Abstract
Introduction: COVID-19 pandemic has placed a large onus on radiologists to help the diagnosis of patients, especially in cases where PCR results may not tie up with clinical situation.

Methods: Prospective cohort study was done with 76 participants who were suspected for COVID-19 infection and were followed to evaluate PCR and HRCT reporting in tandem with clinical symptoms.

Results: 86.8% of patients had a dry cough, followed most commonly with shortness of breath. 57.9% of patients had ground-glass opacities of haze on HRCT followed by 43.4% who had consolidations present. 84.2% patients had a positive PCR whereas 67.1% had an HRCT that was suggestive of having COVID-19 pneumonia. Sensitivity of HRCT using PCR as a gold standard was calculated at 65.6% and specificity was 25% while accuracy was calculated at 59%.

Conclusion: Triple assessment with clinical symptomatology, HRCT findings and PCR should be utilized, especially in areas where there is a lower positivity rate for COVID-19.

Keywords: COVID-19 Pneumonia; HRCT; PCR; Pakistan
Results
Of our 76 participants, mean age of participants was 55.6 years S.D 14.6, the oldest patient was 87 years old and the youngest was 19 years old. 34.2% were female and 65.8% were male.

Of the three most common symptoms, 77.6% had shortness of breath; 86.8% had a dry cough, 57.9% had fever and 6.6% (n=5) had chest pain or tightness.

Findings on examination showed that 15.8% (n=12) patients had a clear chest, 43.4% (n=33) had bilateral crackles, 10.5% (n=8) had bilateral crepitations, and 5.3% (n=4) had bilateral wheeze. 25% (n=19) patients had decreased air entry.

84.2% of patients in our study had a positive PCR test result that is 64 of the participants, whereas only 12 had a negative result 15.8%.

We reviewed HRCTs and enlisted common findings for pulmonary disease and COVID-19 and found the following:

Table 1: Enlisting of different HRCT findings

<table>
<thead>
<tr>
<th>HRCT Findings</th>
<th>N=76</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fibrosis</td>
<td>10</td>
<td>13.2%</td>
</tr>
<tr>
<td>Infiltrates</td>
<td>27</td>
<td>35.5%</td>
</tr>
<tr>
<td>Interstitial Lung Disease Pattern</td>
<td>4</td>
<td>5.3%</td>
</tr>
<tr>
<td>Groundglass opacities or haze</td>
<td>44</td>
<td>57.9%</td>
</tr>
<tr>
<td>Consolidation</td>
<td>33</td>
<td>43.4%</td>
</tr>
<tr>
<td>Atelectasis</td>
<td>13</td>
<td>17.1%</td>
</tr>
</tbody>
</table>

Fibrosis was present in 2 patients who had a history of tuberculosis; however, they were PCR positive.

Of our patients 13.2% (n=10) were diabetic, 21.1% (n=16) were hypertensive, and 13.2% (n=10) were smokers. 14.5% (n=11) had re-infections of COVID-19 at the time of presentation and had already had COVID-19 prior to the current presentation at least 2 months before.

13.2% (n=10) patients were on supplemental oxygen at the time of HRCT.

Of the total HRCTs that were done, 67.1% (n=51) were suggestive of COVID-19 pneumonia. Of the 25 HRCTs that were not suggestive of COVID-19 pneumonia, 16 were normal HRCTs.

A chi-square test was done to see if PCR result was significantly associated to HRCT result, a p-value of 0.01 was obtained, thus showing there is a significant association between a positive PCR test and an HRCT suggestive of COVID-19 pneumonia. However, 9 HRCTs were suggestive of COVID-19 pneumonia, when the PCR was negative, and 22 PCR were positive but HRCT was not suggestive of COVID-19 pneumonia.

Most of our participants were nonsmokers, with only 10 smokers of whom 8 had a positive PCR result, we analyzed whether smoking had a correlation with having a positive PCR result or having COVID-19 and found a p-value of 0.69 which was not significant, thus we can surmise that in our cohort of patients smoking was not associated with having COVID-19 pneumonia.

