ORIGINAL ARTICLE

Lung computed tomography patterns of a cluster of asymptomatic young males with COVID-19 admitted to a teaching hospital in Kuala Lumpur

Boon Hau Ng, MMED[1], Nik Nuratiqah Nik Abeed, MMED[1], Andrea Ban Yu-Lin, MMED[1], Mohamed Faisal Abdul Hamid, MMED[1], Chun Ian Soo, MRCP[1], Najma Kori, MMED[2], Shahizon Azura Mohamed Mukari, MRAD[3], Isa Azzaki Zainal, MRAD[3], Lydia Kamaruzaman, MMED[4], Muhammad Yusuf Abu Shamsi, MMED[4], Halim Gafor, MMED[4], Norlaila Mustafa, MMED[5], Wan Nur Nafisah Wan Yahya, MMED[6], Shahrul Azmin, MMED[6], Khoo Ching Soong, MRCP[6], Hemalatha Munusamy, MD[1], Zhen Hao Ching, MD[1], Hsueh Jing Low, MMED[7], Petrick Periyasamy, MMED[2]

[1]Pulmonology Unit, Department of Internal Medicine, Faculty of Medicine, Universiti Kebangsaan Malaysia Medical Centre, Kuala Lumpur Malaysia, [2]Infectious Diseases Unit, Department of Internal Medicine, Faculty of Medicine, Universiti Kebangsaan Malaysia Medical Centre, Kuala Lumpur Malaysia, [3]Department of Radiology, Faculty of Medicine, Universiti Kebangsaan Malaysia Medical Centre, Kuala Lumpur Malaysia, [4]Nephrology Unit, Department of Internal Medicine, Faculty of Medicine, Universiti Kebangsaan Malaysia Medical Centre, Kuala Lumpur Malaysia, [5]Endocrine Unit, Department of Internal Medicine, Faculty of Medicine, Universiti Kebangsaan Malaysia Medical Centre, Kuala Lumpur Malaysia, [6]Neurology Unit, Department of Internal Medicine, Faculty of Medicine, Universiti Kebangsaan Malaysia Medical Centre, Kuala Lumpur Malaysia, [7]Department of Anaesthesiology and critical care, Faculty of Medicine, Universiti Kebangsaan Malaysia Medical Centre, Kuala Lumpur, Malaysia

ABSTRACT

Background and objective: Coronavirus Disease 2019 (COVID-19) was first reported in Malaysia in March 2020. We describe here the clinical characteristics and computed tomography (CT) patterns in asymptomatic young patients who had laboratory-confirmed COVID-19.

Methods: This is a retrospective observational study where 25 male in-patients with laboratory-confirmed COVID-19 in Hospital Canselor Tuanku Muhriz. Demographics, clinical data and CT images of these patients were reviewed by 2 senior radiologists.

Results: In total there were 25 patients (all males; mean age [±SD], 21.64±2.40 years; range, 18-27 years). Patients with abnormal chest CT showed a relatively low normal absolute lymphocytes count (median: 2.2 x 109/L) and absolute monocyte count (median: 0.5 x 109/L). Lactate dehydrogenase was elevated in 5 (20%) of the patients. The procalcitonin level was normal while elevated levels of alanine aminotransferase, total bilirubin, platelet and C-reactive protein were common. Baseline chest CT showed abnormalities in 6 patients. The distribution of the lesions were; upper lobe 3 (12%) lower lobe 3 (12%) with peripheral distribution 4 (16%). Of the 25 patients included, 4 (16%) had ground glass opacification (GGO), 1 (4%) had a small peripheral subpleural nodule, and 1 (4%) had a dense solitary granuloma. Four patients had typical CT features of COVID-19.

Conclusion: We found that the CT imaging showed peripheral GGO in our patients. They remained clinically stable with no deterioration of their respiratory symptoms suggesting stability in lung involvement. We postulate that rapid changes in CT imaging may not be present in young, asymptomatic, non-smoking COVID-19 patients. Thus the use of CT thorax for early diagnosis may be reserved for patients in the older age groups, and not in younger patients.

