ORIGINAL RESEARCH ARTICLE

High Resolution Computed Tomography (HRCT) Chest Findings in Immunocompromised Host

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ABSTRACT

Introduction: HRCT enables the best precise characterization of the extent, activity and pattern of pulmonary lesions and guides tissue biopsy whenever necessary and it is also useful for monitoring the response of treatment. The aim of this study designed to describe the HRCT (High Resolution Computed tomography) chest findings in Immunocompromised host.
Material and methods: HRCT Chest examination of 50 patients of immunocompromised conditions like human immunodeficiency virus (HIV) infection, primary immune deficiency and immunosuppression for some medical treatments such as chemotherapy and radiotherapy for various malignancies, high dose corticosteroid use, solid organ and bone marrow transplantation, uncontrolled daiabetes mellitus.
Results: Bacterial infections are most common due to renal transplants. Immunocompromised conditions due to uncontrolled diabetes mellitus fungal infections are most commonly noted. Pneumocystis jiroveci is most commonly seen in immunocompromised condition due to HIV infection.
Conclusion: Thus HRCT helps in further diagnostic accuracy to avoid unnecessary delay in medical treatment of pulmonary disease in immunocompromised patients. HRCT chest is the gold standard investigation of choice for pulmonary infections in immunocompromised patients

Keywords: HRCT Chest, Immunocompromised, Bronchial Wall Thickening, Mycobacterium Tuberculosis.

INTRODUCTION

Immunocompromised conditions can be attributed to various disorders which impairs the human immune system, it includes the human immunodeficiency virus (HIV) infection, primary immune deficiency and immunosuppression for some medical treatments such as chemotherapy and radiotherapy for various malignancies, high dose corticosteroid use, solid organ and bone marrow transplantation, uncontrolled diabetes mellitus etc will come under this category.[1] Wide range of clinical complications affecting major organs which variesfrom opportunistic infections to unusual malignancies are seen in immunocompromised patients. Pulmonary infections are an important cause of morbidity and mortality in immunocompromised conditions.

There are certain roles in each of the imaging modality in the evaluation of the pulmonary complications occurring in immunocompromised patients. Mostly cross sectional images from CT/HRCT enables better precise characterization of the extent, activity and pattern of pulmonary lesions and guides tissue biopsy whenever necessary and it is also useful for monitoring the response of treatment. Imaging examination should be always be interpreted in the context of the patients clinical presentation as certain pathogen related pulmonary infection could be negative in imaging at the initial developing phase of the disease.

Mycobacterium tuberculous and non tuberculosis mycobacterial (mycobacterium avium complex) infection is an important cause of morbidity and mortality in immunocompromised patients (In AIDS most commonly). A report from the world health organisation (WHO) says that the fatality rate among the deaths of HIV positive tuberculosis cases are less than the deaths of HIV negative tuberculosis cases.[2] In immunocompromised hosts unusual radiographic manifestations are more common.

Certainly, there is a higher sensitivity in detecting abnormalities in the absence of any conventional radiographic change by HRCT chest examination. Regardless of antiretroviral treatment, no significant differences in the findings of CAP were found in HIV-infected patients.

Occurring predominantly in immunosuppressed patients, nocardosis is uncommon but frequently fatal, with a related mortality of up to 80%. The most frequent risk factor is high dose corticosteroid use in solid organ transplantation, especially lung transplant 3. Husain et al. reported an incidence of nocardial infection of 2.1% in lung transplant recipients4. Differential diagnosis is impossible in certain

