Journal of Surgery and Medicine

Detection of unexpected coronavirus disease (COVID-19) involvement in lung bases on abdominal CT of patients presenting with abdominal symptoms

Abdominal şikayetler ile başvuran hastalarda karın BT'de akciğer bazallerinde beklenmedik koronavirüs hastalığı (COVID-19) tutulumunun saptanması

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Abstract

Aim: Coronavirus disease 2019 (COVID-19) can present with nonspecific abdominal symptoms. The aim of this study is to emphasize the importance of detecting lung basis involvement on abdominal computed tomography (CT) in patients hospitalized with abdominal complaints without known COVID-19 disease.

Methods: CT images of 250 patients who underwent abdominopelvic CT scan due to various abdominal complaints were retrospectively evaluated. Inclusion criteria included patients presenting with primary abdominal complaints without respiratory symptoms, who had suspicious COVID-19 CT findings on lung basis. COVID-19 was not among the differential diagnoses of these patients at the time of admission. CT images of 240 patients were included.

Results: Among 240 patients, twelve (8 females, 4 males, aged 30-69 years) had suspicious findings of COVID-19 on lung bases. Presenting complaints were abdominal pain (n=7), lack of appetite (n=5), diarrhea (n=7), vomiting (n=3), nausea (n=4) and gastric pain (n=1). Lung base CT findings included ground-glass opacities (100%), which were peribronchovascular (66.6%), bilateral (91.6%), peripheral (91.6%), or multifocal (58.3%). Cases were confirmed with laboratory testing.

Conclusion: Considering that some patients present with nonspecific abdominal complaints, identifying the characteristic signs of COVID-19 incidentally in the visualized part of the lung basis on abdominal CT is important for early diagnosis, the protection of health professionals, and in reducing the spread of disease.

Keywords: Coronavirus, Lung base, Abdominal CT, COVID-19, SARS-CoV-2

Öz

Amaç: Koronavirüs hastalığı 2019 (COVID-19), spesifik olmayan karın şikayetleri ile karşımıza çıkabilir. Bu çalışmanın amacı, abdominal yakınmalarla başvuran hastalarda akciğer bazallerindeki bulgulara bakarak COVID-19 tanısı koymada abdomen BT'nin önemini vurgulamaktır.

Yöntemler: Çeşitli abdominal şikayetler nedeniyle abdominopelvik BT taraması yapılan 250 hastanın görüntüleri geriye dönük olarak değerlendirildi. Dahil etme kriterleri, başlangıçta solunum şikayetleri olmaksızın abdominal yakınma ile başvuran, akciğer bazallerinde COVID-19 şüpheli BT bulguları olan, ancak başvuru anında COVID-19 ön tanısı olmayan hastaları içerir. 240 hastanın BT görüntüleri çalışmaya dahil edildi.

Bulgular: 240 hastadan 12'sinde (8K, 4M; 30-69 yaş) akciğer bazallerinde şüpheli COVID-19 bulguları vardı. Başvuru şikayetleri iştahsızlık (n=5), karın ağrısı (n=7), ishal (n=7), bulantı (n=4), kusma (n=3) ve mide ağrısı (n=1) idi. Akciğer bazalleri tutulumunun dağılımı peribronkovasküler (%66,6), bilateral (%91,6), periferik (%91,6) veya multifokal (%58,3) olan buzlu cam opasiteleri (%100) idi. Vakalar laboratuvar testleri ile doğrulandı.

Sonuç: Bazı hastaların nonspesifik karın şikayetleri ile başvurduğu düşünülürse; abdominal BT'de akciğer bazallerinin tetkike dahil kısımlarında COVID-19' un tipik belirtilerini tespit etmek, zamanında tanı koymak, sağlık çalışanlarını korumak ve hastalığın yayılmasını azaltmak açısından çok önemlidir.