KEY WORDS:
COVID-19, SARS-CoV-2, pneumonia, computed tomography, ground-glass opacification

INTRODUCTION

COVID-19 is caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and was first reported in Wuhan, Hubei China.[1] COVID-19 was first detected in Malaysia on the 25th of January 2020 in travellers returning from China. The largest Malaysian cluster was linked to the "Tabligh Jamaah" (religious gathering) in a suburb of Kuala Lumpur in March 2020.

SARS-CoV-2 is a betacoronavirus belonging to the family Coronaviridae of the order Nidovirales.[2] Six coronavirus species (SARS-CoV, MERS-CoV, NL63, OC43, 229E, HKU1) have been identified to have the ability to infect and cause disease in humans. Among them, severe acute respiratory syndrome coronavirus (SARS-CoV) and Middle East respiratory syndrome coronavirus (MERS-CoV), have been reported to cause fatal respiratory failure.[3]

The commonest symptoms of COVID-19 are fever and cough.[4] Approximately 5% of patients can progress to critical disease with acute respiratory distress syndrome, septic shock, myocarditis, multiple organ dysfunctions and high levels serum SARS-CoV-2 nucleic acid.[5] Initial CT features of COVID-19 reported were bilateral multilobar ground glass opacification (GGO) with a

Corresponding Author: Andrea Ban Yu-Lin
Email: andreaban@gmail.com

Table I: Demographics and baseline characteristics of the 25 male inpatients with laboratory-confirmed COVID-19

Parameter	N=25
Age	21.64 (2.40)
Gender – Male	25 (100%)
Temperature (°C)	36.9 (0.38)
SpO_2 (range > 95%)	98.4 (1.32)
Heart rate (beats per minute)	81.88 (13.54)
Systolic blood pressure (mmHg)	129.2 (13.33)
Diastolic blood pressure (mmHg)	75.56 (11.53)
Source of infection	In community (close contact)
Mean time between the positive COVID-19 RT-PCR and the CT scan	13 days

Note. – Data is in Mean (SD) or number (%).

Table II: Laboratory characteristic of the 25 male inpatients with laboratory-confirmed COVID-19

Biochemical Parameter	Range	N=25
Absolute Lymphocytes Count (ALC)	1.0-3.0x10^9/L	2.45 ±0.66
Increased		5 (20%), 3.4±0.2
Absolute Monocytes Count (AMC)	0.2-1.0x10^9/L	0.61 ±0.16
Increased		1 (4%), 1.1±0.0
Absolute Neutrophil Count (ANC)	2.0-7.0x10^9/L	5.42 ±2.15
Increased		5 (20%), 8.8±1.0
Decreased		1 (4%), 1.8±0.0
Total White Blood Cells (TWBC)	4.0-10.0x10^9/L	8.70 ±2.21
Increased		7 (28%), 11.3±1.4
Platelet	150-410x10^9/L	315.68±93.40
Increased		2 (8%), 561.5±54.4
Decreased		1 (4%), 126 ± 0.0
Albumin	35-50g/L	45.84±2.19
Alanine Aminotransferase (ALT)	0-55U/L	32.12 ±21.77
Increased		3 (12%), 77.0 ± 29.7
Alkaline Phosphatase (ALP)	40-150U/L	83.8 ±16.3
Total Bilirubin	3.4-20.5µmol/L	13.0 ±8.85
Increased		3 (12%), 32.9±6.2
Lactate Dehydrogenase (LDH)	125-220U/L	205.08±46.02
Increased		5 (20%), 287.6±32.0
Urea Nitrogen	3.2-7.4mmol/L	3.92 ±0.62
Decreased		4 (16%), 2.8±0.3
Serum Creatinine	63.6-110.5µmol/L	88.26±9.06
Urine Albumin to Creatinine (ACR) Ratio	< 2.5 mg/mmol creatinine	0.75 ±0.60
C-reactive Protein (CRP)	<0.5mg/dL	0.14 ±0.16
Increased		1 (4%), 0.69±0.0
Procalcitonin (PCT)	<0.05ng/mL	0.03 ±0.01

peripheral or posterior distribution, affecting mainly the lower lobes and less frequently the right middle lobe.[6]

Chest radiograph has a lower sensitivity to detect subtle opacities. Thus, chest computed tomogram (CT) is considered an important tool to detect lung abnormalities in COVID-19 disease which allows for early treatment.[7] Because of the primary involvement of the respiratory system, chest CT is recommended in suspected COVID-19 cases, for both initial evaluation and follow-up. However, the reported findings on lung involvement in asymptomatic young COVID-19 patients are scarce. We present here findings on the clinical characteristics and chest CT in a cohort of young asymptomatic COVID-19 patients.