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cases between nocardia and TB infections in lungs.
Other uncommon bacterial pathogens, such as Pseudomonas aeruginosa, Legionella pneumophila, and Rhodococcus are rare. Definitive diagnosis needs multidisciplinary efforts, blood test, sputum examination, imaging, and even biopsy.
The incidence of invasive fungal infections has dramatically increased in the past two decades, in parallel to the growing population of immunocompromised patients. Pneumocystis jiroveci pneumonia (PJP) is the most common infection in HIV-positive patients. P. jiroveci, previously known as Pneumocystis carinii causing P. carinii pneumonia (PCP), has been classified as a fungus. However, the widespread use of prophylaxis therapy has reduced the incidence and severity of classic imaging findings. HRCT has a high sensitivity and specificity for PJP, 100% and 89%, respectively 5. In addition, history of immunosuppression, especially AIDS, favours the diagnosis of PJP.
Cytomegalovirus (CMV) remains the most common pathogen and responsible for up to 50% of immunocompression related viral pneumonia 6. In comparison to immunocompotent population, immunocompromised patients are more prone to viral infections, particularly for those with T-cell defect. However, the range of radiological signs of CMV pneumonia is not subject to the host immune status.
During the past decade, respiratory viruses, including rhinovirus, adenovirus, influenza, parainfluenza and respiratory syncytial virus, have been more frequently detected as pathogens of deadly infections in immunocompromised patients thanks to development of sophisticated molecular diagnostic tools. Additionally, herpes simplex virus may possibly cause a pneumonitis or a focal pneumonia in immunosuppressed.
The aim of this study was to describe the HRCT (High Resolution Computed tomography) chest findings in Immunocompromised host.

MATERIAL AND METHODS

It was a Prospective study._Data was collected from Immunocompromised patients referred to the department of Radiodiagnosis, Narayana Medical College, Nellorefor HRCT Chest examination from General Medicine, Pulmonology and Nephorology departments. Sample size consisted of 50 patients of both sexes.

Inclusion criteria: All patients with post solid organ transplantation and hematopoietic stem cell transplantation; Patients with bone marrow transplantation; Patients with various malignancies; Patients diagnosed with HIV/AIDS; Patients with uncontrolled diabetes mellitus; Patients with various haematological infections; Patients on chemotherapy therapy and radio therapy for various malignancies; Patients taking immunosuppressive drugs.

Exclusion criteria: Pregnant women, Patients with age less than 14 years, Psychiatric patients, Patients who are not co-operative,

Techniques: Imaging done by siemens somatom scope 16 serial slice CT scanner; GE optima 128 serial slice CT scanner.
On these machines HRCT (High Resolution Computed tomography) sections of lung were taken from the apices to the lung bases including bilateral adrenals.
Narrow 1-2mm thick collimation is used to acquire the images in sagittal, coronal reconstruction and volume rendering and high spatial frequency reconstruction algorithm is used. (Or) Narrow 1-2mm thick collimation is used to acquire the images and high spatial frequency reconstruction algorithm is used.

STATISTICAL ANALYSIS

Microsoft word and excel will be used to generate graphs, tables etc. For descriptive statistics, Statistical Package for Social Sciences (SPSS) will be used**.**

RESULTS

Among 50 cases of immunocompromise 24 patients were due to renal transplant (one case is with both renal transplant and uncontrolled diabetes mellitus), uncontrolled diabetes was observed in 18 patients and in 8 patients it was due to human immunodeficiency virus.
Among 50 cases in total there are 36 (72%) were males patients and 24 (28%) were female patients with various immunocompromised conditions (Table 1).
Among 36 male immunocompromised patients, there was 17 (64%) cases were due to renal transplantation, 13 (25%) cases were due to uncontrolled diabetes mellitus and 6 (11%) were due to human immune deficiency virus.
Among 14 female immunocompromised patients there was 7 (50%) cases were due to renal transplantation, 5 (36%) cases were due to uncontrolled diabetes mellitus and 2 (14%) cases were due to human immune deficiency virus.
Among 50 patients of immunocomprimised status of various age groups there was 6 patients in 2nd decade, there was 11 patients in 3rd decade, 14 patients among 4th decade, in 5th decade there are 7 patients, 6 patients among 6th decade and in 7th decade there was 6 patients.
Among 50 immunocompromised patients, there was 36

S.No	Age Groups	Renal Transplant		Uncontrolled Diabetes Mellitus		Human immune deficiency virus +	
		Male	Female	Male	Female	Male	Female
1	20 to 29 yrs	1	3	1	0	1	0
2	30 to 39 yrs	8	1	0	0	1	1
3	40 to 49 yrs	7	3	1	2	0	1
4	50 to 59 yrs	0	0	4	3	0	0
5	60 to 69 yrs	1	0	2	1	2	0
6	70 to 79 yrs	0	0	3	1	2	0

Table-1 Showing the number of cases in various age groups in different immunocompromised conditions in both the genders.

male patients and out of 36 patients (8%) 3 patients were in 2nd decade, 9 patients (25%) were in 3rd and 4thdecades, 4 (11%) patients were in 5th decade, 6 patients (17%) were in 6th decade and (14%) 5 patients were in 7th decade.

