CHEST HIGH RESOLUTION COMPUTED TOMOGRAPHY FINDINGS OF INTERSTITIAL LUNG DISEASE AMONG ADULTS WITH CHRONIC RESPIRATORY DISEASE AT MUHIMBILI NATIONAL HOSPITAL

Lilian Evaristo Salingwa, (MD)

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SCHOOL OF MEDICINE

DEPARTMENT OF RADIOLOGY AND IMAGING

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By

Lilian Evaristo Salingwa

A Dissertation Submitted in (Partial) Fulfillment of the Requirement for the Degree of Master of Medicine (Radiology) of Muhimbili University of Health and Allied Sciences

October, 2020

CERTIFICATION

The undersigned certify that she has read and hereby recommend for acceptance by Muhimbili University of Health and Allied Sciences a dissertation entitled ***"Chest high Resolution Computed Tomography Findings of Interstitial Lung Disease among Adults with Chronic Respiratory Disease at Muhimbili National Hospital",*** in (Partial) Fulfillment of the requirements for the degree of Master of Medicine (Radiology) of Muhimbili University of Health and Allied Sciences.

_____

Dr. Lulu Fundikira
(Supervisor)

Date:_____

_____

Dr. Sylivia Bedas
(Co-Supervisor)

Date:_____

DECLARATION AND COPYRIGHT

I, **Lilian E. Salingwa,** declare that this dissertation is my own original work and that it has not been presented and will not be presented to any other University for a similar or any other degree award.

Signature: .....Date: .....

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DEDICATION

This work is dedicated to

My dearest mother Mrs. Margareth I. Salingwa for her endless love, care and support.

My late father Mr. Evaristo Mohamed Salingwa for ever believing that I could do it.

My beloved husband Mr. Abel George Makuri for unconditional love, care and support.

Our adorable daughters Gabriella and Catie-Bertha for their love and understanding.

And all expected readers who are interested in chest and the related diseases.

ABSTRACT

Background

High Resolution Computed Tomography has become a valuable tool for the evaluation of patients with interstitial lung disease which affect the lung supporting structures, the interstitium. It is known to be sensitive and specific, thus avoiding the torture of some needle pricks. It has high spatial resolution thus detecting details, aiding in the diagnosis and care of patients.

Broad Objective

The study aimed to determine chest high resolution computed tomography findings of interstitial lung disease among adults with chronic respiratory disease at Muhimbili National Hospital.

Methodology

This was a hospital based, cross sectional study where medical records and chest computed tomography images of the 162 adults who underwent chest computed tomography due to chronic respiratory disease at Muhimbili National Hospital were retrospectively reviewed. Data was collected using a pre-structured checklist. The information included socio-demographic information, clinical presentations, imaging findings and final interstitial lung diseases diagnosis. Results were analysed by SPSS and summarized using tables and figures.

Results

Out of 162 adults with chronic respiratory disease, approximately a quarter 39(24.1 %) were found to have interstitial lung disease. A disease burden significantly predominated among females. The most common symptom was progressive difficult in breathing, 53.8% with majority of patients, 64.1% having all specific imaging patterns for interstitial lung disease. The most common interstitial lung disease diagnosis was non-specific interstitial pneumonia, 43.7%.

Conclusion

There is some concordance between chest high resolution computed tomography findings and interstitial lung disease as more than half (64.1%) of patients had all specific patterns of the disease.

Recommendation

More studies need to be conducted with long duration and larger catchment areas in order to establish evidence in our settings.

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ABBREVIATIONS

CLD/CRD	Chronic Lung Disease/ Chronic respiratory diseases
CTD- ILD	Connective Tissue Disease – Interstitial Lung Disease
CVD	Cardio-Vascular Disease
DILD	Drug Induced Lung Disease
DLD/DLPD	Diffuse Lung Disease/ Diffuse Lung Parenchymal Disease
HRCT	High Resolution Computed Tomography
HSP/HP	Hypersensitivity Pneumonitis
IIP	Idiopathic Interstitial Pneumonia
ILD	Interstitial Lung Disease
iNSIP	Idiopathic Non-specific Interstitial Pneumonia
IPF	Idiopathic Pulmonary Fibrosis
IRB	Institutional Review Board
LAM	Lymphangioleiyomatosis
LC	Lymphangitis Carcinomatosis
LCH/PLCH	Langerhans' Cell Histiocytosis/ Pulmonary Langerhans' Cell Histiocytosis
LED	Lung Empysematous Disease
MDCT	Multi-Detector Computed Tomography
MNH	Muhimbili National Hospital
MUHAS	Muhimbili University of Health and Allied Sciences
NSIP	Non-specific Interstitial Pneumonia
OILD	Occupational Induced Lung Disease
RA	Rheumatoid Arthritis
SPSS	Statistical Package for the Social Sciences
UIP	Usual Interstitial Pneumonia

DEFINITION OF TERMS

Age is a period of time someone has been alive. An adult is a person older than 18 years of age unless national law defines a person as being an adult at an earlier age.

Allergy (Asthma, skin atopy, etc) is a chronic condition involving an abnormal reaction to an ordinarily harmless substance called an allergen. Allergens can include aeroallergens such as dust mite, mold, tree weed and grass pollen, as well as food allergens such as milk, egg, soy, wheat, nut or fish proteins.

Chronic Lung Disease/chronic respiratory disease is a disease that persists for a long time; lasting 3 months or more (U.S. National Center for Health Statistics).

Cigarette smoking is inhalation of the smoke of burned tobacco that may occur habitually as a consequence of a physical addiction to some chemicals, primarily nicotine.

Clinical presentation means symptoms and signs especially respiratory at the time of presentation at the Radiology Department for imaging.

Computed Tomography is X-ray technique that uses X-ray sensing unit which rotates around the body along with a computer to create cross sectional images. The images are generated by a computer synthesis of x-ray transmission data obtained from many different directions in a given plane.

Connective tissue disease is a disease (autoimmune or otherwise) that attacks the collagen or other core components of connective tissue.

Drug exposure is usage of drugs (e.g isoniazid) that may cause lung injury.

Gender means characteristics pertaining to and differentiating male and /female.

High resolution computed tomography (HRCT) is a type of Computed Tomography (CT) with specific techniques to enhance image resolution. It is used in the diagnosis of various health problems, though most commonly for lung disease, by assessing the lung parenchyma.

Imaging findings mean lung patterns and non-lung patterns which are seen in the particular image in the lung and in the non-lung areas of the chest respectively.

HRCT patterns mean combination of features seen in the HRCT images

Interstitial lung disease (ILD), or diffuse parenchymal lung disease (DPLD) is a group of lung diseases affecting the interstitium (the tissue and space around the air sacs of the lung). It concerns alveolar epithelium, pulmonary capillary endothelium, basement membrane and peri-vascular and peri-lymphatic tissues.

Industrial/occupational/environmental exposure means a person working in or near the industry or mining areas as well as living near these areas and thus inhaling dust particles found in these areas.

Final ILD diagnosis mean diagnosis attained as a result of correlating clinical features and HRCT patterns.

