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LETTER TO THE EDITOR

Comments on "Review of the role of diagnostic modalities and imaging findings in the COVID-19 pandemic"

Sai Swarupa R Vulasala, Dheeraj R Gopireddy, Priya Bhosale, Mayur K Virarkar

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Abstract

The present letter to the editor corresponds to the article entitled "Comprehensive literature review on the radiographic findings, imaging modalities, and the role of radiology in the coronavirus disease 2019 (COVID-19) pandemic" by Pal *et al*, published in *World J Radiol*. 2021; 13(9): 258-282. With zero to unknown prevalence, COVID-19 has created a heterogeneous and unforeseen situation across the world. Healthcare providers encountered new challenges in image interpretation, characterization, and prognostication of the disease. Pal *et al* delineated the radiological findings, which would guide the radiologists to identify the early signs of severe infection.

Key Words: COVID-19; Computed tomography; Lung ultrasound; COVID-19 scoring systems

Core Tip: Besides reverse transcriptase-polymerase chain reaction being the most standard test, chest X-ray, computed tomography, and lung ultrasound play a supportive role for Coronavirus disease 2019 (COVID-19) diagnosis. The main focus of this letter is to emphasize the importance of imaging in the COVID-19 pandemic. The various imaging characteristics aid in determining the severity of the disease and prognosis. The implementation of scoring systems further improves diagnostic efficiency. In addition, Pal *et al* discussed their COVID-19 first wave experience and recommended a few strategies for overcoming the second wave.

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TO THE EDITOR

We read with interest the article published in the World Journal of Radiology by Pal *et al*[1] on the depiction of radiological findings in identifying and predicting coronavirus disease 2019 (COVID-19) patient patterns. We would like to commend the authors for this vital article encompassing the pathophysiology and evidence-based review of COVID-19 severity scoring systems on chest X-ray (CXR), computed tomography (CT), and lung ultrasound (LUS). The authors outlined the artificial intelligence (AI) aspect of the diagnostic process and its importance in supporting human resources during the pandemic.

Although reverse transcriptase-polymerase chain reaction (RT-PCR) is the standard work-up for a specific diagnosis, it is limited by sample quality, laboratory errors, ribonucleic acid (RNA) stability, and variable sensitivity[2]. RT-PCR involves two steps: (1) Reverse transcription; and (2) Quantitative real time polymerase chain reaction. It can detect RNA by using either RNA or deoxyribonucleic acid (DNA) as positive controls. Most of the commercial kits adopt DNA as control in fear of RNA degradation by ribonucleases (RNases). However, DNA kits cannot report failed reverse transcriptase step, thus resulting in high false negative rates (40%) and variable sensitivity[3]. To avoid this concern, appropriate controls are necessary for viral RNA detection. Also, a negative RT-PCR requires repetition of the test in cases of clinical suspicion[4]. In contrast, imaging is a rapid and reliable procedure to evaluate suspicion of COVID-19 in individuals presenting with cough, dyspnea, and fatigue. At the beginning of the pandemic, there was a distinct and contentious discussion on the role and importance of radiology as part of the clinical management of COVID-19.

CXR is a readily accessible and inexpensive modality in the majority of clinical settings. It is helpful for triage among suspected COVID-19 individuals in the emergency department[5]. Peripheral predominant hazy opacification, bilateral lower lobe consolidation, and air space opacities similar to acute respiratory distress syndrome are the characteristic findings of COVID-19 on CXR. Pleural effusion, nodules, and pneumothorax are also unusual findings that can be discerned in COVID-19 patients[6].

Radiological assessment of lung edema (RALE) (Table 1) and Brixia score (Table 2) are the CXR-based grading systems in practice to predict the severity and prognosis of COVID-19 disease. According to a study by Au-Yong *et al*[7], RALE and Brixia scores have correlations of 0.87 and 0.86, respectively, in predicting patient outcomes. Individuals with high scores (RALE > 25 and Brixia > 11) have increased chances of intensive care unit admission or death within 60 days after diagnosis. As acknowledged by Pal *et al*[1] the usage of CXR has been limited by lower sensitivity (56%) and specificity (60%).

CT imaging is the preferred diagnostic modality, given its high sensitivity (94%)[1]. However, the specificity of CT ranges from 25% to 80%[1]. Lateralized, bilateral, multifocal, basilar and peripheral predominance and peripheral ground-glass opacities are the classical CT findings of COVID-19 pneumonia. Non-classical features include subsegmental vessel engorgement, “atoll sign,” reticular opacifications, subpleural curvilinear opacifications, and bilateral hilar lymphadenopathy. All these findings are well illustrated by Pal *et al*[1].

COVID-19 reporting and data system (CO-RADS) (Table 3) and MuLBSTA (multilobular infiltration, hypo-lymphocytosis, bacterial coinfection, smoking history, hypertension, and age) (Table 4) scoring systems aid in the identification of the lung involvement and prognosis in suspected COVID-19 patients. Pal *et al*[1] described that CO-RADS and MuLBSTA have a sensitivity of 61% and 65.1%, and specificity of 81% and 95.4%, respectively. The main drawbacks of CT in clinical setting are: radiation exposure, the need to transfer the patient to the imaging room, and availability.

