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## Role of x ray and CT/HRCT scan imaging in evaluation of pulmonary abnormalities associated with human immunodeficiency virus infection

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### Abstract

**Aims and Objective:** The purpose of our study is to (a) To demonstrate the different patterns of pulmonary abnormalities in HIV patients. (b) To define imaging features of each disease whether infective, non-infective or HIV associated pulmonary malignancy. (c) To differentiate different pulmonary diseases in HIV patients on the basis of pattern of involvement and localization of lesions. (d) To correlate the X ray and CT scan finding, and to evaluate the role of CT scan imaging in pulmonary abnormalities in HIV patients.

**Materials and Methods:** The present study was carried out at Shree Sayajirao General Hospital (SSGH), vadodara, Gujarat, India from September 2018 to November 2019. Ninety patients with HIV positive having pulmonary symptoms were enrolled in this study, and studied prospectively with X ray chest and HRCT. The pattern, extent and severity of HRCT findings were recorded and compared with the plain x-ray findings. The gathered information and investigations were subjected to statistical analysis.

**Results:** Out of 90 patients X ray was normal in 13 patients (14.44%), while HRCT was normal in only 4(4.44%) patients. Most common finding on x ray was pleural effusion, while most common finding on HRCT was mediastinal lymphadenopathy followed by pulmonary nodules. In our study higher number of sample with pulmonary abnormality were detected on HRCT as compared to X-ray and for consolidation, pulmonary nodules and fibrosis difference were statistically significant ( $p < 0.05$ ).

**Conclusion:** HRCT is better than X ray in evaluation of pulmonary abnormality in HIV positive patients. HRCT limits down the differential diagnosis, helps in early detection of disease. HRCT is recommended when the radiographic findings are normal or inconclusive and pulmonary abnormality is suspected clinically, for the confirmation of diagnosis. Early and proper diagnosis of pulmonary complications in patients with HIV infection will help clinicians to develop a focused therapeutic approach to patient management. Thus HRCT can decrease morbidity and mortality in these patient by early detection of diseases.

**Keywords:** HIV, HRCT, X RAY, Tuberculosis

### Introduction

The lung is one of the most frequently involved organs in the immunocompromised host, for infectious or neoplastic causes [1, 2]. The clinical and radiographic presentation of lung disease associated with HIV infection is non specific. Chest radiographic has limited sensitivity for the detection of early infection in immune compromised patients [2, 3]. The absence of radiographic findings, however, does not rule out pulmonary disease. In the patient respiratory complaint, PCP and TB must be considered even when the radiographic is normal. With the spread of HIV every corner of Indian subcontinent, TB being the main opportunistic pulmonary infection contributing to mortality among HIV infections, it is important to diagnose and treat early. Specific indications for HRCT include the detection of occult disease in symptomatic patients, characterizing nonspecific radiographic disease patterns, assessment of the mediastinum, staging malignancy, assessing complications (particularly pleural disease) and guiding invasive procedures.

### Material and method

This is a analytical study of 90cases carried out in the department of Radiodiagnosis, S.S.G. Hospital, Baroda from September 2018 to November 2019.

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All HIV positive patients presented with pulmonary symptoms like cough, dypnea, wheeze etc, was enrolled in this study.

Patients in whom the x ray chest PA View were inconclusive, were advised further HRCT Chest evaluation. Consent was taken before enrolling the patient in this study. Digital X ray chest PA view and subsequently HRCT Chest was performed for every patient.

**Patient identity was kept confidential in full study**

**Inclusion criteria**

1. Patients with human immunodeficiency virus infection presenting with pulmonary symptoms like cough, breathlessness, night sweats, fever etc.
2. Patients willing to give informed written consent to take part in the study.

3. Patients of all age groups.

**Exclusion criteria**

The study will exclude

1. Uncooperative and extremely debilitated patients.

**Results and discussion**

In our study, maximum number of patients was in the age group of 31–40 years. There were 29 patients in the age group of 31–40 years. Of 90 patients included in our study, 60 (66.6%) were male and 33 (33.3%) were female.

In our study we have compared different pulmonary abnormality on X ray and HRCT Chest in HIV patients. Different abnormality detected on X ray and HRCT are mentioned in following table.

