ORIGINAL RESEARCH

Sensitivity and specificity of RT PCR and HRCT Thorax for Confirmed Diagnosis ofCOVID-19

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Abstract:

Introduction:TheCOVID-19pandemichasrepeatedlyhittheplanetwithawaveofinfection.Clinicians are attempting to defend public health care ethics. Asymptomatic COVID-19 casesgounrecorded,andthemajorityofthemisolatethemselves.Significantradiologicalabnormalities have been discovered in RT-PCR positive asymptomatic COVID-19 cases,accordingto studies.

Objective:Thegoalofthiscross-sectionalstudyistoevaluateasymptomaticRT-PCR-positivepatients'chest CT findingsin oneof India's COVID-designatedinstitutions in a tertiary care centre in Bihar.

Methods: In three months, we did HRCT chest of diverse (200 patient case study) proved andprobableinstances of COVID-19 infection. All patients are underwent HRCT chest by multislice (128 slice) Toshiba CT scan (Aquilion) or 16 slice Toshiba CT scan. The following CT parameters were used: collimation 5mm; slice thickness, 0.5- 2.5 mm; reconstruction interval, 2.5 mm; table speed 13.5 mm per rotation; 150 -250 mA effective current; tube potential 120kVp; and matrix size, 512 x 512. the patient was examined in supine position with both arms extended above the head. All CT chest were taken in caudocranial direction, covering entire chest from diaphragmatic dome up to lung apex, without intravenous contrast administration. The image finally send to PACS for reporting.

Results: Positive HRCT chest results were detected in 196 of 200 scanned individuals withclinical complaints and suspicion, indicating clinical-radiological association and an accuracyof 98 percent. Based on positive RT-PCR data, the sensitivity of chest CT in suggestingCOVID-19was98.6%(146/148patients).90percent(18/20)ofpatientswithnegativeRTPCRresultsandsignificantclinicalsuspicionhadpositivechestCTfindings.

Conclusion:InlaboratorynegativeRT-PCRcaseswithstrongclinicalsuspicionofCOVID-19infection,HRCTchestisparticularly sensitive and accurate in detecting up lung parenchymal abnormalities, as well asin all symptomatic patients whose RT-PCR was not done. In patients

with a strong clinicalsuspicion,HRCTcanbeexceedinglysensitive,cost-effective,andtime-effective.HRCT outperformsRT-PCRintermsofprovidingimmediateresults,measuringdiseaseseverity,andprognosisprediction. InallpatientswithclinicalsymptomsandsuspicionofCOVIDinfection,regardlessoflaboratoryRT-PCRstatus,werecommendHRCTchestforidentificationofearlyparenchymalabnormalities and determining diseaseseverity.
Keywords: HRCT chest, COVID-19, Viral Pneumonia.

Introduction

Since the first reports of the Corona Virus Disease-2019 (COVID-19) in Wuhan, China, caseshavebeenreportedfromallsevencontinents,resultinginmillionsofdeaths.COVID-19,whichis caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and infectsthe lungs, is mostly transferred through respiratory droplets. [1] The confirmatory laboratorydiagnosis test for SARS-CoV2 is the reverse transcriptase polymerase chain reaction (RT-PCR). Inasymptomatic cases, particularly in close contacts, RT-PCR is indicated for infectionscreeningandearlydetectioninhigh-riskpopulationsandsitessuchashealthcarecentres,priorto surgical operations, and prior to receiving immunosuppressive medicine. [2,3] The pooledpercentage of asymptomatic infection was 15.6 percent in a meta-analysisdone by He J et al. [4] Cases with nosymptomsarelessinfectiousthanthosewithsymptoms.[5,6]Despitethemodestinfectivity, 20to50%ofasymptomaticindividualshadparticularalterationsonchestcomputedtomography (CT). However, the likelihood of asymptomatic cases developing pneumonia isextremely low (CT changes in asymptomatic patients are important not only for evaluatingchest CT as an alternative diagnostic modality for selected COVID-19 cases, but also forevaluating the long-term outcomes of COVID-19-related respiratory pathophysiology, whichislargelyunknown).[7, 8]OurgoalistoevaluatethefeaturesofchestCTscansandclinical outcomes of RT-PCR verified asymptomatic COVID-19 patients in a COVID-19 recognisedhospitalin India.

