Global Scientific JOURNALS

GSJ: Volume 9, Issue 1, January 2021, Online: ISSN 2320-9186
www.globalscientificjournal.com

Chest CT findings in COVID-19- Retrospective Study –Our Experience in KAAH

Authors:

Dr. Malak H. Alawi MD[1]

Dr. Wael Hamza Mutair MD[2]

Dr. Nadir Hamza Mutair MD[3]

Dr. Azra Begum DMRD, DNB[4]

Dr. Hatim Abdul Aziz Khogeer MD [5]

Dr. Asim Abdul Aziz Khogeer MD [6]

Dr. Mohammed Harraz MD[7]

Dr. Lubna Abdullrahman Hafiz MD[8]

Mr. Fawzi Mohammed Ali Jeninah B.Sc. [9]

Dr. Hannan AbdulFattah Bin Saddaq MBBS [10].

[1] Head of Department of Radiology and Consultant Radiologist, King Abdul Aziz Hospital, Makkah, Saudi Arabia. Email-m6alawi@hotmail.com.

[2] General Director of Health Affairs, General Directorate of Health Affairs Makkah, Ministry of Health, Makkah, Saudi Arabia. Email-wmotair@moh.gov.sa.

[3] Director of Planning and Research in the health of Makkah region, Ministry of Health, Makkah, Saudi Arabia. Email-nmetair@moh.gov.sa.

[4] Radiology Specialist, King Abdul Aziz Hospital, Makkah. Email-drazrabegum@gmail.com.

[5] Surgical specialist, KFH, Ministry of Health, Makkah, Saudi Arabia. Email-dr_foryou@yahoo.com.

[6] Ministry of Health, Makkah, Saudi Arabia. Email-asimkhogeer@yahoo.uk.

[7] Consultant Radiologist, King Abdul Aziz Hospital, Makkah, Saudi Arabia.

Email- harrazharraz@live.com.

[8] Consultant Family Medicine, Al Zaher PHC, Ministry of Health, Makkah, Saudi Arabia. Email-drlubnahafiz@yahoo.com.

[9] Lab specialist, King Abdul Aziz Hospital, Makkah, Saudi Arabia. Email-Fawzimohd_ali@yahoo.com

[10] Radiology Resident, King Abdul Aziz Hospital, Makkah. Email-hananbinsadeq@gmail.com.

Corresponding author:

Dr. Azra Begum

Dept of Diagnostic Imaging

King Abdul Aziz Hospital,

Zaher,

Makkah, Saudi Arabia

Phone-+966543575319

Email-drazrabegum@gmail.com

Key words- computed tomography, coronavirus, COVID-19, crazy pavement pattern, ground glass opacities , pneumonia , sub-pleural line.

Abstract-

The coronavirus 2019 (COVID-19) pandemic has emerged as a severe healthcare crisis. Thoracic imaging with Chest radiography and CT are crucial for identifying the disease early and help in excluding the differentials and thereby help in management of the disease and its progression. Hence it is crucial that we are familiar with the imaging pattern of COVID-19. Our research is aimed at outlining the common patterns of presentation of COVID-19 on CT chest.

Objective-

Our objective was to analyse the chest computed tomography findings of corona virus disease of COVID-19 pneumonia during the treatment of 71 patients presenting with symptoms such as cough, fever and shortness of breath and to integrate the most frequent imaging features and distribution patterns of this disease.

Introduction-

The novel Coronavirus, currently named as SARS-COV-2, was first identified in Wuhan, in December 2019. Within a few months, the virus has spread from China to worldwide. On March 11, 2020, the World Health Organization (WHO) declared this global outbreak as a pandemic (1). In Saudi Arabia, the first case was reported on 2 March, 2020 (2). There have been 21,756,357 confirmed cases of COVID-19 worldwide, including 771,635 deaths, reported to WHO upto 18 August ,2020 (3). In Saudi Arabia, there have been a total of 301,323 confirmed cases, including 3,470 deaths uptodate (4).
As this disease spreads rapidly through close contact, droplets and aerosol transmission from person to person, there is need for early diagnosis and isolation to control it(5).
The standard confirmatory test is the real-time reverse transcription-polymerase chain reaction(RT-PCR) test(6).
Computed tomography can detect lesions in the lungs at a very early stage, specially in those patients who have symptoms but show negative RT-PCR test initially(7-9).