**Table 1:** Comparison between X-Ray Chest and HRCT Chest.

Findings	X Ray		Hrct Finding	
	No. of patients	Percentage	No. patients	Percentage
Consolidation	25	27.78%	48	53.93%
Cavity	5	5.56%	13	14.61%
Bronchiectasis	14	15.56%	16	17.98%
Bullae	1	1.11%	6	6.74%
Fibrosis	4	4.44%	14	15.73%
GGO	8	8.89%	16	17.98%
Hydropneumothorax	2	2.22%	2	2.25%
Hyperinflation	3	3.33%	3	3.37%
Nodular opacity	19	21.11%	67	75.28%
Pleural effusion	28	31.11%	35	39.33%
Pleural thickening	2	2.22%	5	5.62%
Pneumothorax	2	2.22%	3	3.37%

In our study higher number of sample with pulmonary abnormality were detected on HRCT as compared to X- ray and for consolidation, pulmonary nodules and fibrosis

difference were statistically significant ( $p < 0.05$ ). Maximum difference between HRCT and X ray finding was found in nodular opacity, followed by patchy consolidation.

**Table 2:** Comparison of Consolidation on X ray and HRCT chest.

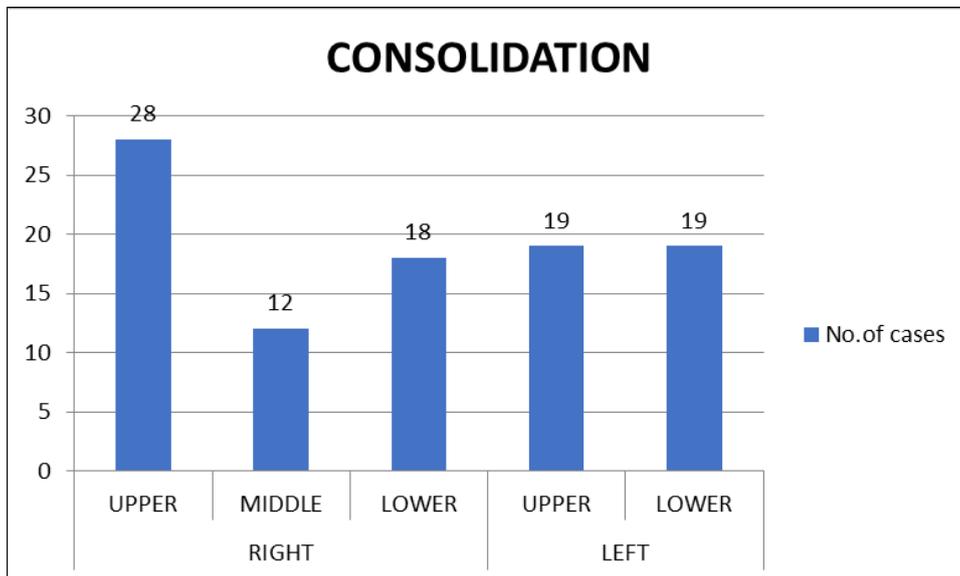
Consolidation	X Ray	X Ray	HRCT Finding	HRCT Finding	X2	P-Value
	No. patients	%	No. patients	%		
Present	25	27.78%	48	53.33%	11.154	0.0008
Absent	65	72.22%	42	46.67%		
Total	90	100.00%	90	100.00%		

Higher no. of sample with consolidation were detected on HRCT chest as compared to X- ray chest and this difference between the two was statistically significant ( $p < 0.05$ ).

Patchy consolidation is not well demonstrated on x ray and often missed, as shown in following fig:1



**Fig 1:** X ray chest was initially given normal, HRCT shows patchy consolidation in left lower lobe.



**Fig 2:** Shows distribution of consolidation in different lobes of lung in our study.

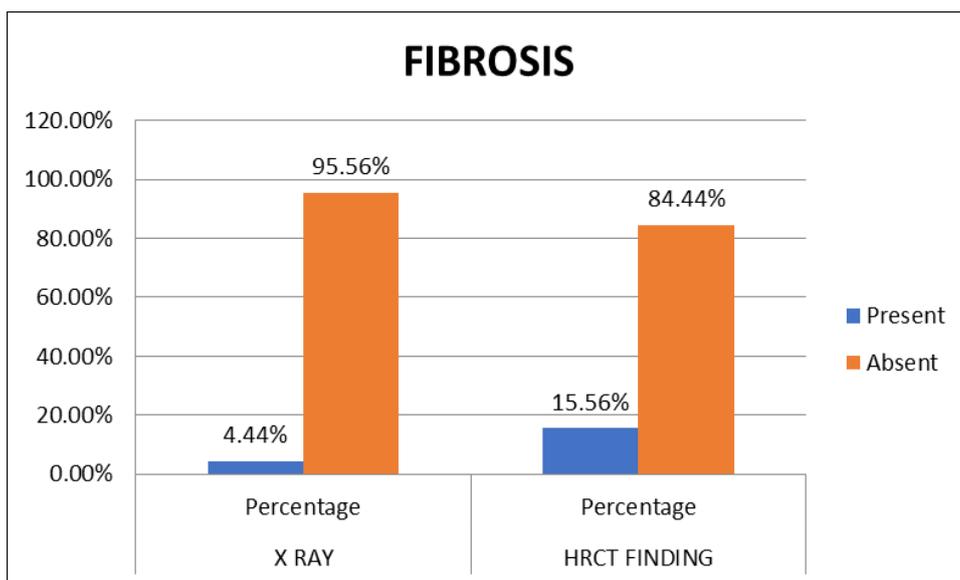
Out of 48 patient positive for consolidation on HRCT chest, right upper lobe consolidation was found in 28 patients (58.33%), left upper and lower consolidation each in 19 patients (39.58%), right lower consolidation in 18 patients

