Volume 3, Issue 1, January 2025 ISSN (E): 2938-3765

CHEST CT SCAN FINDINGS IN A SAMPLE OF PATIENTS WITH COVID19 INFECTION

Karim Mahmood Hussein 1
1Department of Anatomy, College of Medicine, University of Kirkuk, Iraq
Corresponding author: Karim Mahmood Hussein
E-mail: karimazaw@uokirkuk.edu.iq, Mobile: +964 770 124 0295

Abstract

Background: Coronavirus disease 2019 (COVID-19) or severe acute respiratory syndrome coronavirus 2 (SARSCoV-2) on January 7, 2020, was established as a source of the discovered cases, previous name was (2019-NOVAL) corona-virus (2019 nCoV), then the epidemic was termed (covid 19); Fever, fatigue, dry cough, and dyspnea, as well as a variety of chest imaging features are what COVID-19 is characterized by.

Objective: This study focuses on critical imaging chest CT scan characteristics in COVID-19 patients with positive PCR to aid in accurate diagnosis and therapy.
Subjects and Methods: This study concentrated on the most recognizable CT-scan features in established cases of (covid -19) to distinguish the various CT-scan appearance that aid in effective diagnosis as well as proper management.

Results: Ground-glass patchy opacities (33.3%) then b ground-glass opacities with consolidations (24.4%), then ground-glass opacities with subpleural linear fibrotic bands abnormality (14.4), crazy-paving pattern (13.3%), single air bronchogram (10.0%), and consolidation patches only (4.4%) were the most prominent chest CT scan findings in COVID 19 patients. In the examined patients, no cavitary-like lesions or sizable lymphadenopathy were detected. The lesions in the lung displayed distinctive bilateral predominantly right side, mostly all lobes affected, especially basal, and peripheral subpleural in distribution.

Conclusion: The CT-scan imaging features seen in (COVID19) cases may aid a rapid and precise diagnosis of COVID19 then detailed evaluation of pulmonary parenchymal affection and disease severity.

Keywords: Coronavirus infections (COVID-19), Computed tomography findings, ground glass opacity.

Introduction

The first four reported cases were detected by localized hospitals by utilizing surveillance measurements for pneumonia of unknown origin which was established during the 2003 SARS pandemic [1,2,3] .On (31-Dec.-2019) WHO reported several instances of unknown cause type of pneumonia in Wuhan-China [4] on (7-January-2020), corona-virus disease 2019 (COVID19) or severe acute respiratory syndrome coronavirus 2 (SARSCoV-2) verified the etiology of such

Web of Medicine: Journal of Medicine, Practice and Nursing
webofjournals.com/index.php/5

discovered cases (at previous time identified as 2019 new corona-virus 2019-n CoV), and the epidemic was dubbed COVID19 [5]. The World Health Organization declared a global health emergency on January 30, 2020. On 20/Feb/2020, 75,761 cases and about 2130 fatalities were reported in more than 30 countries [6] .Because the COVID-19 largely affects the respiratory system, chest imaging is strongly recommended for both initial screening and follow-up in suspected patients [7], while chest radiographs are ineffective in the early stages of illness, CT lung alterations may be detected even before clinical symptoms arise. Chest radiographs with symptoms of acute respiratory distress syndrome (ARDS) may be beneficial in the mild to severe types of COVID-19 [8, 9], the chest imaging findings are the consequence of COVID-19 overlapping with other viral pneumonias. CT-scan of the chest [10].

In the context of diagnostic CT-scan results, the polymerase chain reaction (PCR) as a screening test may be false negative initially [10, 11] ; with the COVID19 outbreak and the fast growing world-wide pandemic that has resulted in catastrophic mortality, accurate patient diagnosis and care requires a detailed understanding and description of diagnostic imaging characteristics, differential criteria, and chest imaging findings [12]. This study focuses on critical imaging chest CT scan characteristics in COVID-19 patients with positive PCR to aid in accurate diagnosis and therapy.

MATERIALS AND METHODS

This was a retrospective research in which 90 cases that test result positive for newly discovered corona-virus by naso-pharyngeal exchange received a CT-scan of the chest in July 2020. The patients' ages ranged from 20 to 80 years old. There were 55 men and 35 females, for a male to female ratio of (1.6:1).

All pictures were taken while the patients were in the supine position, using CT-Scan Chest procedures. Scans were performed from the proximal thoracic intake to the lower costophrenic angle level, with the following scan settings utilized voltage of the CT tube (120 kVp), (250 mAs), rotation duration (1 second), and thickness of slice section (2.5mm). As a result, for multiplanar reconstruction, all pictures are delivered to the workstation and Picture Archiving and Communication Systems (PACS).

