HRCT FEATURES OF PULMONARY TUBERCUOSIS IN GILGIT BALTISTAN

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ABSTRACT

OBJECTIVE: To study the High Resolution Computed Tomography (HRCT) features of pulmonary tuberculosis (TB) in the population of Gilgit Baltistan (GB). **STUDY DESIGN:** Descriptive case series study. **PLACE AND DURATION OF STUDY:** The study was conducted at Radiology department, CMH Gilgit from 1st October, 2017 to 30th September 2018. **MATERIALS & METHODS:** 30 patients with ages between 18-80 years, with clinically and radiographically diagnosed pulmonary tuberculosis were further evaluated using HRCT lung, after informed consent. **RESULTS:** Total 30 patients underwent HRCT lung scanning. Centrilobular nodules (n=21), tree-in-bud opacities (n=17) and consolidation (n=12) were the most frequent findings of active tuberculosis. Miliary nodules were detected in 8 patients, (n=8). Ground glass opacities (n=6), thick walled cavities (n=5), empyema (n=3), pleural effusion (n=3) and Reverse halo sign (n=1) were also features suggesting active tuberculosis. Features signifying inactive tuberculosis on HRCT were fibrosis (n=5), bronchovascular/architectural distortion (n=5), traction bronchiectasis (n=4) and calcified nodules (n=5). 5 out of 30 patients presented with HRCT features of both active and inactive pulmonary tuberculosis. **CONCLUSION:** Pulmonary tuberculosis manifests itself in a variety of patterns on HRCT in the population of GB. Secondly, miliary tuberculosis is on rise in this region. This is an alarming situation and calls for serious measures to be taken by competent authorities. Studies should be carried out to evaluate the prevalence and cause of rise of miliary tuberculosis in GB.
Key Words: HRCT, Pulmonary Tuberculosis, Miliary Tuberculosis

Introduction

Tuberculosis is a global health problem. Currently 22 high burden countries account for over 80% of worlds TB cases. Pakistan is ranked 5th among 22 high burden countries.[1] Moreover Pakistan has 4th highest multi-drug resistant TB prevalence. And Gilgit Baltistan is a region with high TB prevalence.[2]

Tuberculosis being a contagious infection usually attacks the lungs. It can also spread to other parts of the body and with deteriorated immunity it can disseminate hematogeneously. Miliary tuberculosis is a fatal form of TB that results from massive lympho-hematogeneous dissemination of causative agent;

Mycobacterium tuberculosis.[3] GB declared as a region with high TB prevalence and having limited resources may suffer from tuberculosis of various organs as well as from the fatal disseminated Miliary TB.

Multiple studies have been carried out to assess the prevalence of tuberculosis in Pakistan. Moreover various clinical, radiological and pathological diagnostic features of TB are also frequently studied. However, to our knowledge no such study to assess the HRCT features of pulmonary tuberculosis has been conducted in the region of GB. GB being a most difficult terrain with harsh weather conditions is deprived of

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many health care facilities although some NGOs are religiously putting in their efforts. Yet this region requires special attention of health care sectors as well as research workers.

Rationale of this study is to evaluate HRCT manifestations of pulmonary tuberculosis and follow the trend of this disease in the population of GB, in order to suggest any further necessary measures.

The study is conducted using a reliable diagnostic tool, HRCT as HRCT lung is considered a highly valued modality in the diagnosis of pulmonary TB. It is a powerful and reliable tool in tuberculosis diagnosis when other means of diagnosing TB (e.g., culture, BAL) fail, are not available or time consuming.[4,15]

Material and Method

This prospective descriptive case series was conducted at Radiology department of CMH Gilgit, over a period of one year, from 1st October, 2017 to 30th September, 2018. Prior approval from ethical review board was obtained. Patients with strong clinical suspicion for pulmonary tuberculosis were referred to our department from medicine department for chest radiograph. Patients with chest radiographs positive for pulmonary disease were then subjected to HRCT lung after consulting with treating physician. Informed consent was taken from every patient before performing HRCT.