(37.50%), and right middle lobe consolidation in 12 patients (25.0%).

**Results for detection of fibrosis**

**Table 3:** Fibrosis

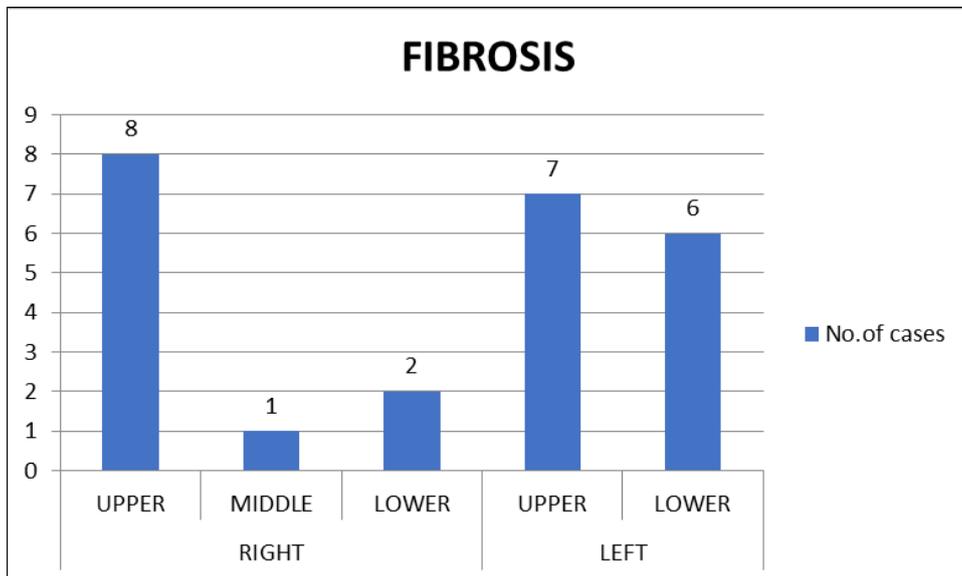
	X Ray	X Ray	HRCT Finding	HRCT Finding	X2	P-Value
	No. patients	%	No. patients	%		
Present	4	4.44%	14	15.56%	5.0000	0.0253
Absent	86	95.56%	76	84.44%		
Total	90	100.00%	90	100.00%		



**Fig 4:** Shows comparison of fibrosis on x ray and HRCT.

Higher number of sample with fibrosis were detected on HRCT chest compared to X- ray chest and this difference

between the two was statistically significant ( $p < 0.05$ ).



**Fig 5:** Shows distribution of fibrosis in different lobes of lung.

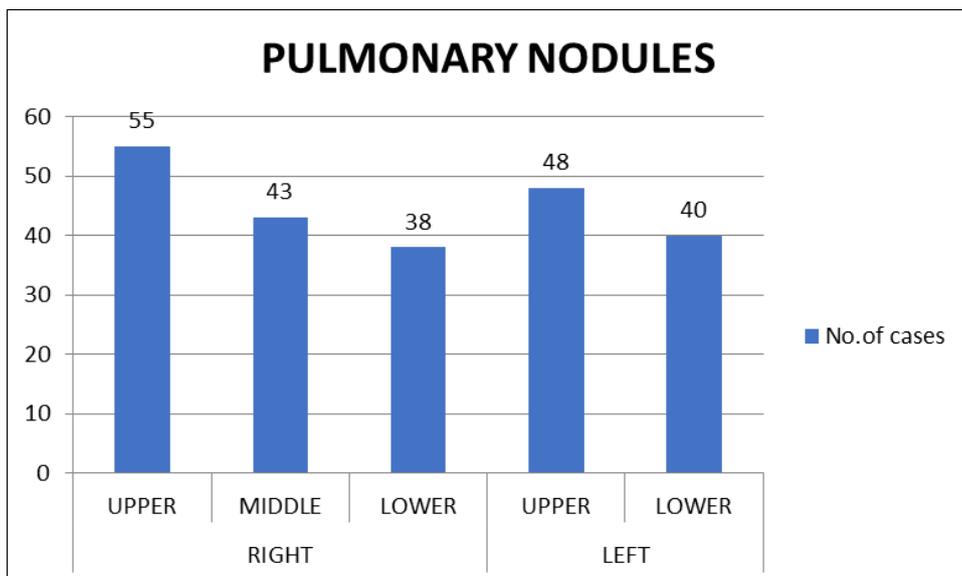
Right upper lobe fibrosis was found in 8 patients (57.14%), left upper lobe fibrosis in 7 patients (50.00%), left lower fibrosis in 6 patients (42.86%), right lower lobe fibrosis in 2 patients (14.29%), and right middle fibrosis in 1 patient (7.14%).