CHAPTER ONE

1.0 INTRODUCTION AND LITERATURE REVIEW

1.1 Background

Chronic respiratory diseases (CRDs) are diseases of the airways and other structures of the lung. Some of the most common are chronic obstructive pulmonary disease (COPD), asthma, Interstitial lung disease (ILD), or diffuse parenchymal lung disease (DPLD) and pulmonary hypertension. [1] CRDs may have obstructive pattern mainly affecting the airways resulting into incomplete exhalation or restrictive pattern affecting the lung parenchyma, pleura and extra-pulmonary structures resulting into incomplete lung expansion. ILD presents mainly with the restrictive pattern. [2]

Since the past 25 years, high resolution computed tomography (HRCT) has transformed the diagnostic landscape by providing detailed cross-sectional imaging of the lungs, which permit ready identification of a variety of ILD[3] which is the scope of this study. ILD, is a group of lung diseases affecting the interstitium (the tissue and space around the air sacs of the lung). It concerns alveolar epithelium, pulmonary capillary endothelium, basement membrane and peri-vascular and peri-lymphatic tissues. It may occur when an injury to the lungs triggers an abnormal healing response. This makes it more difficult for oxygen to pass into the bloodstream. [4, 5] Studies show ILD is prevalent by 8.8-17.3% with an incidence of 4.63-6.9%; the prevalence is higher in males by 20%. [6, 7]

ILD can either be idiopathic such as idiopathic interstitial pneumonia or caused by identified factors such as inhaled substances in working areas or environment, drugs such as chemo- therapeutic agents, connective tissue and autoimmune diseases such as rheumatoid arthritis, infection such as tuberculosis and lastly malignancy such as lymphangitic carcinomatosis. [8]

In the diagnosis of ILD chest radiography is usually the first modality, although it can be normal up to 10% of patients especially early in the disease process. HRCT of the chest is the he preferred modality, and differs from routine CT of the chest. Conventional (regular) CT chest examines 7–10 mm slices obtained at 10 mm intervals; while HRCT examines 1-1.5 mm slices at 10 mm intervals using a high spatial frequency reconstruction algorithm. The HRCT therefore provides approximately 10 times more

resolution than the conventional CT chest, allowing the HRCT to elicit details that cannot otherwise be visualized. Despite all, the radiologic appearance alone is not adequate and should be interpreted in the clinical context, keeping in mind the temporal profile of the disease process. [9, 10]

A range of diseases encompassed in ILD may be differentiated depending on the radiologic patterns (findings) demonstrated in HRCT images. The radiologic patterns may be broadly classified into findings of increased lung opacity which include nodular abnormalities, linear abnormalities, reticular abnormalities, ground-glass opacity together with consolidation and decreased lung opacity which include bronchiectasis, emphysema, honeycomb lung, mosaic pattern and inhomogeneous lung opacity together with normal inspiratory scans with air trapping on expiratory imaging. [9, 11, 12, 13]

The distribution or predominance of the patterns such as upper lobe, lower lobe, peripheral and central (peri-hilar) predominance as well as the associated findings like pleural effusion or thickening, pneumothorax, dilated oesophagus and lymphadenopathy adds into specifying which ILD is affecting an individual.[9, 11, 12, 13]

The specific ILD whose patterns can lead to a single diagnosis include emphysema, LCH, LAM, usual interstitial pneumonitis, hypersensitivity pneumonitis, lymphangitic carcinomatosis, pneumoconiosis, and sarcoidosis. The diagnosis in these cases may be sufficiently specific from HRCT to obviate tissue confirmation. [14]

1.2 Statement of Problem

Chronic non-communicable diseases (NCD) account for almost 60% of global mortality, and 80% of deaths occur in low- and middle-income countries. The major causes being cardiovascular disease (30%), cancers (13%), chronic respiratory disease (7%) and diabetes (2%). [25] In Tanzania WHO estimated that about 20% of all deaths in Tanzania in 2005(fifteen years back) were attributable to chronic diseases; CVD 9%, cancer 4%, chronic respiratory disease 2%, diabetes 1% and other chronic disease 4%. [26]

The burden of ILD which is one of the CRDs in Tanzania is unknown despite the established evidence of this disease affecting a number of Africans in other parts of the world. [6, 24] Not only that but also Tanzania is experiencing considerable growth in all sectors of the economy driven greatly by the development of industry, trade, transport, agriculture, constructions and mining [28, 29] exposure to dust particles which are causative of ILD is expected. It noted in one report that in Tanzania, there is excessive dust exposure (>90%)without the use of personal protective equipment. Other risk factors like allergy (10.3%, have allergic rhinitis) and smoking (17% in males and 5% in females) [30, 31, 32] both of which are potential causes of ILD are identified in Tanzania.

Despite its recognized role in the diagnosis of ILD in the context of adequate clinical information increasing the correctness of making the diagnosis of ILD to 61% from 36% by chest radiography [27, 33, 34, 35, 36] its use is not documented in Tanzania and thus its importance is not known.

1.3 Rationale

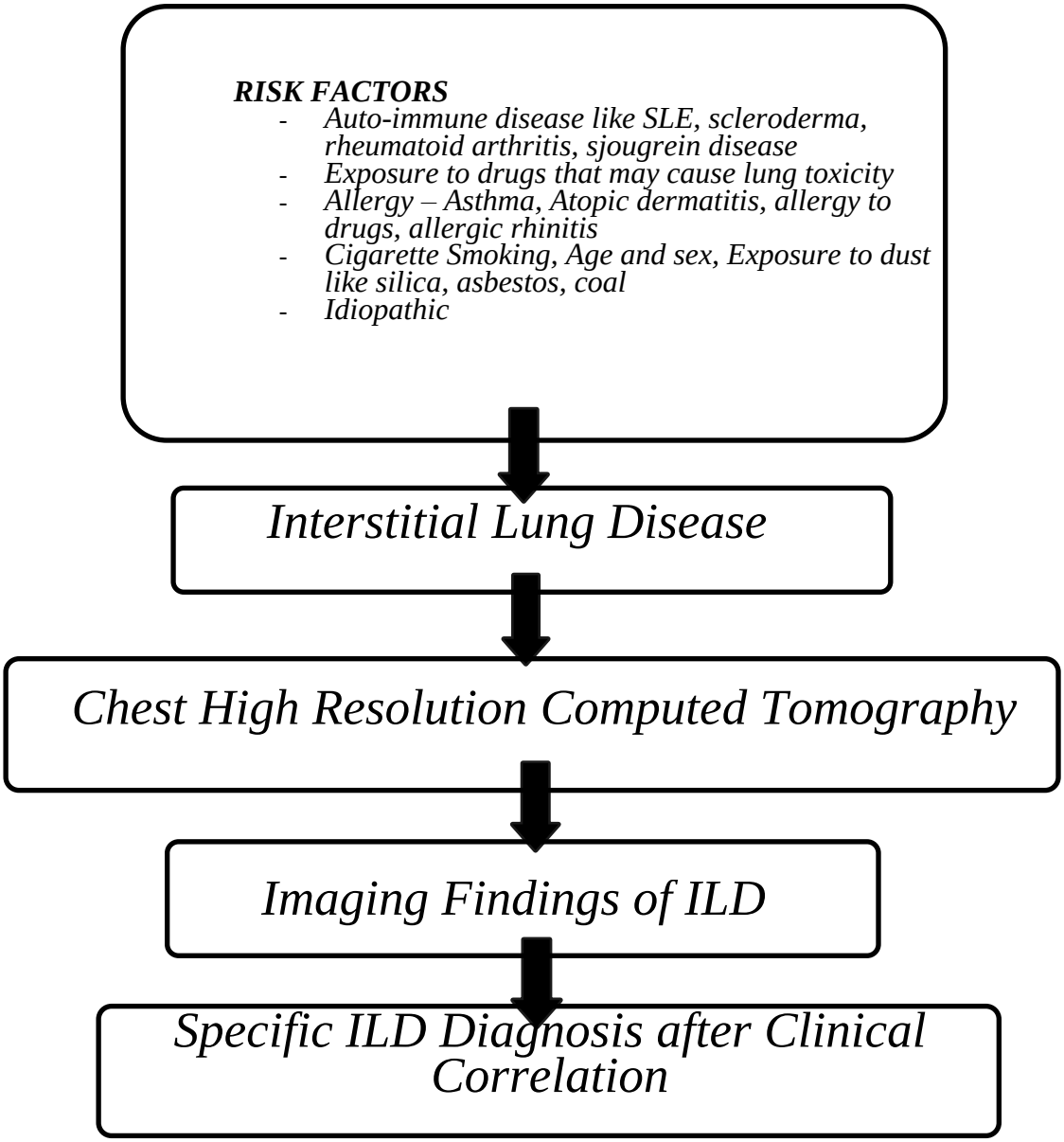
Identification of the burden of ILD among patients with CRD along with its common clinical features, imaging findings and final ILD diagnosis at MNH will provide awareness and thus rightful management and care to the patients. Thus the above information will avoid the potential morbidity and mortality of ILD.