Materials and methods-

A retrospective study as conducted with the approval of the institutional review board, and written informed consent was waived. Totally 71 patients (50men, 21women, mean age 54.2years), with initial positive RT-PCR test or on followup, confirming the diagnosis of COVID -19 disease, who were treated in our hospital between 1st March till 31st July were included in our study . These patients underwent CT chest for respiratory symptoms, chest xray findings or to rule out pulmonary embolism.
A comprehensive analysis was done of the most common findings on CT chest (eg. Types of opacities, distribution pattern, additional findings) and also the atypical presentations in patients diagnosed with COVID-19 pneumonia.

CT imaging and evaluation

Images were taken via a 64-slice CT scanner (GE). The axial images were acquired craniocaudally at shallow inspiration and included the body part from the thoracic inlet to the diaphragm. Multiplanar reconstruction was done. The CT images were evaluated for the following charecterisctics-distribution pattern, laterality of the lesions, lobe involvement, density of the lesions –ground glass opacities or consolidation or both, peribronchovascular thickening, nodules, halo sign, reverse halo sign, air bronchogram, subpleural line, bronchiectasis, cavitation, tree in bud opacities, pleural effusion, pericardial effusion, mediastinal lymphadenopathy, pneumothorax.

Statistical analysis

Continuous data were expressed as mean and standard deviation, while categorical data were expressed as counts (n) and percentages (%). The statistical analysis was carried out on SSPS software(version25.0, IBM).

RESULTS

We evaluated 71 patients who tested positive for RT-PCR on initial testing or on follow up test. Out of 71 patients , 50 were male and 21 were females, age range between 19-86 years.

Most of the patients belonged to the age groups 41-60(40%) and over 60 (38%) (Figure1).

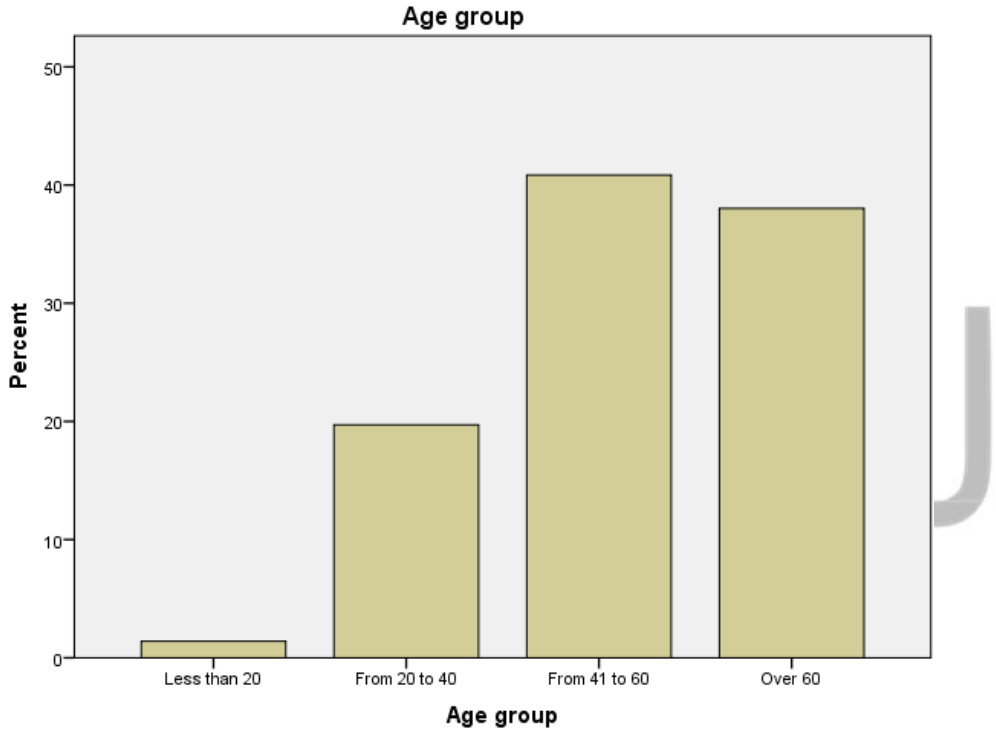

Figure 1- Distribution of study population according to age groups.

