

ORIGINAL ARTICLE

Review of High-Resolution Computed Tomography Chest Incidental Findings in COVID and Post-COVID Era in PIMS Hospital IslamabadSara Shahid^{1*}, Ayesha Isani¹, Hyder Wajid Abbasi², Ana Rizvi³, Hafiza Habiba Mubarik⁴**ABSTRACT**

Objective: To scrutinize the frequency of alternative pulmonary infectious diseases, and incidental findings of the High resolution CT scan chest in COVID-19 screening trials during peak and late COVID era.

Study Design: A cross-sectional study.

Place and Duration of Study: The study was carried out at the Department of Radiology, Pakistan Institute of Medical Sciences (PIMS), Islamabad, Pakistan from June 2021 to June 2022.

Methods: High-resolution computed tomography (HRCT) scan chest reports of 191 patients were analyzed from the Peak COVID period from May 2020 to May 2021 and 191 reports of patients in the late COVID period from June 2021 to June 2022. Reports were evaluated for any alternative disease process or incidental findings, further classified according to their clinical significance.

Results: Incidental findings were seen in 60% of scans in the Peak period of SARS-CoV-2 infection and 75% in the late COVID era. The mean age group of patients in the peak period was 50.76 years and in the late COVID period was 56.65 years, with significant male predominance (76%) in the peak period. Around 30.5% and 56.7% of "major" incidental findings in each peak and late COVID period were recorded, respectively, with Pulmonary nodule being the most frequent incidental finding in the peak period and Tuberculosis often repeatedly encountered incidental finding in the late COVID period.

Conclusion: Incidental findings appear in more than half of the High-resolution CT chest scans in suspected COVID-19 patients, with a substantial number requiring further workup.

Keywords: *Incidental Finding, SARS-CoV-2 Infection, Tuberculosis.*

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Introduction

The COVID-19 pandemic is humanity's most lethal crisis since World War II.¹ According to the WHO Weekly epidemiological update on COVID-19, globally; nearly 20 million new cases and over 114,000 deaths were reported between the periods of 2nd - 29th January 2023. Keeping in view the statistics, the pandemic is far from over, and we should be meticulous in reporting.²

The healthcare system has been overburdened worldwide by the outbreak of novel coronavirus disease 2019.³ It's a widely known fact that the specificity of RT-PCR for Coronavirus detection is great; however, its sensitivity is comparatively less. Therefore, radiological imaging has been used massively for COVID-19 confirmation in clinically

suspected COVID-19 patients worldwide. In our institute, one CT unit was reserved for suspected COVID-19 patients, and High-resolution computed tomography (HRCT) was used as a screening test for COVID-19.

COVID-19 patients commonly presented with fever (83%), cough (76%), shortness of breath (31%), and fatigue (34%). However, these nonspecific symptoms are also seen in other respiratory tract infectious diseases caused by various bacterial and viral etiologies.⁴ Symptoms of dyspnea and chest tightness are also shared by respiratory infectious diseases and confound cardiac symptoms.⁵ These similar clinical presentations have led to the increased use of High-resolution computed tomography (HRCT) chests in emergency department in this pandemic era.

Incidental findings in radiological imaging include any unpredicted findings that are not related to the clinical indication.⁶ Radiologists must be aware of the occurrence and spectrum of alternative or incidental findings when screening for COVID-19. This initiated the objective of the current study, which is to retrospectively analyze such imaging findings to establish the frequency of alternative pulmonary infectious diseases or any other incidental findings that are not related to the purpose of the scan in both the peak and late COVID era.