Rightful preventive measures can also be put in place in the setting of identified risk factors which are related to ILD; thus hindering further occurrence of ILD.

1.4 Conceptual Framework

1.4.1 Chest HRCT Findings of Interstitial Lung Disease among Adults with CRD

In the presence of identified risk factors of ILD (which is one of the CRD), the lung will react to these inflicting factors and thus with time develop patterns in the interstitium which progressively become prominent. These patterns are identified early and with great detail by using HRCT. In the presence of adequate clinical information, specific ILD can be identified.



1.5 Research Questions

What is the burden of ILD among adults with CRD who underwent chest HRCT at Muhimbili National Hospital from June, 2016 to June, 2019 after clinical correlation?

1.6 Hypothesis

There is concordance between HRCT patterns and final diagnosis of ILD.

1.7 Objectives

1.7.1 Broad Objective

To determine chest HRCT findings in ILD among adults with CRD at Muhimbili National Hospital from June, 2016 to June, 2019.

1.7.2 Specific Objectives

1. To determine socio-demographics among adults with CRD who underwent chest HRCT at Muhimbili Hospitals from June, 2016 to June, 2019.
2. To determine clinical information of adults with ILD who underwent chest HRCT at Muhimbili National Hospital from June, 2016 to June, 2019.
3. To determine imaging findings among adults with ILD who underwent chest HRCT at Muhimbili Hospitals from June, 2016 to June, 2019.
4. To determine final ILD diagnoses among adults with ILD who underwent chest HRCT at Muhimbili National Hospital from June, 2016 to June, 2019.
5. To determine the association between socio-demographics and ILD burden among adults with CRD who underwent chest HRCT at Muhimbili National Hospital from June, 2016 to June, 2019.

1.8 Literature Review

1.8.1 Socio-demographics & Clinical Information

Existing publications show the average duration of symptoms in ILD to be more than 3 months [15-17] . The most common presenting symptoms being dyspnoea and cough ranging 90-100% and 74-100% of participants, respectively [15, 17-19]; Other symptoms are chest pain (20%) and joint pain related to connective tissue disorders (44%).[18, 19]

Studies show, the risks associated with ILD are smoking, connective tissue disorder, allergy and exposure history to coal dust particles in coal mine, silica, asbestos, cotton dust, metal dust, iron oxide, organic dust, rubber fumes, plastic fumes, acid fumes, oil fumes, chemotherapy and radiotherapy [18, 20] ILD is also influenced by age, gender and ethnicity. [20] In African- Americans, ILD occurs more in younger age (56 Vs 66) and females (75%) who are less likely to smoke with improved survival. [21]

1.8.2 Radiologic Lung Patterns

Studies show, irrespective of the ILD type the most common radiologic lung pattern is increased lung opacity accounting for 47% to 91%, these include nodule, micro-nodule, ground glass opacity (GGO), consolidation. [18, 22] Another commonly found pattern is reticular opacity accounting for maximum of 64% of the cases; these include thickened inter-lobular septa, intra-lobular septal thickening, sub-pleural interstitial thickening and thickened fissures with or without nodularity and peri-bronchial cuffing. [17-19, 22] Other lung pattern includes decreased opacity which reaches up to 58% in some studies; this may include bronchiectasis, emphysema, cavities and air cysts. [18, 19, 22 and 23]

1.8.3 Non Lung Patterns

Apart from lung radiological patterns, there are non lung patterns shown in different studies which are associated with ILD. Pleural lesions are one of them including pleural thickening, pleural effusion and pneumothorax accounting for 20-34.5% of cases. The other one is lymphadenopathy, calcified or not and may be hilar or mediastinal. Lymphadenopathy accounts for up to 44%. [17, 18, 19 and 22]

1.8.4 Specific ILD Diagnosis

Studies on ILD noted that, final ILD diagnoses after clinical correlation to HRCT Chest findings were sarcoidosis (7.8-42%), hypersensitivity pneumonitis (3-47.3%), CTD-ILD (13.9-17%), idiopathic pulmonary fibrosis (11-36%), *iNSIP*(2-14%), occupational ILD; pneumoconiosis (3-5%), drug-induced ILD (3%) and other ILD's (3-5.7%). [15, 18 and 24]

CHAPTER TWO

2.0 METHODOLOGY

2.1 Study Design

The study was a hospital based, descriptive cross sectional study, where medical records and HRCT images of patients undertaken from March, 2018 to December, 2019 were retrospectively reviewed.

2.2 Study Duration

The study was conducted from September, 2019 to April, 2020 (Data collection for 6 months and thereafter analysis and report writing were done).

2.3 Study Area

Muhimbili National Hospital

The study was conducted at Muhimbili National Hospital (MNH) located in Dar es Salaam city, the commercial capital and largest city in Tanzania. There are five municipal councils in the city (Kinondoni in the North, Ilala in the centre, Ubungo, Temeke in the South and Kigamboni in the East).

Muhimbili National Hospital is the largest tertiary and national referral hospital in Tanzania. It is a teaching hospital for Muhimbili University of Health and Allied Sciences (MUHAS). Currently it has two campuses one at Upanga and one at Kibamba 3 km off Dar es Salaam-Morogoro highway. The study was conducted in Radiology and Medical Records Departments in Upanga campus.

The hospital is well equipped with advanced CT scan machine, experienced radiologists and radiology technologists receiving referral patients from all regions in Tanzania.

2.4 Study Population

The study population was patients with CRD who were referred to the radiology department to do chest HRCT due to chronic respiratory symptoms from March, 2018 to December, 2019.

2.5 Inclusion and Exclusion Criteria

2.5.1 Inclusion Criteria

1. All patients with chronic respiratory related clinical presentation referred to do lung HRCT.
2. Patients above 18 years.
3. Patients with negative HIV serostatus

2.5.2 Exclusion Criteria

1. Patients who have undergone lung surgery, comparison of both sides will lack.
2. Patients who have started treatment for the lung related disease (Follow ups) for these will have modified patterns of diseases.

2.6 Variables

2.6.1 Independent Variables

Age, sex, cigarette smoking, industrial/occupational/environmental exposure, drug exposure (e.g isoniazid), allergy (asthma, skin atopy, etc), connective tissue disease, clinical presentation and imaging findings.