Methodology

Patientswithfever,cough,throatpain,anosmia,anddyspnea(atleasttwoofthesesymptoms)wereinvestigated witha16sliceCTscanoftheirchest.Slicethickness1.2mm,acquisitionprotocolKVp100 mAS 80 Pitch 1.2. Matrix 512 × 512. There were 200 patients scanned in all. For 168cases, RT PCR for Covid 19 was done. RT PCR was performed on 68 patients prior to HRCTchest(1–3dayspriortothescan)and100patientsaftertheHRCTchest(within72hofscan).Groundglassopacities(GGOs),reticularthickening,localisedconsolidations,fibrosis,pleuraleffusion,nodules,andhilarlymphadenopathywereallevaluatedindependentlybytworadiologistswith 8 years ofexpertise in chest imaging. RT PCR was not performed in 32 mildly symptomatic patients who were advised isolation and treatment on CT findings.

Results

Positive HRCT chest findings were detected in 196 of 200 scanned individuals with clinicalcomplaints and suspicion, indicating clinical radiological connection and an accuracy of 98percent [Chart 1]. In all 200 patients, HRCT chest was performed; RT PCR was performedbefore imaging in 68 patients and after imaging in 100 patients (total 168 patients). In 32minimally symptomatic individuals who were advised to be isolated and treated based on CTresults, RT PCR was not done. 60 of the 68 patients who had RT PCR done before imaginghad positive results, while only 8 had negative results. HRCT chest findings were positive

in58of60positiveRTPCRpatients,indicatinga96.6percentassociation.Alleightpatientswithclinical symptoms who had a negative RT PCR test had positive HRCT findings. FollowingHRCTchestobservations,100patientswereevaluatedwithlaboratoryRTPCR,with88testingpositive(88percentcorrelation)and12testingnegative.Out of 100 patients evaluated RTPCRwasnegativein16patients whohadpositiveHRCTchestfindingsatfirst.Later,RTPCRwasperformedonfourofthepatients who were found to be positive. CTscansrevealedpositiveresults in 18 patients out of the total 20 patients who had a negative RT PCR but a high clinical suspicion. Outof168symptomaticpatientswhounderwentbothHRCTchestandRTPCR tests,146patients(86.9%)showedapositiveassociationbetweenthetwotests.88percent(148/168)of 168symptomaticpatientswho received both RT PCR and HRCT chest showed positive RT PCR results, while 98.8%(166/168)showedpositivechestCTscans.BasedonpositiveRTPCRdata,thesensitivityofchestCTinindicatingCOVID19was98.6%(146/148patients).90percent(18/20)ofpatientswithnegative RT PCR results and high clinical suspicion had positive chest CT findings; 14 cases(77.7%) were designated high likely cases. In clinically suspected patients, HRCT chest wasfoundto be moresensitivethan RTPCR.

Discussion

Symptoms

Coronavirusdisease2019(COVID19)symptoms[4,5]mayoccur2to14daysafterexposure.Fever, cough, and exhaustion are common indications and symptoms. A loss of taste or smellmaybeoneofthefirstsignsofCOVID19.Shortnessofbreathordifficultybreathing,muscleaches,chills,sorethroat,runnynose,headache,andchestpainareallpossiblesymptoms.Otherless common symptoms such as rash, nausea, vomiting, and diarrhoea have been recorded.Childrendevelopsymptoms thataresimilarto adults'and sufferfrom aminor disease. COVID19symptomscanrangeinseverityfrommildtosevere.Somepeoplemayexperienceonlyafewmildsymptoms(suchasalow-gradefever,cough,weariness,anosmia,andthroatsoreness),whileothersmayexperiencenoneatall. Aboutaweek aftersymptomsbegin,somepeople may suffer severe symptoms, such as shortness of breath. COVID 19posesagreaterriskofseriousillnessintheelderly,andtheriskriseswithage.Peoplewith persistent medical issues may be at an increased risk of serious illness. The Range of ImagingResultsof achest HRCT

- GGOwasthemost common findingin all(present in 194out of200 patients)
- GGO+underlyinginterstitialreticularthickeningandfocalconsolidations(presentinpatientswithmoresevereclinicalsymptoms)
- Fibrosis(moreinlaterstages)andtractionbronchiectasis
- Distributionwaspredominantlybilateral,multifocal,subpleural,peripheralandmoreinbothlowerlobes
- Pleuraleffusionwasrare(threecasesoutof200,alsocorrelatedwithmoresevereclinicalsymptoms)
- Complicationofpartialpulmonarythromboembolismwaspresentinonecase.