The most common distribution pattern was bilateral (91.5%), peripheral (67.6%) and posterior predominant (87.3%) (Figure 2),(Figure 3). Among the lobar distribution, most commonly involved lobe was the right lower lobe (90.1%), followed by the left lower lobe (84.5%), indicating the tendency for basal predominance (Figure 4).

Distribution Pattern

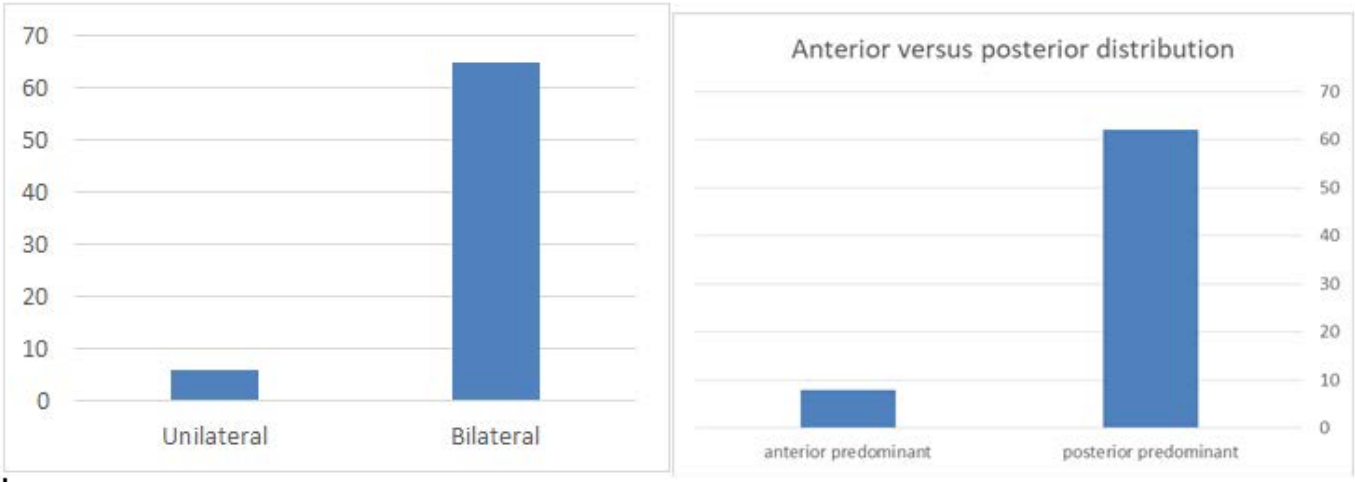

Figure 2- distribution pattern

Central vs peripheral Distribution according to age groups

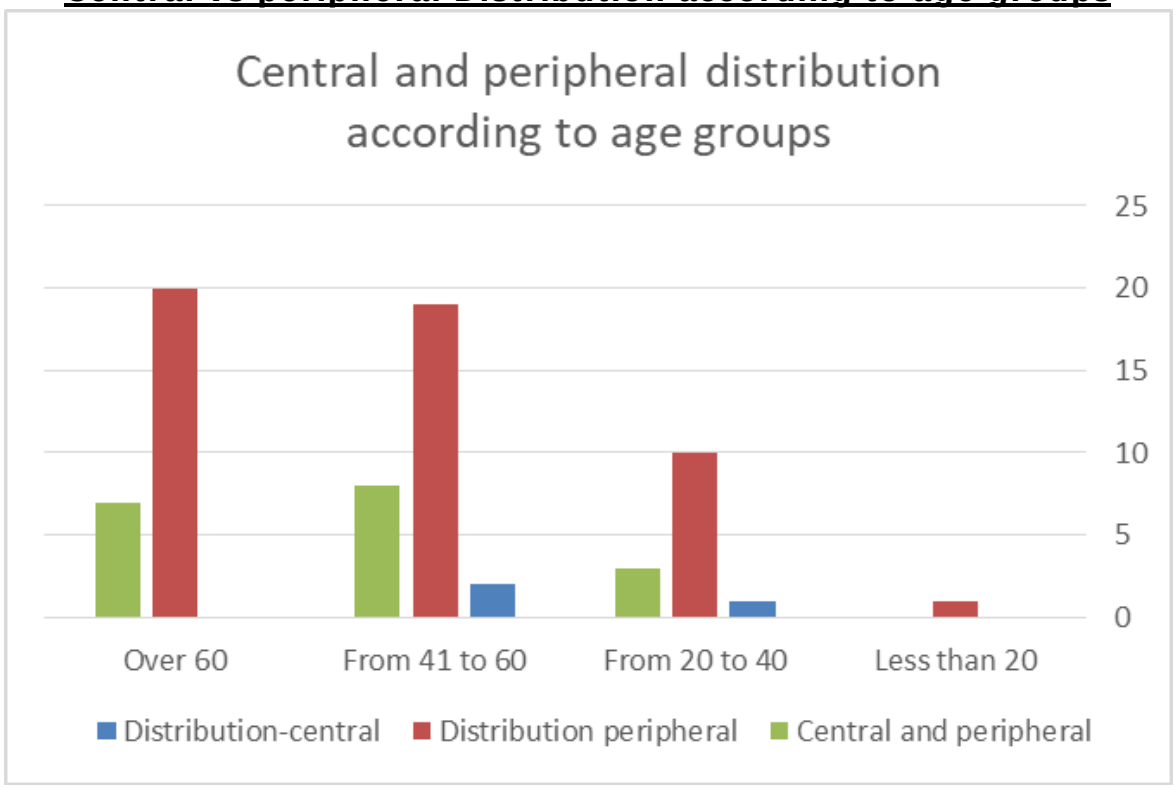

Figure 3- Central vs peripheral distribution pattern according to age groups.