Methods

The cross-sectional study was carried out at the Department of Radiology, Pakistan Institute of Medical Sciences (PIMS), Islamabad, Pakistan from June 2021 to June 2022. Data from 191 patients from the COVID-19 screening program was collected initially for the patients suspected of having COVID-19 in the peak COVID period from May 2020 to May 2021 and then for 191 patients suspected of having COVID-19 in the post-COVID era from June 2021 to June 2022. The patients of all ages, including infants and adults, who were referred to our department for HRCT COVID screening and were re-evaluated by history and symptoms of fever, cough, and shortness of breath for possible COVID-19 infection. These patients, irrespective of any co-morbid, irrespective of any co-morbid, were included in the study. Exclusion criteria included those with no clear history or suspected COVID-19 patients. Ethical

Review Committee approval was taken from the hospital before initiating the research vide letter no: F.3-2/2021(ERRB)/PIMS dated 1st February 2021. A dedicated CT scan machine was allocated near and the hospital's emergency department, and Patients were sent to the Radiology Department suspected of COVID-19 pneumonia underwent the scan. High-resolution CT scan was done in the caudo-cranial direction. Scans were read by a team comprising a resident, registrar, and senior radiologist to rule out COVID-19 pneumonia or any other disease. All CT reports were assessed retrospectively for the evaluation of incidental findings, which were further classified into three groups according to the Guidelines of the Royal College of Radiologists:

Major: It needs additional investigation or treatment or medication changes and is likely to have serious health effects.

Moderate: Commonly requires supplementary investigation, but health effects are uncertain.

Minor: Seldom necessitates more investigation and is unlikely to have unfavorable health effects.

Incidental findings were also grouped according to their anatomical position into pulmonary, cardiovascular, abdominal, skeletal, and other categories (which included mediastinal, breast, and thyroid).

Continuous variables of the study were expressed as mean and standard deviation and categorical variables as numbers and percentages. The SPSS version 24 was used for statistical analysis.

Results

In this analysis of incidental findings, in suspected COVID-19 patients, the peak COVID period showed incidental findings in 116(60%) out of 191 scans. In the late COVID era, 145 scans (75%) out of 191 showed incidental findings. Majority of the patients were male in peak Covid period however near equal distribution of gender in late Covid period was noted as shown in Table-1.

The mean age group of patients in the peak COVID period was 50.76 years, and in the late COVID period was 56.65 years, with our oldest patient being a female 102 years old in the late COVID period and who was diagnosed with COVID-19.

One hundred and twenty-four¹²⁴ patients had findings compatible with COVID-19 in the peak

Table-1: Demographic Distribution of the Patients

Variable	Peak COVID n (%)	Late COVID n (%)
Male	146(76.4 %)	91(47.6 %)
Female	45(23.5 %)	100(52.3%)

COVID era (64.9%) and 25 patients (13%) in the late COVID era.

In our study, we detected 30.5 % and 56.7% of major/significant incidental findings among 191 patients in each peak and late COVID period, respectively, and 24.3% and 29.6% of moderate incidental findings among 191 patients each in peak and late COVID period respectively.

Pulmonary nodules were the most frequent incidental finding (as elaborated in Table-2), seen in 18 of 191 patients in the peak COVID period that is in 9.4% of scans, and Tuberculosis was oft-repeatedly encountered as an incidental finding in the late COVID period observed in 18.3% of scans (Figure.1).

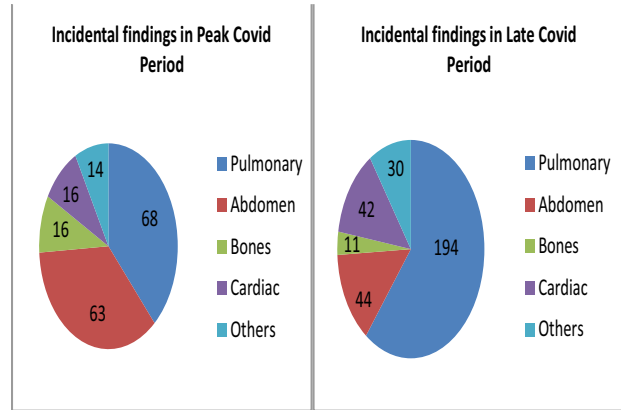


Fig.1: Frequency of Incidental findings according to anatomical distribution during peak and late COVID period (n=191)