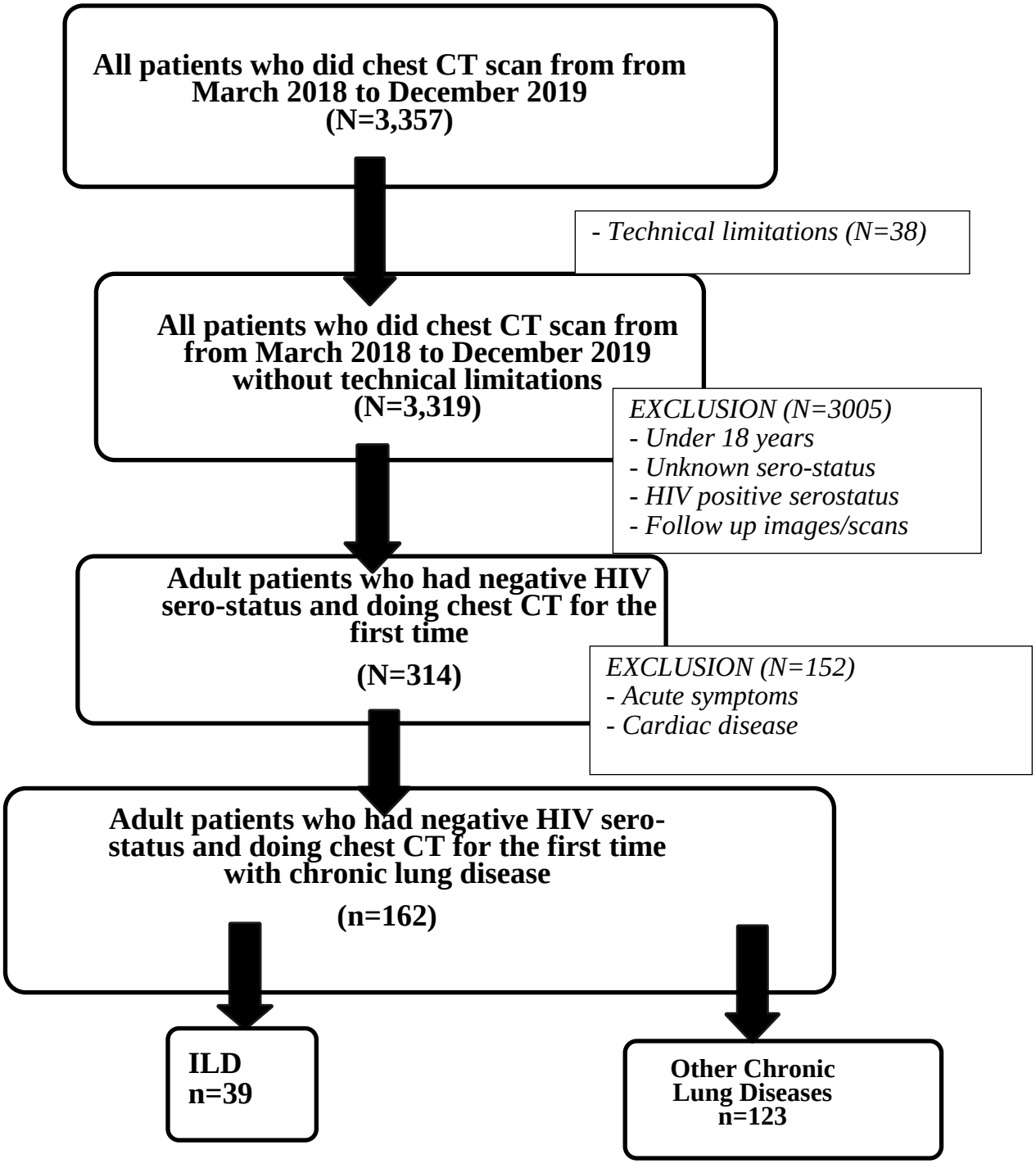
2.6.2 Dependent Variable

Final ILD diagnosis

2.7 Sampling Method

A total of 3,357 chest CT images were obtained in a period of 20 months (from March 2018 to December 2019), as the images obtained in 2016&2017 were not found in the clear canvas following deletion due to the reported system overload. Technical errors were noted in chest CT images of 38(1.13%) patients while 3,005(89.51%) patients had unknown sero-status, positive sero-status, children (under 18 years) and did the imaging for follow up or biopsy; their images were excluded. Thus the remained chest HRCT images of 314 patients were sampled in and then retrospectively reviewed. The chest images and clinical presentation of these patients were reviewed retrospectively and found a total of 152(4.52%) patients had no CRD; either having acute symptoms or cardiac disease, thus they were excluded from the study remaining with 162(4.82%) patients.

2.7.1 Sampling Flow chart



2.8 Sample Size Estimation

All the patients who had the inclusion criteria were sampled in the study.

Thus, a total of 162 adults who were HIV negative with CRD doing HRCT for the first time were included.

2.9 Equipment and Data Collection

2.9.1 Equipment

Equipment which was used for image acquisitions was a multi-slice, multi-detector CT scanners (MDCT). A 128 slices CT scanner (Siemens, Somatom, definitions, Frankfurt, Germany, 2010) was used. The following exposure factors and parameters were used: Kv120, mAs 70, field of view 26cm to 35cm scan mode, with helical image acquisition using slices thickness of 1.5mm and slice spacing of 3mm, 0.6mm (MNH CT) collimations and 410/10 window levels and then reconstruction is done at 0.6265mm slice thickness.

2.9.2 Data Collection Tools, Validity and Reliability Issues

2.9.2.1 Data Collection Tools

The pre structured checklists were used in this study.

2.9.2.2 Validity and Reliability Issues

PI did a pilot study and analyzed the data collected to check the validity and reliability issues of the pre-structured checklists.

The amendments were done accordingly,
thereafter.

2.9.3 Data Collection

Data was then collected through a pre-structured checklist by the PI from the images and medical records from the available databases.

The files of the patients were reviewed to identify socio-demographics and clinical presentation.

The HRCT images were then retrieved from clear canvas; displayed and reviewed on the workstation. The PI did the HRCT images evaluation and then the imaging findings with clinical correlation and then final ILD diagnosis; all of this was then confirmed by Specialist Radiologists. The data obtained from HRCT images was recorded only when

the two reach consensus on the findings. There was no image in which consensus was not reached; but if it could have happen other specialists were to be consulted.

2.10 Data Analysis

Collected data was checked for completeness and accuracy by the PI. Data entry and analysis were done using the Statistical Package for Social Sciences (SPSS) version 20. Frequency distribution, two by two tables and figures were used to summarize data. Quantitative variables were measured using mean and median. Categorical variables were assessed using a $\chi 2$ (Chi square) test. P value of <0.05 was considered statistically significant.

Socio-demographic characteristics: Age was analyzed using mean and median. Gender and other risk factors including industrial/occupational/environmental (dust) exposure, cigarette smoking, drug exposure {e.g isoniazid}, connective tissue disease, allergy {Asthma, skin atopy, etc} were analyzed using proportion and chi-square test.

Respiratory clinical presentation and imaging findings were analyzed by using proportion.

Dependent variable (Final ILD diagnosis) was analysed by using proportion and Chi square test. Association of dependent to independent variable (socio-demographics) was done using proportion and chi-square; where a P value of <0.05 was taken as a cut off point for statistical significance.

