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Chest CT in patients suspected of COVID-19 infection: A reliable alternative for RT-PCR

Dear Sir,

With the increasing prevalence of coronavirus disease-19 (COVID-19) infection worldwide, early detection has become crucial to ensure rapid prevention and timely treatment. However, due to the unknown gene sequence of the supposed coronavirus, the reference standard test has not been established for diagnosis [1]. Several methods have been established for prompt detection of the genetic sequence of COVID-19 nucleic acid such as real-time reverse-transcriptase polymerase chain reaction (RT-PCR). However, this test is not readily available everywhere, especially in developing countries. In addition, its results are not typically readily available, requiring multiple hours for the result [2].

Several studies have suggested pneumonia as the underlying mechanism of lung injury in patients with COVID-19 [3-6]. Accordingly, it is believed that the pulmonary lesions caused by COVID-19 infection are similar to those of pneumonia. More than 75% of suspected patients showed bilateral pneumonia [3]. In this context, the promising findings of several studies have highlighted the growing role of chest computed tomography (CT) scan for identifying the typical findings of suspected or confirmed cases of COVID-19 infection. The common typical chest CT scan findings were summarized in Table 1. Among the published chest CT findings related to the COVID-19 infection, the most common imaging finding was pure ground-glass opacities with the occurrence rate of up to 74% (603 out of 807 patients). More than 62% of patients (224 out of 359) had mixed pattern opacities in their CT, which was a combination of consolidation, ground glass opacities, and reticular opacities. In addition, the bilateral distribution of lung lesions was the cardinal hallmark of COVID-19 with an occurrence rate of up to 76% (365 out of 476 patients). More than 66% of lung lesions was peripherally distributed (399 out of 601 patients).

Some studies have reported that chest CT images have the sensitivity of 80–90% and specificity of 82.8–96% for detecting the lung lesions in patients with COVID-19 (area under the receiver operating characteristic curve, ranged between 0.87 and 0.96) [4,20]. Accordingly, the findings of the available studies support the use of chest CT scan as a reliable test for detecting pulmonary lesions related to the COVID-19 infection. Some studies have reported that chest CT manifestations may associate with the progression and prognosis of COVID-19 [19].

Timely detection of COVID-19 patients is of crucial importance, particularly in those with false-negative RT-PCR or those without symptoms. Given the large global outbreak of COVID-19 infection, limited availability of COVID-19 nucleic acid detection kit, nonspecific clinical manifestations as well as unavailability of reliable standalone tool to rule out COVID-19 infection, performing chest CT may be a helpful test for patients suspected of COVID-19 infection at the beginning of admission in the emergency department. In this context, detecting bilateral, multifocal and peripherally distributed ground-glass opacities with or without consolidation could be a valuable diagnostic clue. These findings were considered highly suspicious of COVID-19 infection; however, these findings can be further confirmed by positive real-time RT-PCR assay for COVID-19 infection.

An important issue is that excessive demand for CT imaging of patient with COVID-19 not only increases costs, but also pose significant risk for transmission or environmental contamination. Therefore, there are several significant considerations for both emergency and radiology departments during the work-up of each patient with COVID-19 that impact use of chest CT, including the safety of personnel, the decontamination of radiology equipment, and the duration of CT room unavailability. Among these cases, the length of time the CT device is out of service has a significant role in increasing the waiting time for performing CT scan and then increasing the emergency department crowding. Currently, there are no valid guidelines for determining the time interval for subsequent patients. However, between 30 min and 1 h of room downtime is recommended for environmental cleaning and equipment decontamination using hospital approved methods such as hydrogen peroxide vapor, ultraviolet light, Phenolic or sodium hypochlorite [21,22]. Accordingly, it is recommended that CT imaging be reserved for emergent cases with suspected COVID-19 infection. As a general rule, standardized infection control and prevention practices should be implemented for all patients with respiratory illness [23]. Protecting radiology personnel from the hazard posed by a patient with COVID-19 involves employing droplet precaution, using appropriate personal protective equipment, limiting the number of staff entering the patient's room, and careful screening of staff to identify possible cases. Environmental decontamination of CT rooms could be achieved thorough cleaning of surfaces with common chemical disinfectants, such as sodium hypochlorite, Phenolic, bleach, hydrogen peroxide, or quaternary ammonium compounds, by someone with appropriate protective equipment, maintaining proper ventilation and airflow in the CT scanner rooms and putting CT equipment out of commission for specific time for cleaning. In this regard, United States Environmental Protection Agency published some registered disinfectants for use against COVID-19 (available at: https://www.epa.gov/pesticide-registration/list-n-disinfectants-use-against-sars-cov-2). In addition, chest CT imaging should be performed at sites with less traffic to avoid uninfected patient and staff exposure. Portable chest X-ray in patient rooms, radiology outposts, and isolated CT imaging rooms are options, if available, to limit contamination of radiology equipment

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Table 1
Chest CT findings of patients with COVID-19 infection.