METHODS

Study participants and design

This is a retrospective observational study of asymptomatic adult inpatients (aged 18 to 27 years) with laboratory-confirmed COVID-19 infection by real-time reverse transcriptase polymerase chain reaction (RT-PCR) and who underwent non-contrast enhanced chest CT. All patients stayed in a religious school. They were screened by the public health authorities because one of their teachers tested positive for COVID-19.

This study was approved by the ethics committee of the University Kebangsaan Malaysia Medical Centre.

Data collection

Clinical records, laboratory results, and non-contrasted chest CT scans were retrospectively reviewed. Asymptomatic confirmed cases of COVID-19 were defined as those with a positive result on RT-PCR assay of nasopharyngeal swab specimens according to the WHO.[8] Disease onset was defined as the day of onset of symptoms or the first detection of RT-PCR for SARS-CoV-2 for asymptomatic patients.

CT images acquisition

CT images were done with the patient in the supine position during full inspiration without intravenous contrast medium on single CT scanner (Toshiba Aquilion 640 slices). The

Table III: Findings of the chest CT of the 25 male inpatients with laboratory-confirmed COVID-19

Chest CT findings	Number of patients (%)
Distribution characteristic	
Central	1 (4)
Peripheral	4(16)
Central and Peripheral	1 (4)
Lobe of the lesion distribution	
Right upper lobe	2 (8)
Right middle lobe	0
Right lower lobe	1 (4)
Left upper lobe	1 (4)
Left lower lobe	2 (8)
Patterns of the lesion	
Ground glass opacification	4 (16)
Consolidation	0
Nodular	2 (8)
Reverse halo sign	0
Perilobular density	0
Crazy paving	0
Other signs in the lesion	
Cavitation	0
Segmental or lobar consolidation without GGO	0
Centrilobular nodule/tree in bud	0
Smooth interlobular septal thickening with pleural effusion	0

detailed parameters for CT acquisition were as follows: reconstructed at 1.0mm slice thickness, with 1mm increment, and a sharp reconstruction kernel.

Image interpretation

CT images were analysed by two senior radiologists with good experience in interpreting chest CT images. The CT images were assessed independently using both axial and multiplanar reconstruction images and a decision was made by consensus. Detailed analysis and evaluation of the imaging were based on the following four criteria: (i) the distribution characteristic of the lesion, (ii) the lobe of the lesion distribution, (iii) the patterns of the lesion, and (iv) other signs in the lesion. The distribution of the lesions were classified into periphery, central, or peripheral and central zones simultaneously. The outer one-third of the lung was defined as peripheral and other lesions were considered as central. The lung lobe distribution of the lesions included the right upper lobe, the right middle lobe, the right lower lobe, the left upper lobe, and the left lower lobe. Patterns of the lesion were divided into GGO (hazy increase in lung attenuation with no obscuration of the underlying vessels), crazy paving (GGO with interlobular septal thickening or reticulation), reverse halo sign, consolidation (opacification with obscuration of bronchial structures and pulmonary vessels), perilobular density, and nodular. We also assessed other signs in the lesion which included cavitation, segmental or lobar consolidation without GGO, centrilobular nodule or tree-in-bud, and smooth interlobular septal thickening with pleural effusion.

Statistical analysis

Continuous data was presented as mean (SD), and the categorical variable was expressed as frequency (%) if the data were normally distributed. The non-normally distributed data were expressed as median with Interquartile Range (IQR) values. The T-test and Mann-Whitney U test was used to calculate the mean and median, respectively. All statistical analyses were performed using SPSS (Statistical Package for the Social Sciences) Statistics version 24.0 software.

