



COVID-19 PANDEMIC- A PERFECT STORM FOR TUBERCULOSIS MANAGEMENT IN INDIA; THROUGH THE EYE OF A RADIOLOGIST.

Dr. Rajjat Shaikh*

MD- 3rd Year Resident, Dept. of Radiodiagnosis, GMCH Nagpur, Maharashtra, India. *Corresponding Author

Dr. Jawahar Rathod

Associate Professor, Dept. of Radiodiagnosis, GMCH Nagpur, Maharashtra, India.

Dr. Rasika Chaudhari

MD- 3rd Year Resident, Dept. of Radiodiagnosis, GMCH Nagpur, Maharashtra, India.

ABSTRACT

OBJECTIVE: This study was conducted to evaluate the Impact of COVID -19 on tuberculosis in India and various imaging features tuberculosis on HRCT chest in post COVID era and compare it with pre COVID times

MATERIAL AND METHOD: In this retrospective cross-sectional study, a total of 2788 HRCT thorax scans were done in our center in four months (April- July) of each pre-COVID (2019), COVID (2020), and post COVID (2021) times were included and evaluated for typical features of tuberculosis.

RESULTS: Most of the scans- 1889 (67.75%) belonged to patients of age group between 30-50 years. Total of 354 scans out of 2788 revealed features suggestive of pulmonary tuberculosis. 4.94%, 9.25% and 22.34% thorax scans had features suggestive of pulmonary tuberculosis in the pre-COVID, COVID era, post COVID era respectively in year wise manner representing significantly the increased prevalence of tuberculosis in post COVID times.. Centrilobular nodules with linear branching opacities giving tree in bud appearance (63.8%) constituted the most frequent finding followed by patchy consolidations (46.1%). Imaging features in the majority of the scans revealed features of reactivation of tuberculosis.

CONCLUSION: COVID - 19 and lockdown restrictions have a significant impact on prevention, treatment, and monitoring & TB surveillance strategies nationally and globally and caused significantly increased prevalence of tuberculosis in a post COVID era.

KEYWORDS : COVID-19, tuberculosis, HRCT thorax, post-COVID tuberculosis. Impact of COVID-19 on tuberculosis.

INTRODUCTION

The COVID-19-corona virus disease pandemic caused by SARS-CoV-2 novel coronavirus is predominantly a respiratory illness that has rapidly spread across the world with symptoms ranging from coughs, colds to fatal pneumonia. [1,2]

2020 witnessed a widespread COVID19 pandemic devastating lives, economies, health systems, and health programs at record speed in India, in just a few months; the pandemic has reversed years of progress made in the fight against tuberculosis (TB).

India accounts for more than one-fourth of the world's TB cases. [3,4]

This amounts to about 2.6 million cases out of 10 million cases worldwide. The disease has been the reason for the death of nearly 0.44 million people in India (pre-COVID era 2019). [5,6,7]

The clinical presentation of COVID-19 is similar to that of tuberculosis (fever, cough, breathlessness) [3,4] thus it is important to differentiate one disease from the other where radiological features can be helpful.

The onset of the pandemic in March 2020 triggered lockdowns, restrictions on movement, repurposing of available health system resources, infrastructure, diagnostics, treatment centers, and manpower to fight COVID-19 which disrupted the ongoing TB elimination efforts and services all over the country which resulted in compromising the quality of services.

This study assesses the impact of COVID- 19 on TB rates by radiological detection of pulmonary tuberculosis on HRCT chest in post COVID era in our tertiary teaching hospital.

HRCT chest has a sensitivity and specificity of 90.9% and 96.4%, respectively, in diagnosing active PTB. (PPV-81.67% and NPV-87.50%). [8]

We have studied various imaging features of tuberculosis on the HRCT chest and correlated demography.

Research Plan:

- Institution- A tertiary care hospital in central India.
- Source of cases- General Medicine, pulmonary medicine departments.

Inclusion Criteria:

- All HRCT thorax scans were done in the department in four months (April- July) of the PRE-COVID era (2019).
- All HRCT thorax scans were done in the department in four months (April- July) of the COVID era (2020).
- All HRCT thorax scans were done in the department in the same four months (April- July) of post COVID era (2021).

Exclusion Criteria:

- All other scans are done in the department.
- All other HRCT thorax is done for the rest of the month of the year.

MATERIAL & METHODS:

Ethics

The study was discussed with the ethical committee of our institution and as it is a retrospective cross-sectional study, the ethical approval was waived off.

