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Case Report

Lung point-of-care (POCUS) ultrasound in a pediatric COVID-19 case ☆☆☆★★★

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ABSTRACT

The World Health Organization categorized coronavirus disease 2019 (COVID-19) as a pandemic due to its high contagion rate and widespread infectivity in February 2020. In the United States, one of the public health concerns is the adequacy of resources to treat infected cases. We describe a case of a previously well, 9-year-old obese boy who presented to the emergency department with shortness of breath, fever, abdominal pain, and cough with chest pain. He was diagnosed with COVID-19 through significant family contact, confirmed by polymerase chain reaction and found to be at high risk of venous thromboembolism due to abnormal d-dimer. Lung point-of-care ultrasound (POCUS) in the emergency department observed significant lung pathology, including pleural thickening, consolidation, and B lines. A chest X-ray found bilateral ground glass opacities and interstitial prominences consistent with viral pneumonia. Our case suggests that lung POCUS can provide adequate and rapid imaging to assess lung pathology of COVID-19 in a pediatric patient. As there is limited literature on use of lung POCUS in pediatric patients infected with SARS-CoV-2, our case emphasizes its function as a potentially efficient modality in bedside assessment.

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Introduction

The World Health Organization categorized coronavirus disease 2019 (COVID-19) as a pandemic due to its high contagion rate and widespread infectivity in February 2020 [1]. In the US, one of the public health concerns is the adequacy of resources to treat infected cases [2]. This novel coronavirus, SARS-CoV-2, which originated in China's Hubei province, has caused global outbreaks through its spread via respiratory droplets or direct contact in asymptomatic and symptomatic humans [3]. The clinical manifestations of COVID-19 infection are varied based on population, with pediatric COVID-19 demonstrating a milder disease course and better prognosis than adults [4]. As of April 2020, 1.7% of laboratory confirmed cases of COVID-19 in the United States occurred in patients under the age of 18 [5]. The symptoms in pediatric cases include fatigue, fever, cough, myalgia, typically seen in acute respiratory infections, and, some gastrointestinal manifestations such as abdominal pain, nausea, vomiting, and diarrhea [6]. In addition to identifying possible COVID-19 positive contacts symptoms during the exam, chest imaging an important clinical criteria for diagnosing COVID-19 in pediatric cases [6]. Lung Point-of-care ultrasound (POCUS) is documented as an accurate diagnostic tool for pediatric pneumonia and potentially offers a fast and portable method of imaging for patients with COVID-19 [7–8]. To perform a lung POCUS, a linear or phased array transducer is placed in multiple locations on the ante-

rior, lateral, and posterior chest walls to ensure imaging of all lobes of each lung. This is typically done in a sliding technique to accomplish performance in a timely fashion. Specifically, the transducer is placed on the chest in a sagittal manner and the areas imaged are the anterior lung (transducer on the chest wall), lateral lung (transducer on the mid-axillary line of the chest), and posterior lung (placed on the back). Image video clips are saved with attention to the ribs, the pleural line, the subpleural space, and the lung parenchyma. The linear transducer allows enhanced imaging of the more superficial pleura. An abdominal transducer or phased array may be used to allow for visualization of deeper structures; because it allows deeper penetration into the chest and lung parenchyma it is useful in looking for pleural effusions above the diaphragms.

Case report

A previously healthy, morbidly obese, 9-year-old male initially complained of abdominal pain, nausea, vomiting, shortness of breath and cough with chest pain. The patient had a history of close contact with multiple family members who were positive for COVID-19, including the recent death of his grandfather due to the infection. His initial vital signs were: BP 128/70 P 101 T 100.6 F RR 22. He was found to be intermittently

