ORIGINAL RESEARCH ARTICLE

Computed Tomographic Findings of chest in Cases of HIV and Correlation with CD4 Counts- A Three Year Study at a Tertiary Care Hospital

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ABSTRACT

Introduction: According to global report, 36.7 million people worldwide are living with AIDS by end of 2016, with 2.1 million children <15 years of age. The primary cell involved in AIDS is CD4 T-lymphocyte; hence the estimation of CD4 cell count helps in assessment and the risk of development of opportunistic infections in affected individual. Our aim of the present study was to assess the prevalence and nature of different radiological presentations by computed tomography in HIV infected individuals presenting with respiratory illness.

Material and methods: A three year prospective study was conducted by Department of Radiology after ethical committee approval. Computed tomography of the chest was performed on all diagnosed cases of HIV presenting with respiratory ailments. CD4 t lymphocyte estimation was done in all the cases by FACS. Descriptive statistics, median and ranges were calculated for continuous data. Frequencies and percentages were calculated for Categorical data. All the data was analyzed by using SPSS software version 19.0(IBM corp, USA)

Results: 550 confirmed cases of HIV with predominant males (69.82%) and M:F ratio of 2.31:1 were included in the study. The mean age was 34.2± 6.2 years.21-30 years was the common age group and 17.82% were on HAART and 56.36% of cases were observed with CD4 counts >200 -<499 cells/mm3.Positive findings on chest CT were observed in 76.36% of cases. Fever was the most common symptom and pulmonary tuberculosis was the most common imaging abnormality on Chest CT in all the cases.

Discussion: our study highlights the patterns of clinical symptoms and their relationship with CD4 counts in cases of HIV. The different presentations on CT imaging studies and their diagnostic patterns are expressed based on the immune status and CD4 counts of the cases and their response based on HAART. We found that pulmonary tuberculosis still remains as the most common clinical entity in cases of HIV and the presentations on CT are variable based upon the CD4 counts of the case.

Key words: HIV, Computed Tomography, CD4 Cell Count, HAART, Pulmonary Tuberculosis.

INTRODUCTION

Human immune deficiency virus (HIV) is the causative agent of AIDS which remains a threat to the developing world. According to global report, 36.7 million people worldwide are living with AIDS by end of 2016, with 2.1 million children <15 years of age. An estimated 1.8 million become newly infected every year with 5000 new cases per day. In India, the prevalence of HIV among adults is 0.3% with an estimated 80,000 new HIV infections.[1] It is a well known fact that the basic pathology in case of HIV infection is suppression of Cell mediated immunity with an increasing risk in development of opportunistic infections. The primary cell involved in AIDS is CD4 T-lymphocyte, hence the estimation of CD4 cell count helps in assessment and the risk of development of opportunistic infections in affected individual. Among the various organs involved in development of opportunistic infections, lung is the primary organ of attack with an increased incidence of infections in HIV cases. The data indicates that 70% of individuals with HIV develop lung infection during their course of illness. Although a tremendous achievements in diagnosis, management of HIV cases by introduction of HAART (Highly active anti retroviral Therapy) have developed the incidence of respiratory infections had never declined and surge in increase has occurred with associated development of multi drug resistant tuberculosis which is one of the leading cause of death in HIV infected individuals. With

the introduction of HAART, the incidence of bacterial pneumonias has decreased, with a reduction in viral and fungal respiratory infections. However confirming a diagnosis in respiratory infections by imaging techniques have gained importance after computed tomography. As the aetiology of respiratory tract infections are wide and the spectrum is variable, the possible presentations in an imaging study pose a difficult task for the radiologist in achieving a clear diagnosis. The clinical presentations are protean and many studies have already reported the wide variety of presentations in chest X rays and computed tomography among HIV infected individuals. Hence understanding the wide variety of presentations in CT findings may be helpful for a radiologist in presenting a clear diagnosis and guiding the clinician among different types of respiratory infections. Our aim of the present study was to assess the prevalence and nature of different radiological presentations by computed tomography in HIV infected individuals presenting with respiratory illness.