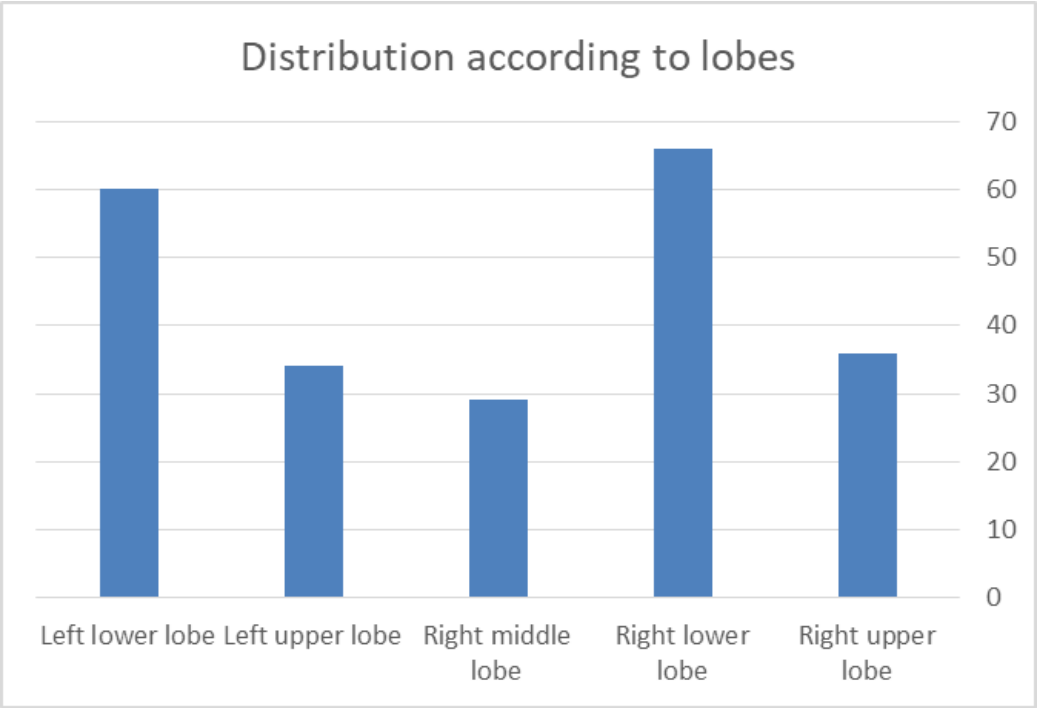

Figure 4- Distribution according to the lobes involved.

Most common detected lesions were GGO (ground glass opacities) with multifocal pattern (69%) while pure consolidation was seen in 28.1% of patients and a mixed GGO with consolidation pattern seen in 32.3% of patients and associated with air bronchograms in (43.6%). Septal thickening (67.6%), crazy pavement pattern (35.2%) , subpleural line (33.8%) , traction bronchiectasis (39.4%) and peribronchovascular wall thickening (33.8%) were a common occurrence. Halo sign (7%) was more commonly seen than the reverse halo sign (1.4%) . Less commonly seen were the reticulonodular opacities, cavitation, pleural thickening and pleural effusion(5-16%), (Table1), (Figure 5).

We did not detect any patients with pneumothorax, tree in bud opacities, mediastinal lymphadenopathy and pericardial effusion.

Table 1- CT imaging findings in COVID-19 pneumonia (n-72)

TYPES OF DENSITIES	n	%
Ground glass opacification –unifocal	2	2.8
Ground glass opacification –multifocal	49	69.0
Consolidation	20	28.1
Ground glass opacification with consolidation	23	32.3
Halo sign	5	7.0
reverse halo sign	1	1.4
Plerual effusion	4	5.6
Pleural thickening	11	15.4
Airbronchogram	31	43.6
Reticulonodular	11	15.4
Septal thickening	48	67.6
Crazy pavement pattern	25	35.2
Subplerual line	24	33.8
Cavitation	4	5.6
Bronchiectasis	28	39.4
Peribronchovascular wall thickening	24	33.8
Micronodular opacities	1	1.4
Not found in our study		
Mediastinal lymphadenopathy	0	0
Pericardial effusion	0	0
Pneumothorax	0	0
Tree in bud	0	0