Among 50 immunocompromised patients there was 14 female patients and out of 14 patients (22%), 3 patients were in 2nd decade, 2 patients (21%) were in 3rd, there was 5 (36%) patients in 4th decade, 3 (21%) patients were in 5th decade, and (1%) 1 patient in 7th decade were recorded.

Among 50 immunocompromised patients there was 21 (42%) cases of bacterial origin, 19 (38%) cases of fungal origin, 2 cases (4%) were of viral origin and rest 8 cases (16%) are normal study (patients having no changes / findings in HRCT chest).

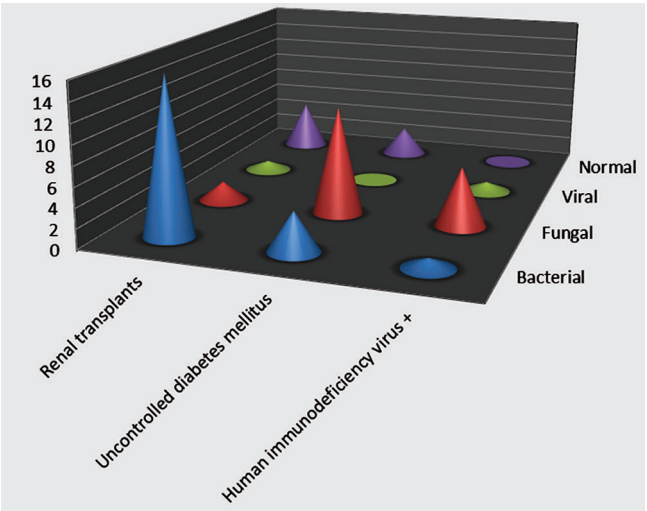
Etiology

Among 24 patients of renal transplantation 16 (67%) were due to bacteria, fungal was observed in 2 (8%), viral in 1 (4%) patient and there was 5 (21%) normal cases, in 18 patients with uncontrolled diabetes fungal was seen in 11 (61%), 4 (22%) were due to bacteria, there were 3 (17%) normal cases and there are no cases due to viral etiology, in 8 cases of human immunodeficiency virus positive cases fungal was seen in 6 (75%), 1 (13%) is due to bacteria, viral in 1 (12%) patient and there was no normal cases (Graph 1).

Immuno compromised male patients due to renal transplant the most common age group involved was 3rd and 4th decade and most of them are bacterial in origin (5 cases in 3rd decade and 4 cases in 4th decade) and two cases are fungal and a case of viral etiology was seen in 4th decade.

Immuno compromised female patients due to renal transplant the most common age group invoved is 2nd decade and bacteria was the causative.

Immuno compromised male patients due to uncontrolled diabetes mellitus the most common age group involved is 5th and 7th decade and was due to fungal etiology (4 cases in 5th decade and 2 in 7th decade).



	Renal transplants	Uncontrolled diabetes mellitus	Human immunodeficiency virus +
Bacterial	16	4	1
Fungal	2	11	6
Viral	1	0	1
Normal	5	3	0

Graph-1: Diagram showing various etiological agents in various immunocompromised conditions.

Immuno compromised female patients due to uncontrolled diabetes mellitus was the most common affected age group is 5th decade.

Immuno compromised male patients due to human immune deficiency virus infected cases 6th decade was the most common age group involved and are bacterial in origin and a viral case in 7th decade, a bacterial case in 3rd decade and there was no significant distribution in age groups in females immuno compromised patients of human immune deficiency virus infection.

Ground Glass Opacities were seen in 23 cases of immunocompromised patients and out of these 23 cases 11 (48%) cases were seen in post renal transplant patients and 5 (22%) observed in patients of uncontrolled diabetes mellitus and 7 (30%) were seen in patients with human immunodeficiency virus positive.

Out of these 23 cases with ground glass opacities 9 (39%) bacterial cases were positive for ground glass opacities and 2(9%) cases due to virus and 12 (52%) cases due to fungal etiology.