Table-2: Incidental Findings Categorization (n=191)

Minor	Moderate		Major					
	Peak	Late	Peak	Late				
Pulmonary & Mediastinal Findings n(%)								
Pulmonary	11(5.7%)	7(3.6%)	Bronchiectasis	13(6.8%) 31(16%)	Lung Mass	2(1%)	2(1%)	
Calcified Cysts	2(1%)		Emphysema	1(0.5%)	27(14.1%)	Tuberculosis	5(2.6%) 35(18.3%)	
Granuloma			Ild	2(1%)	10(5.2%)	Pulmonary Nodules	18(9.4%) 34(17.8%)	
Lymphadenopathy With Explanation	10(5.2%)		Bronchocele	3(1.57%)		Pneumothorax	1(0.5%) 4(2%)	
			Mosaic Attenuation	3(1.57%)	6(3%)	Pulmonary Edema ⁺	2(1%) 22(11.5%)	
			Only Effusion	2(1%)	10(5.2%)	Aspiration Pneumonia ⁺	1(0.5%)	
			Bullae		1(0.5%)	Lobar Pneumonia ⁺	2(1%) 2(1%)	
			Alveolar Microlithiasis		1(0.5%)	Lung Collapse		1(0.5%)
			Coal Worker Pneumoconiosis		1(0.5%)			

Abdomen Findings

Calcified Granuloma Liver	3(1.57%)	8(4.1%)	Gall Bladder Sludge/Cholelithiasis	12(6.2%)	6(3%)	Hypo-Dense Liver Lesion	1(0.5%)	1(0.5%)
Splenic Calcification	2(1%)		Enlarged Adrenal	2(1%)		Gall Bladder Calcification	1(0.5%)	1(0.5%)
Hiatal Hernia	2(1%)	1(0.5%)	Adrenal Nodule	1(0.5%)		Ascites	1(0.5%)	6(3%)
Fatty Liver Infiltration	2(1%)		Irregular Liver Margins	4(2%)	2(1%)			
Renal calculus	10(5.2%)	4(2%)						
Renal Cysts	17(8.9%)	10(5.2%)						
Hepatic Cyst	5(2.6%)	4(2.6%)						
Adrenal Calcification		1(0.5%)						

Bone Pathology

Bone Island	8(4.1%)					Lytic Lesion Vertebrae		1(0.5%)
Old Fractures	1(0.5%)	1(0.5%)				Ivory Vertebrae		1(0.5%)
Vertebral Hemangioma	2(1%)							
Compression Collapse	4(2%)	5(2.6%)						
Fused Vertebrae	1(0.5%)							
Kyphoscoliosis		2(1%)						
Retrolisthesis		1(0.5%)						

Cardiac

Cardiomegaly/ Vascular Aneurysm/ Aortic Dissection / Coronary Vessel Calcification/ Pericardial Effusion / Aberrant Vessel							16(8.3%)	42(21.9%)
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Others

Breast Skin Thickening/Mass Lesion Or Calcification								5(2.6%)
Thyroid Mass Or Lesion / Calcification/Enlarged Gland							4(2%)	25(13%)

⁴Pulmonary edema and pneumonia considered type I/major finding in Incidental findings on computed tomography angiography in patients evaluated for pulmonary embolism

Discussion

This retrospective analysis of incidental findings in suspected COVID-19 patients in the peak COVID period and the late COVID era showed a significant number of incidental findings.

There was a noticeable difference in gender disaggregation with a majority, 76% of male patients in the peak COVID era. None of the previously done studies for COVID-19 screening trials showed this noticeable difference. In the late COVID period, gender distribution in our study was similar to that of

other studies in the literature, with no statistically significant difference between genders.