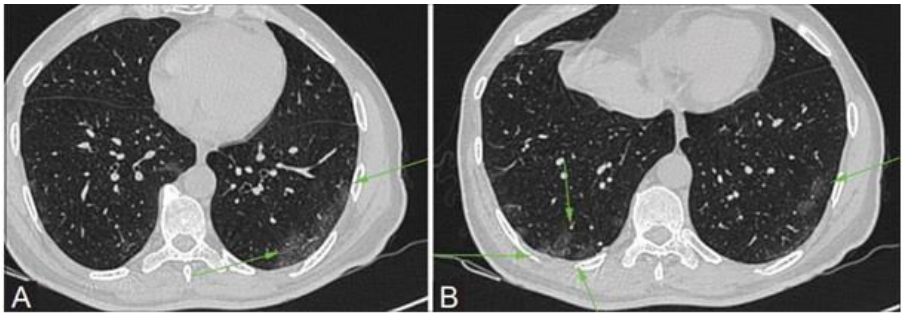


Figure 1 (A and B): *(A) Patient with a low-grade fever and throat pain, with characteristic peripheral GGOscompatiblewithviralpneumonitis.Afterimaging,this patienttestedpositiveforRTPCR.(B)Patientwithalow-grade fever and throat pain who has characteristic peripheral GGOs compatible with viral pneumonitis. Afterimaging,thispatienttestedpositive forRTPCR.*

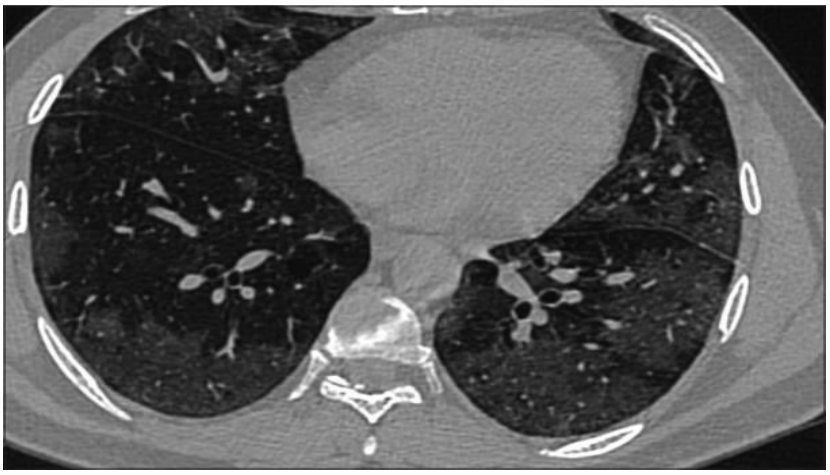


Figure2*:Patienthadminorsymptoms,includingatemperatureandslightchestpain,displayingtheu sualsignsofbilateralGGO.Thispatient'sRTPCRwasnotperformed,andhewasaskedtoremaininiso lationandreceivetherapyathome.Since then, thepatient'sconditionhasimproved.*

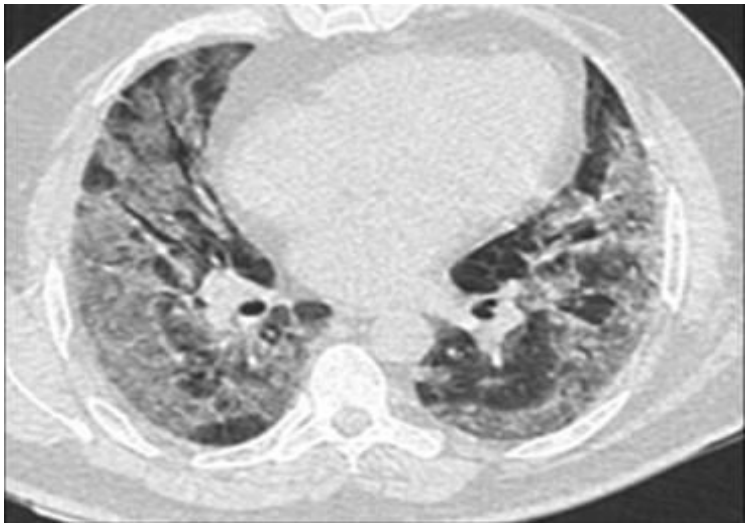


Figure 3*: Bilateral GGOs, underlying interstitial fibrosis, and traction bronchiectasis in an older patient withseveral comorbidities, significant dyspnea, and fever. After the scan, the patient tested positive for RT PCR, andregrettably, this patient died of respiratory problems four days later. The presence of ARDS-like imagingabnormalitiesisnotcommoninCOVID 19infection.*

