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Chest Computed Tomography for Detection of Coronavirus Disease 2019 (COVID-19): Don't Rush the Science

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Amidst the coronavirus disease 2019 (COVID-19) pandemic, there is great pressure on physicians to provide clarity and answers. Good science, however, takes time and careful consideration to prove the value of advancements in diagnosis and treatment. We would like to share what we believe is a classic arc of events for a new imaging indication in the radiology literature: A rush to publish positive results leads to their overinterpretation and, consequently, the dissemination of premature conclusions with broad implications. Although this has occurred before with imaging, our recent experience is unique in that the implications are far-reaching and potentially of immediate importance.

The shortage of rapid and highly sensitive reverse transcriptase polymerase chain reaction (RT-PCR) tests for the diagnosis of COVID-19 has led many in the health care community to consider a screening or diagnostic role for imaging. Publications from China during the outbreak there suggest a central role for computed tomography (CT). Fang and colleagues reported CT findings of pneumonia in 50 of 51 patients with RT-PCR–proven COVID-19 (1). Ai and colleagues then reported CT findings of pneumonia in 580 of 601 patients with RT-PCR–proven COVID-19 (2). Together, these publications ostensibly present a compelling story for CT, with sensitivities for the diagnosis of COVID-19 reported as 98% and 97%, respectively. Ai and colleagues concluded that chest CT may be used as a primary tool for detecting COVID-19 in epidemic areas.

Concurrent with these publications, the journal that published them described an "ultra-rapid peer review" process (3). An expert panel was formed for review of the many manuscripts the journal received about COVID-19 imaging research, with the expectation that panel members would review articles within a 24-hour turnaround time. The commendable goal of this process is to publish key results as fast as possible. But does this ultra-rapid process allow enough time and consideration to ensure that only high-quality research is published?

We believe that the answer is no (4, 5). In reviewing these 2 publications in detail, as well as others that support the use of CT for the diagnosis of COVID-19, we have found that many problems, such as faulty research design, incomplete methods sections with little description of likely biased patient cohorts, absence of a valid gold standard, multiple confounding variables, and scant discussion, limit the generalizability of the results and call into question the broad conclusions that are made. The findings of COVID-19 pneumonia that were used (for example, consolidation and ground-glass opacity) are not specific to the disease; rather, they are commonly seen in a range of infectious and noninfectious conditions. Consequently, positive CT results are only believable if the pretest probability of COVID-19 is high.

Interestingly, a later publication attempted to show that COVID-19 can be differentiated from other viral pneumonias (6). Using 219 cases of COVID-19 pneumonia from China and 205 proven viral pneumonias (not COVID-19) from the United States, the authors asked blinded readers to score the cases as COVID-19 or not. They reported reasonable sensitivities and high specificities for both Chinese and U.S. radiologists and concluded that "Radiologists in China and the United States distinguished COVID-19 from viral pneumonia on chest CT with high specificity but moderate sensitivity." On careful review, we found many methodological flaws (5). Clear differences between the Chinese and U.S. cohorts, which could be obvious by imaging and potentially guide a blinded reviewer, are present, including differences in age (45 vs. 65 years), prevalence of cardiovascular disease (12% vs. 60%), and possibly disease severity. In addition, important and common diseases with imaging appearances that overlap with COVID-19 pneumonia were not included. Moreover, the radiologist's gestalt, and not specific imaging findings, was used to "diagnose" COVID-19 pneumonia.

We acknowledge that these are extraordinary times that place great pressure on the scientific community to produce answers and treatments. This is precisely why we need to rely on a thorough peer review process to scrutinize submissions and make sure that data are carefully collected, results are judiciously analyzed, and conclusions are fair and appropriate. We believe that a 24-hour turnaround time for peer review is likely not adequate.

Although the intention of the literature promoting the use of CT for the diagnosis of COVID-19 is admirable—that is, faster diagnosis—it has caused confusion within the radiology community. One of the repercussions of using CT in the diagnosis of COVID-19, which is not discussed in the radiology literature, is that safely performing imaging is problematic. At the very least, droplet precautions with appropriate protective gear (now in short supply) need to be followed, CT scan rooms must be thoroughly cleaned, and the air needs to be recirculated given that COVID-19 is an airborne disease. Even if all protocols are followed, there is a risk that COVID-19 infection may be passed to other patients or staff in imaging departments. The American College of Radiology helped to resolve this confusion with guidelines for the use of imaging for suspected COVID-19 infection in mid-March (last updated March 22) (7). Their guidance is sound: "The findings on chest imaging in COVID-19 are not specific and overlap with other infections, including influenza, H1N1 [influenza], [severe acute respiratory syndrome], and [Middle

East respiratory syndrome]" and "CT should not be used to screen for or as a first-line test to diagnose COVID-19."

This is a cautionary tale from the radiology community about the consequences of rushing the scientific review process. The best intentions can lead to unforeseen consequences. This may become more relevant as we push forward with potential treatments and vaccines for COVID-19.

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