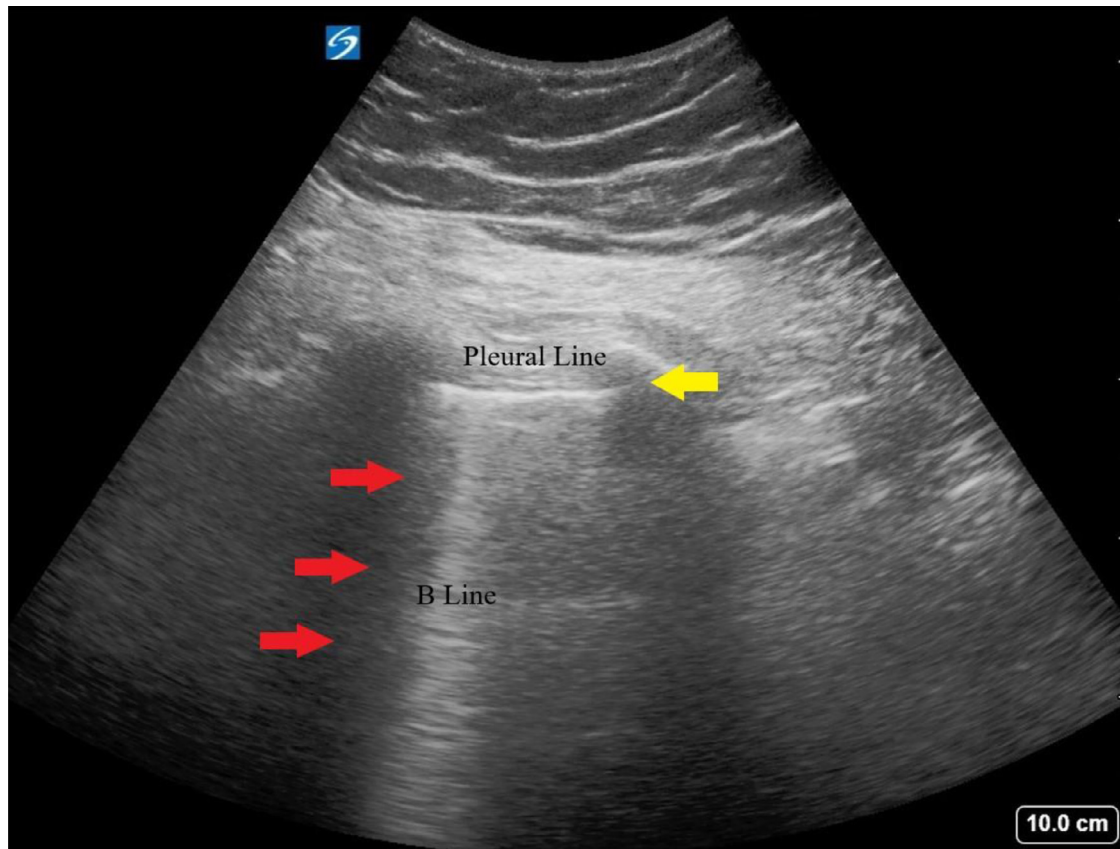


Fig. 1 – Still image of video of lung. B lines were present bilaterally in this patient (red arrow). Pleural line (yellow arrow) is also noted to be thicker than normal lung.