High resolution computed tomography was performed on Hitachi Supria 16 slice CT Scanner. Sections of 1 mm thickness were obtained at 10 mm intervals, from the lung apices to the bases, using a 35 cm FOV, 512 x 512 reconstruction matrix, 130 kV, 150 mA, and 1.5 second scanning time. All images were obtained at suspended end inspiration. I.V contrast was not given. Images were reconstructed using a high spacial frequency algorithm. For lung windows, level/width was -600 HU/1500 HU and for mediastinal windows the level/width was 40/300 HU.

HRCT were evaluated for the presence, size, predominance and distribution of nodules, cavities, consolidation, ground glass opacity, empyema and pleural effusion.

INCLUSION CRITERIA:
Patient fulfilling all four following criteria were included in the study:
   Aged more than 18 years.
   Strong clinical suspicion for tuberculosis.
   Chest radiograph positive for pulmonary disease.

EXCLUSION CRITERIA:
   Refusal to give consent.
   Pregnant patients.
   History of other chest diseases.

Bacteriological evidence of tuberculosis in sputum smear/culture was not taken under consideration as many patients fulfilling above mentioned criteria revealed negative sputum smear for acid fast bacilli. The reasons can be multifactorial and are beyond the scope of this study.

Results

A total of 30 patients were enrolled in the study. Of these 60% (n=18) were males and 40% (n=12) were females. Age ranged from 18 to 80 years, mean ± SD was calculated as 50.3 ± 20.2 years.

HRCT detected features signifying active TB as well as inactive TB. In cases of active TB, centrilobular nodules (n=21 or 70%), tree-in-bud opacities (n=17 or 57%) and consolidation (n=12 or 40%) were the most frequent findings. Miliary nodules were detected in (n=8 or 27%). Ground glass opacities (n=6 or 20%), thick walled cavities (n=5 17%), empyema (n=3 or 10%), pleural effusion (n=3 or 10%) and Reverse halo sign (n=1or 3%) were also features suggesting active tuberculosis. (Fig. 1, 2 and 3).

Features signifying inactive tuberculosis on HRCT were fibrosis (n=5 or 17%), bronchovascular/ architectural distortion (n=5 or 17%), calcified nodules (n=5 or 17%) and traction bronchiectasis (n=4 or 13%). These features are tabulated in (Tab. 1).

Features of active tuberculosis coexisting with inactive TB where identified in 5 cases, (n=5 or 17%).

Discussion

Pulmonary tuberculosis is one of the challenging infectious diseases in Pakistan. In addition to other remote regions of Pakistan the cases of tuberculosis
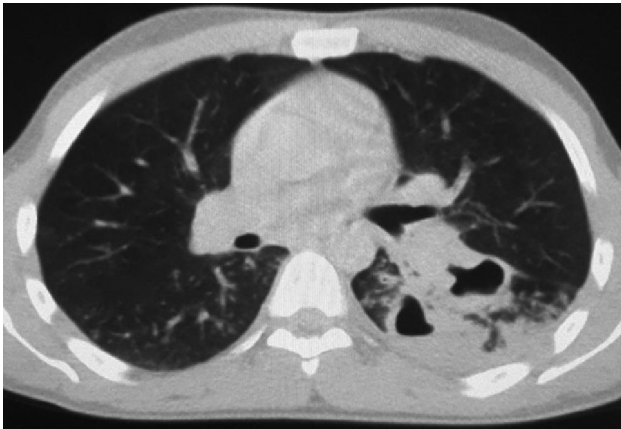
Figure 1: HRCT Chest, lung window, axial section at the level of subcarina reveals two cavitating lesions with thick walls and surrounding alveolar infiltrates in superior segment of lower lobe of left lung. Associated pleural and fissural thickening also appreciated. Few tree-in-bud opacities are demonstrated in superior segment of lower lobe of right lung as well.

