Title
CT on the Diamond Princess: What Might This Tell Us About Sensitivity for COVID-19?

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CT on the Diamond Princess: What Might This Tell Us About Sensitivity for COVID-19?

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Abbreviations

COVID-19 (Coronavirus Disease 2019)

PCR (Polymerase Chain Reaction)

RT-PCR (Real Time Polymerase Chain Reaction)

ACR (American College of Radiology)

Editor:

We read with interest the recent paper by Inui et al describing chest CT findings in patients with COVID-19 infection aboard the "Diamond Princess" cruise ship (1). The study consisted of 104 patients with PCR-confirmed COVID-19, who also underwent chest CT. The authors focused on characterizing findings in symptomatic versus asymptomatic patients, concluding that there was a high incidence of subclinical changes on CT scans performed on confirmed COVID-19 patients.

However, we believe the authors overlooked an important conclusion that has implications regarding the sensitivity of CT for the diagnosis of COVID-19. In this cohort of RT-PCR-confirmed patients, 39% had no lung opacities, including 21% of symptomatic patients. This means chest CT had only a 61% sensitivity for detecting any lung abnormalities in COVID-19, and a 20% false-negative rate in symptomatic patients.

These data starkly contrast with widely cited literature reporting CT sensitivity for COVID-19 as high as 97%-98% (2,3). The differences in sensitivities between studies likely reflects the unique cohorts studied; we believe that the earlier literature from China was likely biased toward symptomatic patients imaged in later stages of disease. The current findings are more in line with Bernheim et al, who found that 56% of CTs were normal in the first 2 days after symptom onset (4).

The article by Inui et al reinforces a limited diagnostic role for CT. Even when RT-PCR may be in limited supply, we endorse the consensus statements provided by the ACR and other societies (5), especially in populations where the prevalence of disease is low. This determination is based on a significant percentage of normal CT scans in RT-PCR confirmed COVID-19 patients (asymptomatic and symptomatic), and the lack of specific imaging findings that are definitive for COVID-19 pneumonia. RT-PCR remains the reference standard for diagnosis; it is a molecular test that identifies a finding not present in normals or those without the disease. This is of particular importance given the logistical and safety issues of imaging suspected or known COVID-19 patients with CT, and the persistent need to isolate patients with clinical suspicion, even if imaging findings are negative or inconclusive.

References
1.   Inui S, Fujikawa A, Jitsu M, Kunishima N, Watanabe S, Suzuki Y, et al. Chest CT Findings in Cases from the Cruise Ship "Diamond Princess" with Coronavirus Disease 2019 (COVID-19). Radiol Cardiothorac Imaging. 2020 Mar 17;2(2):e200110.

2.   Ai T, Yang Z, Hou H, Zhan C, Chen C, Lv W, et al. Correlation of Chest CT and RT-PCR Testing in Coronavirus Disease 2019 (COVID-19) in China: A Report of 1014 Cases. Radiology. 2020 Feb 26;200642.

3.   Fang Y, Zhang H, Xie J, Lin M, Ying L, Pang P, et al. Sensitivity of Chest CT for COVID-19: Comparison to RT-PCR. Radiology. 2020 Feb 19;200432.

4.   Bernheim A, Mei X, Huang M, Yang Y, Fayad ZA, Zhang N, et al. Chest CT Findings in Coronavirus Disease-19 (COVID-19): Relationship to Duration of Infection. Radiology. 2020 Feb 20;200463.

5.   ACR Recommendations for the use of Chest Radiography and Computed Tomography (CT) for Suspected COVID-19 Infection. https://www.acr.org/Advocacy-and-Economics/ACR-Position-Statements/Recommendations-for-Chest-Radiography-and-CT-for-Suspected-COVID19-Infection. Accessed March 20, 2020.j

Response:

Dual Role of Radiologists in the Face of COVID-19

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We thank Dr Isikbay and colleagues for their interest in our article (1) and thoughtful comments that reinforce our findings. Their discussion of sensitivity and specificity of chest CT reminded us that during the COVID-19 pandemic, radiologists have two different roles: individual radiologist and manager of the radiology department.

As individual radiologists we need to be sensitive to the optimal use of CT. As Dr Isikbay and colleagues point out, the sensitivity of our study cohort was 61% (54% for asymptomatic cases and 79% for symptomatic cases). Although our cases had had relatively high-risk contact on a confined cruise ship, the environmentally homogenous population enabled elimination of co-infection with other lung infections. In addition, we hospitalized all cases for isolation and performed CT examination irrespective of the presence of symptoms thereby eliminating one

potential selection bias (2). Therefore, we believe our data to be robust, consistent with a clinical study (3). We agree that the low sensitivity precludes use of CT for the initial screening especially in the areas of low prevalence.

Second, from the management perspective, we have to be sensitive to the cost of CT for COVID-19 cases while preventing nosocomial infection. These costs include personal and airborne precautions, and the time and special separation needed to conduct the radiologic examinations. In our hospital, we adopted a CT-first strategy with a 6-row CT scanner dedicated for COVID-19 cases. The CT scanner room was side-by-side with the emergency room. Patients with positive real-time reverse transcription polymerase chain reaction underwent CT and were admitted to the isolation ward to minimize contact with other persons. Accordingly, initial screening with chest radiography was not done, and so its value as the initial screening measure could not be addressed. Taking these costs and risks of nosocomial infection into account, we agree with expert opinions that chest CT be reserved for cases in which a likely impact on clinical decision making can be anticipated (4-5). Furthermore, the cost and risk of CT examinations should be reconsidered in the context of the potential screening value of chest radiography.

References

1. Inui S, Fujikawa A, Jitsu M, et al. Chest CT Findings in Cases from the Cruise Ship "Diamond Princess" with Coronavirus Disease 2019 (COVID-19). Radiology: Cardiothoracic Imaging. 2020 Mar 17;2(2):e200110.

2. Ai T, Yang Z, Hou H, et al. Correlation of Chest CT and RT-PCR Testing in Coronavirus Disease 2019 (COVID-19) in China: A Report of 1014 Cases. Radiology. 2020 Feb 26;200642.

3. Guan Z, Ni Z, Hu Y, et al. Clinical Characteristics of Coronavirus Disease 2019 in China. N Engl J Med. 2020 Feb 28; DOI: 10.1056/NEJMoa2002032

4. Radiology Department Preparedness for COVID-19: Radiology Scientific Expert Panel. Radiology. 2020 Mar 16; https://doi.org/10.1148/radiol.2020200988

5. ACR Recommendations for the use of Chest Radiography and Computed Tomography (CT) for Suspected COVID-19 Infection [Internet]. [cited 2020 Mar 20]. Available from: https://www.acr.org/Advocacy-and-Economics/ACR-Position-Statements/Recommendations-for-Chest-Radiography-and-CT-for-Suspected-COVID19-Infection