Table 2: findings on HRCT suggestive of COVID-19 Pneumonia

<table>
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<th>HRCT Findings</th>
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<td>Infiltrates</td>
<td>0.001</td>
</tr>
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</tr>
<tr>
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<td>0.001</td>
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<td>Ground glass Density</td>
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We analyzed using Chi-Square test whether the different findings on HRCT were significantly correlated with the HRCT being suggestive of COVID-19 and found the following results: Infiltrates, consolidation and ground-glass haze or densities were positively correlated with having suspicion of COVID-19 pneumonia on HRCT.

Sensitivity of HRCT using PCR as a gold standard was calculated at 65.6% and specificity was 25% while accuracy was calculated at 59%.

Discussion
A study done in Pakistan in 2021 showed that the sensitivity and specificity were 92% and 23% respectively while accuracy was 51%. While they had a sensitivity of 92%, our sensitivity was lower at 65.6% showing that the true positive rate with HRCT in our study was lower, however, their specificity was 23%, ours was 25% as in our study there were only 3 participants that had HRCTs that were negative for COVID-19 and had a negative PCR result as well. Of the twelve PCRs that were negative, 9 patients had symptoms and HRCT findings that were suggestive of COVID-19 pneumonia [7].

A systematic review done found that the sensitivity was higher, especially in areas where the epidemic was more profound; with values above 90%, however in areas where the cases were lower sensitivity was down to even 61%. We can appreciate this in Pakistan’s case where cases are lower and positivity rates are lower than most other regions, with the highest positivity rate being around 25% in May 2020. The systematic review further noticed that specificity rate were variable with values above 90%, however in areas where the cases were lower at 65.6% showing that the true positive rate with HRCT in our study was lower, however, their specificity was 23%, ours was 25% as in our study there were only 3 participants that had HRCTs that were negative for COVID-19 and had a negative PCR result as well. Of the twelve PCRs that were negative, 9 patients had symptoms and HRCT findings that were suggestive of COVID-19 pneumonia [7].

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symptomatology, perhaps they had a false negative PCR result, but the HRCT was correctly positive in this situation.

It raises the question that instead of using PCR as a gold standard, clinical scenarios should be evaluated based on symptomatology, PCR result and HRCT findings; a form of triple testing. Wherein, two positives of the three should be fundamentally the criterion to label someone has being affected by COVID-19 pneumonia.

Though research suggests that the odds of getting severe COVID-19 disease in twice that in smokers, it is interesting to note that a smaller percentage of smokers had disease in our cohort of patients [9]. Pakistan is a country with a high usage of tobacco products, with 19.1% adults using them and above 80% being exposed to second hand smoke in public areas [10], however the percentage of smokers in our participants was much lower than expected. The odds of having COVID-19 and being a non-smoker were 1.06 times more in our participants than being a smoker.

Ground-glass opacities, infiltrates and consolidation were the most specific findings for COVID-19 pneumonia, with most emphasis placed on ground-glass opacities being a typical finding defined by the Dutch Radiological Society [11].

It is interesting to note that these were the findings that were positively correlated in our study to have been found on HRCTs where COVID-19 was confirmed by PCR. Keeping this in view, we can assume that such findings in tandem with the clinical scenario should raise high suspicion for COVID-19 pneumonia for clinicians who may be facing diagnostic dilemmas or entertaining different diagnoses during the pandemic.

Conclusion

We found that COVID-19 pneumonia has typical patterns on HRCT and using the CO-RADS criteria HRCT is a useful tool in establishing a diagnosis. Triple assessment with clinical symptomatology, HRCT findings and PCR should be utilized, especially in areas where there is a lower positivity rate for COVID-19.

Declarations

Funding: All funding was done by the authors themselves

Conflicts of Interest: None to declare

Availability of data and material: Available with corresponding author

Code availability: Available with corresponding author

Author's contributions: SA, SA, and VFR participated in data collection, writing of manuscript and concept design. AA participated in concept design, final editing of manuscript and proof-editing.

Ethics approval: Approval from ERC was sought and taken to undertake this study.

References