Picture analysis: Three radiologists with chest CT scan experience reviewed the image results (from 5 to 8 years). Lesions were characterized according to the number of lobar involvement (one or more lobes involved), lung impacted (right, left, or both lungs affected), and zonal distribution (peripheral, central and both). Lesions were classified as having ground- glass opacities solely, crazy-paving appearance or consolidations only, both ground-glass opacity with consolidations, ground-glass opacity with subpleural lines, or a single air bronchogram on a chest CT scan.

Ethical Approval:

Both the University of Kirkuk's Departments of Anatomy and Internal Medicine's College of Medicine and the Ethics Committee of the Iraqi Ministry of Health gave their blessing to the study. The consent document was signed by all involved parties. The principles outlined in the Helsinki Declaration by the World Medical Association have been strictly adhered to in all studies involving human participants.

Web of Medicine: Journal of Medicine, Practice and Nursing
webofjournals.com/index.php/5

RESULT

In this retrospective study, ninety cases that were tested as PCR (+ve) for coronavirus by naso-pharyngeal swap underwent chest CT scan examination. Patients ages ranged (from 21 to 80) years old, as seen at (Table 1) the peak age group was between (40-60) were about 48 patients (53.3%). Results were shows 55 males with 35 females and male against female ratio about (1.6:1), as seen at (Table 2).

Table (1): distribution of age groups

Age	Frequency	Percent (%)
20-40	31	34.4
40-60	48	53.3
>60	11	12.2
Total	90	100.0

Table (2): Percentage of gender

Sex	Frequency	Percent
Male	55	61.1
Female	35	38.9
Total	90	100.0

The detected patterns of lung parenchymal at chest CT scan are clarified in (Table 3). Ground-glass opacities (33.3%) followed by ground-glass opacities as well as consolidation patches (reverse halo sign) were about (24.4%), then ground glass opacities with subpleural linear bands (14.4%), crazy-paving pattern (13.3%), single large air bronchogram (10.0%), and multiple consolidation patches only (4.4%) were only the predominant CT scan findings detected in COVID19 patients .

Table (3): CT scan patterns of lung parenchymal

CT scan findings	Frequency	Percent
ground glass opacities only	30	33.3
crazy paving	12	13.3
consolidation patches only	4	4.4
Ground glass opacities with consolidations	22	24.4
Ground glass opacities with subpleural fibrotic bands	13	14.4
single large air bronchogram	9	10.0
Total	90	100.0

The predominance transverse distribution of the lesions was categorized as peripheral, central, diffuse (both peripheral and central distribution), the majority of the patients display peripheral pulmonary distribution that was detected in (60 cases) (66.7%), diffuse distribution that mean both central ad peripheral distribution was seen in 28 patients (31.1%), and merely 2 patients (2.2%) had central predominance (Table 4). While the pattern of covid-19 lesions stated as

Web of Medicine: Journal of Medicine, Practice and Nursing
webofjournals.com/index.php/5

scattered (non-confluent) were seen in about 54 of patients (60.0%) and confluent continuous pattern that seen in 36 of cases (40.0) as demonstrated at (Table 5).

Table (4): transverse distribution of the lesions

Distribution	Frequency	Percent
Peripheral	60	66.7
Central	2	2.2
both central and peripheral	28	31.1
Total	90	100.0

Table (5): The pattern of covid-19 lesions

Lesions pattern	Frequency	Percent
scattered lesions	54	60.0
confluent lesion	36	40.0
Total	90	100.0

Table 5 shows the number of the involved lung lobes. The number of the patients who had five involved lung lobes was 41 patients (45.6%), those who had four involved lung lobes were18 patients (20.0%), who had three involved lung lobes, were 8 patients (8.9%), those who had two involved lung lobes were 8 patients (8.9%), and there were 15 patients (16.7%) who had one involved lung lobe (Table 6). On the other hands, the laterality that mean the affect side (right, left or both sides) seen at (Table 7), right lung predominant affected in 15 patient (16.7%) , left lung in 3 patients (3.3%) while in most of cases 72 patients (80.0%) both lungs involved .