**Results for detection of pulmonary nodule.**

**Table 4:** Pulmonary nodule

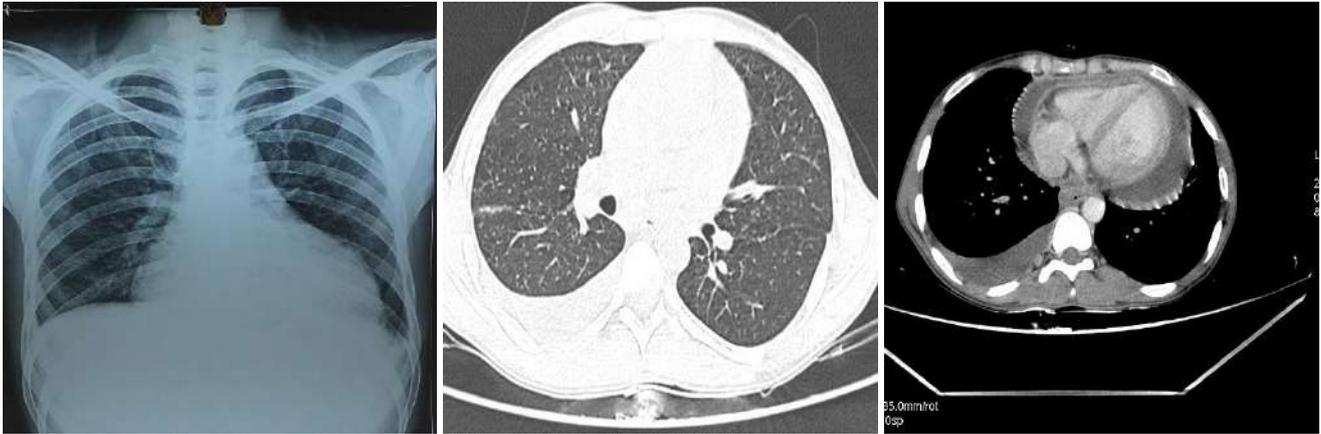
Pulmonary Nodules	X Ray	X Ray	HRCT Finding	HRCT Finding	X2	P-Value
	No. patients	%	No. patients	%		
Present	19	21.11%	67	74.44%	49.1860	<0.0001
Absent	71	78.89%	23	25.56%		
Total	90	100.00%	90	100.00%		

Higher number of sample with pulmonary nodule were detected on HRCT chest as compared to X- ray chest and this difference between the two was statistically significant ( $p < 0.05$ ).