Technique-

High resolution computed tomography (HRCT) study of the chest was done using Philips Brilliance i256 slice Spiral CT & Siemens 128 slice CT machine to look for typical radiological features of active and old pulmonary tuberculosis.

Proper clinical history of the patient taken with correlation done with RTPCR report if any.

During the scan, The patient was kept in the supine position, lying with feet first and extended hand. All patients were asked for a proper breath-hold.

OBSERVATIONS & RESULTS:

HRCT Features:

We evaluated the patients radio-logically in a detailed manner for lung parenchymal involvement, lymph nodes, residual changes of COVID in these patients and compared the results with pre-COVID era data.

Radiological Findings:

We evaluated the scans radio-logically in a detailed manner concerning lung parenchymal involvement, lymph nodes, and residual changes of COVID. Typical imaging features of tuberculosis and their prevalence in the scans done in the post COVID era (2021) are described below;

- Centrilobular nodules with linear branching opacities giving tree in bud appearance (63.8%) constituted the most frequent finding which is suggestive of reactivation of tuberculosis.
- In the majority of cases, this finding was seen in the superior segment of the right lower lobe.
- Consolidations were found in (46.1%) cases.
- Enlarged lymph nodes in pre, para-tracheal, pre vascular, and aortopulmonary window (38%)
- Pleural effusion (36.1%)
- Fibro-bronchiectatic changes (24.9%),
- Fibro-cavitary changes (17.2%)
- Calcific granuloma in lung parenchyma & fibro-calcific changes (23.1%),
- Fungal ball/Aspergilloma (3%)
- Miliary pulmonary tuberculosis (6.3%).

Data:

Table 1: Total Number of HRCT thorax (April- July) in year-wise distribution and number of scans showing features of TB, sex distribution, and yearly prevalence.

Year	Total Number of HRCT thorax (April- July)	Features of TB seen in	Male	female	Total Prevalence
2019	790	39	20	19	4.94
2020	1005	93	59	34	9.25
2021	993	222	135	87	22.34

Table 2: Number of HRCT thorax showing typical features of tuberculosis in year-wise distribution.

Imaging Feature	year		
	2019	2020	2021
Tree in bud appearance	19	40	141
Consolidation	15	22	102
Lymphadenopathy	9	17	84
Pleural effusion	9	12	80
Fibrobronchiectatic	11	17	55
Fibro-cavitary change	0	10	38
Calcific granuloma	11	33	57
Fungal ball /Aspergilloma	0	0	7
Miliary pulmonary tuberculosis	8	6	14
Empyema	0	7	8

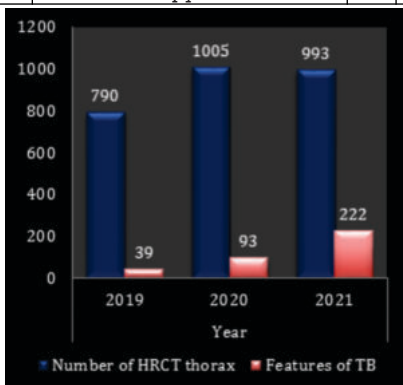


Figure 1: Schematic graph demonstrating the number of HRCT thorax scans showing features of tuberculosis in year

wise manner.

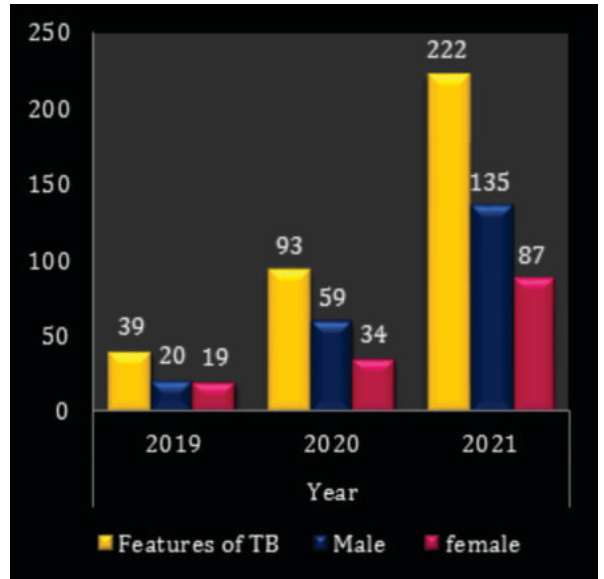


Figure 2: Schematic graph demonstrating the number of HRCT thorax scans showing features of tuberculosis and their sex distribution in year wise manner.

