Radiology: Cardiothoracic Imaging

Accuracy of Low-Dose Chest CT Scan in Detection of COVID-19

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Editor:

We read the informative article published by Dangis et al in the journal about the accuracy of low-dose chest CT in the diagnosis of COVID-19 disease (1). Considering that in many settings chest CT scan is used widely for detection of COVID-19 pneumonia, using a low-dose protocol especially in patients younger than 40 years is important. This interesting study reported accuracy of 90.2% in all patients and 94% in the subset of patients with chest CT performed 48 hours after the symptom's onset. The sensitivity and specificity values were respectively 86.7%

and 93.6%, while in a recent meta-analysis including 63 studies, Kim et al (2) reported combined sensitivity and specificity of chest CT for the diagnosis of COVID -19, considering PCR test as the reference standard, as 94% and 37%, respectively. Pooled prevalence of COVID-19 mainly from reports in China is about 39%, which is near to what Dangis et al (1) report with described pretest probability of 43%. Additionally, we have conducted a study in Tehran, Iran, utilizing low-dose chest CT on 163 patients and observed a sensitivity value of 96.6% (95% CI: 90%, 99%), and specificity value of 36.5% (95% CI: 26%, 49%) (unpublished results), more compatible with the numbers in the mentioned meta-analysis. Although Dangis et al (1) stated that a potential reason for their high specificity was the repeated RT-PCR test after 24 hours in cases with initial negative RT-PCR result, the specificity of standard-dose CT scan in four previous studies with repeated RT-PCR have ranged between 25% and 56% (3-6). It seems that other explanations for the observed high specificity of low-dose chest CT should be explored. Additionally, the specificity of low-dose CT scan for subset of patients with initial negative RT-PCR results are not reported separately in their study.

In conclusion, this remarkable study by Dangis et al (1) demonstrates excellent accuracy of low-dose chest CT in the diagnosis of COVID-19 pneumonia, with exceptional high specificity compared to previous standard-dose studies, which remains to be further validated.

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Response:

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We thank the authors for their interest in our article (1). The plethora of research articles on coronavirus disease 2019 (COVID-19) may tempt us to directly compare studies or translate results to our own daily routine. It is important, however, to realize that measurements of diagnostic accuracy such as sensitivity and specificity are *only* valid for the study population from which they are obtained and for the reference test against which they are compared.

First, the use of low-sensitivity real-time polymerase chain reaction (RT-PCR) reference tests in early studies from China leads to an underestimation of CT specificity and is directly mentioned by Ai et al in their study limitations (2). As the vast majority of studies in the meta-analysis by Kim et al originate from China, their likely use of low-sensitivity RT-PCR assays explains the observed low specificity (3). Caruso et al from Italy do not directly mention the sensitivity of their RT-PCR assay, but as this study included 96 RT-PCR negative subjects of which 42 had positive findings on chest CT, it is very likely that part of these “false positives” on CT were in fact true positives (4). In a reader study eliminating effects of an imperfect reference test, Bai et al reported specificity of 93%–100%, similar to our results (5). Our RT-PCR was externally validated against the National Reference Laboratory of University Hospitals, Leuven, Belgium as well as in two international independent External Quality Control (EQC) Programs (QCMD, Scotland, UK, and Instand, Düsseldorf, Germany, www.instand-ev.de).

Second, there is an inherent trade-off between test sensitivity and specificity. In a situation with limited availability of an imperfect reference test, sensitivity is typically preferred over specificity, and a

low threshold for diagnosis is used. As previous studies reported a very high sensitivity (97% vs 86% in our study), this negatively affected specificity (2,4).

Third, our study should not be read as superior performance of low-dose versus standard-dose CT. However, excellent reproducibility and accuracy suggests low dose is sufficient for diagnosis, and radiation exposure should be reduced. We used CareDose4D (Siemens Healthineers) to adapt radiation parameters, including CarekV which selects the optimal tube voltage. New techniques may even further reduce radiation exposure (6).

Fourth, the prevalence of pneumonia from non-COVID-19 viruses (the most challenging differential diagnosis of COVID-19 on CT) in our cohort was very low, further increasing CT specificity.

In conclusion, differences in study populations and reference tests change the estimated performance of a screening test. Careful consideration of these differences is necessary in order to place research results in a proper clinical context.

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