**Fig 6:** Shows distribution of pulmonary nodule in different lobes of lung.

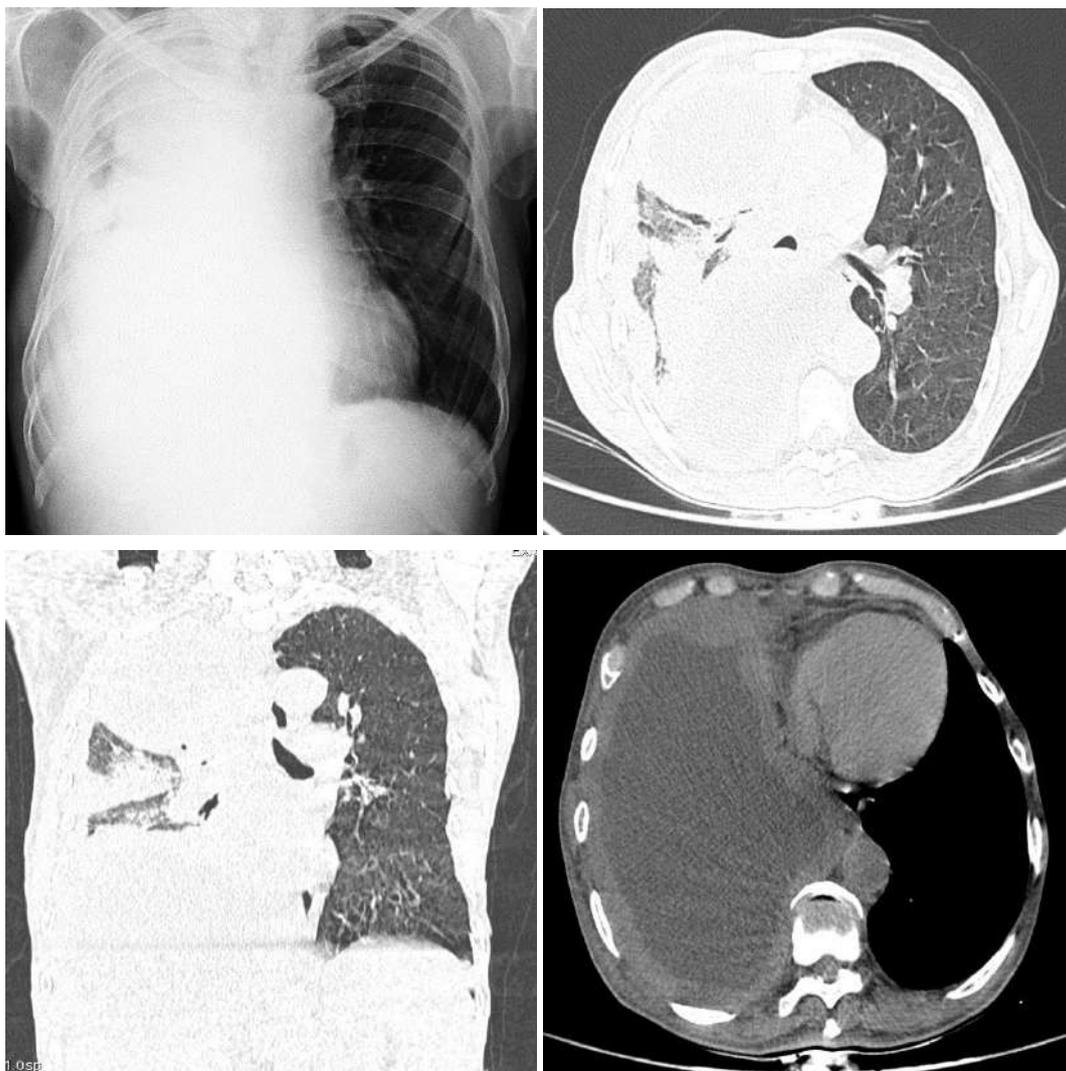
Right upper lobe nodule was found in 55 patients (82.09%), left upper lobe nodule in 48 patients (71.64%), right middle lobe nodule in 43 patients (64.18%), left lower lobe nodule in 40 patients (59.70%), and left lower lobe nodule in 38 patient (56.72%).



**Fig 7:** X ray and HRCT. Image (a) shows cardiomegaly with subtle nodular opacity in bilateral lower lung zone. On HRCT it was diagnosed as miliary tuberculosis with pericardial effusion.

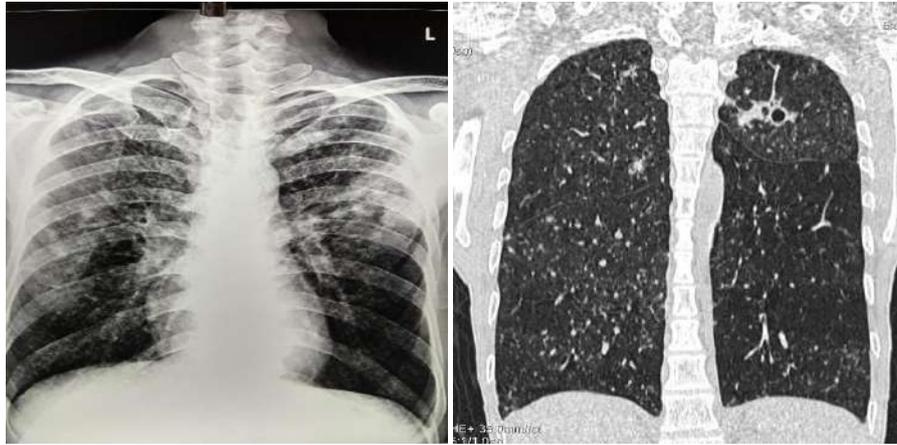
In our study there were 35 patients with pleural effusion, among that 12 patients have moderate to severe pleural effusion. Underlying lung abnormality, cardiac-thoracic

ratio cannot be commented on X ray when there is ipsilateral moderate to gross pleural effusion (fig 8)