RESULTS

Demographic, clinical and laboratory characteristics

All the 25 patients had a positive contact with a COVID-19 patient. The mean age was 21.64±2.40 years old, and all were males. None of the patients had comorbidities, and none of them were smokers. The demographic data and the clinical characteristic of all patients are shown in Table I. On admission, 5 (20%) and 1 (4%) patients had lymphocytosis and monocytosis respectively. Subgroup analysis of patients with abnormal CT chest, showed a relatively low normal absolute lymphocytes count (median: $2.2x10^9$/L) and absolute monocytes count (median: $0.5x10^9$/L). Lactate dehydrogenase was elevated in 5 (20%) of these patients. The procalcitonin level was normal and elevated levels of alanine aminotransferase, total bilirubin, platelet and C-reactive protein were common (Table II). All patients were discharged well after a mean hospitalised period of 10.36±0.69 days (range 10-12 days).

Imaging findings

The median interval between detection of COVID-19 RT-PCR and CT examination was 13 days. Baseline chest CT showed abnormalities in 6 patients. Lesions involved were the upper lobe 3 (12%) and the lower lobes 3 (12%) with peripheral distribution 4 (16%). Of the 25 patients included, 4 (16%) had GGO, 1 (4%) had a small peripheral subpleural nodule, and 1 (4%) had dense solitary granuloma (Table III). Four patients had typical CT features of COVID-19.

DISCUSSION

COVID-19 affects mainly individuals between the ages of 30–79 years.[9,10] In our study, the affected patients were relatively young with the mean age of 21.64 years old. The reported

abnormal laboratory findings that were suggestive of COVID-19 infection included lymphopenia, neutrophilia, eosinopenia, elevated lactate dehydrogenase (LDH), elevated alanine aminotransferase (ALT), elevated aspartate aminotransferase (AST), elevated D-dimer, prolonged prothrombin time (PT), elevated C-reactive protein (CRP), and elevated troponin.[9,11] In our study, laboratory tests showed lymphocytosis and monocytosis which were inconsistent with the reported cases. In the subgroup analysis of patients with abnormal CT chest, we found a relatively low normal absolute lymphocytes count (median: $2.2x10^9$/L) and absolute monocytes count (median: $0.5x10^9$/L). Overall, elevated levels of LDH, ALT, total bilirubin, CRP were common.

All 25 patients remained asymptomatic before and throughout their hospitalisation. These findings indicate that even in the absence of clinical symptoms, active screening with isolation should be considered for young persons with a clear history of exposure to SARS-CoV-2. Similarly, patients with symptoms without a known history of exposure or close contact with the laboratory-confirmed COVID-19 should also undergo further workup.

Characteristics of CT of COVID-19 patients show different manifestations at different stages of the disease, which ranges from single or GGO at the early stages of the disease to consolidation and crazy paving in the later stages.[12,13] Younger patients tend to have more GGO on chest CT compared to the older age group.14 In this study, the GGO with peripheral distribution was common in patients with abnormal chest CT, and this was consistent with reports thus far.[15-17] The peripheral distribution of the lung lesion may be due to the coronavirus mainly affecting the terminal bronchioles and lung parenchyma around the respiratory bronchioles.18 The GGO in our patients involved mainly unilateral upper or lower lobes. The unilateral involvement of the lung is more common than multifocal involvement showing that SARS-CoV-2 shares similar imaging features of SARS-CoV and MERS-CoV infection.[19,20] No patients had centrilobular nodules, cavitation, pleural effusion, and lymphadenopathy.

Although the patients in our cohort were asymptomatic with normal chest X-rays, they still had subclinical CT features of pneumonia. We postulate here that the low number of CT chest changes in our patients was possibly explained by delayed CT from the time of detection of SARS-CoV-2 real-time PCR. Our patients had their CT scan done on day-13 of their illness. Another postulation is that the COVID-19 has weak virulence, resulting in lighter imaging signs in these young patients.[21] Therefore, chest CT is important to complement clinical symptoms and laboratory parameters in the treatment of COVID-19 infection.

In our patients we found the CT imaging of peripheral GGO and they remained clinically stable with no deterioration of respiratory symptoms suggesting stability of the lung involvement. We postulate that rapid imaging changes in CT may not be present in young asymptomatic non-smoking COVID-19 patients. CT thorax for early diagnosis may be reserved for the older age groups and not be done in a younger patient.

The authors declare no conflict of interests

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