MATERIAL AND METHODS

A prospective observational study was conducted by the department of Radiology for a period of three years from January 2015 to December 2107. All the cases diagnosed and confirmed with HIV status and referred from various departments by attending physician or surgeon or Paediatrician for computed tomography of chest were included in the study. The patients were informed about the study and written consent was obtained from all the cases in the study. The study was approved by the institutional ethical committee and all the guidelines of the committee were followed. The HIV status of the cases in the study was confirmed by the central Microbiology Laboratory as per the NACO guidelines. The CD4 counts of all the cases were estimated by FACS count system using flow cytometric technique (Beckton-Dickinson Biosciences) and were recorded in a separate sheet. The CD4 count results were divide into three groups, namely CD4 counts <200cells/ mm^3, >200 cells/mm^3 ≤ 499cells/mm^3 and >500cells/mm^3 as per the CDC classification system.[5] The clinical history of the case was recorded in a separate predesigned proforma which included all the signs, symptoms, duration, and any opportunistic infections. In all the cases with signs and symptoms of respiratory tract infection with expectoration, in suspected cases of pulmonary tuberculosis and cases positive by chest X-ray sputum was screened for acid fast bacilli by Kinyoun's modification of acid fast staining technique and culture on VITEK-2 automated system. Cases with past history of CNS lesions, known cases of Pulmonary Tuberculosis, on immunosuppressive drugs and other immunocompromised history were excluded from the study.

Computed tomography was performed by a senior resident of radiology department and the findings were confirmed by senior radiologist and all the cases in the study were reported by a single radiologist to avoid bias in reporting. The findings of all the cases were noted in a data sheet and analyzed. The decision to administer iodinated contrast was based on the findings observed in the non contrast imaging.

STATISTICAL ANALYSIS

Descriptive statistics, median and ranges were calculated for continuous data. Frequencies and percentages were calculated for Categorical data. All the data was analyzed by using SPSS software version 19.0(IBM corp, USA)

RESULTS

In the present prospective study for a period of three years, a total of 550 cases which fulfilled the inclusion criteria were
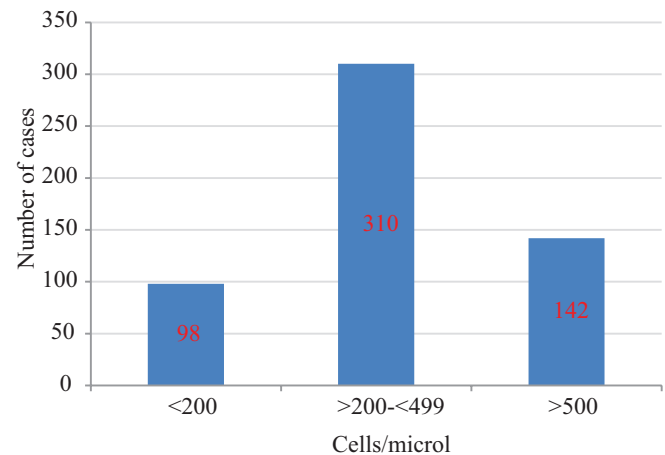

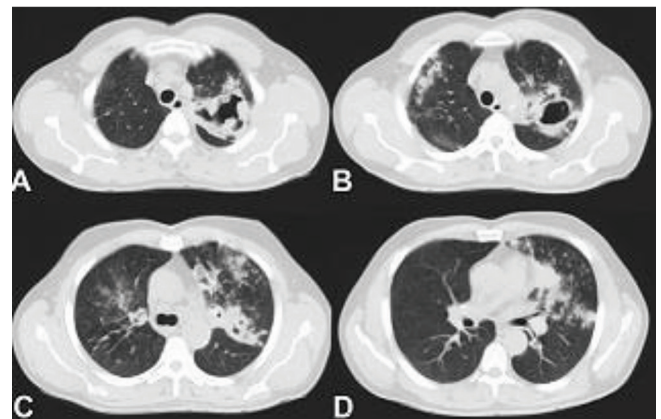**Figure-1:** Distribution of cases by CD4 counts