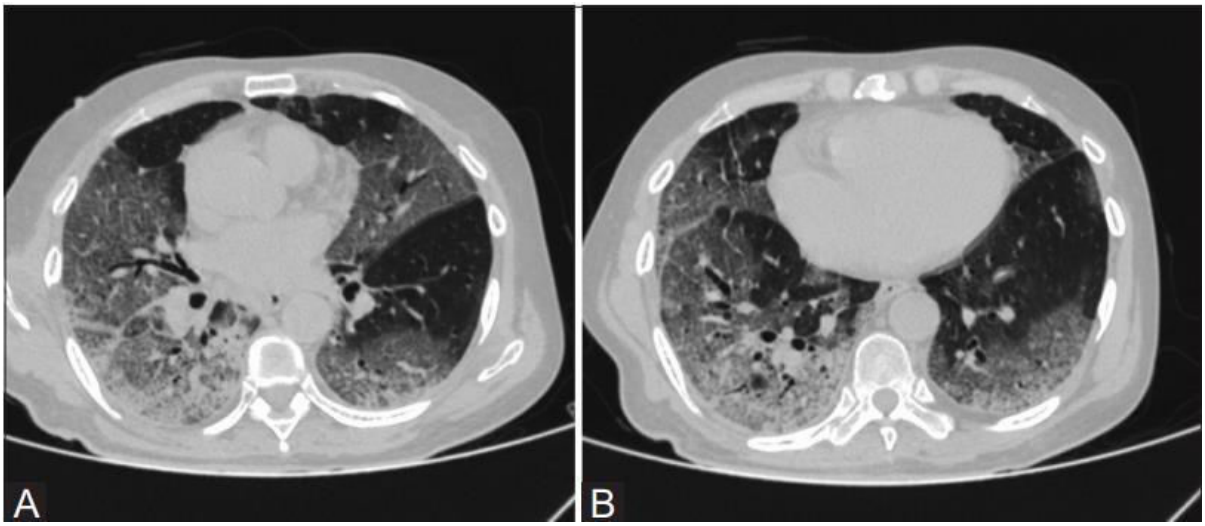


Figure4(AandB)*: (A)GGO, interstitialthickening,crazypaving,andtractionbronchiectasisina patientwitha high fever and shortness of breath. COVID infection confirmed by RT PCR. (B) GGO, interstitial thickening,crazypaving,andtractionbronchiectasisinapatientwithahighfeverandshortnessofbreath.COVIDinfectionconfirmed by RTPCR.*

