MICROALBUMINURIA IN PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASES ATTENDING PULMONOLOGY CLINIC AT MUHIMBILI NATIONAL HOSPITAL, DAR ES SALAAM, TANZANIA

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Department of Internal Medicine

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By

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A Dissertation Submitted in (partial) Fulfilment of the Requirement for the Degree of Masters of Medicine in Internal Medicine

Muhimbili University of Health and Allied Sciences
October, 2017

CERTIFICATION

The undersigned certifies that she has read and hereby recommended for acceptance by Muhimbili University of Health and Allied Sciences a dissertation entitled ***Microalbuminuria in patients with Chronic Obstructive Pulmonary Diseases attending Pulmonology Clinic at the Muhimbili National Hospital, Dar Es Salaam, Tanzania"*** in (partial) fulfilment of the requirements for the degree of Master of Medicine (Internal Medicine) of Muhimbili University of Health and Allied Sciences.

_____

Prof. Janet Lutale

Supervisor

_____

Date

DECLARATION AND COPYRIGHT

I, **Festo Kasmir Shayo,** declare that this **dissertation** is my own original work and has not been presented and will not be presented to any other university for similar or any other degree award.

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

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Thanks to all my patients who participated in this study.

Lastly, I am sincerely grateful to my wife Sophia Amsi, my children Noreen and Norbert for making harmonized studying environment at home.

DEDICATION

This dissertation is dedicated to my beloved parents; Casmir A. Shayo (father) and Yovitha F. Maucky (mother) for their endless love and motivation throught my academic life history and making me who I am today.

To my wife Sophia Amsi, my children Noreen and Norbert for their unconditional love and support during my studies.

ABSTRACT

Background:

Extra pulmonary co morbidities particularly cardiovascular diseases (CVD) are common and significant in chronic obstructive pulmonary disease (COPD). Extra pulmonary involvement often contributes to exacerbations, frequent hospital admissions and high mortality. COPD patients do die more due to extra-pulmonary than COPD itself. Microalbuminuria gives an important evidence of endothelial dysfunction in COPD patients. Using microalbuminuria, early detection and therefore appropriate management of the subclinical extra pulmonary involvement in COPD patients will help in reducing morbidity and mortality.

Objective:

To determine the prevalence of microalbuminuria and severity correlates in COPD patients attending the MNH pulmonology clinic, Dar es Salaam Tanzania

Methodology:

A cross-sectional descriptive study was conducted from July 2016 to December 2016. Study participants were consecutively recruited from the MNH Pulmonology Clinic. A structured questionnaire was used to collect social demographic factors and clinical parameters from the study participants. Lung functions were assessed by means of the Easy One™ spirometer. Post bronchodilator spirometry value of FEV1/FVC<70% confirmed COPD diagnosis. COPD severity was classified according to the Global initiative for Obstructive Lung Disease (GOLD) guidelines 2015. Microalbuminuria was tested on early morning spot urine using CYBOW 12MAC microalbumin strips. UAlb was defined by Urine albumin to Creatinine ratio (ACR). Statistical Package for Social Sciences (SPSS) version 20 was used for data analysis.

Results:

Of the 104 enrolled COPD patients, 58 were known COPD and 46 were newly diagnosed COPD patients. The 46 newly diagnosed COPD patients underwent post bronchodilator COPD severity classification. Out of 104 participants, 16(15.4%) had co-morbid CVD, twenty-five (24.0%) had microalbuminuria and 26(29.8%) macroalbuminuria. The proportion of macroalbuminuria was significantly higher in COPD patients with history of

co morbid CVD than those without; (81.2% vs. 20.5%, p < 0.001). On the other hand microalbuminuria was significantly lower in those with CVD than those without CVD; (25.0% vs. 18.8%, p<0.001). The new 46 COPD patients underwent post bronchodilator COPD severity classification of whom, 60.9% (95%CIs 46.1–73.9) had moderate COPD and 30.4% (95%CIs, 17.9-49.0) severe COPD. Microalbuminuria increased significantly with COPD severity (p=0.049).

Conclusion:

Microalbuminuria was prevalent in patients regardless of coexistence of co morbid CVD. Microalbuminuria risk increased significant with COPD severity or with the decreased level of FEV1% predicted. Exclusion of other conditions that could give microalbuminuria was limited to history rather than laboratory markers. Therefore the degree of microalbuminuria may be overestimated. A few study participants had co morbid CVD based on medical history. Microalbuminuria seemed to be an important biomarker for the prediction of cardiovascular diseases in COPD patients.