Anahtar kelimeler: Koronavirüs, Akciğer bazalleri, Abdomen BT, COVID-19, SARS-CoV-2

Introduction

The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), a new type of coronavirus, was initially identified in December 2019 in Wuhan City, China. World Health Organization (WHO) announced this disease as a global pandemic on March 11, 2020 with more than 118,000 confirmed cases in 114 countries, and 4,291 deaths [1]. Clinical diseases caused by SARS-CoV-2 infection are called coronavirus disease 2019 (COVID-19) [2].

COVID-19 may present with typical symptoms such as shortness of breath, cough, fever, while it may also present with nonspecific abdominal complaints such as nausea, vomiting and diarrhea. Of 204 patients, 50.5% of patients reported gastrointestinal (GI) symptoms on presentation in a study in China [3].

As of June 2, 2020, there were 6 million verified cases and 371,000 deaths worldwide. Global economic losses exceeded $2.7 trillion [2]. It is especially important for patients who present with extrapulmonary symptoms to be diagnosed early to provide treatment on time and prevent spread. In the recent weeks, some patients visited our hospital with various abdominal complaints, underwent abdominal multidetector computed tomography (MDCT) and had characteristic COVID-19 involvement of the lung bases without respiratory symptoms. They were subsequently confirmed positive for COVID-19. First indicators of disease were the lung base involvements detected on abdomen computed tomography (CT).

Abdominal radiologists should know that the disease may also occur with abdominal symptoms and pay attention to the lung bases included in the examination. The goal of this study is to emphasize the importance of detecting lung basis involvement on abdominal CT in patients admitted to hospital with abdominal complaints without known COVID-19 disease.

Materials and methods

Patients

We retrospectively analyzed the abdominal CT images of 250 patients who underwent abdominal MDCT screening in our radiology department due to varied abdominal complaints between July 1, 2020 and July 15, 2020. When patients with lung trauma were excluded, a total of 240 CTs remained. Inclusion criteria included patients presenting with primary abdominal complaints without respiratory symptoms, who had suspicious COVID-19 CT findings on lung basis. COVID-19 was not among the differential diagnoses of these patients at the time of admission. CT lung base findings, clinical characteristics including symptoms, laboratory findings, gender, and age were noted. Presence of ground-glass opacities (GGOs), consolidation, septal thickening, morphological round lesions, 'crazy paving' pattern, multifocal involvement, peripheral distribution, bilateral involvement, and pleural effusion were assessed on the bases of the lungs. We found 12 patients with unexpected lung base findings on abdominal CT who were suspicious for Covid-19. SARS-CoV-2 polymerase chain reaction (PCR) laboratory test was performed to confirm the diagnosis.

CT protocol

Patients were scanned with a CT scanner (Toshiba Aquilion (80x2), Otawara, Japan). MDCT was performed after 1-2 ml/kg iodinated nonionic contrast agent, with an iodine concentration of 300 mg/cc, was intravenously administered. CT images were obtained with the following parameters while the patient was holding breath: Slice thickness: 2 mm, tube voltage 120 kVp, reconstruction index: 1 mm, pitch: 0.75. Slices were extended from lung basis to the end of pelvis. From axial CT images, sagittal and coronal multiplanar reconstructed (MPR) images were obtained. All images were transferred to a picture archiving communication system (PACS) workstation and examined by an abdominal radiologist with 15 years of experience and a thoracic radiologist with 12 years of experience. Two radiologists made joint decisions for lung base CT findings.

Results

Patients

Twelve of 240 patients (8 females, 4 males) had suspicious findings of COVID-19 on lung bases. Their ages ranged between 30-69 (mean 54.5) years. The presenting complaints of the patients were abdominal pain (n=7), lack of appetite (n=5), diarrhea (n=7), vomiting (n=3), nausea (n=4) and gastric pain (n=1). None of the patients had fever or cough. The average time from symptom onset to abdominal CT was 6.6 days (range, 3-15 days). Three patients (25%) had underlying health conditions (1 lung cancer, 1 diabetes mellitus and 1 chronic renal disease).