Figure 2: HRCT Chest, lung window, axial section at the level of cardiac ventricles demonstrates multiple tree-in-bud opacities and centrilobular nodules predominantly confined to superior segment of lower lobe of left lung.
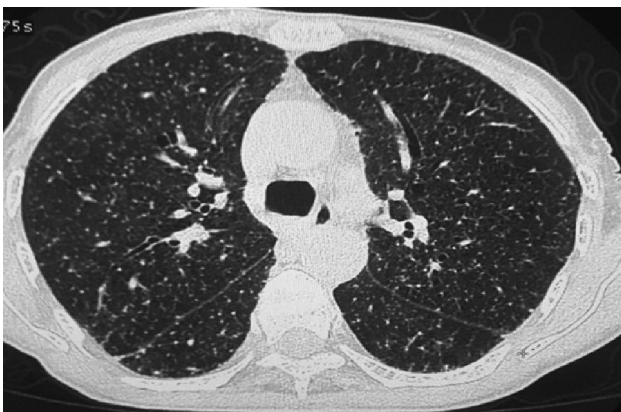

Figure 3: HRCT Chest, lung window, axial section at the level of carina shows bilateral upper and lower lobes of lungs impregnated with numerous tiny discrete nodules in random distribution i.e. along fissures, pleural surfaces, bronchovascular bundles and centrilobular regions, suggesting miliary tuberculosis.

HRCT Findings	Frequency n=30*	Percentages (%)
Centrilobular nodules	21	70
Tree-in-bud nodules	17	57
Consolidation	12	40
Miliary nodules	8	27
Ground glass haze	6	20
Cavity	5	17
Empyema	3	10
Pleural effusion	3	10
Reverse halo sign	1	3
Fibrosis	5	17
Architectural distortion	5	17
Calcified nodules	5	17
bronchiectasis	4	13

*The total is more than 30 as more than one HRCT features were present in a patient

Table 1: HRCT Features of Pulmonary Tuberculosis

HRCT Findings	Drusty et al n=22	Hatipoglu et al n=32	Present study n=30
Centrilobular nodules	16 (72%)	29 (91%)	21 (70%)
Tree-in-bud nodules	17 (77%)	23 (71%)	17 (57%)
Consolidation	15 (68%)	14 (44%)	12 (40%)
Cavity	9 (41%)	16 (50%)	5 (17%)
Miliary Nodules	-	1 (3%)	8 (27%)

Table 2: Comparison of HRCT Findings with Previous Studies

are on rise in Gilgit Baltistan. Particularly Darel, Tangeer, Chilas, Chamogarh, Ghanche and parts of Astore valley are the most vulnerable areas.[5] Pulmonary tuberculosis is a highly contagious infectious disease and requires clinical, radiological as well as bacteriological diagnosis before a well targeted treatment is implemented.

Although chest radiograph is the most cost effective and first line radiological investigation in the diagnosis of pulmonary tuberculosis, HRCT has a higher sensitivity and specificity in this respect. Activity of disease cannot be properly assessed by chest radiography. A normal chest radiograph has a high negative predictive value for the presence of active TB. HRCT is helpful in detecting indicators of active disease not seen on chest x ray.[6] HRCT provides trust to treating doctors and radiologists in differentiating the other diseases that produce similar appearances without

using invasive methods. In view of delay in reports of sputum culture HRCT has vital role in primary diagnosis of tuberculosis and empirical therapy can be started.[7,15]

Tuberculous lesions may manifest in various forms on HRCT. Irrespective of primary or post primary TB, different patterns of active disease recognized in the population of GB, in this study are, i. Centrilobular nodules, ii. Tree-in-bud opacities, iii. Cavity, iv. Ground glass opacities, v. Consolidation, vi. GGO surrounded by consolidation (reverse halo sign), vii. Random miliary nodules, viii. Empyema and ix. Pleural effusion. Chronic inactive tuberculosis represented as i. Fibrosis, ii. Architectural / bronchovascular distortion, iii. Calcified granuloma, iv. Traction bronchiectasis.