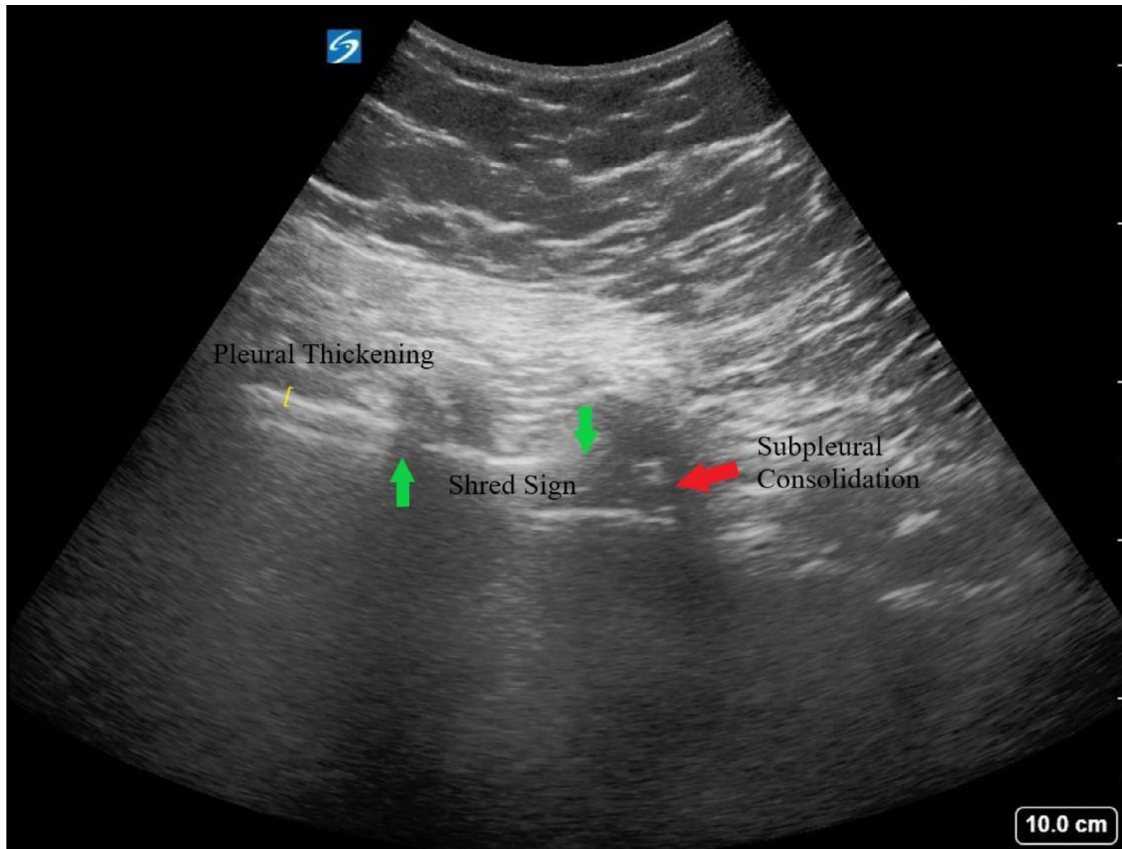


Fig. 2 – Re-demonstration of pleural thickening (yellow bracket). Shred sign is demonstrated in the right lung, indicating discontinuity in the pleural line (green arrows). A subpleural consolidation can be seen on this image (red arrow).

hypoxic with a SpO₂ as low as 71%. A physical exam revealed that the patient had a BMI of 43.93, and was uncomfortable though not ill-appearing. He had tender cervical adenopathy, dry mucous membranes, pale skin, and abdominal tenderness. A lung POCUS (Figs. 1–2) was concerning for thickening of pleural line, B lines, and consolidation. A CXR suggested multifocal or viral pneumonia, with patchy bilateral ground glass opacities and bilateral perihilar interstitial prominence. (Fig. 3) His WBC was 2.7 thou/cmm, with an absolute lymphocyte count of 0.7 thou/cmm. He was thrombocytopenic with a platelet count of 181 thou/cmm. His d-dimer was 1.01 ug/mL, which alongside his morbid obesity, increased his risk for pediatric venous thromboembolism. The presumed COVID-19 positive patient was admitted to the PICU for the possibility of worsening respiratory status.

The patient eventually had a positive SARS-CoV-2 polymerase chain reaction, IgG antibody test. He was managed with a 5-day course of remdesivir, supplemental oxygen via nasal cannula for hypoxia, enoxaparin due to increased risk for venous thromboembolism. Over the course of his 6-day hospital stay, his vitals and labs improved. He was able to tolerate oral intake, and was discharged home after resolution of hypoxia.