2.11 Ethical considerations and clearance

A formal ethical approval was obtained from the Muhimbili University of Health and Allied Sciences Senate Research and Publications Committee. All ethical issues were adhered to as per Senate Research and Publications Committee criterion. Permission to conduct the study at MNH Radiology and Medical Records departments was obtained from necessary authorities. Patients' confidentiality was observed; research identification numbers were used for all participants in the data collection tools instead of any identifiable information.

CHAPTER THREE

3.0 RESULTS

During the study period chest images and medical records of a total of 162 patients with CRD were retrospectively reviewed.

3.1.1 Socio-demographics among Adults with CRD who Underwent Chest HRCT at Muhimbili National Hospital.

Among the patients studied, majority were males 111(68.5%) and aged 60 years and less 103(63.6%) with a male and female medians of 60 and 50 years respectively. The smoking behaviour, exposure to dust and usage of drugs which can potentially cause ILD being found in 22 (18.3%), 22 (18.3%) and 19(15.8%) respectively (Table 1). Others features included history of allergy 9(7.5%), use of wood fire smoke 5(4.2%), chemotherapy exposure 3(2.5%) and connective tissue disease 2 (1.7%).

Table 1: Socio-demographics among adults with chronic CRD at MNH.

Age groups (years)	***Chronic Respiratory Disease*** **TOTAL n, (%) n=162, (100)**
60 and less	103(63.6)
Above 60	59(36.4)
Sex	**n=162, (100)**
Male	111(68.5)
Female	50(31.5)
Smoking behaviour	**n=120, (100)**
Yes	22(18.3)
No	98(81.7)
Exposure to dust	**n=120, (100)**
Yes	22(18.3)
No	98(81.7)
Usage of drugs	**n=120, (100)**
Yes	19(15.8)
No	101(84.2)

ILD constituted 39(24.1 %) of adults with CRD. ILD burden noted (table 2) to vary by sex and age; where ILD was predominant in those aged above 60 and males. The variation was not significant though.

Table 2: Distribution of ILD burden by age and sex among adults at Muhimbili National Hospital.

Age groups (in years)	***SEX***		***Total*** *(No. of patients)* *n (%)*	*P-value 0.58*
	Male n (%)	Female n (%)		
18 to 40	3 (37.5)	5 (62.5)	8 (20.5)	
41 to 60	8 (57.1)	6 (42.9)	14(35.9)	
61 and above	10(58.8)	7 (41.2)	**17(43.6)**	
Total	**21(53.8)**	18(46.2)	39(100)	

3.1.2: Clinical presentations of adults with ILD who underwent chest HRCT at Muhimbili National Hospital.

Among patients with ILD, the most common presenting symptoms were progressive shortness of breath, 53.8% followed by dry cough, 51.3% (Figure 1). The worst presentation noted in one is respiratory failure.

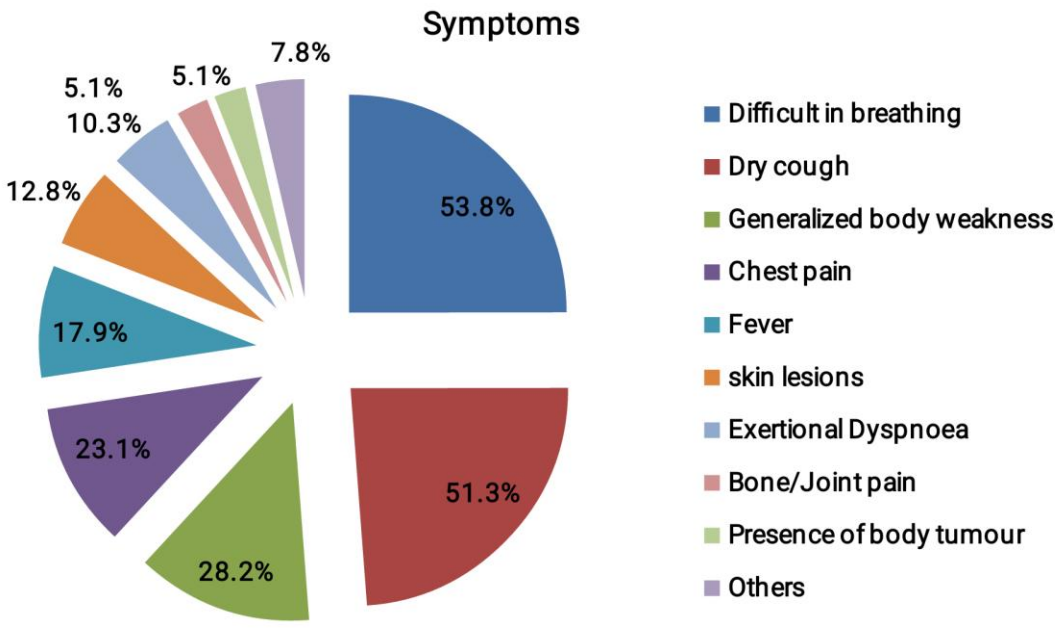


Figure 1: Distribution of Various Presenting Symptoms among Adults with ILD at MNH

3.1.3: Imaging findings among adults with ILD who underwent chest HRCT at Muhimbili Hospital

3.1.3.1: Imaging Findings in the Lungs

The lung imaging findings (Figure 2) of ILD identified in this study after reviewing HRCT images (Sample shown in Figure 3 and 4) were reticular opacity (97.4%), increased opacity 94.9% (ground grass opacity), and decreased opacity 64.1% (bronchiectasis, honey combing {entirely found in UIP} and emphysema). Patients who were found to have all the specific HRCT finding for ILD (GGO, reticular opacity and bronchiectasis) were 64.1%. Other findings were right upper lobe calcified mass (2.6%), right middle lobe collapse (2.6%) and bronchial wall thickening (5.1%) .

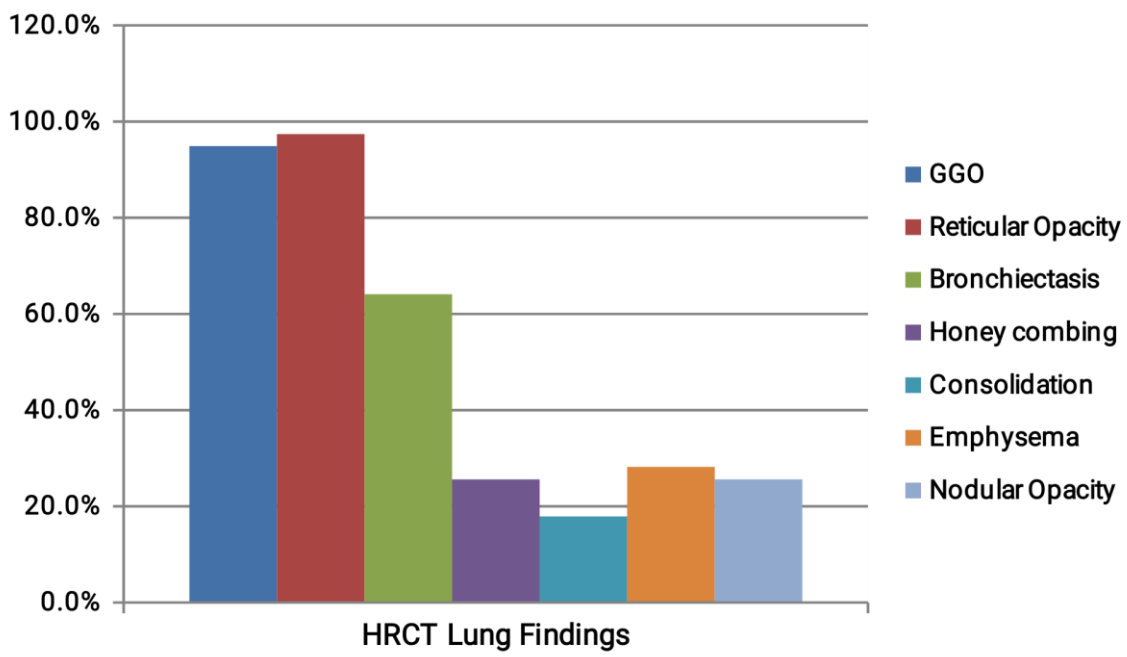


Figure 2: Distribution of HRCT Lung Imaging Findings among Adults with ILD at Muhimbili National Hospital.