Detection of microalbuminuria will help to provide early treatment of these extra-pulmonary co-morbidities like CVD and consolidating the COPD management and therefore delaying progression of the disease and death. This is an important study in our country - Tanzaniaespecially in this era of rapid emerging non communicable diseases on very limited health facilities.

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LIST OF ABBREVIATIONS

ACR	Albumin Creatinine ratio
ATS	American Thoracic Society
BMI	Body Mass Index
BP	Blood Pressure
COPD	Chronic Obstructive Pulmonary Disease
CVD	Cardiovascular Disease
ERS	European Respiratory Society
FEV1	Forced Expiratory Volume in one second
FVC	Forced Vital Capacity
GOLD	Global Initiative for Chronic Obstructive Lung Disease
MAB	Microalbuminuria
MNH	Muhimbili National Hospital
MI	Myocardial Infarction
UAlb	Urinary Albumin
UTI	Urinary Tract Infections

INTRODUCTION

Chronic Obstructive Pulmonary Diseases (COPD)

Chronic Obstructive Pulmonary Diseases is an umbrella term used to describe progressive lung diseases which include: emphysema, chronic bronchitis, refractory (irreversible) asthma and severe bronchiectasis (1–3).

COPD is to a large extent a preventable and treatable disease with some significant extra-pulmonary effects that may contribute to the severity in individual patients. The airflow limitation is usually progressive and associated with abnormal inflammatory response of lung to noxious particles or gases (1).

The formal diagnosis and assessment of airway obstruction in COPD is by spirometry which is a gold standard as it is the most reproducible, standardized, and an objective way of measuring airflow limitation. Airflow obstruction is defined as FEV1 < 80% predicted and FEV1/FVC < 0.7. Airflow obstruction in COPD after spirometry is defined by the ratio of forced expiratory volume to forced vital capacity (FEV1/FVC<70%) and confirmed by a post-bronchodilator FEV1< 80% predicted(1,2,4).

Chronic hypoxia in COPD patients causes both systemic and pulmonary arteries to constrict and therefore induces endothelial cells to release vasoactive agents like endothelin-1, platelet derived growth factor, nitric oxide which are responsible for endovascular dysfunction(5). Recent studies have shown association between lower FEV1 values and endothelial dysfunction.

Extra pulmonary co morbidities in COPD

Extra pulmonary co morbidities are common and significant in COPD, often contributing to symptoms, exacerbations, frequent hospital admissions and high mortality(6,7). Different studies have shown that extra pulmonary co morbidities are common in COPD and likely add to the complexity and cost of care(8,9).

For instance; in the USA, the prevalence of CVD in COPD patients was reported to be 22% versus 9% in non COPD patients. Angina prevalence was 22% and 19% for a previous MI in COPD patients. In UK, the relative risks of angina and MI were 1.67 and 1.75, respectively, versus subjects without COPD (6).

In a large longitudinal Canadian health database study, COPD patients were found to have higher risk ratios for angina (2.02) and myocardial infarction (1.99) compared with matched controls following adjustment for known cardiovascular risk factors. Mortality due to cardiovascular disease in COPD patients was also approximately doubled compared with controls in this study (6).

A CONSISTE study in Spain, studiedCOPD as a cardiovascular risk factor, whereby, a total of 1200 COPD patients and 300 control subjects were recruited for this multicenter, cross-sectional, case–control study. From this study, the COPD group showed a significantly higher prevalence of ischemic heart disease (12.5% versus 4.7%; $P<0.0001$), cerebrovascular disease (10% versus 2%; $P<0.0001$), and peripheral vascular disease (16.4% versus 4.1%; $P<0.001$). In a univariate risk analysis, COPD, hypertension, diabetes, obesity, and dyslipidemia were risk factors for ischemic heart disease. In the multivariate analysis adjusted for the remaining factors, COPD was still an independent risk factor (odds ratio: 2.23; 95% confidence interval: 1.18–4.24; $P = 0.014$).

The study concluded that**,** COPD patients show a high prevalence of cardiovascular disease, higher than expected given their age and the coexistence of classic cardiovascular risk factors(10).

Extra pulmonary co morbidities in general have a significant impact on health status, healthcare utilization, all-cause hospital admissions and mortality in COPD patients. Judicious recognition, assessment and appropriate management of important co morbidities may have large mortality benefits(11).The discovery of novels biomarkers to help identify the endothelial dysfunctions that occurs with most of the extra pulmonary cardiovascular risk in patients with COPD could help individualize therapy for COPD patients. Microalbuminuria has been shown to be a sensitive biomarker for prediction of cardiovascular risk as results of endovascular dysfunction.