Table (6): the percentage of involved lung lobes

Affected lobes	Frequency	Percent
one lobe	15	16.7
tow lobes	8	8.9
three lobes	8	8.9
four lobes	18	20.0
five lobes	41	45.6
Total	90	100.0

Table (7) : Percentage of laterality

Laterality	Frequency	Percent
right lung only	15	16.7
left lung only	3	3.3
both lungs	72	80.0
Total	90	100.0

Web of Medicine: Journal of Medicine, Practice and Nursing
webofjournals.com/index.php/5

DISCUSSION

COVID-19 computed tomography imaging characteristics are non-specific since it always interacts with other causes of acute lung illness and organizing pneumonia, however COVID-19 imaging features in new research have been documented in CT-scan. Thus, the difference in these traits through time can be utilized to distinguish COVID19 from other viral infections with comparable features [13, 14] Furthermore, other lung parenchymal illnesses, like emphysematous lung disease and interstitial parenchymal lung disease, that may be related with increased morbidity of COVID19 pneumonia should be documented and reported. Pneumonia that caused by viral infection have a broad range of CT-scan presentations and varied characteristics; part of these imaging abnormalities are rare or unique in COVID19 pneumonia, example (intra-bronchial mucus plugs, tree-in-bud, and tiny nodules), So viral pneumonia as a term has a wide-spectrum of CT-scan lung parenchymal findings not all appearance are classical features of COVID19 [15] Chronic conditions (such as hypertension and diabetes) and advanced age are linked with a significant COVID-19 pneumonia-related death risk [16] The chest radiograph is the initial imaging modality used in immunocompetent individuals to evaluate acute respiratory illnesses. Despite the obvious COVID-19 anomalies found on chest radiographs, in almost two/thirds of positive cases the chest radiographs were normal without detectable findings, most of published publications describe positive CT scan imaging findings such as Ground-glass opacities that are not detected on plan chest x-ray film of those individuals [17] CT scans are important in the detection of COVID19 pulmonary infection [18]

The chest CT-scan as a screening imaging is not recommended by the majority of radiology associations and professional organizations for COVID-19 diagnosis [19] the presentation of chest imaging abnormalities is also related to time of the imaging investigation according to the course of sickness. most instances revealed (-ve) chest CT-scan within the 1st two days since beginning of symptoms, then the Ground glass opacities start to detected within four days from start of symptom then the symptoms peak around (6-13) days [20] Negative chest CT imaging did not rule out the presence of (COVID19) especially earlier in the illness. The prevalence of patchy consolidations rises as the illness progresses. [21] At present study, most patients age are within (40-60years) group were about (53.5%) and male to female ratio (1.6: 1) may be due sample size. Ground-glass opacities about (33.3%) followed by ground-glass opacities as well as consolidation patches (reverse halo sign) were about (24.4%), then ground glass opacities with subpleural linear bands (14.4%), crazy paving pattern (13.3%), single large air bronchogram (10.0%), and the less common pattern were multiple consolidation patches only (4.4%) were only the most common CT findings visualized in covid -19 patients.

This is consistent with Wang et al description of the most prevalent CT results as ground glass opacities alone or combined with consolidative opacities [22]. Aside from a few minor mediastinal lymph nodes, no detected cavitary pulmonary lesions or considerable size lymphadenopathy were seen in studied sample of individuals, which might be due to viral infection. While 28 patients (31.1%) out of 60 patients (66.7%) show both central and peripheral lung distribution, only 2 patients (2.2%) had central predominance (Table 4). Right lung predominant affected in 15 patients (16.7%), left lung in 3 patients (3.3%) while in most of cases 72 patients (80.0%) both lungs involved. The most common CT scan chest findings of COVID19 associated pneumonia are bilateral lung involvement with posterior peripheral sub-pleural distribution and no detectable pleural effusion [22] The pattern of covid-19 lesions stated as scattered (non-confluent) were seen

in about 54 of patients (60.0%) and confluent continuous pattern that seen in 36 of cases (40.0) as demonstrated at (Table 5). Table (5) shows the number of the involved lung lobes. The patients who had five affected lobes were 41 patients(45.6%), those who had four affected lobes were18 patients (20.0%), those who had three affected lobes were 8 patients (8.9%), those who had two affected lobes8 patients (8.9%), and those had single lobe affected were 15 of cases (16.7%) (Table 6). Many investigations have been conducted on patients with covid-19 who have documented ground glass opacities with or without lung consolidations, particularly in the posterior segments peripherally distributed at diffuse or lower lung lobes, ground glass opacity can shows either a circular or a crazy paving appearance [23, 24] According to these investigations, covid-19 often produces CT scan patterns similar to that of Organizing pneumonia, namely peripheral distributed ground-glass opacity that may be similar to lung mass or nodal-like that are generally bilateral and multi-lobar [25]