In 11 cases of ground glass opacities in immunocompromised patients due to renal transplants 9 (6 males and 3 females) observed in bacterial infection, one(male) in viral infection and one (male) in fungal infection.

In 5 cases of ground glass opacities in immunocompromised patients due to uncontrolled diabetes mellitus all the 5 cases (4 males and 1 female) observed in fungal infection.

In 7 cases of ground glass opacities in immunocompromised patients due to HIV infection 6 cases (4 males and 2 females) observed in fungal infection and one (male) case is seen in viral infection.

Consolidation

Consolidation seen in 28 cases of immunocompromised patients and among these 28 cases 17 (63%) cases observed in post renal transplant patients and 7 (26%) are seen in patients of uncontrolled diabetes mellitus and 4 (11%) are seen in patients with human immunodeficiency virus positive.

Out of these 28 cases with consolidation 19 (68%) bacterial cases were positive for condilidation and 1 (3%) case was due to virus and 8 (29%) are due to fungal etiology.

In 17 cases of consolidation in immunocompromised patients due to renal transplants 14 (9 males and 5 females) observed in bacterial infection, one case (male) in viral infection and 2 cases (males) in fungal infection.

In 7 cases of consolidation in immunocompromised patients due to uncontrolled diabetes mellitus all the 3 cases (2 males and 1 female) are seen in fungal infection and 4 cases (3 males and 1 female) observed in bacterial infection.

In 4 cases of consolidation in immunocompromised patients due to HIV infection 3 cases (1 male and 2 females) were seen in fungal infection and one (male) case is seen in bacterial infection.

Pulmonary nodules

Pulmonary nodules observed in 16 cases of immunocompromised patients and out of these 16 cases, 6 (37%) cases observed in post renal transplant patients and 8 cases(50%) observed in patients of uncontrolled diabetes

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mellitus and 2 (13%) observed in patients with human immunodeficiency virus positive.

Out of these 16 cases with pulmonary nodules 6 (38%) bacterial cases are positive for pulmonary nodules and 1 (6%) in cases due to virus and 9 (56%) due to fungal etiology.

In 6 cases of pulmonary nodules in immunocompromised patients due to renal transplants 6 (3 males and 2 females) are seen in bacterial infection and 1 case (male) in fungal infection.

In 8 cases of pulmonary nodules in immunocompromised patients due to uncontrolled diabetes mellitus all the 8 cases (7 males and 1 female) are seen in fungal infection(FIGURE 1).

In 2 cases of pulmonary nodules in immunocompromised patients due to HIV infection one (male) case is seen in bacterial infection and one (male) case is seen in viral infection.

Bronchiectasis

Bronchiectasis observed in 17 cases of immunocompromised patients and out of these 17 cases 6 (35%) cases observed in post renal transplant patients and 6 (35%) are seen in patients of uncontrolled diabetes mellitus and 5 (30%) observed in patients with human immunodeficiency virus positive.