Caldas dos Reis et al. reported Incidental cardiovascular findings in suspected COVID-19 patients with findings compatible with COVID-19 on HRCT chest in 56% of the patients.⁶ In a similar study, Kilsdonk reported findings suggesting COVID-19 in 39% of the patients.⁷ A slightly higher number of COVID detections on HRCT in peak COVID in our country could be due to less availability of PCR kits and more reliance on HRCT as in Pakistan, RT-PCR

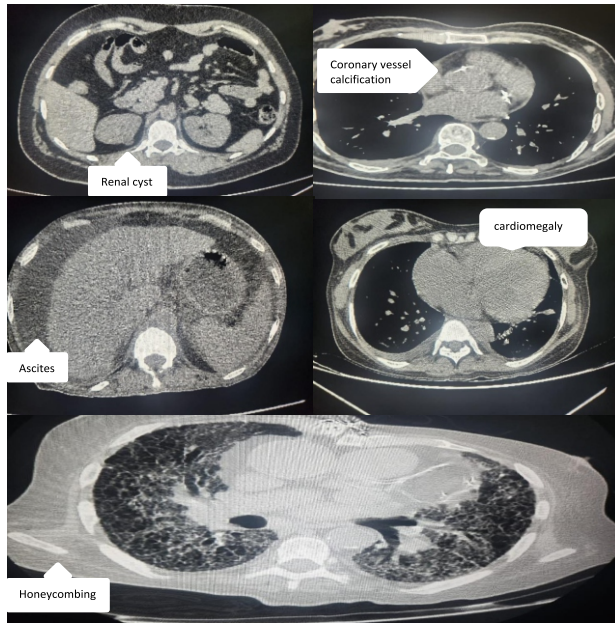


Fig.2: Incidental findings from the radiological scan

testing capacity was half of that endorsed by the WHO.⁸

Kilsdonk reported incidental findings in 54 % of patients and minor incidental findings in 37 % of the study population. Emphysema and bronchial wall thickening were the most appreciated minor incidental findings.⁷ We reported air cysts as the most commonly seen minor pulmonary incidental finding and as per the RCR (Royal College of Radiologists) scoring system of the incidental findings. Emphysema was considered a moderate finding in our study. DüNDAR et al. reported cardiomegaly as the most common incidental finding and one patient was diagnosed with tuberculosis.⁹ Valluri et al. in their study done in India, reported only 8.68% of patients having incidental findings; however, 2% of their population showed features indicative of Tuberculosis on HRCT.¹⁰ This is similar to our study with 5/191 (2.6%) patients' findings of Tuberculosis in the peak COVID era. It's a widely known fact that Pakistan lies in fifth position among TB high-burden countries globally, and even more alarming is that the Tuberculosis burden very significantly increased in the late COVID period. Pulmonary nodules were often reported as the most common incidental pulmonary finding in previously available literature for screening studies, while, in our study, tuberculosis incidence in the late COVID period was

so commonly reported that it outnumbered the incidence of pulmonary nodules. These figures are representative of the WHO Global Tuberculosis Report 2022, which also calculated a 3.6% Increase in TB incidence rate between 2020 and 2021, stating the most understandable cause as a direct impact on TB healthcare system disruptions caused by the COVID-19 pandemic lockdowns.¹¹ The WHO Global Tuberculosis Report is a shocking revelation that tuberculosis is now causing nearly twice as many deaths as COVID-19, and our study unequivocally supports the fact.¹¹

Our detection of major/significant incidental findings for the peak COVID period is in concordance with the study of Shruti Valluri, who calculated that 33% of cases require further workup for their incidental findings.¹⁰ Unlike other countries, there was still more reliance on HRCT for COVID screening in our country in the late COVID period as well, but as mentioned in Table-1, there are various other diseases more prevalent now than COVID-19 that a clinician should be looking for.