CT findings	Author [ref]	n	Total	%	CT findings	Author [ref]	n	Total	%
Peripheral distribution	Xu [7]	46	90	51.11	Consolidation	Xu [7]	12	90	13.33
	Shi [8]	44	81	54.32		Shi [8]	14	81	17.28
	Zhao [9]	88	101	87.13		Zhao [9]	44	101	43.56
	Zhou [10]	48	62	77.42		Zhou [10]	21	62	33.87
	Cheng [11]	11	11	100.0		Cheng [11]	6	11	54.55
	Xiong [12]	12	42	28.57		Xu YH [6]	15	41	36.59
	Song [1]	44	51	86.27		Xiong [12]	23	42	54.76
	Chung [13]	7	21	33.33		Xia [14]	10	20	50.00
	Xu YH [6]	39	41	95.12		Li [15]	3	51	5.88
	Wu [16]	42	80	52.50		Pan [5]	12	63	19.05
	Ng [17]	18	21	85.71		Song [1]	28	51	54.90
	Total	399	601	66.39		Huang [18]	41	41	100.0
Bilateral lung involvement	Xu [7]	53	90	58.89		Liu [19]	8	73	10.96
	Shi [8]	64	81	79.01		Wu [16]	50	80	62.50
	Zhao [9]	83	101	82.18		Ng [17]	13	21	61.90
	Song [1]	44	51	86.27		Total	300	828	36.23
	Huang [18]	40	41	97.56	Reticular pattern	Zhao [9]	49	101	48.51
	Chung [13]	16	21	76.19		Cheng [11]	9	11	81.82
	Xia [14]	10	20	50.00		Song [1]	11	51	21.57
	Liu [19]	55	73	75.34		Total	69	163	42.33
	Total	365	478	76.36	Mixed pattern	Zhao [9]	65	101	64.36
Multifocal involvement	Xu [7]	62	90	68.89		Zhou [10]	39	62	62.90
	Shi [8]	30	81	37.04		Cheng [11]	7	11	63.64
	Zhao [9]	55	101	54.46		Xu YH [6]	25	41	60.98
	Zhou [10]	52	62	83.87		Li [15]	28	51	54.90
	Song [1]	46	51	90.20		Song [1]	38	51	74.51
	Cheng [11]	5	11	45.45		Chung [13]	18	21	85.71
	Xiong [12]	32	42	76.19		Ng [17]	4	21	19.05
	Pan [5]	28	63	44.44		Total	224	359	62.40
	Chung [13]	15	21	71.43	Air bronchogram sign	Xu [7]	7	90	7.78
	Total	325	522	62.26		Shi [8]	38	81	46.91
Ground glass opacification	Xu [7]	65	90	72.22		Zhou [10]	45	62	72.58
	Shi [8]	53	81	65.43		Cheng [11]	8	11	72.73
	Zhao [9]	87	101	86.14		Xu YH [6]	22	41	53.66
	Xu YH [6]	30	41	73.17		Xiong [12]	14	42	33.33
	Zhou [10]	25	62	40.32		Li [15]	35	51	68.63
	Cheng [11]	11	11	100.0		Song [1]	41	51	80.39
	Li [15]	18	51	35.29		Total	210	429	48.95
	Pan [5]	54	63	85.71	Adjacent pleura thickening	Xu [7]	50	90	55.56
	Xia [14]	12	20	60.00		Shi [8]	26	81	32.10
	Song [1]	39	51	76.47		Zhou [10]	30	62	48.39
	Huang [18]	41	41	100.0		Total	106	233	45.49
	Chung [13]	12	21	57.14	Pleural effusion	Xu [7]	4	90	4.44
	Liu [19]	65	73	89.04		Shi [8]	4	81	4.94
	Wu [16]	73	80	91.25		Zhao [9]	14	101	13.86
	Ng [17]	18	21	85.71		Xu YH [6]	4	41	9.76
	Total	603	807	74.72		Zhou [10]	6	62	9.68
Crazy paving appearance	Xu [7]	11	90	12.22		Cheng [11]	0	11	0.00
	Shi [8]	8	81	9.88		Xiong [12]	5	42	11.90
	Chung [13]	4	21	19.05		Li [15]	1	51	1.96
	Liu [19]	28	73	38.36		Song [1]	4	51	7.84
	Wu [16]	23	80	28.75		Liu [19]	3	73	4.11
	Total	74	345	21.45		Wu [16]	5	80	6.25
Interlobular septal thickening	Xu [7]	33	90	36.67		Total	50	683	7.32
	Shi [8]	28	81	34.57	Lymphadenopathy	Shi [8]	5	81	6.17
	Zhao [9]	29	101	28.71		Zhao [9]	1	101	0.99
	Xu YH [6]	33	41	80.49		Xu [7]	1	90	1.11
	Xiong [12]	17	42	40.48		Cheng [11]	0	11	0.00
	Li [15]	36	51	70.59		Xiong [12]	12	42	28.57
	Liu [19]	19	73	26.03		Song [1]	3	51	5.88
	Wu [16]	47	80	58.75		Wu [16]	3	80	3.75
	Total	242	559	43.29		Total	25	456	5.48
Bronchiolectasis	Shi [8]	9	81	11.11					
	Zhao [9]	53	101	52.48					
	Zhou [10]	20	62	32.26					
	Total	82	244	33.61					

and environment [22]. Undoubtedly, performing these protective measures may reduce access to CT imaging suites, leading problems for patient care, especially critically ill patients.

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Declaration of competing interest

The authors declare that there is no conflict of interest regarding the publication of this paper. In addition, they have no relevant affiliations or financial involvement with any organization or entity with a financial interest in or financial conflict with the subject matter or materials discussed in the manuscript.

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