Discussion

Lung POCUS has emerged as a useful modality in diagnosing and monitoring the severity of COVID-19 lung involvement among adult patients [9–10]. Perhaps due to the limited number of reported pediatric cases in hospital settings, the use of lung POCUS in this patient population is not well documented. A previous report of lung POCUS in adult patients found a pattern of (1) thickened and/or irregular pleural lines, (2) isolated B lines, (3) subpleural consolidations, and (4) air bronchograms [11]. Notably, in our patient three of the four patterns were found: B lines, bilateral pleural thickening and right-sided consolidation. Current literature suggests that lung POCUS findings in children and adults with coronavirus lung pathology appear similar [12]. However, the comparison between these two population groups is limited. A case series on lung POCUS in presumed neonatal COVID-19 patients did not observe respiratory deterioration with the emergence of consolidation and coalescent B-lines, as has been reported in literature on adult cases [13–14]. Of note, the patient's obesity made it more challenging to obtain POCUS images so we used an abdominal transducer in place of the higher frequency

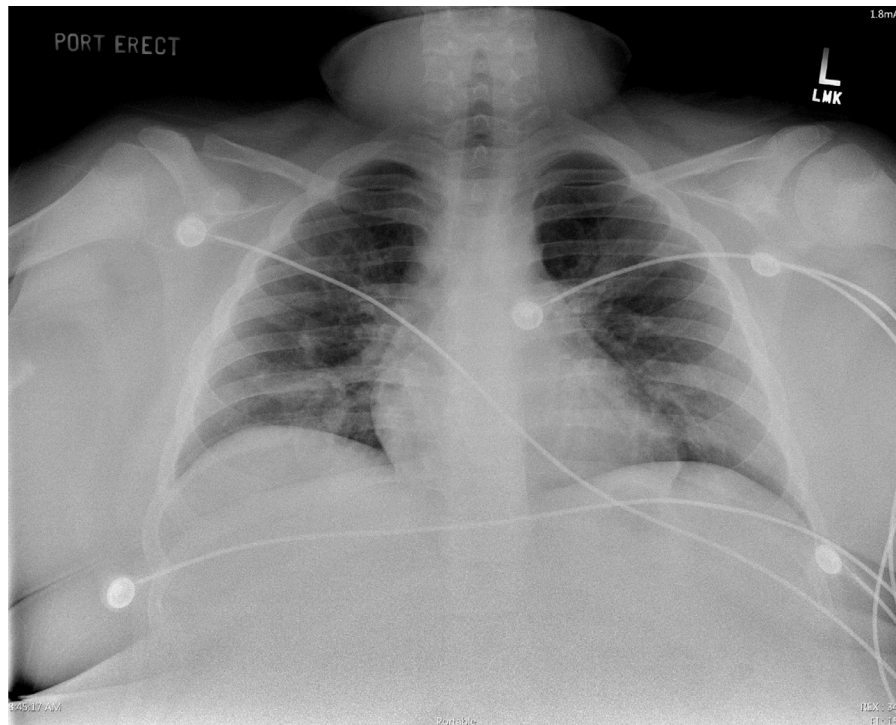


Fig. 3 – Chest X-ray. Patchy medial right basilar groundglass opacity. There is minimal patchy mixed interstitial and groundglass opacity in the left mid to lower lung. Bilateral perihilar and suprahilar interstitial prominence.

linear transducer. We were able to identify the structures, but the need for depth was vital in imaging. Although abdominal and phased array transducers allow deeper visualization, it becomes more difficult to see higher definition.

Despite the lung POCUS findings, our patient responded well to supplemental oxygen and did not require further imaging investigation during his hospital stay. The advantages of lung POCUS span beyond its function as a highly sensitive and specific technique to diagnose viral pneumonia. The lack of ionizing radiation exposure, lower cost, portability, and better patient cooperation makes it a desirable tool in the pediatric population [15]. Further research is needed to accurately correspond the lung POCUS findings to the disease course in pediatric patients suspected of SARS-CoV-2. As the COVID-19 pandemic has spread across both resource-poor and rich areas and placed stress on current healthcare infrastructure, finding alternative means of diagnosing and monitoring the disease has potential to improve management. This case highlights the need to expand the evidence surrounding the use of lung POCUS in pediatric patients with COVID-19, and also highlights the advantage of an efficient means of diagnosing and managing the infection.

Patient Consent

We confirm that written, informed consent for publication of this case was obtained from the patient.

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