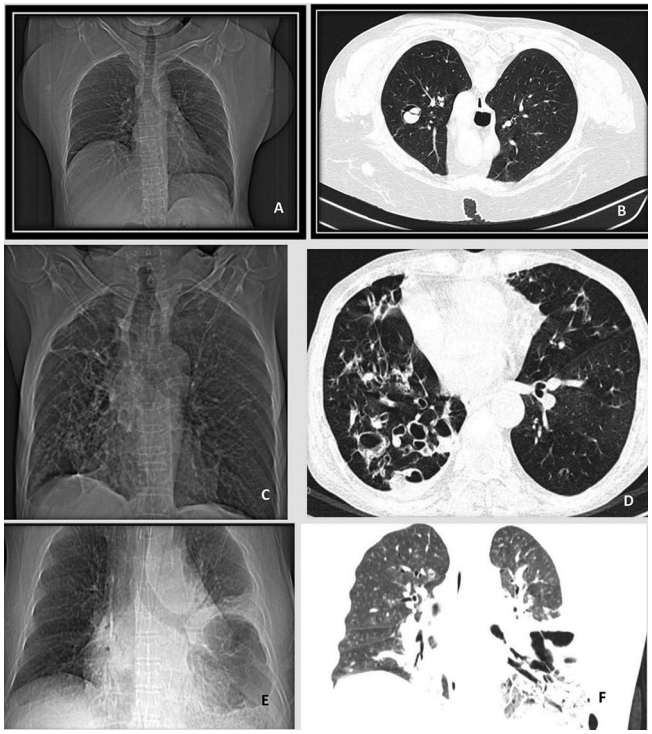

Figure-1: A&B. HRCT topogram and axial images of a female patient of age 47 yrs immunocopromised due to uncontrolled diabetes mellitus showing a cavitatory lesion with hyperdense content within and this was showing postural variation. S/o Aspergilloma (Fungal infection). C & D. HRCT topogram and axial images of a male patient of age 66 yrs immunocompromised due to diabetes mellitus and post tuberculosis now showing fibrocavitatory infection (koch's). E & F. HRCT topogram and axial images of a male patient of age 75 yrs immunocompromised due to HIV infection showing features of viral infection.

Out of these 17 cases with bronchiectassis 7 (41%) bacterial cases were positive for bronchiectasis and 2 (12%) in cases due to virus and 8 (47%) due to fungal etiology.

In 6 cases of bronchiectasis in immunocompromised patients due to renal transplants 3 (2 males and 1 female) observed in bacterial infection, 1 case (male) in viral infection and two (males) in fungal infection.

In 6 cases of bronchiectasis in immunocompromised patients due to uncontrolled diabetes mellitus all the 3 cases (3 males) observed in fungal infection and 3 cases (2 males and 1 female) are seen in bacterial infection.

In 5 cases of bronchiectasis in immunocompromised patients due to HIV infection one (male) case observed in bacterial infection and one (male) case observed in viral infection and 3 cases observed in fungal infection.

Emphysematous changes

Emphysematous changes were seen in 8 cases of immunocompromised patients and out of these 8 cases 5 (62%) cases observed in post renal transplant patients and 1 (13%) are seen in patients of uncontrolled diabetes mellitus and 2 (25%) cases observed in patients with human immunodeficiency virus positive.

Out of these 8 cases with emphysematous changes 5 (62%) bacterial cases were positive for emphysematous changes and 0 in cases due to virus and 3 (38%) due to fungal etiology.

In 5 cases of emphysematous changes in immunocompromised patients due to renal transplants 3 (1 male and 2 females) observed in bacterial infection, 1 case (male) in fungal infection.

One case of emphysematous changes in immunocompromised patients due to uncontrolled diabetes was observed in bacterial infection and it is male patient.

Two cases of emphysematous changes in immunocompromised patients due to HIV infection was observed in fungal infection and both the cases are male patients.

In all the cases of immunocompromised with various etiological factors all of them are showing bilateral lung involvement without any significant lobar involvement.

Additional findings in the form of pleural effusion was seen in almost all the cases and lymphnodes was observed in immunocompromised hosts due to renal transplantation and positive for hsuman immunodeficiency virus.

Fibrosis was most common in immunocompromised patients due to uncontrolled diabetes mellitus and are mostly seen in fungal origin of chest symptamatology and then followed in patients of renal transplant and then HIV positive patients.

Tree in bud opacities are seen in post renal transplant patients with bacterial orign of symptomatology and are not seen in patients with uncontrolled diabetes mellitus and HIV infection.

Air cysts are seen in uncontrolled diabetes mellitus (fungal etiology) and are not seen in renal transplants and HIV positive cases.

Interlobular septal thickening are mostly seen in cases of immunocompromise due to HIV infection and in a case of post renal transplant.

Peribronchial thickening was observed in few cases of all the immunocompromiosed conditions. Fissural thickening