Figure-2: Chest CT lung window of immunocompromised patient showing large well defined cavity in left upper with adjacent centrilobular nodules, Scattered centrilobular air space nodules also seen in the right middle lobe and left lingular segments, these imaging features favour for Koch's etiology.
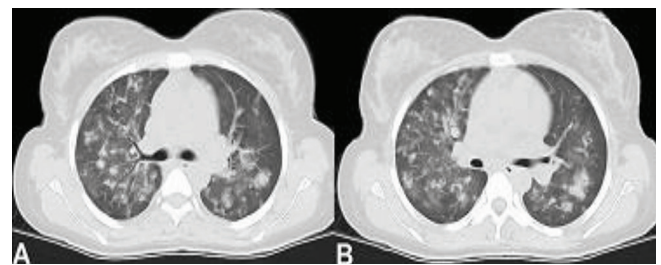

Figure-3: HRCT lung window of immunocompromised patient showing scattered centrilobular nodules in both lung fields in perihilar region (Right middle lobe, Left lung lingular segment and bilateral lower lobes and ground glass opacification.

Respiratory symptoms	All patients No (%) (n=550)	CD4 counts (Cells/μl)		
		<200	>200-<499	>500
Fever	478 (86.91)	88	288	102
Cough with Expectoration	410 (74.55)	90	258	62
Shortness of Breath (SOB)	206 (37.45)	68	116	22
Fever, Cough and SOB	324 (58.91)	90	156	78
Cough and SOB	298 (54.18)	88	162	48
Fever and SOB	248 (45.09)	92	101	55

Table-1: Distribution of symptoms in the cases with respect to CD4 counts

Pulmonary manifestations	No of cases	%
Emphysema	58	13.8
Bronchitis/Bronchiolitis	48	11.43
Bronchiectasis	36	8.57
Bacterial Pneumonia	122	29.05
Pulmonary Tuberculosis	158	37.62
Fungal pneumonia	48	11.43
Sarcoidosis	12	2.86
CMV Pneumonia	8	1.90
PCP Pneumonia	14	3.33
Lymphoma	6	1.43
Pleural effussion	28	6.67

Table-2: Type of Infectious and Non infectious diagnosis by CT among the cases in the study

Tomographic findings	Total Cases No (%)	CD4 counts (Cells/μl)		
		<200	>200-<499	>500
Pleural effusion	28 (6.67)	12	8	8
Mediastinal or Hilar Lymph node enlargement	212 (50.48)	87	105	20
Centrilobular Nodules with segmental distribution	187 (44.52)	66	85	36
Consolidation	98 (23.33)	54	22	22
Micro nodules Confluence	170 (40.48)	74	65	31
Centri lobular Distribution of Ill defined nodules	143 (34.05)	55	42	46
" Tree-in Bud" pattern	186 (44.29)	87	63	36
Thickening of Bronchial wall	69 (16.43)	44	17	8
Miliary Nodules	24 (5.71)	14	7	3
Thick walled cavity	88 (20.95)	43	34	11
Bronchiectasis	36 (8.57)	22	8	6