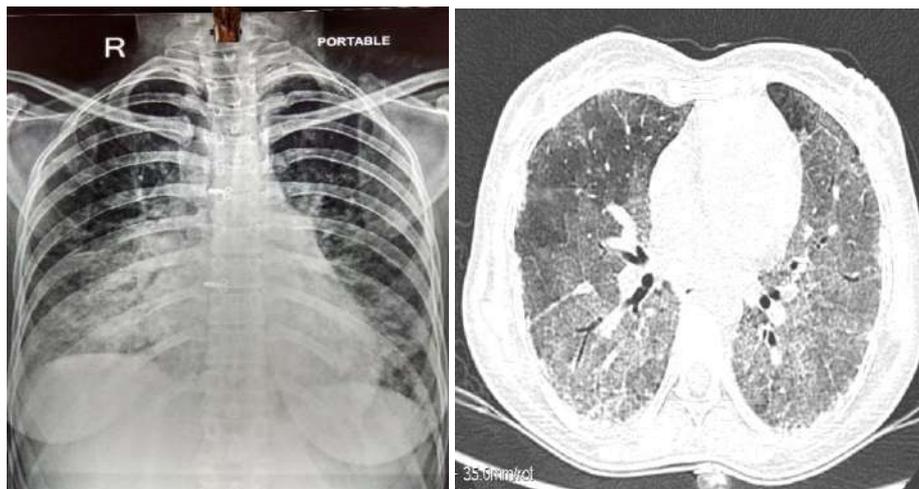


**Fig 8:** X ray and HRCT shows gross right sided pleural effusion. HRCT shows collapsed and consolidated underlying lung with pleural thickening.

Small cavity especially in apical segments and in postero-basal segments are not well demonstrated on x ray (Fig 9)



**Fig 9:** X ray shows multi focal patchy consolidation in bilateral lungs fields, small cavity can't be appreciated on x ray. HRCT shows small cavity in apico-posterior segment of left upper lobe.



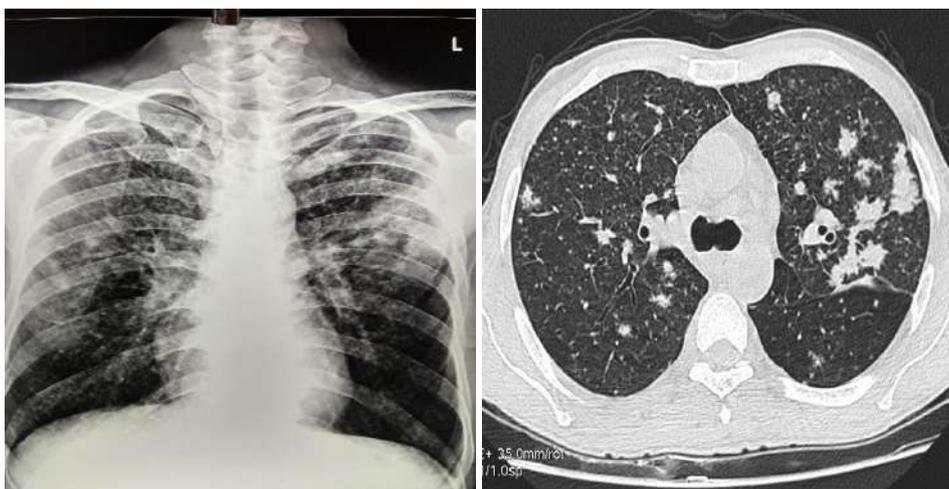
**Fig 10:** X ray shows patchy consolidation on bilateral lower lung zone and HRCT shows diffuse ground glass opacity.

Ground glass opacity is difficult to appreciate on x ray and often missed. In HIV Patients with low CD4 Count diffuse GGO signifies cytomegalovirus/pneumocystis carinii infection [5, 6]. These infections have high mortality if not detected and treated early. In Our study, there were 4 cases of PCP/CMV infection, all of them died due to late diagnosis.