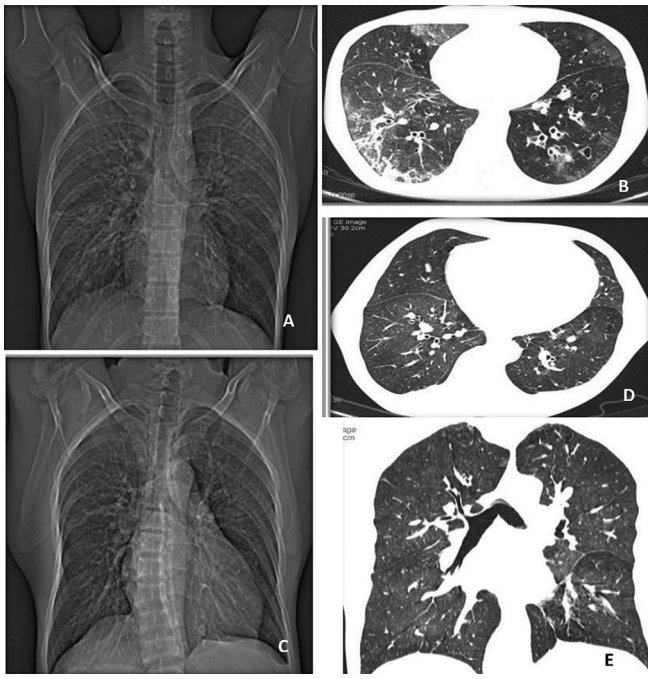

Figure-2: A & B. HRCT topogram and axial images of the male patient of age 21 yrs immunocompromised due to HIV infection showing "crazy paving pattern". S/o Pneumocystis jiroveci pneumonia (fungal). C,D & E. HRCT topogram and axial images of a male patient of age 41 yrs immunocompromised due to renal transplantation and immunosuppressive drugs showing features resembling viral infection.

was seen in post renal transplants and pleural thickening was observed in immunocompromise due to uncontrolled diabetes mellitus (figure 2).

DISCUSSION

Ground glass opacities, consolidation, pulmonary nodules are the patterns seen with increased attenuation noted in the chest and bronchiectasis, bronchioloectasis, mosaic attenuation, emphysematous changes and air cysts are the patterns with decreased attenuation noted. Additional findings such as pleural effusion, lymphadenopathy, pleural, fissural and bronchial wall thickening are seen. Bilateral lungs are involved without any lobar/segmental predisposition.

Bacterial, fungal and viral are the causative organisms responsible for the infection. Most of the cases are due to bacterial in origin. Fungal etiology was observed in uncontrolled diabetes mellitus and HIV infection and viral was seen less number of cases.

Out of 50 patients of immunocompromised condition there are 24 patients with immunocompromised condition due to renal transplantation between age 20 to 80 years. Both the males and females are with immunocomprised condition out of 24 patients 17 are males and 7 are females.

The most common effected age group in males is 3rd and 4th decade of life and in females it is 2nd and 4th decade of life. 67% cases are due to bacterial origin, 8% cases are due to fungal etiology and 4% cases are due to viral etiology and there are 21% normal cases.

In both males and females bacteria is main organism responsible for pathology and followed by fungal and then viral.

In 50 cases of immunocompromised condition 11 cases (8 males and 3 female patients) of post renal transplantation showed ground glass opacities, among them 9 cases are seen in bacterial infection and 1 case with viral and 1 cases with fungal infection.

Pulmonary nodules are seen in 6 cases (4 males and 2 females) among these 6 cases of pulmonary nodules 5 cases are seen in bacterial infection and a case in fungal infection. Tree in bud opacities were observed in patients with bacterial infection.

Interlobular septal thickening was observed in a case of post renal transplant. Peribronchial and fissural thickening is seen in few cases. Out of 50 patients of immunocompromised condition there are 18 patients with immunocompromised condition due to uncontrolled diabetes mellitus between age 20 to 80 years.

The most common effected age group in both males and females is 5th decade of life.

61% cases were due to fungal origin, 22% cases were due to bacterial etiology and no cases due to viral etiology and there are 17% normal cases.

In immunocompromised condition due to uncontrolled diabetes mellitus there was 5 cases (4 males and 1 female patients) showing ground glass opacities and all these 5 cases were observed in fungal infection.

There are 16 cases with pulmonary nodules in total among them 8 cases (7 males and one female patient) are seen in the immunocompromised patients due to uncontrolled diabetes mellitus and all of these cases are seen in fungal infection.

Most of the fungal cases in uncontrolled diabetes showed a positive air crescent sign.

Bronchiectasis was observed in 6 cases (5 males and 1 female) of immunocompromised condition due to uncontrolled diabetes mellitus out of the 6 cases 3 are seen in bacterial infection, 3 cases are seen in fungal infection.