DüNDAR et al. listed 34(2.21%) patients with Incidental findings in the thyroid tissue.⁹ Likewise, we also noted four patients (2%) with incidental thyroid lesions in the peak COVID period; however, we also noticed 25 patients (13%) with thyroid lesions in the late COVID era, with one of those 25 patients having heterogeneous/suspicious-looking lesion in thyroid with miliary lung nodules raising the possibility of miliary metastases. The possible reason for the high prevalence of thyroid findings in our population is likely related to is among the severely iodine-deficient countries.¹² Valluri et al. Saeedan's studies emphasize the implications of follow-up for even benign-looking thyroid lesions, stating that overlooking benign etiologies like calcifications could miss possible malignancy at an initial stage.¹⁰ This is something we also advocate, and any thyroid finding was considered up a major in this study requiring follow-up. Previous CT screening studies for COPD, lung malignancy, and cardiovascular etiology showed that incidental interstitial lung disease (ILD) abnormalities are not so uncommon with a 7% prevalence.¹³ In our study, interstitial lung disease, specifically with UIP pattern, was reported in 5% of patients in late COVID and 1% in the peak

COVID period, but in contrast to other studies done for COVID screening trials, pulmonary edema was one over and again reported disease in our study which is not cited in previous studies related to incidental findings in COVID screening trials. However, in the literature, not done for the sole purpose of evaluation of incidental findings, there are mentions of pulmonary edema associated with COVID-19 along with signs of volume overload in COVID-19.¹⁴ Lung mass was reported in 2 of the patients in peak COVID and 2 of the patients in late COVID. This can be correlated with previous study findings of D. Kilsdonk et al. Unlike previous studies, no incidental breast lesions were seen in our study during the peak COVID period, likely because males outnumbered females by a great proportion in the Peak COVID period, and Male breast disease is rare, with male breast malignancy constituting less than 1% of breast cancers.^{7,15}

Considering the significant number of incidental findings/ alternative infectious diseases noted in our population, it is imperative to highlight them as they constitute an essential event for a patient's clinical outcome.

Recently, the Radiology Finding Incidental Disease (FIND) Program was launched to track the follow-up of incidental imaging findings.¹⁶ We should try to inculcate a similar program in our population to diagnose any disease at an initial stage, as failing to recognize a potential malignancy will have fatal long-term consequences.

The present study is subject to some limitations since it is a retrospective study with selection bias. Also, as the primary purpose of HRCT reporting was not the assessment of incidental findings, some findings were likely not reported or incidental at the time of the scan.

Conclusion

A significant number of incidental findings were detected in our scans; therefore, we believe that a bespoke approach to identifying and reporting these incidental findings aiming at preventive measures and halting further disease processes will enable people to tackle their diseases better and improve their quality of life. Furthermore, the decision to conclude a finding as significant is fundamental, but without identifying the problem, if major having

serious health implications or minor that is unlikely to have any health effects and precisely mentioning it in the report, a suitable management plan cannot be commenced, leading to sub-optimal care of the patients hence necessitating the need for their documentation.