So, ground glass opacity can be missed or even wrongly

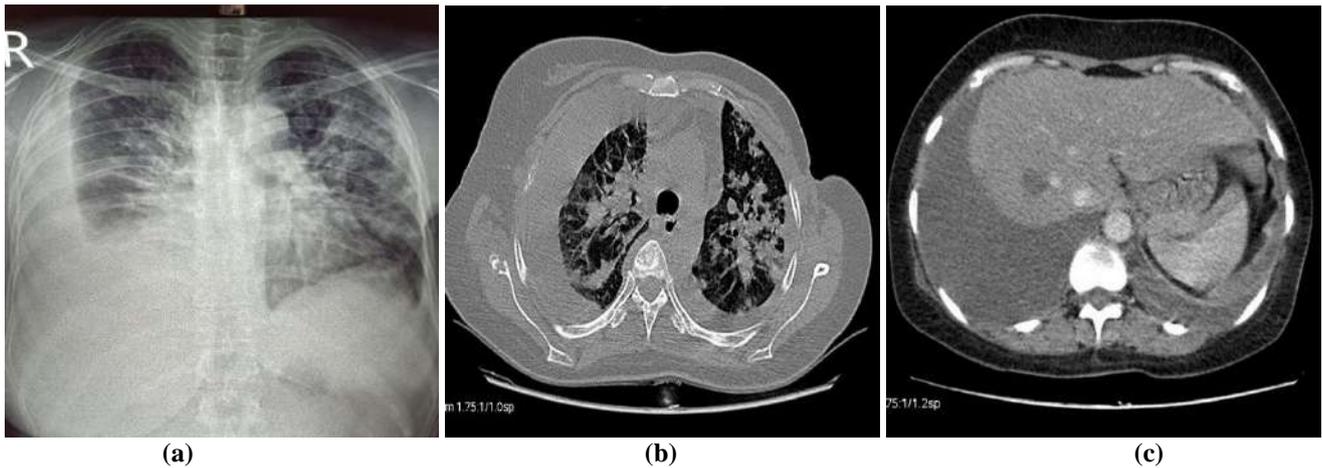
interpreted as consolidation on x ray chest (Fig 10), shows limitation of X ray over HRCT Chest.

Tree in bud sign which describes multiple areas of centrilobular nodules with a linear branching pattern, describes endobronchial spread and is important sign of active tuberculosis [8, 10]. These lesions are not seen frequently on chest radiographs, and HRCT is particularly sensitive in this finding (FIG).

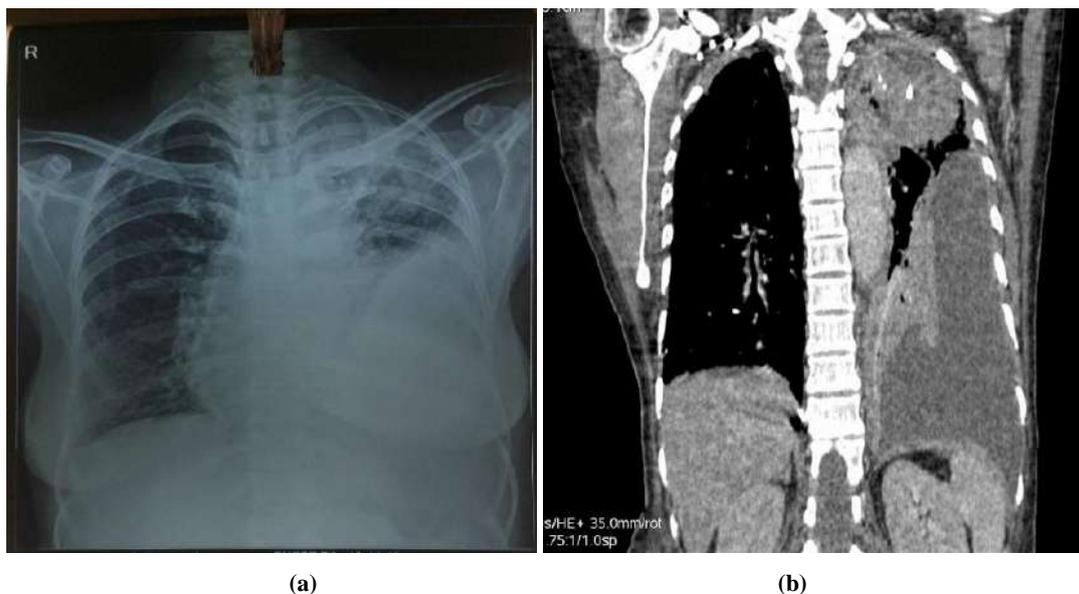


**Fig 11:** X ray shows multi focal patchy consolidation in bilateral lung field. HRCT shows multifocal consolidation, centrilobular nodule with tree in bud sign.

X ray has also its limitation in detection of thoracic mass and lung metastasis, especially when it is associated with pleural effusion.



**Fig 12:** Xray and HRCT: Image (a) shows multifocal patchy opacity with bilateral pleural effusion. HRCT (b, c) shows multiple soft tissue nodules, with lytic lesion on right scapula and hypodense lesion on liver, suggestive of multiple metastasis.

