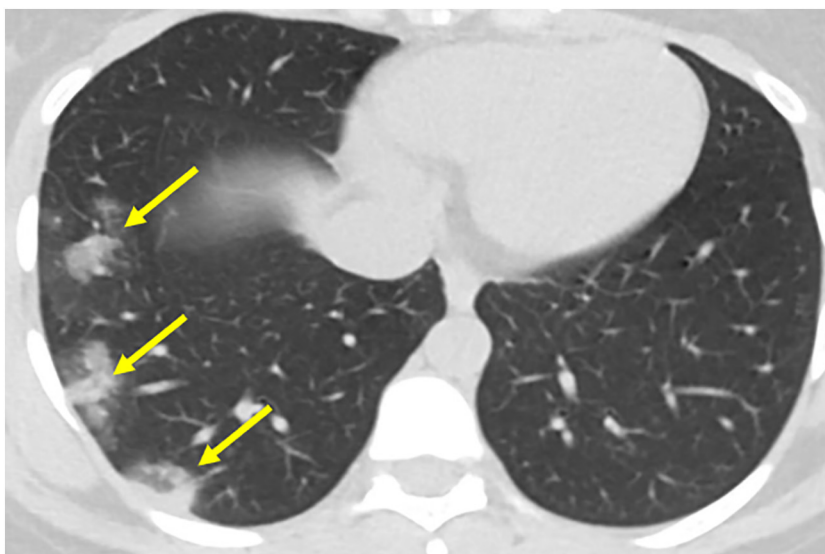


Fig. 5. (Case 4): axial CT imaging in a 27-year-old female with abdominal symptoms demonstrates multiple ground-glass and consolidative pulmonary opacities with a rounded morphology and peripheral distribution in the imaged right lower lobe. This patient subsequently tested positive for COVID-19.

in that realm.

This case series illustrates that the clinical presentation of COVID-19 encompasses a diverse gamut with atypical presentations including abdominal pain, and clinicians and radiologists should be aware of this spectrum. Abdominal and back pain has long been described as a symptom in pneumonia in both adults and children secondary to pleural irritation [9–11]. In some patients, abdominal pain is the dominant symptom without obvious respiratory symptomatology [9–11]. This information would support the hypothesis that the abdominal pain felt by patient 2 was from the COVID-19 associated ground glass opacities causing pleural irritation, given that despite his five-day admission, no other diagnoses were made that could explain his abdominal pain. These may be crucial findings to recognize in combating the current pandemic as COVID-19 prevalence rises. It is also possible that as COVID-19 prevalence rises, with many asymptomatic carriers, that patients presenting for any other complaints are more likely to have incidental pulmonary findings of COVID-19 on CT. Of note, all four of the patients described in this case series were under the age of 50; this may indicate that despite parenchymal disease on imaging, younger patients present with milder or absent respiratory symptomatology. All patients received a phone call one week after discharge from either the emergency department or hospital, as per our institutions COVID-19 protocol. None of the patients endorsed respiratory symptoms developing since their initial presentation. It is important to note that although this case series is only four patients, this is to confine the discussion to patients who were confirmed COVID-19 positive via laboratory testing. Excluded from this series are presumed COVID-19 patients who presented with abdominal pain and similar lung CT findings, but not confirmed positive with nasopharyngeal swab.

Furthermore, incidental pulmonary parenchymal findings in these patients on CT occurred in the absence of respiratory symptoms, indicating that parenchymal injury may precede respiratory symptomatology. It is also noteworthy that our series identified pulmonary opacities that were overall less solid as compared with the more consolidative lesions seen in other investigations examining patients

later in disease course who often had respiratory symptoms. This supports the hypothesis that pulmonary lesion density may directly correlate with infection time course.

As COVID-19 testing becomes more widely accessible, it can be employed more readily in patients with atypical symptoms such as abdominal complaints. This may lead to more prompt diagnosis and quarantine, which is of vital benefit to the patient as well as to the public health efforts at large to contain disease spread.

References

- [1] Chung M, Bernheim A, Mei X, et al. CT imaging features of 2019 novel coronavirus (2019-nCoV). *Radiology* 2020;295(1):202–7 <https://doi.org/10.1148/radiol.2020200230>.
- [2] Bernheim A, Mei X, Huang M, et al. Chest CT findings in coronavirus disease-19 (COVID-19): relationship to duration of infection. *Radiology* 2020. <https://doi.org/10.1148/radiol.2020200463>.
- [3] Wang Y, Dong C, Hu Y, et al. Temporal changes of CT findings in 90 patients with COVID-19 pneumonia: a longitudinal study. *Radiology* 2020. <https://doi.org/10.1148/radiol.2020200843>.
- [4] Yang W, Cao Q, Qin L, et al. Clinical characteristics and imaging manifestations of the 2019 novel coronavirus disease (COVID-19): a multi-center study in Wenzhou city, Zhejiang, China. *J Infect* 2020. <https://doi.org/10.1016/j.jinf.2020.02.016>.
- [5] Del rio C, Malani PN. COVID-19-new insights on a rapidly changing epidemic. *JAMA* 2020. <https://doi.org/10.1001/jama.2020.3072>.
- [6] Song Y, Liu P, Shi XL, et al. SARS-CoV-2 induced diarrhoea as onset symptom in patient with COVID-19. *Gut* 2020. <https://doi.org/10.1136/gutjnl-2020-320891>.
- [7] Miri SM, Roozbeh F, Omranirad A, Alavian SM. Panic of buying toilet papers: a historical memory or a horrible truth? Systematic review of gastrointestinal manifestations of COVID-19. *Hepat Mon* 2020;20(3):e102729 <https://doi.org/10.5812/hepatmon.102729>.
- [8] Carvalho A, Alquasairi R, Adams A, et al. SARS-CoV-2 gastrointestinal infection causing hemorrhagic colitis: implications for detection and transmission of COVID-19 disease. *Am J Gastroenterol* 2020. <https://doi.org/10.14309/ajg.000000000000667>.
- [9] Gauss H. Abdominal pain in pneumonia. *Jour D D* 1946;13:73–7. <https://doi.org/10.1007/BF03002754>.
- [10] Ravichandran D, Burge DM. Pneumonia presenting with acute abdominal pain in children. *Br J Surg* 1996;83(12):1707–8. <https://doi.org/10.1002/bjs.1800831214>.
- [11] Grief SN, Loza JK. Guidelines for the evaluation and treatment of pneumonia. *Prim Care* 2018;45(3):485–503. <https://doi.org/10.1016/j.pop.2018.04.001>.