REFERENCES

1. Seddighi H. COVID-19 as a natural disaster: focusing on exposure and vulnerability for response. *Disaster Medicine and Public Health Preparedness*. 2020; 14: e42-3. doi: 10.1017/dmp.2020.279
2. Lancet T. The COVID-19 pandemic in 2023: far from over. *Lancet*. 2023; 401: 79. doi: 10.1016/S0140-6736(23)00050-8
3. Radmard AR, Gholamrezanezhad A, Montazeri SA, Kasaeian A, Nematollahy N, Langrudi RM, et al. A multicenter survey on the trend of chest CT scan utilization: tracing the first footsteps of COVID-19 in Iran. *Archives of Iranian medicine*. 2020; 23: 787-93. doi: 10.34172/aim.2020.105
4. Krati K, Rizkou J, Errami AA, Essaadouni L. Differential diagnosis of COVID-19 in symptomatic patients at the University Hospital Center Mohammed VI, Marrakesh. *Pan African Medical Journal*. 2020; 36: 269. doi: 10.11604/pamj.2020.36.269.24558
5. Waheed S, Tuyyab F, Raja W, Saif M, Nayyar B, Bokhari SA. Screening High Resolution Computed Tomography (Hrct) Chest Among Patients Undergoing Cardiac Interventions During Covid-19 Pandemic; Radiological Findings and Clinical Associations. *Pakistan Armed Forces Medical Journal*. 2020; 70: S527-32.
6. Reis JM, Melo GD, Oliveira MV, Fernandez MM, Silva TM, Ferreira HL, et al. Incidental cardiovascular findings on chest CT scans requested for suspected COVID-19. *Journal Vascular Brasileiro*. 2022; 20: e20210052. doi: 10.1590/1677-5449.210052
7. Kilsdonk ID, de Roos MP, Bresser P, Reesink HJ, Peringa J. Frequency and spectrum of incidental findings when using chest CT as a primary triage tool for COVID-19. *European Journal of Radiology Open*. 2021; 8: 100366. doi: 10.1016/j.ejro.2021.100366
8. Khalid A, Ali S. COVID-19 and its Challenges for the Healthcare System in Pakistan. *Asian bioethics review*. 2020; 12: 551-64. doi: 10.1007/s41649-020-00139-x
9. Dündar İ, Özkaçmaz S, Durmaz F, Çoban L, Aygün G, Yıldız R, et al. Detection of incidental findings on chest CT scans in patients with suspected COVID-19 pneumonia. *Eastern*

- Journal of Medicine. 2021; 26: 566-74. doi: 10.5505/ejm.2021.26428
10. Valluri S, Lakshmi HN, Sunkavalli C. Incidental Findings in CT Scans on Screening for COVID-19. *Indian Journal of Surgical Oncology*. 2022; 14: 318-23. doi: 10.1007/s13193-022-01669-6
 11. Bagcchi S. WHO's Global Tuberculosis Report 2022. *The Lancet Microbe*. 2023; 4: e20. doi: 10.1016/S2666-5247(22)00359-7
 12. Sohail R, Yasmin H, Tasneem N, Khanum Z, Sachdeve PS, Pal SA, et al. The Prevalence of Subclinical Hypothyroidism During Early Pregnancy in Pakistan: A Cross-Sectional Study. *Cureus*. 2021; 13: e20316. doi: 10.7759/cureus.20316
 13. Tomassetti S, Poletti V, Ravaglia C, Sverzellati N, Piciucchi S, Cozzi D, et al. Incidental discovery of interstitial lung disease: diagnostic approach, surveillance and perspectives. *European Respiratory Review*. 2022; 31: 210206. doi: 10.1183/16000617.0206-2021
 14. Santos JL, Zanardi P, Alo V, Rodriguez M, Magdaleno F, De Langhe V, et al. Pulmonary edema in COVID-19 treated with furosemide and negative fluid balance (NEGBAL): a different and promising approach. *Journal of Clinical Medicine*. 2021; 10: 5599. doi: 10.3390/jcm10235599
 15. Scomersi S, Giudici F, Cacciatore G, Losurdo P, Fracon S, Cortinovi S, et al. Comparison between male and female breast cancer survival using propensity score matching analysis. *Scientific Reports*. 2021; 11: 11639. doi: 10.1038/s41598-021-91131-4
 16. Zaki-Metias KM, MacLean JJ, Satei AM, Medvedev S, Wang H, Zarour CC, et al. The Find Program: Improving Follow-up of Incidental Imaging Findings. *Journal of Digital Imaging*. 2023; 36: 804-11. doi: 10.1007/s10278-023-00780-6

Authors Contribution

SS: Idea conception, study designing, data collection, data analysis, results and interpretation, manuscript writing, and proofreading

AI: Idea conception

HWA: Idea conception, study designing

AR: Data analysis, results and interpretation

HBM: Manuscript writing, and proofreading