Microalbuminuria

Microalbuminuria is a marker of endovascular dysfunction and an important predictor of cardiovascular events and all-cause mortality in the general population. It is a sensitive marker of cardiovascular risk. There is evidence of vascular dysfunction in patients with chronic obstructive pulmonary disease (COPD) (12). Microalbuminuria reflects a state of

generalized endothelial dysfunction; hence it is an emerging therapeutic target for primary prevention strategies (13).

Microalbuminuria is frequent in patients with COPD and is associated with hypoxemia independent of other cardiovascular risk factors (12–14). In patients with COPD a chronic hypoxia causes systemic and pulmonary arteries constriction which induces endothelial dysfunction through release of various vasoactive substances. Hypoxia also appears to contribute to the development of endothelial dysfunction, characterized by loss of the physiological balance between vasodilation and vasoconstriction. Also hypoxia induces endothelial dysfunction by up regulating the production of vasoconstrictive mediators, such as endothelin-1, thus leading to increased vascular tone(15,16). Peinado et al. demonstrated that endothelial dysfunction is present in COPD patients at the very early start of the disease process. Endothelial dysfunction is associated with severity of COPD assessed by post-bronchodilator FEV1. It is postulated that increased endothelial dysfunction may induce the development of systemic atherosclerosis and therefore the increased cardiac events seen in these patients(17)

Microalbuminuria is defined as urinary excretion of albumin that is persistently increased above normal although below the sensitivity of conventional semi quantitative test strips. Microalbuminuria can be diagnosed from elevated concentrations in a spot sample (20 to <200 mg/L). Microalbuminuria measured by the albumin creatine ratio (ACR) of >30mg/mmol by a conventional semi-quantitative strips defines the upper limit (13,18).

LITERATURE REVIEW

There are very few published studies worldwide on microalbuminuria and COPD. The available studieshave shown a significant association between COPD and microalbuminuria. All these studies have been done in Caucasian and Orientals population of European and Indian subcontinent respectively.

In India for instance, a 2 years prospective cohort study on urinary albumin (UAlb) and hypoxemia in COPD patients, showed a high prevalence of UAlb in 97 COPD smokers versus 94 non COPD smokers as a controls, (20.6% vs. 7.4%); p=0.007). The confounding co morbidities like renal diseases, diabetes, cardiovascular diseases and dyslipidemia were excluded using laboratory biomarkers and relevant history. In this study COPD was classified according to GOLD criteria and majority of study population were in stage III (severe) and above; 55.7%. Also COPD patients with microalbuminuria had significantly lower levels of FEV1. Out of 20 COPD patients with microalbuminuria17 (85%) had FEV1 below 50 and 3 (15%) had FEV1 above 50 which was statistically significant; p=0.003. All the study participants were heavy smokers; who smoked >10pack year(13).

Another study in Spain by Casanova et al. studied UAlb and hypoxemia in COPD patients. There was a higher UAlb excretion in COPD than in control smokers without obstruction (24% vs. 6%; p=0.005).This difference between groups persisted after the analysis was stratified using accepted pathological thresholds (12).

A cross sectional study done in Turkey by Bulcun E. et al. on prevalence and relationship of microalbuminuria with clinical and physiological parameters in patients with COPD included 66 consecutive patients with COPD and 40 control cases smokers with normal spirometry. Results from this study showed that; the rate of presence of microalbuminuria was statistically significant higher in patients with COPD than smokers with normal spirometry. A Pearson correlation analysis showed a significant inverse relationship between ACR and FEV_1% (19).

A 12-year follow-up study of 3129 COPD participants was done in Norway by SolfridRomundstad et al. onCOPD and microalbuminuria. Of the study participants, 136 had microalbuminuria. The main outcome measures were hazard ratio of all-cause mortality according to severity of microalbuminuria. The adjusted hazard ratio for all-cause mortality in those with COPD and microalbuminuria was 1.54, 95%CIs (1.16–2.04). By using the GOLD COPD severity classification, there was a positive association trend of

microalbuminuria with increasing severity stages. Microalbuminuria was associated with all-cause mortality in individuals with COPD and was arelevant tool in identification of patients with poor prognosis(20).

There other studies that have investigated the presence of microalbuminuria in patients with COPD have reported a high prevalence in patients during acute exacerbations and, importantly, also in stable state. Several authors have shown that after adjusting for smoking and independent of the presence of diabetes and hypertension, the prevalence is 25% of patients with stable COPD (21).