Lung ultrasound (LUS) may assist physicians in assessing the disease severity with sensitivity and specificity of 65%-76.9% and 72.7%-77.1%, respectively[1]. It identifies subtle lung findings in the periphery which remain hidden in majority of CXR[8]. In addition, the findings of COVID-19 pneumonia on LUS correlate well with CT findings[9,10]. Hence LUS can be employed in the common and standard practice. LUS is advantageous as it eliminates the radiation risk and resource consumption of CXR and CT, if the patients require daily monitoring of lung status. It also overcomes the limitations of CT by its portability and accessibility at bedside with great learning curve. B-line artifacts, subpleural consolidations, pleural irregularities, and patchy opacities can be seen on the LUS of COVID-19-infected patients. The presence of B-lines indicates parenchymal involvement, and they increase proportionately with the disease, resulting in “white lungs”[2]. With recuperation from illness, B-lines are replaced with A-lines, which represent normal lung surface. Subpleural consolidation specifies the inflammatory changes; however, these findings may last for several weeks after recovery.

Table 1 Radiological assessment of lung edema classification[13]

Consolidation	
Score	Extent of alveolar opacities in each lung quadrant.
0	0%
1	0-25%
2	25-50%
3	50-75%
4	> 75%
If consolidation is ≥ 1, then score density	
1	Hazy
2	Moderate
3	Dense
Final RALE scoring	
Right lung	**Left lung**
Upper quadrant, Cons × Density= Q1	Upper quadrant, Cons × Density= Q3
Lower quadrant, Cons × Density= Q2	Lower quadrant, Cons × Density= Q4
Total RALE: Q1+Q2+Q3+Q4	

RALE: Radiological assessment of lung edema.

Table 2 Brixia score

Score	Findings on CXR in three divided zones of each lung
0	No abnormal findings
1	Interstitial infiltrates
2	Interstitial > Alveolar infiltrates
3	Alveolar > Interstitial infiltrates

CXR: Chest X-ray.

A 12-zone scoring system is used to quantify and predict the severity of lung involvement. Individuals are classified as normal, mild, moderate, and severely infected, with scores of 0, 1-5, 6-14, and ≥ 15, respectively. A cutoff score of 8 of 36 is 91% sensitive in predicting COVID-19 diagnosis. Hence LUS may be used as a screening tool, but in conjunction with other imaging modalities due to its ineffective differentiation between acute ongoing infection and recovery[1,2].

Although the role of magnetic resonance imaging, Fluorodeoxyglucose positron emission tomography, CT pulmonary angiography, and point-of-care echocardiography is limited in COVID-19, they may help detect complications such as myocarditis, cardiomyopathy, right ventricular dilatation, and pulmonary embolism and monitor the treatment response. AI is an algorithm-based entity that allows rapid diagnosis and enhances a health system's capability. AI COVID-19 algorithm has a sensitivity, specificity, and accuracy of 84%, 93%, and 90.8%, respectively. AI-based deep learning technology has detected COVID-19 on CT with an area under the receiver operating characteristic curve of 0.96 and sensitivity and specificity of 90% and 96%, respectively[11]. Wehbe *et al*[12] compared the performance of AI and radiologists and reported similar diagnostic accuracy of 82% and 81%, respectively. Hence, AI has the ability to assist radiologists in prompt diagnosis and to improve workflow efficiency.

Familiarity with the COVID-19 imaging findings was essential for radiologists working during the pandemic. Even though the disease spread is controlled currently, the discovery of newer virus strains highlights the importance of strategies such as increasing work capacity and imaging capabilities that might be helpful during a future unanticipated outbreak.

Table 3 Coronavirus disease 2019 reporting and data system classification.

Category	Level of COVID-19 suspicion	Findings
0	Non-interpretable	Technically insufficient scan to assign a score
1	Very low	Normal lung
2	Low	Typical of infection other than COVID-19
3	Equivalent/unsure	Non-specific findings to COVID-19 and other infections
4	High	Suspicious of COVID-19
5	Very high	Typical COVID-19 findings
6	Proven	Positive RT-PCR for COVID-19

COVID-19: Coronavirus disease 2019; RT-PCR: Reverse transcriptase- polymerase chain reaction.

Table 4 Multilobular infiltration, hypo-lymphocytosis, bacterial coinfection, smoking history, hypertension, and age scoring system

Parameter	Yes	No
Multi-lobar involvement	+ 5	0
Lymphopenia (≤ 0.8 $\times 10^9$/L)	+ 4	0
Bacterial co-infection in blood or sputum	+ 4	0
Smoking history	Active smoker: + 3; Prior Smoker: + 2	0
Hypertension	+ 2	0
Age ≥ 60 yr	+ 2	0

FOOTNOTES

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