These lung findings were bilateral in all patients and predominantly in the lower lobes in majority (76.9%), while they were diffuse in (20.5%) patients and one centrally dominating.

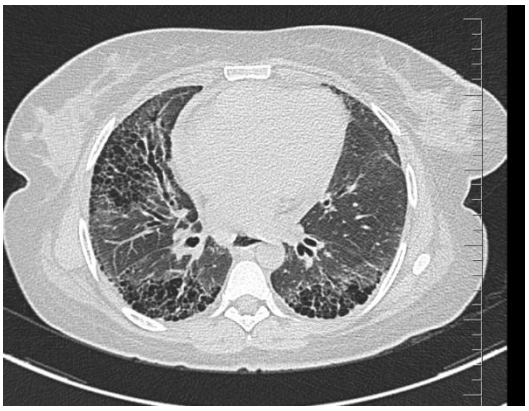


Figure 3

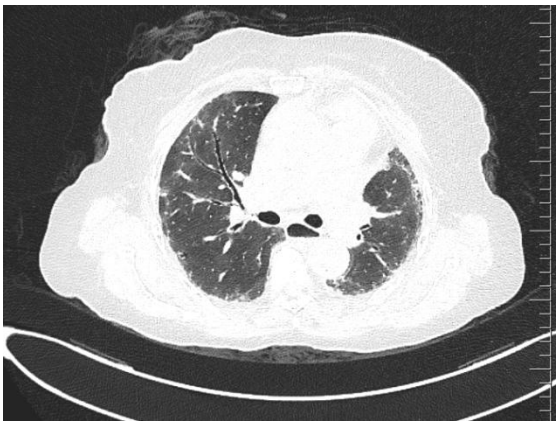


Figure 4

Figure 3:CT scan axial plane shows bilateral ground glass opacities, inter-lobular and sub pleural septal thickening with a predominant peripheral and basal distribution.

Traction Bronchiectasis with layers of honeycombing cysts and pleural thickening are present, more in the right. Overall lung volume is reduced. Features are consistent with UIP.

Figure 4: CT scan axial plane shows bilateral ground glass opacities, reticulation, traction Bronchiectasis and pleural thickening predominant peripheral and basal distribution. Overall lung volume is reduced. Features are consistent with NSIP.

3.1.3.1: Non-Lung Imaging Findings

The most common non-lung findings noted in this study (Figure 5) were pleural thickening (59.0%) and mediastinal lymphadenopathy (56.4%). Others were dilated main pulmonary trunk, pleural effusion, hilar lymphadenopathy and pericardial effusion; 41%, 23.1%, 17.9% and 5.1% respectively.

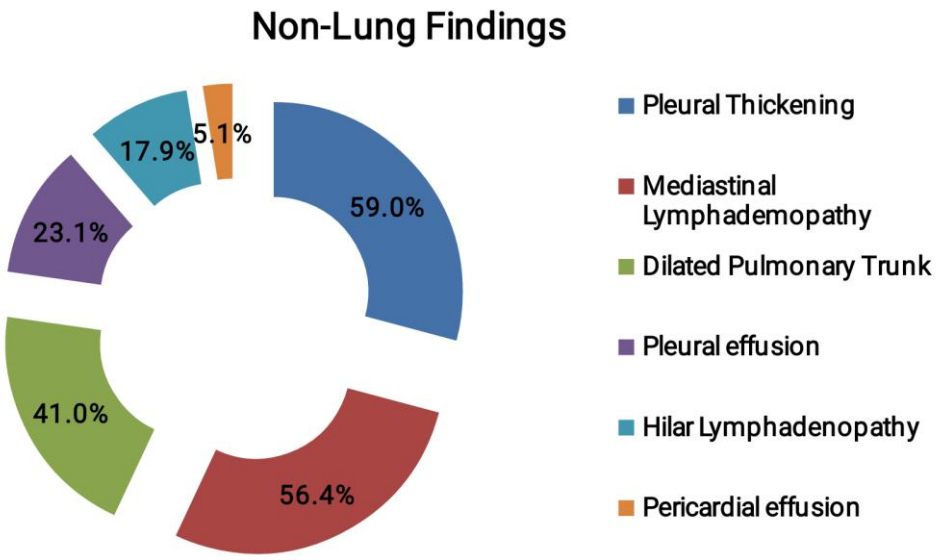


Figure 5: Distribution of HRCT Non-lung Imaging Findings among Adults with ILD at Muhimbili National Hospital.

3.1.4: Final ILD diagnoses among adults with ILD who underwent chest HRCT at Muhimbili Hospital

The most common interstitial lung diseases final/specific diagnosis found in this study (Figure 6) was non-specific lung disease (43.6%).

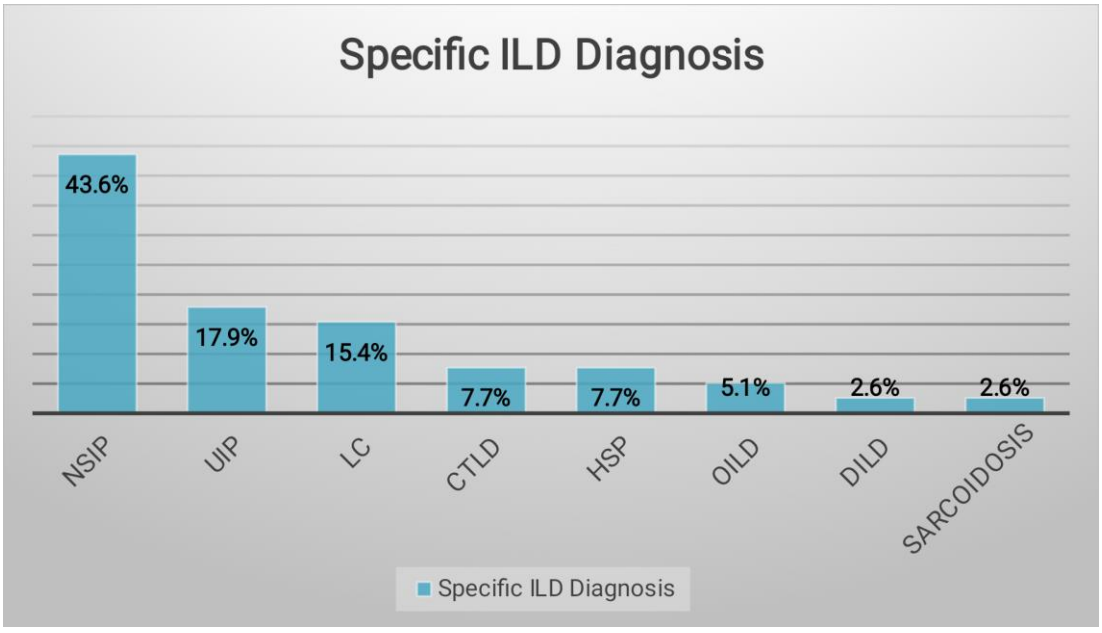


Figure 6: Distribution of specific interstitial lung disease diagnoses among Adults with ILD at Muhimbili National Hospital.

