

Chest Computed Tomography Presentation in Pediatric Patients with Covid-19

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Abstract: Background Coronavirus Disease 2019 (COVID-19) affects patients from all age groups but has been mainly described in adults. Due to the novel nature of the virus, there is a great deal of uncertainty surrounding the diagnosis and management of COVID-19 pneumonia in pediatric patients. Chest imaging plays an important role in evaluation of pediatric patients with COVID-19, however there is currently little information available describing imaging manifestations these patients. **Objective** To describe and emphasize the peculiarity of imaging features of COVID-19 in pediatric patients undergoing chest computed tomography (CT). **Materials and Methods** A total of 35 pediatric patients (younger than 16 years old) with laboratory-confirmed COVID-19 by real-time reverse transcriptase polymerase chain reaction (RT-PCR) were studied in a large tertiary-care hospital in Fez, Morocco between Mars 25, 2020 and June 10, 2020. All patients underwent chest CT within 2 to 3 days after the initial RT-PCR. The clinical presentation and CT findings were assessed and described. **Results** We included 35 children aging from 6 months to 16 years (mean age 7,8). All had a CT scan after 2 to 3 days of admission and had at least one control CT during their hospitalizations. Only 5 patients had abnormality features on the first CT scan in the form of patchy ground-glass opacities mostly; all normalized during treatment. **Conclusions** Pediatric patients tend to have milder to nonclinical symptoms, fewer positive or extensive involvement on CT imaging.

Keywords: Child, COVID-19, Computed tomography

Key Points:

- Pediatric patients had a low rate of positive CT findings
- The most common CT feature was ground glass opacities.
- All patients had normalized CTs after treatment

INTRODUCTION

The coronavirus disease 2019 (COVID-19) is a viral infection caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), a member of the β -coronavirus cluster of enveloped single-stranded RNA viruses. This “unknown viral pneumonia” was first reported on 31 December 2019, in Wuhan, China. [1, 2]. On 11 February 2020, the International Committee on Taxonomy of Viruses referred to a new coronavirus capable of infecting humans as SARS CoV-2 [3]. On the same day, the World Health Organization announced that the official name of the disease caused by this virus is COVID-19 [4]. Since then, cases have since spread worldwide, with significant numbers of cases occurring throughout Asia, Europe, and North America [5,6]. In Morocco, as of June 3, 2020, the total number of cases reached 7 922, with a total of 206 deaths [7].

The median age of affected patients is 47 years [8], with older men with comorbidities disproportionately more severely affected [9]. Pediatric patients account for approximately 2% of reported cases [10,11].

According to recently published literature, similar to previously reported coronavirus infections, the typical radiographic image of pulmonary involvement in COVID-19 is parenchymal destruction expressed as ground-glass opacities and consolidation [12]. It has been reported that the susceptible population to the virus is mainly older adults with low immunity, and there have been few reports of pediatric patients [13].

In the present study, we characterize the CT findings of 35 children from a large tertiary-care hospital in Fez, Morocco with laboratory-confirmed COVID-19. Our main goal is to present preliminary findings of chest CT abnormalities in children with proven COVID-19.

MATERIEL ET METHODE:

From March 25, 2020, to June 10, 2020, a total of 35 pediatric patients with COVID-19 underwent chest CT at the University Hospital Center HASSAN II in Fez, Morocco. All patients underwent a control CT during their hospitalizations to evaluate the progression of the disease. All patients had findings positive for COVID-19 via quantitative real-time reverse transcription–polymerase chain reaction (RT-PCR) testing of respiratory secretions obtained by use of a nasopharyngeal or oropharyngeal swab. All patients had the same treatment consisting of chloroquine 500mg/12h, Azithromycin 500 mg/24h, Vitamin C and zinc.

All Patients older than 16 years of age or those without chest CT scans were excluded. We did not review chest radiographs.

CT Image Review

Images were viewed on a PACS workstation. CT scans were reviewed on both standard mediastinal and lung windows in the axial plane and with multiplanar reformation. Chest CT scans of each of the 35 patients were evaluated for ground-glass opacities and consolidation,

which are characteristics that have been associated with COVID-19 in adult patients [14–17], and for more rare findings in adult patients, including pulmonary nodules, pleural effusions, lymphadenopathy, bronchiectasis, and linear atelectasis or fibrosis. The number of lobes affected, and the degree of lobe involvement were assessed. Disease severity was calculated based on the overall extent of disease in each lung. Each of the five lung lobes was assessed for degree of involvement, which was classified as none (0%), minimal (<10%), mild (10-25%), moderate (25-50%), severe (50-75%) or critical (>75%). All patients had follow-up chest CT scans obtained during the study period, and all such scans were assessed for degree of involvement.