Blood laboratory results

All patients had elevated serum C-reactive protein (CRP), lactic acid dehydrogenase (LDH) and ferritin levels. In addition, the Aspartate Aminotransferase (AST) levels of three patients (25%), Alanine transaminase (ALT) levels of two patients (16.6%), and the D-dimer levels of 9 patients (75%) were elevated. Hemoglobin was lower in 8 (66.6%) of the patients. Eleven (91.6%) patients had lymphopenia. Table 1 shows the interquartile and median ranges of selected blood laboratory values.

Table 1: Blood laboratory values

Parameter [normal range]	Value
C-reactive protein (CRP) [0–5.0 mg/L]	37.9 (16.9-99.8)
Lactic acid dehydrogenase (LDH) [135-225 U/L]	336 (241-631)
Aspartate aminotransferase (AST) [1–35 U/L]	32.25 (15-74)
Alanine transaminase (ALT) [1–45 U/L]	23.0 (5-77)
Procalcitonin [0–0.49 ng/mL]	0.15 (0.1-0.4)
D-dimer [0–0.5 μg/mL]	0.74 (0.38-1.64)
Ferritin (males) [30–400 ng/mL]	758.3 (411-2000)
Ferritin (females) [15–150 ng/mL]	826.3 (211-1145)
White blood cell count (WBC) [4.5–11.0 K/μL]	6.6 (3.2-10.7)
Lymphocyte % [20-52]	15.9 (9.5-19.5)
Hemoglobin (Hb) (males) [13.9–16.3 g/D]	11.8 (8.7-15.4)
Hemoglobin (Hb) (females) [11.7–15.0 g/DL]	9.65 (5.7-12.4)

Values are given as median with interquartile range in parentheses unless otherwise stated. Reference ranges are given below each laboratory value name in brackets.

Imaging results

GGOs (n=12, 100%) were the most common lung base involvement patterns on abdominal CT. They were mostly peribronchovascular (n=8, 66.6%) (Figure 1), bilateral (n=11, 91.6%), peripheral (n=11, 91.6%) (Figure 2, 3), or multifocal (n=7, 58.3%) (Figure 4) in distribution. Septal thickening was observed in 2 patients. None of the patients had pleural effusion, cavitation, solid nodules, or halo sign.
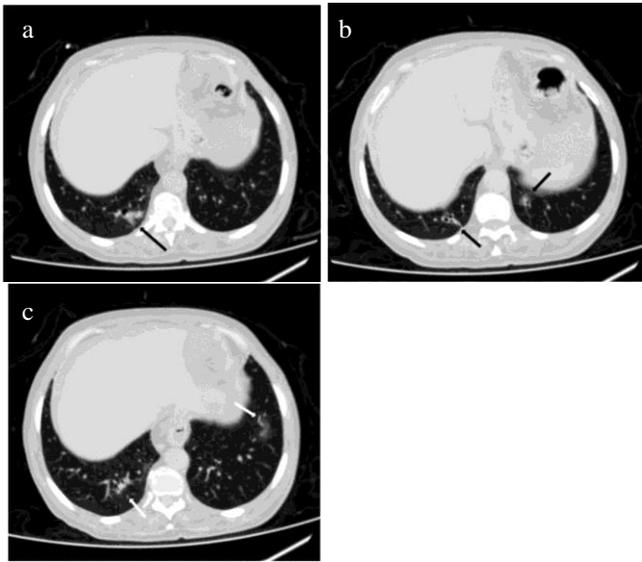
Figure 1: 69-year-old female patient who presented with lack of appetite, diarrhea, and abdominal pain. Axial abdominopelvic CT images with lung windows (a, b, c) demonstrate bilateral, peribronchovascular ground-glass nodules and opacities in lower lobes (arrows). After abdominal CT findings raised concern for COVID-19, the patient was found positive for coronavirus disease.
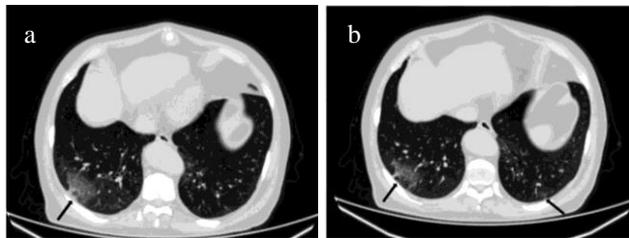