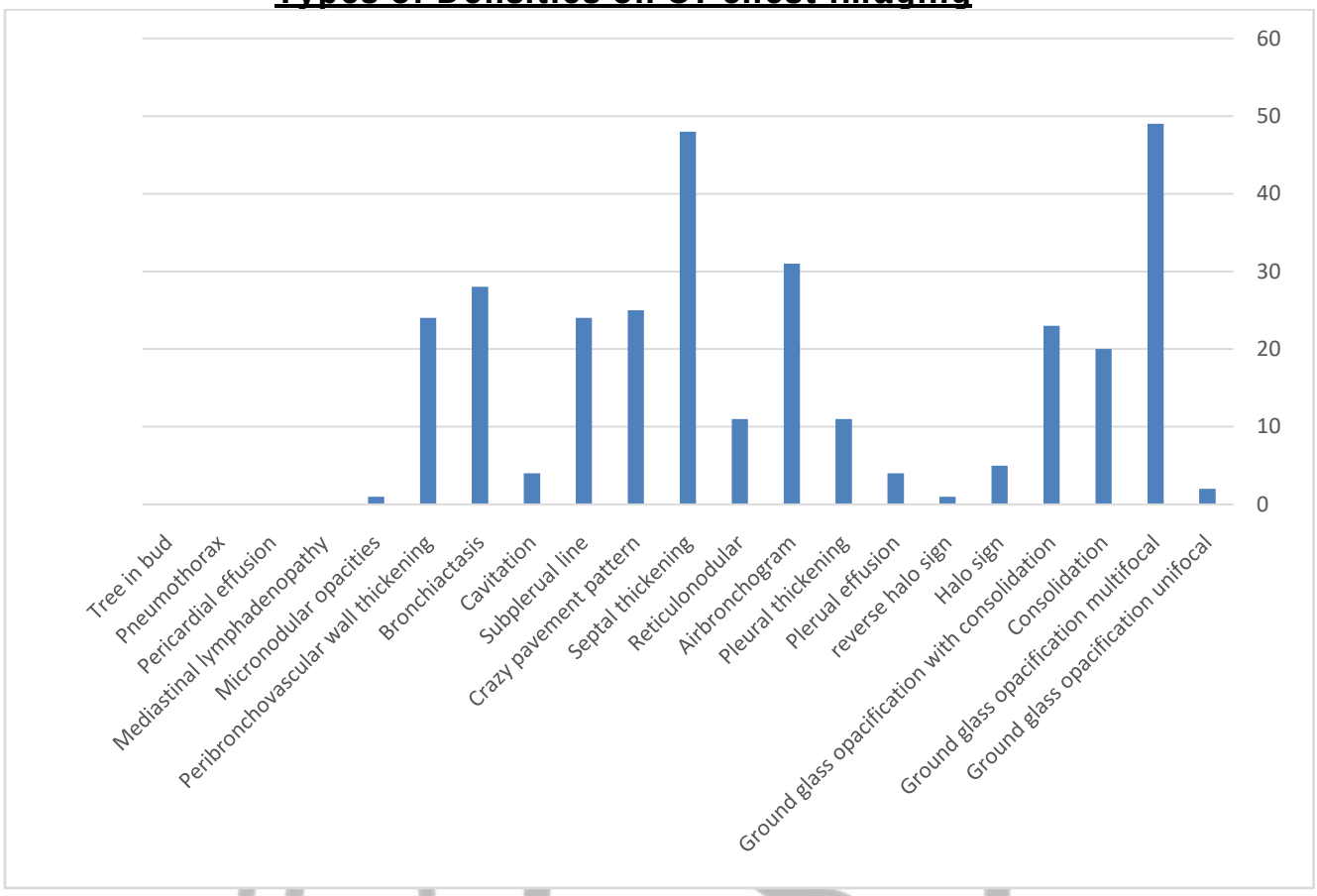

Figure 5- Distribution according to the types of densities seen on CT chest.

Discussion-

Based on our study, the typical CT chest findings of COVID -19 infections are ground glass opacities GGO in multifocal, peripheral and basal distribution bilaterally. Along with these, there is increased incidence of consolidation with air bronchogram, traction bronchiectasis, crazy pavement pattern and sub pleural line (Figure 6). However, these findings are non specific and could be seen in other infectious diseases, For eg. Viral pneumonias (influenza pneumonia, SARS, RSV, rhino virus and adenovirus pneumonias, Non viral infections eg mycoplasma pneumonia, or non-infectious pneumonia eg hypersensitivity pneumonitis, interstitial pneumonia etc.(10-18). Therefore, it is essential to take thorough relevant clinical history in order to narrow the differentiatial.