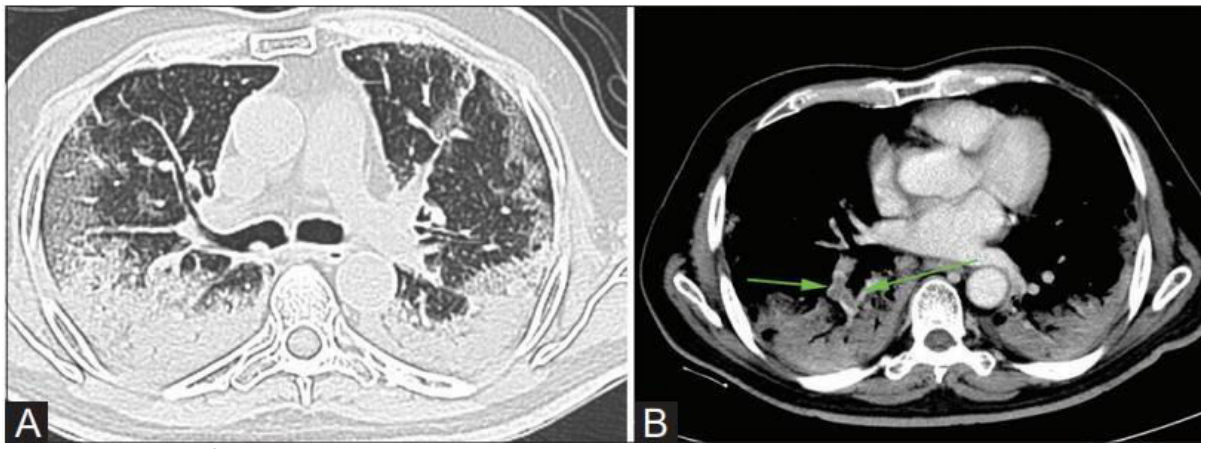


Figure 5 (A and B)*: (A) This patient experienced significant dyspnea, as well as a high D dimer level. On thelung window, imaging revealed peripheral GGOs and consolidations. The initial RT PCR in this patient wasnegative;however,afterahigh clinicalsuspicionandpositiveimagingresults,arepeatRTPCRwasperformed,whichwaspositive.(B)Thispatientshowedsignificantdyspnea,aswellasahighDdimerlevel.Inthesofttissuewindow, contrast images revealed partial pulmonary thrombosis (arrow marks). The initial RT PCR in this patientwas negative; however, after a high clinical suspicion and positive imaging results, a repeat RT PCR wasperformed,whichwaspositive.*

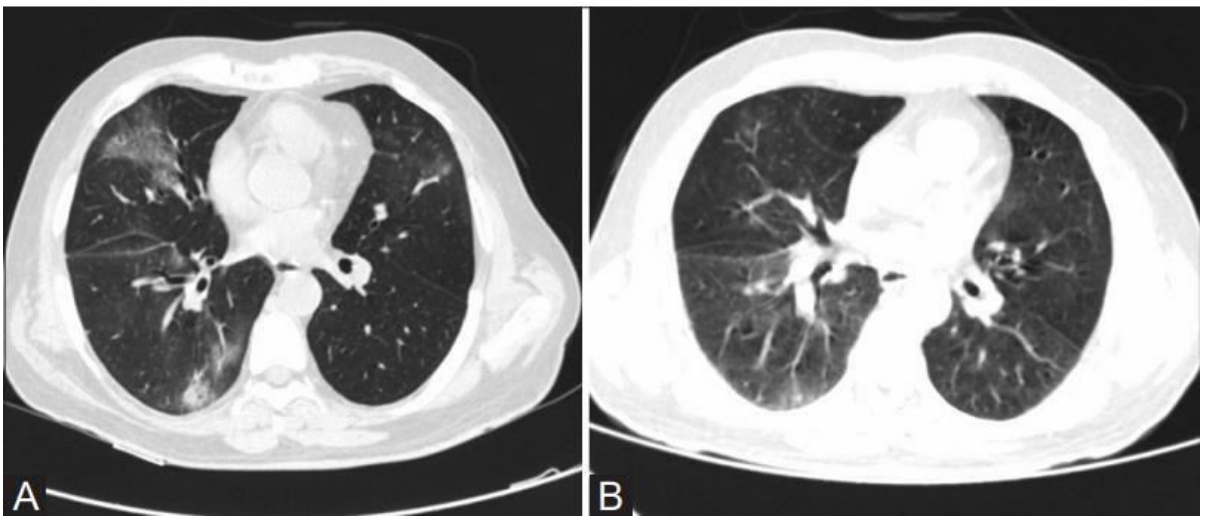
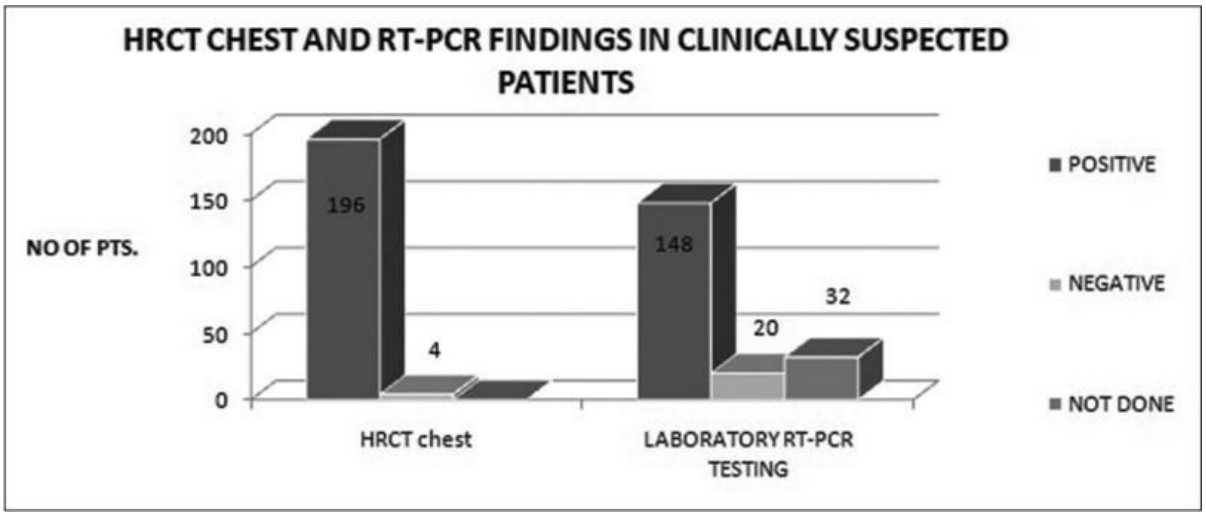