TABLE 1: Characteristics of 05 Study Patients with abnormal CTs

Age (yo)	Gender	History	Presentation symptoms	Initial CT	Interval between initial and control CT	Control CT	Outcome
9	M	Atopy	Exposure to infected patient Asymptomatique	Ground glasse opacities Extend minimal	7 days	Normal	Asymptomatique

10	F	Atopy	Exposure to infected patient Asymptomatique	Ground glasse opacities Extend minimal	12 days	Normal	Asymptomatique
3	F	Asthma	Exposure to infected patient Asymptomatique	Ground glasse opacities Extend minimal	12 days	Normal	Asymptomatique
4	F	None	Exposure to infected patient Asymptomatique	Ground glasse opacities + consolidation Extend moderate	8 days	Normal	Asymptomatique
5	F	None	Exposure to infected patient Asymptomatique	Ground glasse opacities + consolidation Extend moderate	8 days	Normal	Asymptomatique

RESULTS

Patient Information

Thirty-Five children with positive rt-PCR were evaluated. All had a non-enhanced chest CT after admission. Patient age ranged from 6 months to 16 years old, with a median age of 7,8 years and a ratio of male patients to female patients of 1,19. Only Four of 35 patients had mild symptoms at the time of diagnosis, and all four patients had negative CT findings.

Clinical information

All patients were immunocompetent. Thirty of 35 patients had normal CTs (85%). Of those, only four patients had mild symptoms (13%). None of the patients with positive CT findings had clinical symptoms, but three of them had a context of atopy or asthma (60%). The most frequent clinical presentations were dry cough in 3 of the 4 symptomatic patients (8%), headache was present in 2 patients (6%), and fever in one (3%). The condition of all patients remained stable throughout hospitalization. No patients required supplemental oxygen, intubation, or ICU admission.

CT Findings:

Presence of abnormalities

Thirty of 35 patients (85%) had normal CT findings without ground-glass opacities or consolidation. Five of 35 patients (14%) had positive chest CT findings (Table 1), with ground glass opacities, consolidation, or both findings observed in at least one lobe.

Types of abnormalities

All five patients with CT abnormalities had ground-glass opacities (100%). Of the five patients, three (60%) had ground-glass opacities only (with no consolidation), no patients had consolidation in the absence of ground-glass opacities, and two (40%) had both ground-glass opacification and consolidation. These last two patients had both moderate extend of lesions. A crazy paving pattern was identified in one patient (29%) (Figs. 1). 4 patients (86%) had findings with a peripheral lung distribution against one with central distribution. Findings that were absent in all patients included lymphadenopathy, pleural effusions, pulmonary nodularity, and fibrosis.

Extent of abnormalities

Three patients had unilateral disease, and two patients (71%) had bilateral disease. Two patients had a moderate extend of lesions (ranging from 25-50%), and the other three had minimal extend (<10%).

DISCUSSION:

Although the imaging literature in pediatric patients isn't much present, overall pediatric patients tend to demonstrate milder imaging findings compared to adults. A study evaluating CT findings in 98 COVID-19 positive patients across multiple age groups found that pediatric patients (< 18 years old) had a lower total number of pulmonary lesions and smaller size of pulmonary lesions compared with adults.[18] Similarly, a comparison study of CT findings in 14 pediatric patients compared with 47 adults, found that the pediatric patients had significantly lower rate of positive CT findings, lower number of pulmonary lobes involved and lower overall semi-quantitative lung score.[19]

We had similar findings in our study, since 85% of our patients had normal CT scans even if symptomatic. Only 15% showed some minor CT abnormality, characterized mostly by ground glass opacities, and when consolidative opacities were identified, the extend of lesions was moderate and they were always accompanied by a ground-glass opacity.

The distribution of abnormalities in our cohort suggests a predominant pattern of disease. three patients in five had unilateral lung involvement, four patients in five had a peripheral distribution of lesions, and 4 of five patients showed involvement most commonly in the lower lobes. These imaging findings suggest that COVID- 19 may appear predominantly as ground-glass opacities in a unilateral, peripheral, and lower-lobe distribution in the pediatric population. These results concord partially with a cohort study showing that ground glass opacities are more bilateral in children, but still occur on peripheral lower lobe. [20]

Contrarily to previous studies showing that the "halo" sign, which describes a focal consolidation with a rim of surrounding ground-glass opacity, has been reported in up to 50% of pediatric population [21] we didn't have any CT with similar findings.

Our rate of negative CT findings (85%) is significantly higher than that in previous reports of COVID-19 in the adult population (8–14%) [14-15,19]. These findings are consistent with those of Streinberger and al. [20] that found that 77% of CTs in pediatric population were negative. It is also consistent with the findings of Chen et al. [19], who found that compared with findings in the adult population, CT findings in the pediatric population are more often negative and, when positive, show less extensive disease.

The low incidence of CT scans with positive findings and the low severity of disease on CT in pediatric patients in our study can be considered when comparing the benefits and limitations of CT in the evaluation of COVID-19 in the pediatric population. However, CT imaging may be necessary in case of suspected complications of COVID-19, such as other superimposed infections or pulmonary emboli, which are non-existent in our study.

CONCLUSION:

Our investigation reveals a high frequency of negative chest CT findings among pediatric patients with COVID-19, with less severe extend in comparison with previously reported adult populations. It also suggests that unilateral, lower lobe–predominant ground-glass opacities are the most common CT findings. These observations should be heavily weighted when balancing the risk-benefit ratio for using chest CT in the pediatric population with COVID-19.

CONFLICT OF INTEREST: none

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