Letter to the Editor

The humble chest radiograph: an overlooked diagnostic modality in the COVID-19 pandemic

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The COVID-19 pandemic is the most serious public health crisis in recent history, affecting 213 countries and territories with close to 8 million confirmed cases worldwide at the time of writing. The amount of research on the diagnosis and management of this novel disease has also grown exponentially as the number of cases surge globally.

In regard to imaging, the performance of computed tomography (CT) in the diagnosis of COVID-19 has generated the most attention, with initial studies reporting a high sensitivity that allowed it to replace the gold standard real-time reverse-transcriptase polymerase chain reaction (RT-PCR) tests (1). As such, current radiological literature on COVID-19 is dominated by CT, with scant publications available on chest radiography (CXR).

We note with interest an astute warning by your Editor-in-Chief, as early as March 2020, highlighting concern that the reported high sensitivity of CT by Ai *et al.* (2) may only be valid in epidemic areas with high pre-test probability for this disease. In a setting of lower pre-test probability, the risk of false negative results becomes incrementally higher (3). This risk is particularly true in asymptomatic patients, who have a higher incidence of negative imaging findings, especially in the early stages of disease (4,5). Furthermore, the limited specificity of CT due to overlapping imaging features with several other viral pneumonias cannot be over-emphasized (6).

The above concerns have been echoed by multiple professional bodies, which have issued guidelines against the use of CT for primary diagnosis of COVID-19. These include the American College of Radiology (7), European Society of Thoracic Imaging (8), British Society of Thoracic Imaging (9) and The Royal Australian and New Zealand College of Radiologists (10). CT is recommended for patients with worsening respiratory status to look for associated complications, such as thromboembolic disease (11).

While the CXR is not as sensitive as chest CT in the detection of COVID-19 associated lung abnormalities, it has the benefit of having lower ionizing radiation exposure while maintaining diagnostic throughput. The frequency and distribution of CXR abnormalities in COVID-19 patients has been described by Wong *et al.* (12), with peak severity of CXR findings at 10–12 days from symptom onset. It is prudent to note that the utility of the CXR varies in different communities, depending on the underlying public health directives and healthcare infrastructure (13). For example, in hard hit areas where patients are instructed to stay at home and to present only when symptomatic, CXRs tend to be abnormal due to the high pre-test probability. Eighty-five point seven percent of CXRs were abnormal in a cohort of COVID-19 patients from Detroit, Michigan (14), which had the third-highest number of recorded cases in the United States at the time of writing. In contrast, the CXR may be of lesser value in

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cities with aggressive testing and contact tracing, given its poor sensitivity in early and mild disease. This has been observed in Singapore; in our cohort of 109 patients, only 1 in 2 patients were eventually found to have abnormal CXRs, with only 1 in 3 overall showing abnormality at presentation (15). This may be due to (I) patients presenting early in the course of disease (<5 days); (II) subtle radiographic abnormalities (typically ground-glass changes) not detected or obscured, and (III) majority of cases being mild and not progressing to pneumonia.

There are inherent challenges in performing a CT for a critically ill patient, including the need for accompanying medical personnel, mobile ventilatory support, and the physical task of transferring the patient. In these instances, the value of portability of the CXR increases. By bringing the X-ray machine to the bedside of a COVID-19 patient, these difficulties are virtually eliminated, along with the risk of transmission during transportation en-route to the hospital's CT scanner. Such a consideration is of even greater significance in resource constrained communities where personal protective equipment is limited. In addition, portable CXR significantly reduces the risk of cross-infection by reducing the need to decontaminate the CT scanning room after each use. This also helps increase the availability of the CT scanner to other patients.

Given that CT may not be widely available, and the relative affordability and ease of acquiring a CXR, it is imperative for us to scientifically and rigorously assess its clinical utility. Unfortunately, there is currently little evidence to show that the CXR is accurate for evaluation of management. At least two groups have recently proposed quantitative scoring systems for COVID-19 pneumonia on CXRs. Toussie *et al.* (16) found that CXR severity score of 2 or more and obesity/morbid obesity were independent predictors of hospital admission, and a score of 3 or greater could predict the need for intubation. The CXR scoring studied by Borghesi *et al.* (17) identified males aged 50 years or older and females aged 80 years or older showing higher risk of severe lung disease. Its role in relation to other clinical and lab markers should also be properly assessed. In our own experience (15), we have shown that the CXR (I) parallels known markers of disease severity (like SARS)—lactate dehydrogenase (LDH), C-reactive protein (CRP) and lymphocyte count, (II) severity of abnormalities correlates well with the need for supplemental oxygen, (III) may predict the need for supplemental oxygen based on quantified severity, best at D6-10, and (IV) can predict a benign clinical course when normal or with very mild abnormalities.

There is also growing interest in the role of artificial intelligence (AI) in detection of COVID-19 on CXRs. A Dutch group found that their AI system could correctly identify COVID-19 on CXRs with performance comparable to six independent readers, with a positive predictive value (PPV) of 77% (18). In our hospital, we have also recently started using AI to help identify abnormal CXRs for prompt reporting. Such systems will be helpful in communities where manpower is limited, to help triage cases and to generate reports for positive cases expeditiously.

As this is likely to be a long-drawn pandemic, we urge the medical community to place greater attention on scientifically assessing the role of CXR as a triage and monitoring tool of COVID-19.

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Footnote

Conflicts of Interest: Both authors have completed the ICMJE uniform disclosure form (available at http://dx.doi.org/10.21037/qims-20-771). The authors have no conflicts of interest to declare.

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