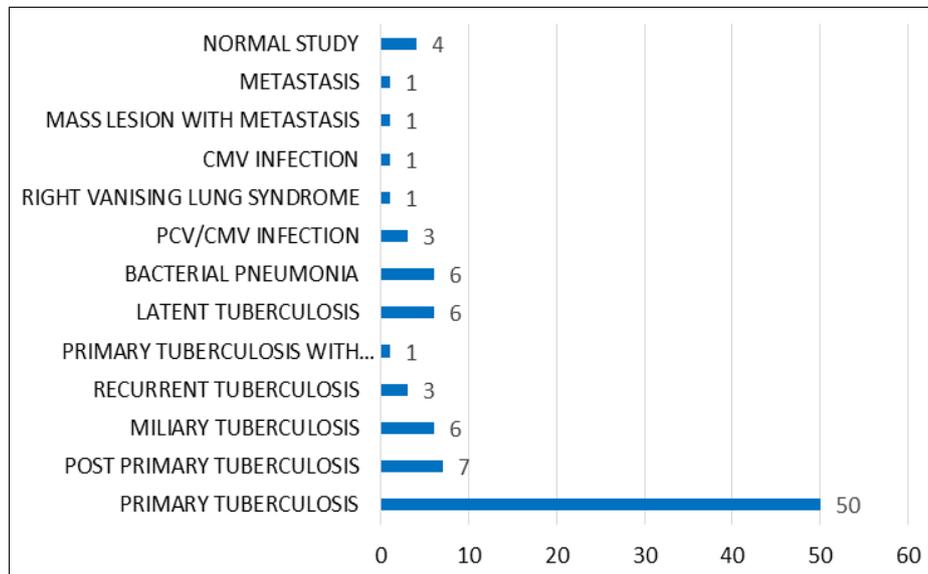


**Fig 13:** X ray and HRCT (a) shows gross left sided pleural effusion with homogenous radio-opacity in left apical and upper lung zone. Image (b) show ill defined mass lesion with foci of calcification in left upper lobe in subpleural location extending into apical segment of left upper lobe.

**Pulmonary Diseases in our Study**

Out of 90 patients, primary tuberculosis was diagnosed in 50 patients (55.56%), post primary tuberculosis in 7 patients (7.78%), miliary tuberculosis in 6 patients (6.67%), latent tuberculosis in 6 patient (6.67%), Bacterial pneumonia in 6

patients (6.67%) PCP/CM V infection in 4 patients (4.44%) recurrent tuberculosis in 3 patients (3.33%), primary tuberculosis with pseudomonas infection in 1 patient (1.11%), mass lesion in 1 patient (1.11%), metastasis in lung in 1 patient (1.11%) and 4 normal patient (4.44%).



**Fig 14:** Shows radiological diagnosis made in our study

### Summary and Conclusion

Although chest radiography remains the foremost imaging technique in the evaluation of pulmonary abnormality, HRCT is helpful in the proper localization and characterization of these abnormality.

Tuberculosis is most common opportunistic infection in HIV patients, distinction of active from inactive TB is very important. "Tree in bud" appearance suggestive of endobronchial spread and hence active disease. These lesions are not seen frequently on chest radiographs, and HRCT is particularly sensitive in this finding. HRCT is better than chest X ray in identification of extent of pulmonary TB, especially subtle areas of consolidation, cavitation, bronchogenic and miliary spread.

Similarly ground glass opacity (GGO) are very difficult to find on chest radiography, hence often missed. Diffuse GGO opacity in patient with low CD4 count gives clue for PCP/CMV infection. Early diagnosis of these infections decreases morbidity and mortality of these patients.

Further the location and distribution of nodules in relation to lung structures is a key determinant in limiting down the differential diagnosis. Such limiting down of the differential diagnosis based on the nodule distribution was possible only on HRCT and not on chest x ray.

In our study higher number of sample with pulmonary abnormality were detected on HRCT as compared to X-ray and for consolidation, pulmonary nodules and fibrosis difference were statistically significant ( $p < 0.05$ ).

Thus HRCT is better than x ray in evaluation of pulmonary abnormality in HIV positive patients. HRCT limits down the differential diagnosis, helps in early detection of disease.

HRCT is recommended when the radiographic findings are normal or inconclusive and pulmonary abnormality is suspected clinically, for the confirmation of diagnosis. Early and proper diagnosis of pulmonary complications in patients with HIV infection will help clinicians to develop a focused therapeutic approach to patient management. Thus HRCT can decrease morbidity and mortality in these patient by early detection of diseases.

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