Out of 50 patients of immunocompromised condition there are 8 patients with immunocompromised condition due to Human immunodeficiency virus infection between age 20 to 80 years. The most common effected age group in both males is 6th and 7th decade and in females there was no age predisposition.

75% cases are due to fungal origin, 13% cases are due to bacterial etiology and 12% cases due to viral etiology and there are no normal cases. In immunocompromised condition due to HIV infection there are 7 cases (5 males and 2 females patients) showing ground glass opacities among these 7 cases 6 cases are seen in fungal infection and one case is seen in viral etiology.2 cases (2 males) showed pulmonary nodules and one is seen in bacterial infection and other was seen in viral infection. Bronchiectasis was seen in 5 cases (5 males) of immunocompromised condition due to HIV infection and out of the 5 cases 3 are fungal, one was observed in bacterial infection and other was observed in viral infection. Emphysematous changes are seen in 2 cases (2 males) of HIV infection and both were observed in fungal infection.

Additional findings in the form of pleural effusion and lymph nodes are seen in almost all the cases. Peribronchial thickening was observed in few cases of all the immunocompromiosed

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conditions.

There is a similar study (Basaran et al.)[7]as our study, according to their study they examined 57 cases of immunocompromised condition and results were 19 cases of bacterial infection, 8 cases are viral infection, 20 cases of fungal infection, pneumocystis jiroveci pneumonia were 8 cases and tuberculosis in 2 cases.

The total number of cases due to bacterial infections are 21 in Basaran Demirkazik et al.[7] study and in our study these are 21 cases and total number of viral infection in Basaran Demirkazik et al. study was 8, and in our study these are 2 and total number of fungal cases in Basaran Demirkazik et al. study were 28 and in our study these were 19.[7]

Out of 50 immunocompromised patients there are 21 (42%) cases of bacterial infection among them 16 cases are seen in post renal transplantation, 4 cases are seen in uncontrolled diabetes mellitus and 1 case in HIV infection. Bacterial infections in immunocompromised male patients due to renal transplant the most common age group involved is 3rd and 4th decade and in females it is 2nd decade.

In immunocompromised conditions such as uncontrolled diabetes mellitus and HIV infection there is no gender and age predisposition. There are 23 cases with ground glass opacities in immunocompromised condition and all these 9 cases are seen in bacterial infection of post renal transplant patients.

Consolidation was seen in 28 cases of immunocompromsed status of various causes and 19 cases are in bacterial infection (14 cases in post renal transplants, 4 cases in uncontrolled diabetes mellitus and one case in HIV infection).

Out of 16 cases of immunocompromised condition with pulmonary nodules 6 cases was observed in bacterial infection (5 cases in post renal transplants, one in HIV infection).

Immunocompromised condition due to various causes shows bronchiectasis in 17 cases and out of these 17 cases 7 are seen in bacterial infection (5 cases in post renal transplants, 3 in uncontrolled diabetes mellitus, one in HIV infection).

13 cases of immunocompromised condition showed mosaic attenuation in 5 cases were observed in bacterial infection (2 cases in post renal transplants, 3 in uncontrolled diabetes mellitus).

Emphysematous changes were observed in 8 cases of immunocompromised condition and 5 cases are in bacterial infection (4 cases in post renal transplants, 1 in uncontrolled diabetes mellitus). According to Mc Loud TC et al. study focal areas of consolidation was the most common Radiological manifestation noted in the immunocompromised patients.[8] In some patients these were followed by ground glass opacities, nodules, thickening of bronchial walls and pleural effusion[9] and these findings were observed in the bacterial infections in our study.

Out of 50 immunocompromised patients there are 19 (38%) cases of fungal infection among them 2 cases are seen in post renal transplantation, 11 cases are seen in uncontrolled diabetes mellitus and 6 cases in HIV infection.Fungal infections in immunocompromised male patients due to HIV infection the most common age group involved is 6th decade and in females there is no age predisposition.

There are 23 cases with ground glass opacities in various immune compromised condition and out of these 26 cases 12 cases are seen in fungal infection (1 in post renal transplants, 5 in uncontrolled diabetes mellitus patients,6 in HIV infection).

Consolidation was observed in 17 cases of immunocompromised condition and out of these 8 cases 8 cases are in fungal infection (2 in post renal transplants, 3 in uncontrolled diabetes mellitus patients, 3 in HIV infection).