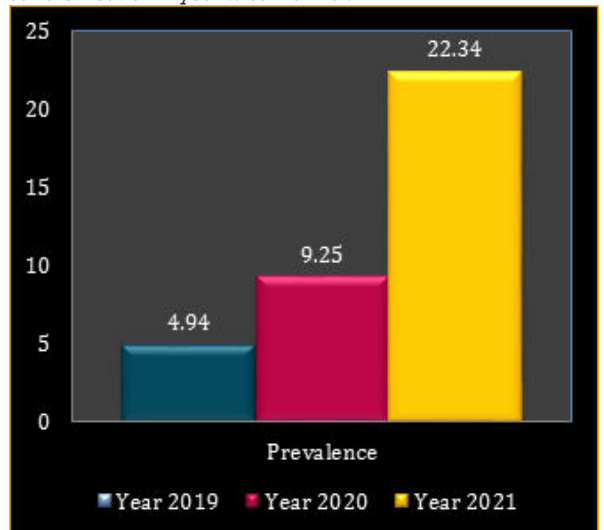


Figure 3: Schematic graph representing a yearly percentage of HRCT thorax scan with features tuberculosis.

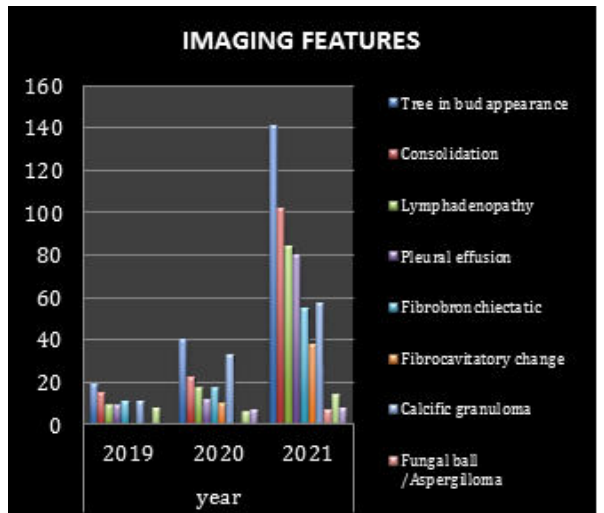


Figure 4: Schematic graph representing the prevalence of typical imaging features of tuberculosis in HRCT thorax scans

done in post COVID era (2021).

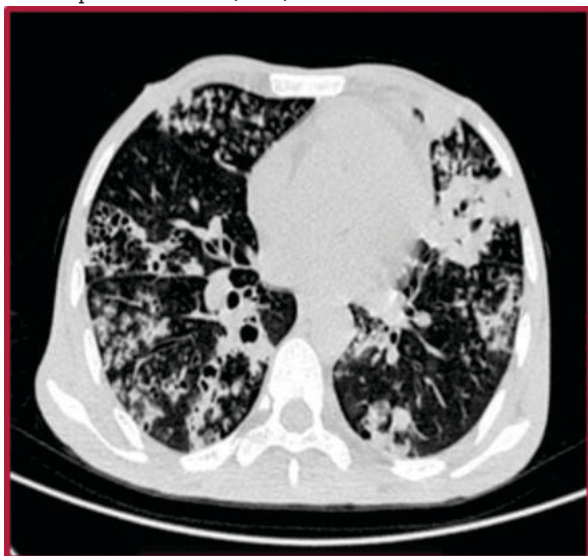


Figure 5: Axial CT thorax lung window demonstrating multiple centrilobular nodules in linear branching opacities, giving tree in bud appearance scattered extensively in the bilateral lung parenchyma. This finding was seen in 63.8% of scans.



Figure 8: CT thorax mediastinal window in sagittal view demonstrating large patch of consolidation in lingular segment of the left upper lobe with air bronchogram within.