Table-3: Frequency distribution of tomographic findings among the cases in the study with positive signs on CT with relation to CD4 counts

included in the study. All the cases were confirmed with HIV status and refereed for Chest computed tomography. The majority in the study were male (384/550, 69.82%) with females (166/550, 30.18%) and male to female ratio in the study was 2.31:1. The mean age of the participants in the study was 34.2± 6.2 years and range was 12-67 years with youngest at 12 years and oldest at 67 years. Majority of the cases were in the 3rd decade between 21-30 years (28%) followed in order by < 20 years (24.36%) and 31-40 years (22.55%). Of the total 550 cases in the study, 98 cases (17.82%) were on HAART and 452 cases (82.18%) were not on anti retroviral therapy. The CD4 cell count of the cases was evaluated by FACS and categorized into three groups with Group-1, CD4 counts <200 cells/μl (98/550, 17.82%), Group-2 CD4 cell counts >200-<499 cells/μl (310/550, 56.36%) and Group-3 CD4 cell counts>500 cells/μl (142/550, 25.82%). The mean age of the cases in group-1 was 32.6± 2 years, in group-2 was

30.2± 3 years and in group-3 was 33.1± 5.2 years. In group-1 cases, all the 98 cases were not on HAART, in group-2, 268 cases were not receiving ART and in Group-3, 88 cases were not receiving ART. All the cases were subjected to Chest computed tomography and positive signs on CT were observed in 420 cases (76.36%).All the patients in the study had respiratory infections and the clinical symptoms of the cases were noted and summarized in Table-1. Fever, shortness of breath and cough with expectoration were the symptoms commonly observed in our study. Fever was the most common symptom in 86.91% cases, followed by cough with expectoration in 74.55% and shortness of breath in 37.45%. All the three symptoms were present in 58.91% of cases. The distribution of symptoms in relation with CD4 counts is summarized in Table-1 and indicates that majority were present in Group-2 than Group-1 and 3.

Table-2 summarizes the various clinical spectrums of

infections and non infectious conditions among the cases in the study based on the CT findings. Bacterial infections and the causative pathogen were identified by sputum culture and pulmonary tuberculosis cases by Kinyoun's acid fast staining technique for Mycobacterium tuberculosis or atypical Mycobacteria. Pulmonary Tuberculosis was the commonest infection associated with HIV among the cases with 37.62% followed by Bacterial pneumonia (29.05%), fungal pneumonia and Bronchitis (11.43%), Bronchiectasis (8.57%) and pleural effusion in 6.67% of cases in the study. Other conditions noted were emphysema (13.8%), Cytomegalo virus pneumonia, Pneumocystis carnii pneumonia, sarcoidosis and Lymphoma.

Tomographic findings in the study

Table-3 enumerates the findings on Computed tomography among the cases and association with their CD4 counts.

Pleural effusion was noticed in 28 cases, with 12 cases having CD4 cell counts <200 and 16 with >200 cells/μl. In the study, of total 98 cases with CD4 counts <200, 12 cases presented with pleural effusion and of the rest only 16 presented with pleural effusion on tomography. mediastinal or Hilar lymphadenopathy was the most common finding observed in 50.48% of cases, and 87 of the cases were with CD4 count <200 cells/μl. Among the 98 cases with CD4 count<200 cells/mm3, 87 had mediastinal and hilar lymph node enlargement. Next common findings were Centri lobular nodules with segmental distribution (44%) and "Tree in Bud" appearance (44%) and these findings were observed in majority of the cases with CD4 counts <200 cells/mm3.

DISCUSSION

Our study has evaluated the computed tomography findings of chest among HIV cases with reference to their CD4 counts. A majority of the cases in our study (76.36%) were found to have radiographic positive findings on CT imaging which was also similar to the findings of Miller R who reported the incidence of positive signs in HIV cases as 78% in his study.[6] Most of the studies performed previously confined to all the cases of HIV irrespective of their ART status, but in the present study we divided the cases in to those receiving HAART and that not on therapy. In our study, we observed that 92% of cases not on HAART were found positive for CT imaging and only 8% of cases on HAART developed positive signs on CT imaging studies. This clearly explains the advantage of HAART in preventing the development of respiratory infections among HIV cases. Similar study was also done by Grubb JR et al who reported still higher i.e.; 98% of Cases not on HAART in his study were positive for CT imaging studies.[7] In our study, based on the findings on the CT diseases were characterised. Most of the studies conducted earlier have characterised diseases in the era of Non ART and hence the findings on the CT were variable from present study which compared with patients on HAART. In the present study, most of the cases were present in 3rd decade of life (21-30 years) as observed in majority because this group forms the sexually active age in all years of life and are more actively involved in outdoor sexual exposure in life time.[8] The cases in our study were categorised as Groups 1,2 and 3 based on the CD4 counts and majority of the cases