3.1.5: Association between socio-demographics and ILD burden among adults with CRD who underwent chest HRCT at Muhimbili National Hospital

In table 3, the ILD burden is shown to be significantly higher among females with a p value of 0.024. Others factors did not show association.

Table 3: Association between socio-demographics and ILD burden among adults with CRD who underwent chest HRCT at Muhimbili National Hospitall.

	ILD			
Age Groups (Years)	**Yes n=39, 24.1%**	**No n=123, 75.9%**	**Total (%) n=162, 100%**	P value 0.531
60 and Less (%)	22(21.4)	81(78.6)	103(100)	
Above 60 (%)	17(28.8)	42(71.2)	59(100)	
Sex	**n=39, 24.1%**	**n=123, 75.9%**	**n=162, 100%**	**P value 0.024**
Male (%)	21(18.9)	90(81.1)	111(100)	
Female (%)	**18(35.5)**	32(64.7)	50(100)	
Smoking Behaviour	**n=38, 31.7%**	**n=82, 68.3%**	**n=120, 100%**	P value 0.987
Yes (%)	7(31.8)	15(68.2)	22(100)	
No (%)	31(31.6)	67(68.4)	98(100)	
Exposure to Dust	**n=38, 31.7%**	**n=82, 68.3%**	**n=120, 100%**	P value 0.624
Yes (%)	6(27.3)	16(72.7)	22(100)	
No (%)	32(32.7)	66(67.3)	98(100)	
Usage of Drugs	**n=38, 31.7%**	**n=82, 68.3%**	**n=120, 100%**	P value 0.421
Yes (%)	4(21.1)	15(78.9)	19(100)	
No (%)	34(33.7)	67(66.3)	101(100)	
Allergy	**n=38, 31.7%**	**n=82, 68.3%**	**n=120, 100%**	P value 0.106
Yes (%)	5(55.6)	4(44.4)	9(100)	
No (%)	33(29.7)	78(70.3)	111(100)	

CHAPTER FOUR

4.0 DISCUSSION

This study aimed at determining the burden of ILD among adults with CRD by correlating the HRCT findings and clinical information.

4.1.1 ILD among adults with CRD

The study found approximately quarter of the adults with CRD at MNH have ILD. More disease burden is identified than in other studies done in other parts of the world [6, 7]. This could be explained by the over-estimation in the current study as it was done among patients with CRD in the hospital settings while some were done using registries and others in the public. Similar to other studies the disease burden is statistically significant higher among females[21] but insignificantly high in those aged above 60 years [23]. Thus exposure and causative agents probably occurred earlier in life resulting in ongoing insult to the lung with diagnosis at older age; calling for more studies identifying associated factors and exposures in order to cut the disease process before its manifestations. More females are affected probably due to the increment of bread earning activities in females and thus exposure which when identified they can be concurred. Other risk factor like exposure to smoke due to cooking using wood which is identified in this study is usually more in women; may add into this disease burden.

4.1.2 Clinical Presentations among patients with ILD

In agreement with previous studies, this study found the commonest main complaints to be progressive shortness of breath (53.8%), followed by dry cough (51.3%). Others being joint pain, skin rashes, chest pain, productive cough and fever[15, 17-19]. These similarities bring on the awareness that in the setting of CRD and the patient is presenting with the progressive shortness of breath and dry cough; one has to suspect ILD's and consider HRCT as an investigation of choice where available. Joint pain and skin rashes suggested connective tissue disorder while chest pain, productive cough and fever indicated the probability of secondary infection.

Among the identified possible exposures in this study; the commonest were usage of drugs potentially to cause ILD (15.8%), smoking (18.3%) and exposure to dust particles (18.3%). Others are allergy (7.5%), fire wood smoke(4.2%) and chemotherapy exposure

(1.7%). Same to other studies most of the factors with potential effect in the lung interstitium and likely to cause ILD identified in this study have not shown significant association [18, 20 and 23]. The presence of multiple risk factors in one patient poses a challenge, more studies need to be conducted in order to establish the causative relationship.

4.1.3 Imaging findings of ILD

In similarity to other studies; the chest HRCT images reviewed in this study revealed that reticular opacities, increased lung opacities (GGO, consolidation and nodular opacities), and decreased opacities (bronchiectasis, emphysema and honey combing) were 97.4%, 94.9% and 64.1% respectively which were bilateral in more than two-thirds; Majority, 64.1% had all specific HRCT patterns for ILD (reticular opacity, ground glass opacity and bronchiectasis) [18, 23]. This explains the importance of looking for the specific patterns; this will help in easy detection of ILD.

In accordance with other studies non lung findings were also noted in this study which includes pleural lesions in terms of pleural thickening (59%) and pleural effusion (23.1%) as well as lymphadenopathy (calcified or not), mediastinal (56.4%) or hilar (17.9%), either calcified or not [17, 20, 19 and 25]. Thus non lung findings in the presence of specific features for ILD may be suggesting on the presence of ILD in the lung parenchyma. Another identified feature was dilated main pulmonary trunk (41%) [18]. This suggests increased pulmonary pressure as a result of lung fibrosis caused by the ongoing process of the ILD.

4.1.4 Specific ILD diagnoses among adults with ILD

Specific ILD in this study included non-specific lung disease (43.6%), usual interstitial pneumonia (17.9%), lymphangitis carcinomatosis (15.4%), hypersensitivity pneumonitis (7.7%), connective related lung disease (7.7%), occupational lung disease (5.1%), drug induced lung disease (2.6%), and sarcoidosis (2.6%). Other studies reports the same picture of ILD [15, 18 and 27] .The variation in the prevalence of specific ILD diagnoses could be due to limited sample size, study settings or the difference in ethnicity and thus exposure.

4.1.5 Study limitations and mitigation

However this study had some limitations. These included a recall bias and limited sample size. This was a retrospective study; some of the information is incomplete and data obtained may not be representative of general population. And due to the said deletion of images due to system overload, the chest images reviewed were limited. These limitations were mitigated by using all the information provided in the consultation and reporting facets as well as taking all the patients who met the inclusion criteria after extending the study duration for six months.

CHAPTER FIVE

5.0 CONCLUSION, RECOMMENDATION AND DISSEMINATION PLAN

5.1 CONCLUSION

There is some concordance between chest high resolution computed tomography findings and interstitial lung disease as more than half (64.1%) of patients had all specific patterns of the disease.

Along with that:

- ✓ Approximately a quarter of the adults with CRD at MNH have ILD, the disease is significantly predominant in females despite of being few in this study.
- ✓ In the setting of progressive difficult in breathing and dry cough; ILD should be sought.
- ✓ The most common specific ILD diagnosis was NSIP.

5.2 RECOMMENDATIONS

- ✧ More studies need to be conducted with long duration and larger catchment areas in order to establish evidence in our settings.
- ✧ Despite the above fact, HRCT should be used as a investigation of choice in patients with CRD to diagnose ILD wherever CT scan facilities are available. In the setting of adequate clinical context specific ILD can be identified.