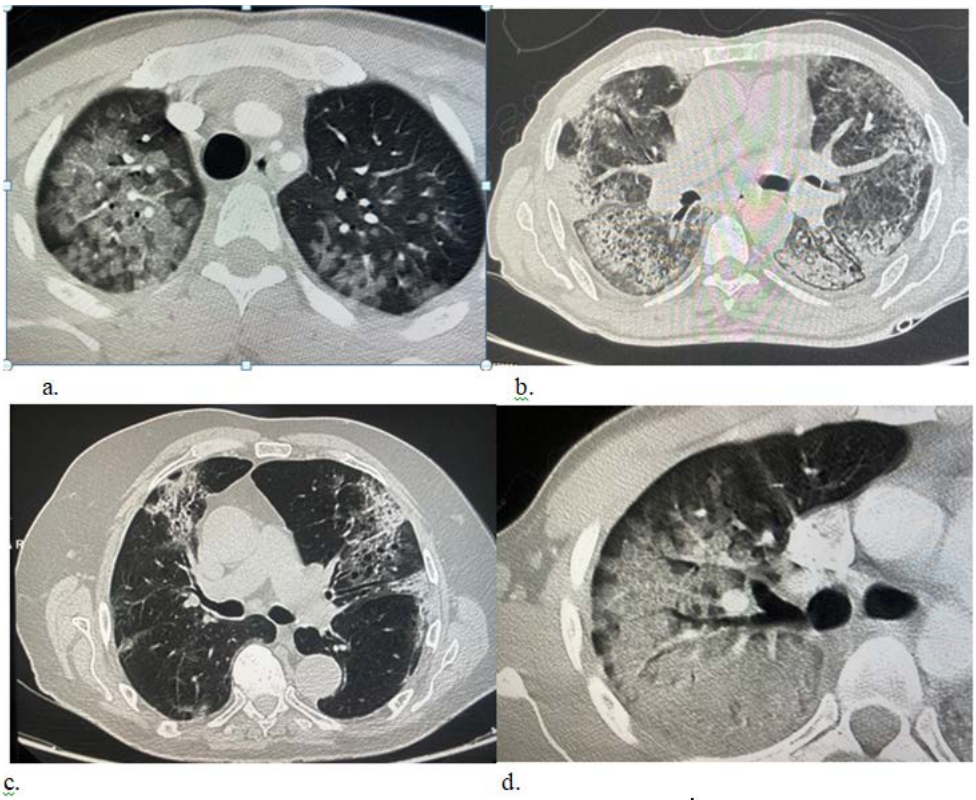

Figure6a.GGO ground glass opacities. b.subpleural line c.traction bronchiectasis, d.crazy pavement pattern.

CT is more sensitive for early parenchymal lung disease, disease progression, and alternative diagnoses including acute heart failure, myocardial injury and, when performed with intravenous contrast material, pulmonary thromboembolism.(19)
The characteristic lesions and their distribution pattern can help narrow down the differentials and help save live by initiating early treatment. According to research study and guidelines set by Fleischner Society, the recommendations for imaging are for those patients who are symptomatic, age over 65 years and those with co morbities eg. Diabetes, cardiovascular disease, hypertension etc.(19)

Patients with functional impairment after recovery from COVID-19 should undergo imaging to differentiate between expected morphologic abnormalities as sequelae of infection, mechanical ventilation, or both versus a different and potentially treatable process.(19)

Conclusion-

The most common findings in CT chest imaging of COVID-19 patients are bilateral, peripheral distribution, septal thickening and multifocal GGO with basal and posterior predominance and crazy pavement pattern.

Therefore CT proves to a very reliable, easily accessable and effective tool in the early diagnosis and management of symptomatic patient's who initially test negative for COVID-19 and also for the assessment of the progression of the disease.

References-

1.World Health Organization. 2020. Coronavirus disease 2019 (COV-ID- 19) situation report-51. World Health Organization, Geneva. Avail-able from: https://www.who.int/docs/default-source/coronaviruse/situa-tionreports/20200311-sitrep-51-covid-19.pdf?sfvrsn=1ba62e57_10.

2.Saudi Arabia government. Ministry of health. Available fromhttps://www.moh.gov.sa/en/Ministry/MediaCenter/News/Pages/News-2020-03-02-002.aspx

3. World Health Organisation Coronavirus Disease Dashboard. Available from https://covid19.who.int/

4. Saudi Arabia government. Ministry of health. Available from https://covid19.moh.gov.sa/

5. Riou J, Althaus CL. Pattern of early human-to-human transmission of Wuhan 2019 novel coronavirus (2019-nCoV), December 2019 to January 2020. Euro Surveill 2020; 25:2000058. [Crossref]