were in Group-2 (> 200-<499 cells/mm3). This was on par with the findings of Sigel K who reported the same and were contrast to findings of Sampio M who reported that majority in his study (94%) were with CD4 counts <200cells/mm3, however this is dependent upon the healthcare status in the country and vary from country to country and place to place within the same country.[9,10]

The common clinical symptom in the study was Fever, which was observed in majority along with Shortness of breath and Cough with expectoration. However the symptoms in our study were correlated with CD4 counts of the cases which clearly demonstrated that majority and a combination of the symptoms were noted in majority of cases with CD4 counts >200- <499 cells/mm3. These findings of our study correlate with the findings of Kothari K et al who reported that 92% of cases in his study had CD4 counts in range of <200->499 cells/mm3.[11] Majority of clinical features were associated in cases who were not on anti retro viral therapy and >80% of cases with CD4 counts <200 cells/mm3 were associated with two or more clinical symptoms in our study. Similar findings were also seen in the reports of Hull MW et al in their study.[12]

Pulmonary tuberculosis was the commonest clinical entity identified by tomographic findings and further confirmed by AFB sputum staining in our study. The tomographic presentations were different in cases undergoing Therapy and without therapy. These differences were based on the CD4 counts of the cases in the study. The presentations that were commonly observed were asymmetric reticulo nodular pattern mostly involving the upper and lower lobes. Similar findings were reported by Swaminathan S et al in his study.[13] As mentioned few studies reported contrast findings which were due to difference in the CD4 counts and immune status of the cases in their study. [Figure-2]

Bacterial pneumonias were the next imaging findings in our study with appearance as ground glass opacities and lobar consolidation. These findings were variable depending upon the pathogen involved and in few cases as poorly defined centrilobular nodules. The pathogen was identified by sputum culture and was managed. Tree in Bud and centrilobular nodules were observed in cases with H.influenzae pneumoniae. These findings observed in our study were similar to the findings observed in studies of Mehta AA et al.[14] Viral pneumonias were only 1.9% in our study and identified by appearance of multifocal and bilateral areas of ground glass opacities and foci of airspace consolidation. This was similar to findings of George MP in his study and the incidence was 2.4% in his study.[15]

The incidence of Pneumocystis carni pneumonia was 3.33% and all the cases were identified with CD4 counts <50 cells/mm3. The appearance on CT imaging was Ground glass opacities mostly central in distribution with few pneumatoceles. [Figure-3] However few cases of CMV also documented Ground glass opacities but were differentiated by CD4 counts and other findings in CXR. Similar reports were seen in the study of Stansell JD in his study.[16] Other pulmonary manifestations diagnosed in our study were emphysema (13.8%), Bronchiectasis (8.57%) and Bronchitis/Bronchiolitis. (11.43%)

Fungal infections presented with variable and different patterns on CT. The findings observed were small nodules, unilateral and bilateral lymphadenopathy or calcification of lymph nodes. Disseminated fungal infections presented with miliary pattern in cases of histoplasmosis and coccidiomycosis in our study. These findings were on par with Aviram G in their study.[17]

CONCLUSION

To conclude our study highlights the patterns of clinical symptoms and their relationship with CD4 counts in cases of HIV. The different presentations on CT imaging studies and their diagnostic patterns are expressed based on the immune status and CD4 counts of the cases and their response based on HAART. We found that pulmonary tuberculosis still remains as the most common clinical entity in cases of HIV and the presentations on CT are variable based upon the CD4 counts of the case.

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