Drusty K et al mentioned in their study that Ill-defined nodules, consolidation and tree-in-bud appearance were the best indicators of active disease. Combination of indicators was found to improve the predictive value.[6]

Kyung Soo et al reported in their study that HRCT findings in active disease are patchy consolidation on one side or both sides, thick or thin wall cavity, airspace nodules, centrilobular branching structures and tree-in-bud appearance, miliary pattern, pleural effusion, empyema and bronchopleural fistula, and lymph nodes present in hilar / mediastinal region.[8] HRCT findings in patients with inactive TB are deranged bronchovascular structures, bronchiectasis, emphysema, and fibrotic bands suggestive of past infection.[8]

Hatipoglu ON et al reported centrilobular nodules, tree in bud opacities, macronodules, cavity, consolidation, ground glass opacity, miliary nodules, bronchiectasis, interlobular septal thickening, pleural effusion and hilar/mediastinal lymphadenopathy as features of disease activity.[9] They reported fibrosis, bronchovascular distortion, parenchymal calcification, bronchiectasis, emphysema, pleural thickening and calcified mediastinal lymph nodes as features of inactive tuberculosis.[9]

Comparing these studies, shown in (Tab. 2), our study reveals a more varied presentation of tuberculous lesions on HRCT. However the study of Hatipoglu ON shows much similarity of lesions in active and inactive forms of disease, although the frequencies vary.

Nevertheless our study has shown that reverse halo sign, a ring of consolidation surrounding an area of ground glass opacity, is also a feature of active tuberculosis. Edson M et al mentioned in their study that Kim et al regarded reverse halo sign specific for COP, subsequently various authors have reported the presence of this sign in a wide spectrum of infectious and non infectious disease.[8] The study reported that the presence of nodular reverse halo sign is highly suggestive of granulomatous disease, especially tuberculosis, rather than COP and it should be included among the HRCT findings that are suggestive of active tuberculosis.[10]

Moreover our study shows a high number of patients, 8/30 (27%) with innumerable randomly distributed miliary nodules throughout both lungs, suggestive of miliary tuberculosis (Fig. 3) which is a potentially lethal disease if not diagnosed and treated early. This is in contrary to findings of Drusty et al and Hatipoglu et al. Drusty et al shows non case of miliary TB whereas Hatipoglu shows a single case i.e., 3%.

Such a high number of miliary tuberculosis in the region of GB is alarming. Diagnosing miliary TB can be a challenge that can perplex even the most experienced clinicians. Clinical manifestations are nonspecific, typical chest radiograph findings may not be evident till late in the disease, high resolution computed tomography (HRCT) shows randomly distributed miliary nodules and is relatively more sensitive.[11,12] This reveals that diagnosing miliary TB is another dilemma.[13] Many patients suffering from hematogeneously disseminated miliary tuberculosis usually present late, when treating it becomes a challenge.[14] Keeping in view these facts early diagnosis of TB is necessary for effective treatment and leads to a reduced onward transmission of such a highly contagious infectious disease.[16] This justifies the role of HRCT lung in early and confident diagnosis of pulmonary and miliary tuberculosis.

Challenges faced in the region of Gilgit Baltistan necessitate bold and drastic measures to be taken by the authorities concerned.

Conclusion

Pulmonary tuberculosis manifests itself in a variety of patterns on HRCT in the population of GB. Secondly, miliary tuberculosis is on rise in this region. This is

an alarming situation and calls for serious measures to be taken by competent authorities. Studies should be carried out to evaluate the prevalence and cause of rise of miliary tuberculosis in GB.

Conflict of Interest: This study has no conflict of interest to declare by any author.

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