Other CT-scan lung abnormalities such as (curvilinear/ linear-like, peri-lobular opacity, diffusely distributed ground glass lung opacity and consolidations), can mimic many disorders, such as (medication toxicity, many pulmonary infections as well as inhalational exposure) [26] .In any of the individuals evaluated, there were no lung cavitary lesions or particular abnormal lymph nodes. Other investigations have identified cavitary lung parenchymal lesion, halo - sign in chest CT-scan, mediastinal lymph nodes enlargement, pneumothorax pericardial/ pleural effusion as unusual chest ct-scan features seen in COVID19 cases [27] .According to several researches, patient age may influence the COVID19 appearance and findings on chest CT-scans. To put it another way, younger patients have more GGO, whereas older individuals have predominant consolidative opacities [28]. In a prospective case study of (41) covid positive cases, chest CT-scan imaging abnormalities indicative of lung pneumonia were described in (100%) of cases, with (98%) of patients having bilateral pulmonary parenchymal affection, Lobar and sub-segmental consolidations were the commonest chest CT-scan features in ICU cases [29] Isolated ground-glass opacity, reticular or inter-lobular septal thickening, and ground-glass opacity with consolidation patches are the most prevalent chest CT scan characteristics in these individuals [20] Chung et al. The research investigated the CT scan findings of covid-19 pneumonia in (21 individuals) and found that 76% of the patients had bilateral lung involvement and 33% had peripheral airspace opacities. At presentation, more than 50% of patients had ground-glass opacities with no consolidation, while roughly 29% had ground-glass opacities with patchy consolidations. According to study lung lesions with a circular pattern in 33% of cases, linear-pattern in about (14%) then a crazy-paving lesion pattern around (19%). Furthermore, all lung lobes were damaged in 38% of the patients. The right lower -lobe (76%) was more involved than the right middle- lobe (57%) [23]. Ground glass opacities and air bronchogram opacities were shown to be the most prevalent CT chest patterns in two further investigations with (138 and 99) covid-19 confirmed patients [30, 31]. The current study's shortcomings were a small sample size, poor patient follow-up, and no lung tissue biopsy for histological association.

CONCLUSION

The utilization of chest CT-scan findings seen in COVID19 cases assist the early and correct detection the COVID19 positive cases, as well as the appropriate evaluation of the disease severity and establishment the care strategy.

Web of Medicine: Journal of Medicine, Practice and Nursing
webofjournals.com/index.php/5

ABBRIVIATION

SARS-CoV2: Severe acute respiratory syndrome coronavirus 2; WHO: World Health Organization; GGO: Ground glass opacity; RT-PCR: Reverse transcription polymerase chain reaction.

REFERENCES

1. Li Q, Med M, Guan X et al. (2020): Early Transmission dynamics in Wuhan, China, of novel coronavirus–infected pneumonia. N Engl J Med., 382:1199–1207.
2. Abdulla AK, AL-Barzinji RM, Taher CA. OPEN READING FRAME 8 GENE SEQUENCE VARIATION OF CORONA VIRUS IN PATIENTS FROM ERBIL CITY, IRAQ. Gomal Journal of Medical Sciences. 2024 Apr 18;22(1):44-51.
3. Abdulla AK, Salman OA, Mahmood AA. Study of some hematological, and biochemical parameters in patients with SARS-CoV-2 in Kirkuk City/Iraq. Systematic Reviews in Pharmacy. 2020;11(11):8.
4. World Health Organization. Pneumonia of Unknown Cause – China https://www.who.int/csr/don/05-january-2020-pneumonia-of-unkown-cause-china/en/ (14 February 2020, date last assessed).
5. WHO Statement Regarding Cluster of Pneumonia Cases in Wuhan, China https://www.who.int/china/news/detail/09-01-2020-who-statement-regarding-cluster-of-pneumonia-cases-in-wuhan-china (14 February 2020, date last assessed).
6. Chung R, Li M (2020): Anti-Chinese sentiment during the 2019-nCoV outbreak. Lancet 395(10225):686–687.
7. Jin YH, Cai L, Cheng ZS et al. (2020): A rapid advice guideline for the diagnosis and treatment of 2019 novel coronavirus (2019-nCoV) infected pneumonia (standard version). Military Med Res 7, 4 (2020). https://doi.org/10.1186/s40779-020-0233-6.
8. Kim J, Choe P, Oh Y et a.l (2020): The first case of 2019 novel coronavirus pneumonia imported into Korea from Wuhan, China: implication for infection prevention and control measures. J Korean Med Sci 35:5.DOI: https://doi.org/10.3346/jkms.2020.35.e61
9. Pan Y, Guan H, Zhou S et al. (2020): Initial CT findings and temporal changes in patients with the novel coronavirus pneumonia (2019-nCoV): a study of 63 patients in Wuhan, China. Eur Radiol., 30(6): 3306-3309.
10. Xie X, Zhong Z, Zhao W et al. (2020): Chest CT for typical 2019-nCoV pneumonia: relationship to negative RT-PCR testing. Radiology. 296(2), E41–E45. https://doi.org/10.1148/radiol.2020200343.
11. Huang P, Liu T, Huang L et al. (2020): Use of chest CT in combination with negative RT-PCR assay for the 2019 novel coronavirus but high clinical suspicion. Radiology. 295(1), 22–23. https://doi.org/10.1148/radiol.2020200330.
12. Cheng V, Lau S, Woo P et al. (2007): Severe acute respiratory syndrome coronavirus as an agent of emerging and reemerging infection. Clin Microbiol Rev., 20:660–694.
13. Obadina E, Torrealba J, Kanne J (2013): Acute pulmonary injury: high resolution CT and histopathological spectrum. Br J Radiol 86:1027. https://doi.org/10.1259/bjr.20120614.
14. Bai H, Hsieh B, Xiong Z et al. (2020): Performance of radiologists in differentiating COVID-19 from viral pneumonia on chest CT. Radiology. 296(2), E46-E54. https://doi.org/10.1148/radiol.2020200823.

