



CHEST RADIOGRAPHIC FINDINGS IN PEDIATRIC HOSPITALIZED PATIENTS WITH COVID-19 INFECTION

Radiology

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ABSTRACT

Background: This study aims to evaluate the COVID-19 related chest radiographic findings in hospitalised paediatric patients in tertiary care hospital.

Method: In this retrospective study, we included 52 RT-PCR COVID-19 positive hospitalized paediatric patients who presented with moderate to severe COVID-19 related symptoms or patients admitted in medical/surgical wards and found to be RT PCR positive during screening process as per our hospital policy.

Results: Only Consolidation was seen in 8 (22.3%) patients. Interstitial markings and peribronchial thickening without consolidation was seen in 12 (33.3%) patients. Consolidation with interstitial markings were seen in 16 (44.4%) patients. Most common distribution pattern of consolidation/interstitial markings was central seen in 24 (66.7%) patients followed by mixed (peripheral and central) seen in 8(22.3%) patients and peripheral in 4 (11%) patient. Pleural effusion was present in 4(11%) patient. Pneumothorax was present in 2(5.5%) patient.

Conclusion: Imaging findings of COVID-19 pneumonia have been less studied in paediatric population due to its asymptomatic/mild clinical presentation and poor sensitivity of RTPCR test in detecting COVID-19 infection. We found central and mixed chest radiographic pattern as most common abnormal pattern in paediatric population which is in contrast to the peripheral pattern seen in adult population.

KEYWORDS

COVID-19 pneumonia, Paediatric patients, Chest radiograph.

INTRODUCTION:

On 31st December 2019, the WHO China Country Office was informed of a pneumonia of unknown cause, detected in the city of wuhan, China(1). On 11th February 2020, the International Committee on Taxonomy of Viruses (ICTV), named this novel coronavirus "severe acute respiratory syndrome coronavirus 2"(SARS-CoV-2)(2). On the same day, the World Health Organization (WHO) declared the disease caused by this novel virus as COVID-19(3). Upon spreading all over the world, on Mar 11, 2020, COVID-19 disease was accepted as a pandemic disease by WHO(4).

COVID-19 pneumonia in adult population has been studied thoroughly and the imaging guidelines and findings have been extensively published. However, in paediatric population there are no clear imaging guidelines/imaging findings due to its asymptomatic/mild clinical presentation and poor sensitivity of RTPCR test in detecting COVID-19 infection. The incidence in children has been reported as 1.7–2.4% in the literature (5–7). Most of the paediatric cases are mild to moderate but a significant proportion of the paediatric patients has been observed to develop multi-system inflammatory syndrome related to coronavirus (MIS-C)(8). Since MIS-C is a new entity related to COVID-19 infection and due to its nonspecific and variable presentation, imaging has a pivotal role in its evaluation.

Chest CT is the important investigation for COVID-19 pneumonia diagnosis in adult population. However, to protect from radiation, chest radiograph is the first preferred imaging method in pediatric patients who are clinically considered to have COVID-19 pneumonia (5). In our study, we aim to evaluate the chest radiographic findings of COVID pneumonia in hospitalised paediatric patients.

MATERIALS AND METHODS:

The study was done in department of radiology, JK lone, paediatric hospital of SMS medical college, Jaipur, Rajasthan(India). In this retrospective study we included 52 RT-PCR COVID-19 positive hospitalized patients who presented with moderate to severe COVID-19 related symptoms or medical/surgical ward admitted patients who were found to be RT PCR positive during screening process as per our hospital policy. The records were analyzed from 25 April to 10th may 2021(15 days). Chest radiographs were performed on portable

radiograph machines.

Radiographic features were assessed in terms of type of abnormality and distribution in the lung fields. Two main categories were created: interstitial septal thickening and consolidations. Distribution was considered in terms of peripheral, central and mixed (both peripheral and central). Central distribution was considered if the hilar regions were involved with or without extension to middle third of the lung. Peripheral distribution meant distribution predominantly in peripheral third of the lung. Additional findings considered were pleural effusion and pneumothorax. Descriptive analysis was performed for each variable using frequency tables.

RESULTS:

Among 52 children, 36 (69.2%) were male and 16 (30.8%) were female. Majority of the patients were in 1-5 year age group (n= 24, 46.2%) followed by < 1 year age group (n= 16, 30.8%), 6-10 year age group (n= 8, 15.4%) and 11-18 year age group (n=4, 7.6%). (Table 1)

Chest radiographs were normal in 16 (30.8%) out of 52 patients. Chest radiograph abnormalities were unilateral in 12 (33.3%) and bilateral in 24 (66.7%) patients. Unilateral abnormalities were observed only on right side (Figure 3). Most commonly affected areas were right upper and right middle zones. The right upper zone was affected in 32 (88.9%), right middle zone in 32 (88.9 percent), right lower zone in 28 (77.8%), left upper zone in 24 (66.7%), left middle zone in 20 (55.6%) and left lower zone in 8 (22.2%). Consolidation was seen in 8 (22.3%) patients. Interstitial markings and peribronchial thickening without consolidation was seen in 12 (33.3%) patients (Figure 2). Consolidation with interstitial markings were seen in 16 (44.4%) patients (Figure 4). Most common distribution pattern of consolidation/interstitial markings was central seen in 24(66.7%) patients followed by mixed (peripheral and central) seen in 8(22.3%) patients and peripheral in 4 (11%) patients. Pleural effusion was present in 4(11%) patient. Pneumothorax was present in 2(5.5%) patient (Figure 1). (Table 2)