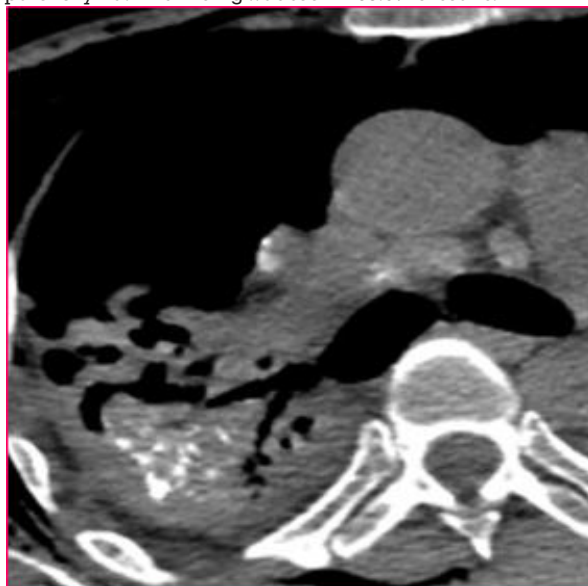


Figure 6: Axial CT thorax mediastinal window showing multiple tiny calcific granulomas in lung parenchyma & fibro-calcific changes (23.1%)

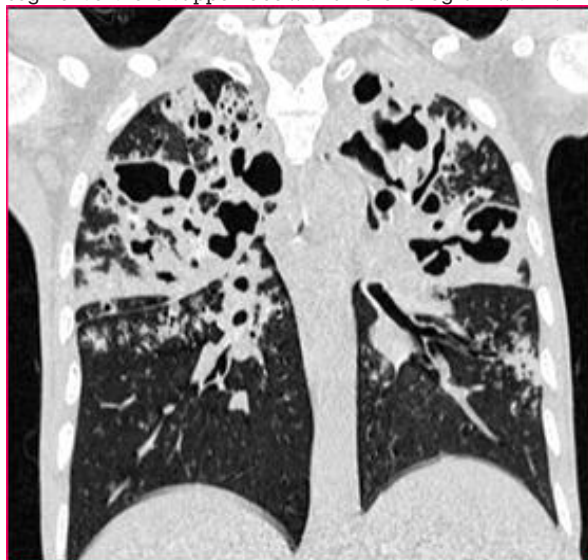


Figure 9: CT thorax lung window in Coronal view demonstrating multiple cavities, areas of parenchymal destruction, and associated fibrotic changes (17.2%) seen predominantly in bilateral upper lobes.



Figure 7: CT thorax lung window in coronal view demonstrating few patchy areas of consolidation (46.1% cases) seen, a large patch of consolidation in lingular segment of the left upper lobe with air bronchogram within.



Figure 10: CT thorax lung window in axial view demonstrating multiple dilated bronchioles (24.9%) seen in the bilateral lung parenchyma.

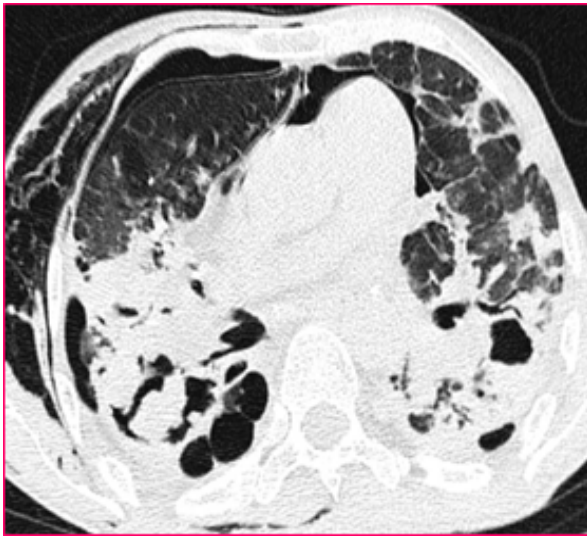


Figure 11: CT thorax lung window in axial view demonstrating fungal ball/Aspergilloma (3 %) seen in the cavity in the right lower lobe. Subcutaneous emphysema is also seen on the right side.



Figure 12: CT thorax mediastinal window in axial view demonstrating the shift of peripheral rim of air surrounding the fungal ball.