Figure 2: 47-year-old male patient who presented with lack of appetite and vomiting. Axial abdominopelvic CT images with lung windows (a, b) show bilateral, peripheral, ground-glass opacities in lung bases (arrows). The patient was found positive for coronavirus disease after abdominopelvic CT findings raised concern for COVID-19.
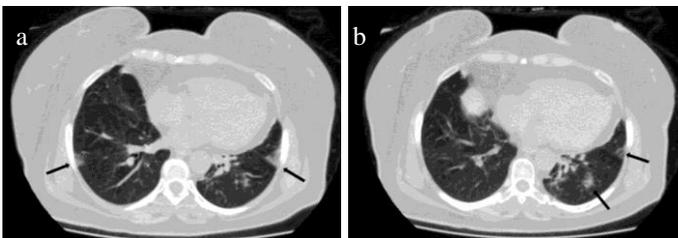

Figure 3: 61-year-old female patient who presented with nausea and gastric pain. Axial abdominopelvic CT images with lung windows (a, b) demonstrate bilateral peripheral located ground-glass opacities and nodules (arrows). After abdominal CT findings raised concern for COVID-19, the patient was found positive for coronavirus disease.
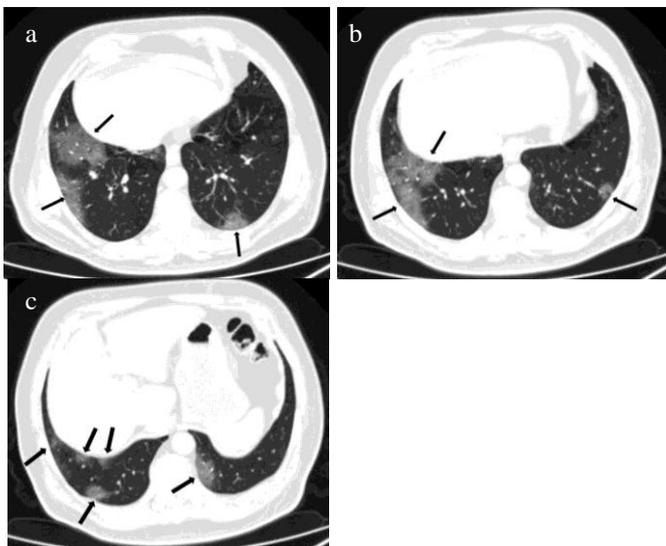

Figure 4: 63-year-old male patient who admitted with nausea, diarrhea, and abdominal pain. Axial abdominopelvic CT images with lung windows (a, b, c) show bilateral multifocal and peripheral distribution of ground-glass opacities and nodules (arrows). The patient was found positive for coronavirus disease after abdominopelvic CT findings raised concern for COVID-19.

SARS-CoV-2 PCR laboratory test was performed to confirm the diagnosis, and the results of eight patients came back positive at the first time. In the other 4 patients, the first tests were negative. Since the radiological findings were highly suspicious for SARS-CoV-2, the PCR test was repeated, and a positive result was confirmed in the second test.

All patients were hospitalized. Seven of these patients eventually developed respiratory symptoms such as dyspnea, cough, and fever. One patient with underlying lung cancer was admitted to the intensive care unit due to severe shortness of breath and hypoxia. He was intubated, but then lost. The remaining eleven patients were discharged after their symptoms regressed and their general condition improved. Median hospital stay (until death or discharge) was 8 days (4-20 days).

