

Value of Chest CT in Context of COVID-19 Pandemic

R&D Radiology / Medical and Clinical Affairs (MCA) CT position

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Background:

In context of the COVID-19 pandemic, Auntminnie.com and several other medical news outlets reported that recent clinical studies suggest that non-enhanced low dose CT scans show promise in identifying COVID-19 patients early. Since then a number of questions from customers on the Bayer Radiology position have been received.

In the most recognized study in *RADIOLOGY (Ai et al.)*¹ published online February 19, 2020, Chest CT was reported to provide higher sensitivity than a virologic lab test (reverse transcriptase polymerase chain reaction or RT-PCR) at detecting coronavirus disease (COVID-19) in high-risk individuals upon initial presentation of symptoms. However, there are methodological limitations relating to subject selection and standard of truth to be acknowledged.

The German DRG, US ACR and other radiological societies have published views on the value of Chest CT in context of the current pandemic.

With the disease progression and the increased patients who got infected, the complications and associated symptoms are highlighted more in literature.

Hypercoagulability has been reported in patients who have COVID-19 (COVID+), with increased mortality associated with elevated serum thrombogenic proteins such as D-dimer. In fact, patients with severe COVID-19 who were empirically treated with low-molecular weight heparin (LMWH) had a lower 28-day mortality compared with similarly ill patients that were not treated with LMWH. This raises the question of whether thrombotic and embolic events in various organ systems worsen the patient's clinical status.

In a recent study published by *Kaminetzky et al., 2020*¹⁰, the authors found that patients in the study with confirmed COVID-19 had pulmonary embolism diagnosed in 37% of CTPA examinations with D-dimer levels associated with the presence of pulmonary embolism and the degree of pulmonary artery obstruction.

Short Recap of Ai et al. Radiology 2020:

Purpose:

To investigate the diagnostic value and consistency of chest CT [non-contrast] as compared to RT-PCR assay in COVID-19 patients.

Methodology

Retrospective evaluation of 1049 patients who were suspected of COVID-19 infection and underwent both RT-PCR and CT imaging. 2 Radiologists (one experienced, one junior) read the images without knowing PCR results but with other clinical information (fever, dry cough). For patients with negative RT-PCR tests but positive CT results, follow-up chest CT images were re-reviewed to further confirm the imaging diagnosis if available.

Results:

Of 1014 patients, 601 had positive and 413 had negative RT-PCR results with a positive rate of 59%. Of 601 patients with positive RT-PCR results, 97% (580/601) had positive chest CT scans. Of 413 patients with negative RT-PCR result, 75% (308/413) had positive chest CT scans. The chest CT images of 308 patients suggested COVID-19, while their RT-PCR assays from throat swab samples were negative. Based on the analysis of clinical symptoms, CT features and serial CT scans if available, 48% (147/308) of patients were considered as highly likely cases, 33 % (103/308) as probable cases and 19 % (58/308) as uncertain cases. However, formal specificity of CT was 25% and PPV 65%.

Author's Conclusion

Chest CT imaging has high sensitivity for diagnosis of COVID-19. Our data and analysis suggest that chest CT should be considered for the COVID-19 screening, comprehensive evaluation, and following-up, especially in epidemic areas with high pre-test probability for disease.

Short Recap of Kaminetzky M Pulmonary Embolism on CTPA in COVID-19 Patients Radiology: Cardiothoracic Imaging July 2020¹⁰

Purpose:

To evaluate PE prevalence on computed tomography pulmonary angiogram (CTPA) in COVID+ patients and factors associated with PE severity

Methodology:

A retrospective, single-center study evaluated 62 COVID+ patients who underwent CTPA between March 13 and April 5, 2020. A 62-patient cohort who underwent CTPA prior to the first reported local COVID-19 case was retrogradely selected. The relative rate of CTPA-positivity was recorded. For the COVID+ cohort, comorbidities, laboratory values, clinical outcome, and venous thrombosis were recorded.