Web of Medicine: Journal of Medicine, Practice and Nursing
webofjournals.com/index.php/5

15. Franquet T (2011): Imaging of pulmonary viral pneumonia. Radiology. 260(1):18–39.
16. Sen-Crowe B, McKenney M, Elkbuli A (2020): Social distancing during the COVID-19 pandemic: Staying home save lives. Am J Emerg Med., 38(7): 1519–1520.
17. Ng M-Y, Lee EY, Yang J et al. (2020): Imaging profile of the COVID-19 infection: radiologic findings and literature review. Radiol Cardiothoracic Imaging, 2(1): e200034. https://doi.org/10.1148/ryct.2020200034.
18. Zhou W, Liu Y, Tian D et al. (2020): Potential benefits of precise corticosteroids therapy for severe 2019-nCoV pneumonia. Sig Transduct Target Ther., 5 (1): 1-3 https://doi.org/10.1038/s41392-020-0127-9.
19. Jacobi A, Chung M, Bernheim A et al. (2020): Portable chest X-ray in coronavirus disease-19 (COVID-19): A pictorial review. Clin imaging., 64: 35-42.
20. Song F, Shi N, Shan F et al. (2020): Emerging 2019 novel coronavirus (2019nCoV) pneumonia. Radiology. 295(1):210–217.
21. Bernheim A, Mei X, Huang M et al. (2020): Chest CT findings in coronavirus disease-19 (COVID-19): relationship to duration of infection. Radiology. 295(3), 200463. https://doi.org/10.1148/radiol.2020200463.
22. Wang W, Dong C, Hu Y et al. (2020): Temporal changes of CT findings in 90 patients with COVID-19 pneumonia: a longitudinal study. Radiology. 296(2), E55–E64. https://doi.org/10.1148/radiol.2020200843.
23. Chung M, Bernheim A, Mei X et al. (2020): CT imaging features of 2019 novel coronavirus (2019-nCoV). Radiology. 295(1):202–207.
24. Shi X, Jiang N, Cao Y et al. (2020): Radiological findings from 81 patients with COVID-19 pneumonia in Wuhan, China: a descriptive study. Lancet Infect Dis., 20(4), 425-434.
25. Salehi S, Abedi A, Balakrishnan S et al. (2020): Coronavirus disease 2019 (COVID-19): a systematic review of imaging findings in 919 patients. AJR Am J Roentgenol., 215:1–7.
26. Nishino M, Hatabu H, Hodi F (2019): Imaging of cancer immunotherapy: current approaches and future directions. Radiology. 290(1):9–22.
27. Kong W, Agarwal PP (2020): Chest imaging appearance of COVID-19 infection. Radiol Cardiothorac Imaging., e200028. https://doi.org/10.1148/ryct.2020200028.
28. Kanne J (2020): Chest CT findings in 2019 novel coronavirus (2019-nCoV) infections from Wuhan, China: key points for the radiologist. Radiology. 295(1), 16–17. https://doi.org/10.1148/radiol.2020200241.
29. Huang C, Wang Y, Li X et al. (2020): Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet 395:497–506.
30. Wang D, Hu B, Hu C et al. (2020): Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus-infected pneumonia in Wuhan, China. JAMA., 323(11), 1061-1069.
31. Chen N, Zhou M, Dong X et al. (2020): Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. Lancet 395:507–513.

Web of Medicine: Journal of Medicine, Practice and Nursing
webofjournals.com/index.php/5