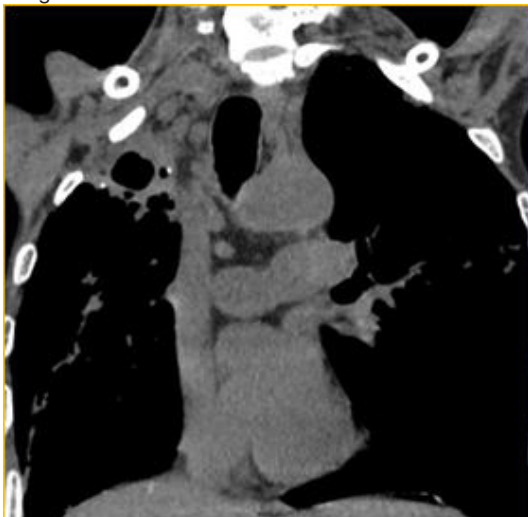


Figure 13: CT thorax mediastinal window in Coronal view

demonstrating multiple enlarged mediastinal & hilar lymph nodes on the right side. Cavitation and volume loss were seen in the right upper lobe with the shift of the trachea towards the right side.

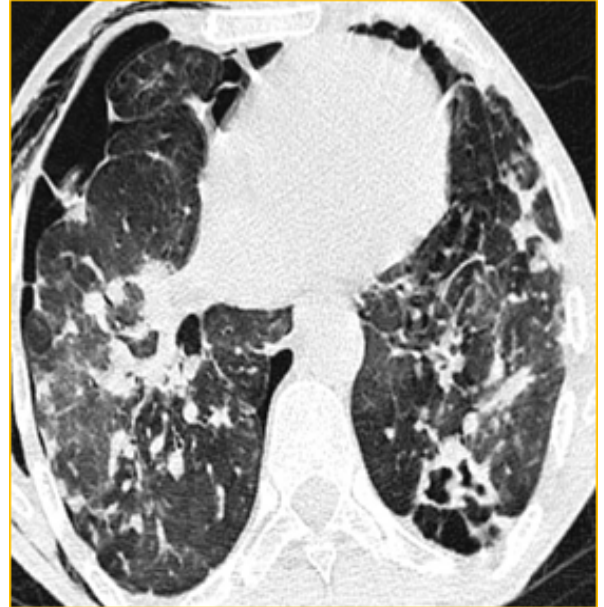


Figure 14: CT thorax lung window in axial view demonstrating Lung Cicatrization with spontaneous pneumothorax and subcutaneous emphysema on the right side.



Figure 15: CT thorax lung window in axial view demonstrating post-COVID residual changes seen in the form of multiple curvilinear subpleural atelectatic bands with areas of patchy consolidation and centrilobular nodules representing active TB infection.

DISCUSSION

TB has been labeled as a pandemic many times over the past three centuries, whereas this is the first COVID-19 pandemic. The clinical presentation of COVID-19 & mode of transmission is nearly the same as that of tuberculosis like fever, cough, and shortness of breath.

COVID-19 pandemic has disturbed the delivery of health care in almost all countries of the world. This has affected mostly the public health control programs. [9] Because of lockdowns, restrictions in movement, psychological fear of contracting the disease in health care facilities, diversion of health care workers for containment and management of COVID-19, utilization of diagnostic facilities like CBNAAT machines for

COVID work, conversion of hospitals for the care of these patients, financial diversion, etc. has created difficulties in the nationwide programs like *National Tuberculosis Elimination Programme (NTEP)* to focus on TB control in India.

PTB is differentiated into primary and post-primary TB, having different radiological features with slight overlapping. Typical radiological features of primary pulmonary tuberculosis include patchy or lobar consolidation, ipsilateral hilar & mediastinal lymphadenopathy. Pleural effusion Cavitation is uncommon in primary TB.

Post-primary PTB also known as reactivation tuberculosis or secondary tuberculosis occurs in previously infected/sensitized patients via re-infection/re-activation and this may be due to malnutrition or immunosuppression [10].

Post-primary infections are far more likely to cavitate than primary infections and are seen in 20-45% of cases. [11].

The typical feature of post-primary tuberculosis is endobronchial spread along nearby airways resulting in relatively well-defined 2-4 mm nodules or branching lesions (tree-in-bud sign) & patchy consolidation [12]. Hilar nodal enlargement is seen in only approximately a third of cases. Lobar consolidation, tuberculoma formation, and miliary TB are also recognized patterns of post-primary TB but are less common.