Out of 16 cases of immunocompromise condition with pulmonary nodules 9 cases were observed in fungal infection (1 in post renal transplants, 8 in uncontrolled diabetes mellitus patients).

17 cases of immnucompromised condition with bronchiectasis 8 cases were observed in fungal infection (2 in post renal transplants, 3 in uncontrolled diabetes mellitus patients, 3 in HIV infection).

13 cases of immunocompromised condition showed mosaic attenuation and out of these 13 cases 7 are seen in fungal infection (2 in post renal transplants, 5 in uncontrolled diabetes mellitus patients).

Immunocompromised condition due to various causes emphysematous changes are seen in 8 cases and 3 cases are in fungal infection (1 in post renal transplants, 2 in HIV infection).Halo sign i.e, early in the course of infection in fungal (aspergillous) infection HRCT reveals single or multiple nodules with surrounding ground glass opacities representing haemorrhage and necrosis around the central necrotic nodule containing Aspergillus hyphae.[10]

Heussel et al. reported that Aspergillus infection is often associated with ground glass opacities, nodules and consolidation and consistent with their study.[11]

In our study detected nodules in 8 out of 11 patients and four patients with consolidation and ground glass opacities.

Mori et al. reported that nodules are seen in 20 cases out of 21 cases and cavities in 7 patients out of 21 cases[12] and in our study there are nodules in 8 cases out of 11 cases and cavities are seen in all the cases. Pneumocystis jiroveci is classified as a protozoan initially later it was suggested as fungus.[13]

Bergimn et al. reported that predominant finding was areas of consolidation or ground glass opacities or both[14] with central or peripheral opacity, thickening of bronchial walls and interlobular septum were additional findings and our findings were consistent with this study in our study there are ground glass opacities and consolidation with thickening of interlobular septum. Out of 50 immunocompromised patients there are 2 (4%) cases of viral infection among them one case is seen in post renal transplantation and other case in HIV infection. Viral infections in immunocompromised due to renal transplant is seen in 4th decade and due to HIV infection is seen in 6th decade and both of them are males.

There are 23 cases of immunocompromised condition with ground glass opacities and 2 cases are seen in viral infection (1 case in post renal transplants, one in HIV infection).

Consolidation is seen in 14 cases of immunocompromised condition and 1 case is seen in viral infection in post renal transplant patients.

Pulmonary nodules are seen in 16 cases of immunocompromised condition of various causes and 1 case is seen in viral infection in HIV infection.

17 cases of immunocompromised condition showed bronchiectasis out of these 7 cases 2 were seen in viral infection (1 case in post renal transplants and other in HIV infection).13 cases of immunocompromised condition showed mosaic attenuation and one case is seen in viral infection of post renal transplantation.Additional findings in the form of pleural effusion and lymphnodes are seen in both the cases

Bronchial thickening was seen both the cases.Emphysematous and bronchiectactic changes are seen.

HRCT chest shows patchy or diffuse consolidation, ground glass opacities, small centrilobular nodules, bronchial wall thickening, a combination of consolidation and reticular opacities and pleural effusion.[15]

Kang et al., reported that ground glass opacities, nodules and consolidation were also present in viral infection[16]

According to Franquet et al. study ground glass opacities were detected in 66% of their cases and our study had 50% of cases with ground glass opacities. They also stated that multiple nodules and consolidation were also present in viral infection of immunocompromised patients and in our study nodules are seen in 50% of cases and consolidation was observed seen in all the cases.[17]

Moon et al reported that ground glass opacities were observed all the cases of their study and centrilobular nodules in 9 cases out of 10 cases[18] and in our study ground glass opacities are seen observed in one out of two cases and nodules also in one of two cases. In both the studies consolidation was observed in all the cases.

CONCLUSION

HRCT shows pulmonary abnormalities in the immunocompromised patients with normal findings on chest radiograph. Fungal, bacterial, viral infections can be differentiated with high accuracy. It helps in demonstrating the distribution and extent of lung parenchymal abnormalities. Thus HRCT helps in further diagnostic accuracy to avoid unnecessary delay in medical treatment of pulmonary disease in immunocompromised patients. HRCT chest was the gold standard investigation of choice for pulmonary infections in immunocompromised patients.

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