Table 1: Age and gender distribution in study population

S.NO.		N (%)
1	TOTAL NUMBER OF PATIENTS	52

2	GENDER	
	MALE	36(69.2%)
	FEMALE	16(30.8%)
3	AGE	
	LESS THAN 1 YEAR	16(30.8%)
	1-5 YEAR	24(46.2%)
	6-10 YEAR	8(15.4%)
	11-18 YEAR	4(7.6%)

Table 2: Chest radiographic findings of COVID-19 pneumonia in hospitalized paediatric patients

S.NO			NO OF PATIENTS(% OF PATIENTS)
1	CHEST RADIOGRAPH ABNORMALITY	PRESENT	36(69.2%)
		ABSENT	16(30.8%)
2	AFFECTED LUNG SIDE	RIGHT	12(33.3%)
		LEFT	0(0%)
		BOTH	24(66.7%)
3	AFFECTED LUNG ZONE	RUZ	32(88.9%)
		RMZ	32(88.9%)
		RLZ	28(77.8%)
		LUZ	24(66.7%)
		LMZ	20(55.6%)
		LLZ	8(22.2%)
4	DISTRIBUTION PATTERN	PERIPHERAL	4(11%)
		CENTRAL	24(66.7%)
		MIXED	8(22.3%)
5	ABNORMALITY PATTERN	ONLY CONSOLIDATION	8(22.3%)
		ONLY INTERSTITIAL MARKINGS AND PERIBROCHIAL THICKENING	12(33.3%)
		BOTH CONSOLIDATION AND INTERSTITIAL MARKINGS	16(44.4%)
6	ASSOCIATED OTHER ABNORMALITIES	PLEURAL EFFUSION	4(11%)
		PNEUMOTHORAX	2 (5.5%)



Figure 1: Chest Radiograph of COVID-19 positive 6 month old male child showing predominantly bilateral perihilar increased interstitial markings (black arrows). Pneumothorax is seen on the right side (white arrow) with intercostal drainage tube in situ (blue arrow).



Figure 2: Chest Radiograph of COVID-19 positive 9 month old male infant showing bilateral perihilar (central distribution) increased interstitial markings (black arrows).



Figure 3: Chest Radiograph of COVID-19 positive 7 month old male infant showing unilateral (right sided) perihilar consolidation (black arrows).



Figure 4: Chest Radiograph of COVID-19 positive 6 yr old female child showing consolidations with increased interstitial markings (black arrows) in bilateral perihilar distribution.

DISCUSSION:

In an attempt to enumerate radiographic findings of COVID-19 pneumonia in paediatric population, we retrospectively analysed 52 hospitalised patients in a tertiary hospital who were found to be RT-PCR COVID-19 positive. Majority (77%) of the patients were in less than 5 years age group in our study. Many other studies have reported similar most commonly affected age group among children (9–12). Gender distribution was towards male predominance in our study (M:F=2:1). Associated comorbidities seen in our patients were chronic kidney disease, leukaemia and tubercular meningitis with VP shunt.

Chest radiographic abnormalities were present in majority of the patients (69.2%) on initial presentation. These findings are in concordance with studies done by Ilundain López et al and Oterino

Serrano et al (8, 9). In our study bilateral (66.7%) involvement was more common compared to the unilateral involvement on chest radiograph. This is in discordance with the study done by Palabiyik F et al (5), who found unilateral increase in density as a most common chest radiograph finding in paediatric COVID-19 pneumonia. Ilundain López et al and Oterino Serrano et al concluded that bilateral chest radiograph abnormalities were more common compared to the unilateral which is in concordance with our study (8,9).

Consolidation with interstitial markings was most common abnormality pattern (44.4%) in our study followed by interstitial markings and peribronchial thickening without consolidation (33.3%). Oterino Serrano et al described peribronchial cuffing and ground-glass opacities as most common findings(9). Ilundain López et al found bilateral diffuse interstitial pattern as most common abnormal pattern(8).

In our study most common chest radiographic distribution pattern of consolidation/interstitial markings was central followed by mixed (peripheral and central) which is in concordance with the study done by Oterino Serrano et al (9). Mixed pattern was also most common distribution pattern in paediatric chest CT in a study done by Palabiyik F et al (5). In Adults most common described chest radiograph distribution pattern is peripheral. Possible explanation for central distribution pattern in paediatric patients may be due to cardiogenic pulmonary oedema secondary to myocarditis component of MIS-C.

Additional uncommon chest radiograph findings in paediatric COVID-19 patients were pleural effusion and pneumothorax. Pneumothorax was seen in intubated patients; hence the cause can be attributed to complication of mechanical ventilation.

Limitations:

Our study has a small sample size. More elaborate studies are required to further validate our results. Further, chest radiographs are less sensitive compared to CT; therefore, several findings must have been underestimated.

CONCLUSION:

Imaging findings of COVID-19 pneumonia have been less studied in paediatric population due to low incidence and its asymptomatic/mild clinical presentation. We found central/mixed chest radiographic pattern as most common abnormal pattern in paediatric population which is in contrast to the peripheral pattern seen in adult population.

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