Results:

37.1% of COVID+ patients had PE, higher than 14.5% of pre-COVID patients (P=.007). D-dimer levels closest to CTPA date correlated with Mastora obstruction score. ROC analysis identified optimal sensitivity (95%) and specificity (71%) for PE diagnosis at 1394 ng/mL DDU. The mean D-dimer was 1774 ng/mL and 6432 ng/mL DDU in CTPA-negative and CTPA-positive subgroups, respectively. One additional CTPA-negative patient had DVT, for a total 38.7% with PE/DVT, despite 40% receiving prophylactic anticoagulation. Other factors did not demonstrate significant PE association.

Author's Conclusion

37.1% of COVID+ CTPA exams diagnosed PE. PE can be a cause of decompensation in COVID+, and D-dimer can be used to stratify patients regarding PE risk and severity.

MCA CT comments:

- The reported high CT sensitivities for COVID-19 reflect the high pretest probability of included subjects and the known general high CT sensitivity for pneumonic infiltrates, like the ones COVID-19 can cause.
- No solid gold standard was applied especially in those subjects with positive CT findings but negative RT-PCR findings. The occurrence of other viral pneumonias (adeno virus, influenza) might have influenced the results in favor of CT.
- No conclusion can be drawn on the specificity or overall accuracy regarding other viral pneumonias like influenza or adeno virus presenting with similar pulmonary expression.
- Hyper coagulability associated with COVID-19 is a serious complication, the use of D-dimer and CTPA will help in the diagnosis and management of any associated PE.

MCA evaluation results:

- The situation is still fluid, research continues to be performed, and knowledge is rapidly evolving.
- Chest X-rays as well as non-enhanced Chest CT findings are not specific and thus COVID-19 findings cannot be differentiated from other viral respiratory infections such as SARS and influenza.
- In comparison to Chest X-rays, Chest CT provides a significantly higher sensitivity for pneumonic infiltrates which is based on its volumetric capability and on the strong contrast between healthy (air filled) and pathologic (fluid filled, compressed or fibrotic) lung areas.
- Viral pneumonia patterns in CT include ground glass opacifications, consolidations, no lymphadenopathy, no pleural effusions (same for all viral infections of the lung).
- Currently, viral RNA tests (RT-PCR) remain the only specific diagnostic test for COVID-19.

- D-dimer levels can potentially be used to risk stratify patients in terms of suspicion for pulmonary embolism and severity. CTPA should be used in patients with elevated D-dimer levels and associated clinical symptoms to diagnose PE.
- Additionally, there are concerns about infection control issues that COVID-19 patients could present by entering CT suites.

MCA Conclusions:

- Current research around the value of CT in context of COVID-19 shows high sensitivities to detect pulmonary complications but is not suitable to suggest a larger role for CT in diagnosing COVID-19.
- At this state, CT should not be broadly used in suspected COVID-19 subjects but only in specific patients with clear clinical indication for CT (differential diagnosis in patients with multi-morbidity, respiratory high-risk patients, clinical complications). This is in line with the current position of the German DRG and the US ACR.
- CT has not currently emerged as a first-line test or as a screening tool for COVID-19 diagnosis also because at this point a negative CT would not prove that a patient is not infected and even with positive CT findings, a virologic test (such as reverse transcriptase polymerase chain reaction, RT-PCR) needs to be performed in addition to confirm the COVID-19 diagnosis.
- Appropriate disinfection procedures of the imaging room and equipment have to be employed following each visit of a patient with known or suspected COVID-19 infection negatively affecting efficiency of the current integrated CT suite set up. Current WHO recommendations for disinfection of medical devices are not always in line with current device labeling.
- There could be an increasing role for CT for COVID-19 patients in the future:
 - In screening and identifying those patients with developing pulmonary complications early.
 - In helping to classify and quantify disease severity or progression and predict respirator needs as early as possible.
 - As a fallback or as a way to limit RT-PCR test usage in case RT-PCR tests run into a supply shortage.
 - By deployment of mobile CT units for infection control or when regular radiography suites are running out of capacity.
 - To identify blood clots in various organs in patients with suspected coagulation complications.

Sources

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10. [Kaminetzky M Pulmonary Embolism on CTPA in COVID-19 Patients. *Radiology: Cardiothoracic Imaging* 2020 2:4](#)