***Figure6(AandB)**:(A)GGOs,localisedconsolidation,andmoderatefibrosisinbilaterallungsoninitialHRCTchest of a symptomatic RT PCR confirmed COVID patient. (B) A 10-day HRCT chest of the same patientdemonstratessignificantresolutionofGGO and fibrosis.Clinically, thepatienthad improved.*



***Graph1**:ResultsofHRCTfindingsandlaboratoryRT-PCRfindingsof200patients*

Patients with low-grade fever, cough,anosmia, and throat soreness demonstratedcharacteristicperipheralGGO[Figures1A,B,and2].Denselocalisedconsolidations,reticularthickening, and fibrosis were detected as the severity and duration of symptoms increased[Figures 3 and 4]. In one patient with a strong suspicion for pulmonary thromboembolism, aCTthoraxwithcontrastandpulmonaryangiographywasperformed[Figure5AandB],whichrevealedpartialpulmonarythrombosisaswellasotherconventionalandatypicalHRCTchestabnormalities. Pleural effusions and acute respiratory distress syndrome (ARDS) type HRCTchestabnormalities wereatypical andless commonobservations in ouranalysis [Figure3]. The gold standard test for diagnosingCOVID 19 is reverse transcription polymerase chain reaction (RT-PCR). A substantial falsenegativeratehasbeenreported[6],whichincreasesthedangerofadditionaltransmissionwhileal so delaying the timely management of suspected patients. CT scans are very useful indetecting parenchymal pneumonic patches. One of the most crucial diagnostic criteria forsuspectedcases is the discoveryofpatches of viralpneumonia/pneumonitis.

IncomparisontoRTPCR,CThasbeenreportedtohavegoodaccuracy.[3]DespiteanegativeRTPCRtest,itisindicatedthatifthepatienthasanepidemiologicalhistory,clinicalsymptoms,andviralpneumoniafeaturessuggestiveforCOVID19onHRCTchest,theyshouldbe regarded positive for COVID 19 infection. In our opinion, HRCT chest can be used todiagnose COVID 19 infection even before the results of the RT PCR tests are received. If aconsiderable portion of the population is waiting for the RT PCR test to be performed owingto a lack of kits or a delay in the results, as well as in cases of false negative results, HRCTchest may be considered. HRCT chest can also reveal the amount of the lungs' involvement,which can aid in planning for patient management. Patients with moderate to severe lung involvement onHRCTchestwere usuallyadmittedtothe hospitalandgiven more intensive treatments(steroids, low molecular weight heparin or similar drugs, tocilizunab, remdesivir, etc.). Follow-up HRCT chest test was performed in eight patients with improving symptoms after a 7–12day delay, and HRCT chest results improved. A chest X-ray was taken in70oftheseindividuals1–2daysbeforetheCTscan,and42ofthemshowedgoodresults.

ConclusionandSuggestions

HRCTchestscanswerefoundtobepositivein98percentofindividualswithclinicalsuspicionand symptoms of Covid-19 in our study. Based on positive RT PCR data, the sensitivity of chest CT indetectingCOVID19was98.6%.Inlaboratory person withnegativeRTPCRcaseswithstrongclinical suspicionofCOVID19infection,HRCTchestisparticularlysensitiveandaccurateindetectinglungparenchymalabnormalities,aswellasinallsymptomaticpatientswhoseRTPCRwasnotdone.HRCTcanalsobeusedtoscreenindividualswithahighclinicalsuspicionatalow costandinashortamountoftime.HRCToutperformsRTPCRin termsofprovidingimmediateresults, measuring diseaseseverity,andprognosis prediction. Inallpatientswithclinicalsymptomsandsuspicionof COVID infection,regardlessoflaboratoryRTPCRstatus,werecommendHRCTchestforidentificationofearlyparenchymalabnormalitiesand determining diseaseseverity.

The diagnosis and management of RT-PCR negative COVID suspected as well as RT-PCRpositiveasymptomaticCOVID-19casesrelyheavily on chest CT.

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