6. Kim H, Hong H, Yoon SH. Diagnostic performance of CT and reverse transcriptase-polymerase chain reaction for coronavirus disease 2019: A meta-analysis. Radiology 2020; 201343. [Crossref]

7. Ai T, Yang Z, Hou H, et al. Correlation of chest CT and RT-PCR testing in coronavirus disease 2019 (COVID-19) in China: A report of 1014 cases. Radiology 2020; 200642. [Crossref]

8. Fang Y, Zhang H, Xie J, et al. Sensitivity of chest CT for COVID-19: comparison to RT-PCR. Radiology 2020; 200432. [Crossref]

9. Dai WC, Zhang HW, Yu J, et al. CT imaging and differential diagnosis of COVID-19. Can Assoc Radiol J 2020; 71:195–200. [Crossref]

10. Oikonomou A, Müller NL, Nantel S.. Radiographic and high-Resolution CT findings of influenza virus pneumonia in patients with Hematologic Malignancies. Am J Roentgenol. 2003/08/01;181(2):507–511. doi: 10.2214/ajr.181.2.1810507 [PubMed] [CrossRef] [Google Scholar]

11. Franquet T. Imaging of pulmonary viral pneumonia. Radiology. 2011/07/01;260(1):18–39. doi: 10.1148/radiol.11092149 [PubMed] [CrossRef] [Google Scholar]

12. Choi S-H, Hong S-B, Ko G-B, et al. . Viral infection in patients with severe pneumonia requiring intensive care unit admission. Am J Respir Crit Care Med. 2012;186(4):325–332. doi: 10.1164/rccm.201112-2240OC [PubMed] [CrossRef] [Google Scholar]

13. Choi S-H, Huh JW, Hong S-B, et al. . Clinical characteristics and outcomes of severe rhinovirus-associated pneumonia identified by bronchoscopic bronchoalveolar lavage in adults: comparison with severe influenza virus-associated pneumonia. J Clin Virol. 2015/01/01/;62:41–47. doi: 10.1016/j.jcv.2014.11.010 [PMC free article] [PubMed] [CrossRef] [Google Scholar]

14. Ooi GC, Khong PL, Müller NL, et al. . Severe acute respiratory Syndrome: Temporal lung changes at Thin-Section CT in 30 patients. Radiology. 2004/03/01;230(3):836–844. doi: 10.1148/radiol.2303030853 [PubMed] [CrossRef] [Google Scholar]

15. Mackay IM, Arden KE.. MERS coronavirus: diagnostics, epidemiology and transmission. Virol J. 2015/12/22;12(1):222. doi: 10.1186/s12985-015-0439-5 [PMC free article] [PubMed] [CrossRef] [Google Scholar]

16. Akira M, Inoue Y, Arai T, et al. . Pulmonary Fibrosis on high-Resolution CT of patients With pulmonary alveolar proteinosis. Am J Roentgenol. 2016/09/01;207(3):544–551. doi: 10.2214/AJR.15.14982 [PubMed] [CrossRef] [Google Scholar]

17. Silva CIS, Churg A, Müller NL.. Hypersensitivity Pneumonitis: Spectrum of high-Resolution CT and Pathologic findings. Am J Roentgenol. 2007/02/01;188(2):334–344. doi: 10.2214/AJR.05.1826 [PubMed] [CrossRef] [Google Scholar]

18. Ichikado K, Johkoh T, Ikezoe J, et al. . Acute interstitial pneumonia: high-resolution CT findings correlated with pathology. Am J Roentgenol. 1997/02/01;168(2):333–338. doi: 10.2214/ajr.168.2.9016201 [PubMed] [CrossRef] [Google Scholar]

19. *Geoffrey D. Rubin, MD, MBA • Christopher J. Ryerson, MD, MAS et al. .* The Role of Chest Imaging in Patient Management during the COVID-19 Pandemic: A Multinational Consensus
Statement from the Fleischner Society. Radiology.2020/07/01;296(1). doi/10.1148/radiol.2020201365[PubMed] [CrossRef] [Google Scholar]