Lockdown caused interruption of the supply chain in health care during the COVID-19 pandemic thus there was concern that there may be a surge in the number of patients with TB once the lockdown is lifted was predicted in one study. [2]

The major factors affecting tuberculosis management in India that were affected due to COVID are as discussed below

- Decreased notification- The diagnosis of new TB cases has seen a dramatic drop in lockdown according to the Central TB NIKSHAY portal of the Government of India.
- The COVID-19 pandemic has severely affected the TB control programs.
- Shut down TB OPDs, decrease access to health care.
- Inadequate follow up of patients,
- Disrupted chain of supply of AKT medication,
- Delay in the treatment of new TB patients,
- Lockdown effects and interruption of TB prevention services, monitoring TB surveillance strategies nationally.
- Also, the immune modulation by COVID virus in RTPCR positive as well as asymptomatic COVID infected patients.
- Overuse of steroids in the treatment of COVID-positive patients.
- Bacille Calmette-Guerin vaccine (BCG) has a protective effect against tuberculosis. COVID-19 also interrupted Due to COVID-19 pandemic lockdown, suspension of TB immunization program services has been observed, this may result in the vaccine.

These factors create a favorable aura for tuberculosis to augment in India.

Limitations:

Only the cases admitted in a tertiary care hospital in whom HRCT thorax scan was done were evaluated, so the large community scenario may be different. A similar study should be performed on a larger cohort in detail to study immune modulation due to COVID infection and temporal causation with tuberculosis.

CONCLUSION

- COVID - 19 and lockdown restrictions have had a significant impact on prevention, treatment, and monitoring & TB surveillance strategies nationally and globally.

- There is a significantly increased prevalence of tuberculosis in a post COVID era, however further detailed studies are needed to prove the temporal causation.
- TB Cases increased in both genders, TB features are more commonly seen in males.
- Most scans denoted imaging features of reactivation of tuberculosis with extensive involvement of lung and increased severity of the disease.
- Suspension of BCG immunization services may result in increased vaccine-preventable disease-related deaths and an increased burden on health systems in the future.
- Thus, Together with social, economic, and biomedical consequences of the COVID-19 pandemic have created a perfect storm for tuberculosis disease management that has resulted in increased reactivation of pulmonary TB and the severity of disease & overall increased prevalence of pulmonary tuberculosis.

REFERENCES

1. World Health Organisation Dashboard Coronavirus. 2020. Experiencearcgis. Com. Retrieved December 29, 2021, from [https:// experiencearcgis.com/experience/685d0ace521648f8a5beeee1b9125cd](https://experiencearcgis.com/experience/685d0ace521648f8a5beeee1b9125cd).
2. Iyengar, K. P. Ish, P, Upadhyaya, G. K., Malhotra, N., Vaishya, R., & Jain, V. K. (2020). COVID-19 and mortality in doctors. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*, 14(6), 1743-1746.
3. Behera, D. (2021). TB control in India in the COVID era. *indian journal of tuberculosis*, 68(1), 128-133.
4. Lancet, T. (2020). India under COVID-19 lockdown. *Lancet*.
5. Mohfw.Gov. Retrieved December 29, 2021, from <https://www.mohfw.gov>.
6. Government of India. Central Tuberculosis Division. India TB report 2020.
7. TB Facts - TB statistics, India. (2018, June 25). TB Facts. <https://tbfacts.org/tb-statistics-india>
8. Rasheed, W., Qureshi, R., Jabeen, N., Shah, H. A., & Khan, R. N. (2020). Diagnostic Accuracy of High-Resolution Computed Tomography of Chest in Diagnosing Sputum Smear Positive and Sputum Smear Negative Pulmonary Tuberculosis. *Cureus*, 12(6).
9. Who.Int. Retrieved December 29, 2021, from [https:// www.who.int/ docs/default-source/documents/tuberculosis/infonote-tb-covid-19.pdf](https://www.who.int/docs/default-source/documents/tuberculosis/infonote-tb-covid-19.pdf).
10. Van Dyck, P., Vanhoenacker, F. M., Van den Brande, P., & De Schepper, A. M. (2003). Imaging of pulmonary tuberculosis. *European radiology*, 13(8), 1771-1785.
11. Leung, A. N. (1999). Pulmonary tuberculosis: the essentials. *Radiology*, 210(2), 307-322..
12. Nachiappan, A. C., Rahbar, K., Shi, X., Guy, E. S., Mortani Barbosa Jr, E. J., Shroff, G. S., ... & Hammer, M. M. (2017). Pulmonary tuberculosis: role of radiology in diagnosis and management. *Radiographics*, 37(1), 52-72.
13. McQuaid, C. F., Vassall, A., Cohen, T., Fiekert, K., & White, R. G. (2021). The impact of COVID-19 on TB: a review of the data. *The International Journal of Tuberculosis and Lung Disease*, 25(6), 436-446.