Chest CT was not performed on any patient simultaneously with abdominal CT. After abdominopelvic CT was performed, 10 patients underwent follow-up chest radiography, which confirmed the findings described on CT and showed regression of disease. Follow-up Chest CT was performed in only 2 patients after an average of 17 days. Follow-up CT showed progression in one and regression in the other patient. The patient with progression was intubated and died.

Discussion

The number COVID-19 diagnosed cases is increasing significantly. In the current global pandemic, typical symptoms of COVID-19 are well known, however, it may also present with nonspecific gastrointestinal symptoms. Early detection of the disease is the main challenge in patients with nonspecific abdominal complaints [4].

Early studies on COVID-19 reported that the rate of patients presenting with asymptomatic gastrointestinal complaints was low [5]. On the contrary, Pan et al. [3] evaluated 204 COVID-19 patients and reported that 50.5 % of patients presented with gastrointestinal symptoms as their chief complaint. Most common gastrointestinal symptoms included lack of appetite (78.6%), diarrhea (34%), vomiting (3.9%) and abdominal pain (1.9%).

To the best of our knowledge, there are very few studies reporting diagnosis of COVID-19 from unexpected lung base findings on abdominopelvic CT [2,4,6-9]. Most of these are case reports or case series [2,7-9]. King et al. [2] evaluated abdominal CT scans of 76 patients presenting with abdominal symptoms and found that the most common abdominal complaints were pain (83.9%) and nausea-vomiting-anorexia (46.8%). They also found CGOs (95.2%) in a peripheral (66.1%) and multifocal (95.2%) dispersion pattern on the lung bases in CT images. Dane et al. [6] reported 23 patients who underwent abdominopelvic CT for abdominal complaints, and according to CT lung base findings, COVID-19 was suspected. Abdominal pain was the most common complaint in 19 patients. COVID-19 PCR test was positive in 17 patients. CGOs were the most common lung base findings they found on abdominal CT.

The mechanism by which SARS-CoV-2 causes abdominal complaints is interesting. Probable causes include co-infection with another pathogen, direct viral infection of genitourinary and/or gastrointestinal tracts, or reflection of the pain from lung base infection [2, 10]. In humans, SARS-CoV-2

infection occurs according to the ability of the virus to bind to the angiotensin converting enzyme 2 (ACE2) receptor. It has much higher affinity than the 2003 coronavirus SARS-CoV [2,11,12]. ACE2 is released from the lung, gastrointestinal and genitourinary tracts (i.e. ileum, colon, upper esophagus, renal proximal tubules and urinary bladder) and provides a reasonable clarification for involvement in these areas [2,13,14]. Viral infection of enterocytes causes changes in intestinal permeability and can lead to various gastrointestinal symptoms such as abdominal pain, diarrhea, nausea, and vomiting [2,15].

Characteristic lung CT imaging features that have been widely described in COVID-19 are CGOs in the lung bases, peripheral distribution, rounded morphology, and basilar predominance. In case of more severe lung disease or longer infection duration, consolidative opacities may be seen [8,16-18]. Kim et al. [19] reported the sensitivity and specificity of chest CT as 94% and 37%, respectively, in their meta-analysis. The combination of consolidative opacities and GGOs are the most common CT findings, occurring in 88% of COVID-19 cases [20-22].

Limitations

Our study has some limitations. First, it is a retrospective study with a small sample size. This may cause bias and limit the generalizability or reliability of our results. Second, the follow-up period was not long. We believe that future studies should include larger patient populations and longer follow-up periods.

Conclusion

Considering that some patients present with nonspecific abdominal complaints, identifying the characteristic involvement of COVID-19 in the lung bases included on abdominal CT is important for early diagnosis, the protection of health professionals and in reducing the spread of disease. When examining abdominopelvic CT, radiologists should also evaluate lung bases included in the examination. If such findings are detected, they should promptly alert the referring clinician about COVID-19.

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