5.3 DISSEMINATION PLAN

The final report is submitted to the Muhimbili University of Health and Allied Sciences as part of fulfillment for the Award of the Master of Medicine Degree in Radiology and Imaging. Later on, presentations to the local & international conferences and formal university research meetings at MUHAS will be done as well as publication in scientific and peer reviewed journals with the assistance by the supervisors.

CHAPTER SIX

6.0 REFERENCES AND APPENDICES

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6.2 APPENDICES

6.2.1 Diagnostic tool of ILD

(Adopted from a number of literatures since one guideline with all ILD could not be found to the best of my knowledge; included are the information from Fleischner society guideline (2018)[37], radiographics[3] and radiology assistant[])

SNo.	RISK FACTORS	HISTORY	PATTERNS	DIAGNOSIS
1	Age between 40 to 50 Males Cigarette smoking	Respond well to steroids Good prognosis	Ground glass opacity Traction bronchiectasis Reticular opacities Basilar and peripheral distribution with sparing of immediately sub-pleural area. Slight architectural distortion	NSIP
2	Age, above 60 Female Cigarette smoking	Do not respond well to steroids Poor prognosis	Ground glass opacity Traction bronchiectasis Reticular opacities Honey combing Basilar and peripheral distribution . Extensive architectural distortion	UIP
3		History of primary tumour or metastasis elsewhere Progressive shortness of breathing Dry cough	Typically lower lung asymmetry distribution Beaded or irregular interstitial thickening Associated with: ✓ Lymphadenopathy ✓ Pleural disease ✓ Absence of architectural distortion and extensive fibrosis	Lymphangitic Carcinomatosis
4	Allergic diseases like asthma, atopic dermatitis, allergy to drugs (sulphur	Progressive shortness of breathing	Relative sparing of the extreme lung apices and bases. Bilateral GGO in the middle	Hypersensitivity pneumonitis

	containing)	Dry cough	and basal lung zones Traction bronchiectasis Reticular opacities Inter-lobular septa thickening Centri-lobular nodules usually less than 5mm in diameter Mosaic attenuation pattern Hypodense regions indicative of air-trapping. Other features include: ✓ Small mediastinal lymphadenopathy ✓ Pulmonary arterial hypertension ✓ Centri-lobular emphysema	
5	Usage of drugs that may cause lung injury presenting with ILD	Progressive shortness of breathing Dry cough	Reticular opacities which may be fine or course Honey combing Traction bronchiectasis	Drug Related ILD
6	Exposure to dusts that may cause lung injury presenting with ILD e.g asbestos, silica, coal	Progressive shortness of breathing Dry cough	Reticular opacities which may be fine or course Honey combing Traction bronchiectasis	Occupational Or Environmental Related ILD
7	Women of reproductive age	Progressive shortness of breathing Dry cough Joint pain	Ground glass opacities (GGO) Traction bronchiectasis Reticular opacities Basilar and peripheral distribution Aspiration from disturbed oesophagus Oesophageal dilatation Pleural disease (Rare)	CTL-ILD Sclerodema RA
8		Progressive shortness of breathing Dry cough	Ground glass opacities (GGO) Traction bronchiectasis Honey combing	Sarcoidosis

			Reticular opacities Air-trapping (emphysematous changes) Other findings ✓ Pleural disease ✓ Lymphadenopathy	
9	Women of reproductive age, mainly 20 to 40.	Progressive shortness of breathing Haemoptysis	Generalized symmetrical reticular or reticular-nodular opacities Normal or increased lung volumes Randomly distributed and numerous large regularly shaped thin-walled cysts with no zonal predilection (these eventually replace the entire lung) Occasional inter-lobular septal thickening (pleura-pulmonary lymphatic obstruction) Patchy ground-glass attenuation (pulmonary haemorrhage) Pneumothorax Pleural effusions (chylous)	LAM
10	Cigarette smoking F:M ratio is 4:1	Progressive shortness of breathing Dry cough	Nodules (a few mm to 2cm) that are surrounded by normal lung which can cavitate to form thin walled irregular cysts They typically spare the extreme lung bases and anterior tips of the middle and lingular lobes (this is preserved even in end-stage disease)	PLCH

6.2.2 Data Collection Checklist

TITLE: ***Chest High Resolution Computed Tomography Findings Of Interstitial Lung Disease Among Adults With Chronic Respiratory Disease At Muhimbili National Hospital***

(Put a mark in the chosen option)

1. SNo. ……..
2. Age (Years) ……..
3. Age groups
    a. 18 to 40 years ……..
    b. 41 to 60 years ……..
    c. 61 years and above ……
4. Duration of symptom ……
5. Sex
    a. Male ……
    b. Female …….
6. Clinical presentation

a.	Dry cough	Yes….. No……
b.	DIB	Yes….. No……
c.	Productive cough	Yes….. No……
d.	Chest pain	Yes….. No……
e.	Wheeze	Yes….. No……
f.	Bone pain/Joint	Yes….. No……
g.	Haemoptysis	Yes….. No……
h.	Weight loss	Yes….. No……
i.	Generalized Body Malaise	Yes….. No……
j.	Extertional dyspnoea	Yes….. No……
k.	Fever	Yes….. No……
l.	Night sweats	Yes….. No……
m.	Skin lesions	Yes….. No……

n. Body tumour Yes….. No……

7. Risk factors

a. Cigarette smoking Yes….. No……
b. Dust Yes….. No……
c. Connective tissue disorder Yes….. No……
d. Radiation Yes….. No……
e. Chemotherapy Yes….. No……
f. Smoke Yes….. No……
g. Drug Yes….. No……

8. Lung disease type

a. ILD Yes….. No……
b. PTB and sequelae Yes….. No……
c. Lung tumour Yes….. No……
d. Cardiac Yes….. No……
e. Normal Yes….. No……
f. Post chronic infection Yes….. No……
g. LED Yes….. No……
h. Air way disease Yes….. No……
i. Pleural disease Yes….. No……
j. Lung Metastasis Yes….. No……
k. Alveolar disease Yes….. No……

9. Lung HRCT patterns

a. GGO Yes….. No……
b. Reticular Yes….. No……
c. Bronchiectasis Yes….. No……
d. Specific patterns for ILD (GGO, reticular and bronchiectasis) Yes….. No……
e. Honey combing Yes….. No……
f. Alveolar Yes….. No……
g. Emphysema Yes….. No……
h. Nodular Yes….. No……
i. Decreased attenuation (bronchiectasis, honey combing and emphysema) Yes….. No……

10. Laterality

a.	Unilateral	Yes….. No……
b.	Bilateral	Yes….. No……

11. Predominant distribution of the patterns

a.	Diffuse	Yes….. No……
b.	Lower lobes	Yes….. No……
c.	Upper lobes	Yes….. No……
d.	Central (Hilar)	Yes….. No……
e.	Peripheral	Yes….. No……

12. Non lung chest findings

a.	Pleural thickening	Yes….. No……
b.	Pleural effusion	Yes….. No……
c.	Mediastinal lymphadenopathy	Yes….. No……
d.	Hilar lymphadenopathy	Yes….. No……
e.	Dilated main pulmonary trunk	Yes….. No……
f.	Pericardial effusion	Yes….. No……
g.	Others	Yes….. No……
	Explain ……	

13. Final ILD diagnoses

a.	UIP	Yes….. No……
b.	NSIP	Yes….. No……
c.	OILD	Yes….. No……
d.	CILD	Yes….. No……
e.	DILD	Yes….. No……
f.	HSP	Yes….. No……
g.	LC	Yes….. No……
h.	Sarcoidosis	Yes….. No……