In a very recent study done in India,*Rakesh Kumar et al.* aimed at finding the prevalence and relationship of MAB with clinical and physiological parameters in stable COPD patients. The clinical diagnosis was considered if any of chronic cough, chronic sputum production, breathlessness like symptoms were present along with a history of exposure to risk factors like tobacco smoke, occupational dust and chemical and biomass fuel. Clinically stable COPD patients were included in the present study and patients with history of renal disease or presence of macroalbuminuria [urinary albumin to creatinine ratio (UACR) ≥ 300 m/g], unstable COPD patients with acute exacerbation, severe congestive heart failure, other respiratory diseases such as asthma, interstitial lung diseases, obstructive sleep apnea, acute infections and severe hepatic failure and uncontrolled co morbidities such as malignancy and patients with systemic hypertension and diabetes mellitus were excluded from the present study. The predominant symptom of COPD patients was cough (100%) and breathlessness (100%) followed by chest pain in 44 (86.27%) patients and in control group, 2 (5%) patients had cough and 2 (5%) had breathlessness. Severity of obstruction according to forced expiratory volume in one second (FEV1) values showed that most of the cases had [37 (72.54%)] FEV1 in the range of 50-80%, whereas only 2 (3.9%) cases had an FEV1 <30% and 38 (95%) of controls had FEV1>80%; 2 (5%) had FEV1 in the range of 50-80%. Amongst cases all patients had MAB whereas amongst controls only 4 (10%) had MAB ($p<0.0001$) (14).

Kömürcüoğlu A. et al. did a study on Microalbuminuria in chronic obstructive pulmonary disease. The study included 25 cases with COPD who had been hospitalized due to an acute exacerbation and 25 healthy controls. Microalbuminuria measurement, arterial blood gas analysis, and forced expiratory volume in one second (FEV1), forced vital capacity (FVC) measurements were performed in the COPD group on admission and after treatment

for an average period of 14±6 days at discharge when they were stable. Urinary albumin/creatinine ratio of ≥2.5 mg/mmol was accepted as microalbuminuria. Microalbuminuria was present in 14 (56%) subjects at admission and in 7 (28%) subjects at discharge in the COPD group and in 1 (4%) subject in the control group. There were statistically significant differences among these groups (admission-control $p < 0.001$, discharge-control $p = 0.023$, admission-discharge $p = 0.016$ (22).

Other studies have also shown association between hypoxia and microalbuminuria. For instance studies at high altitude reported that systemic hypoxia causes increased urinary albumin excretion with increasing of renal capillary permeability. In other condition manifesting with hypoxia, example in patients with sleep apnoea syndrome, tissue hypoxia has been shown to have temporary proteinuria(22–24).

COPD severity is based on GOLD classification following a post-bronchodilator FEV_1. In patients with $FEV_1/FVC< 0.70$ may fall in the following categories: - GOLD 1: Mild; FEV1≥80% predicted, GOLD 2: Moderate; 50%≤ FEV_1<80% predicted, GOLD 3: Severe; 30%≤ FEV_1<50% predicted and GOLD 4: Very Severe; FEV1< 30% predicted (31).Spirometry has high accuracy in diagnosing COPD in suspected patients. The sensitivity and specificity of diagnosing COPD is 92% (95%CI 80-97) and 84% (95%CI 77-89) respectively (32).

In Africa and Tanzania in particular the magnitude of COPD and microalbuminuria is not yet known; no published data available. Therefore it is not known whether the same could be seen in black population and reflects the similar pattern as in Caucasians and Orientals population.

STATEMENT OF THE PROBLEM

COPD is currently the 4thcause of death worldwide; projected the 3rd by 2020. About 6 million died worldwide in 2012 which makes 6% of all death globally. COPD is a frequent disorder and it is difficult to estimate because of disparities of methods used and geographical location.

The co existence of CVD in COPD has been reported in numbers of studies in high income countries. For example; in the USA, the prevalence of CVD in COPD patients was 22% versus 9% in non COPD patients and Angina prevalence was 22% and 19% for a previous MI in COPD patients. In United Kingdom, the relative risks of angina and MI were 1.67 and 1.75, respectively, versus subjects without COPD (6). In Tanzania the burden of COPD and its correlates with CVD has not been explained yet.

Management of patients with COPD has been concentrated much on their primary pulmonary pathology without looking for the extra pulmonary co morbidities. CVD are the major cause of mortality in COPD, particularly in patients with mild to moderate severity COPD (19,23,24). The identification of extra pulmonary subclinical co morbidities in patients with COPD during daily clinical practice is of importance in holistic management of COPD patients.

Microalbuminuria gives an important evidence of endothelial dysfunction in COPD patients therefore giving an opportunity for preventive strategies to be instituted to this group of patients. Screening and treatment for subclinical extra pulmonary co morbidities in COPD patients in Tanzania is of paramount importance especially in a setting of overburdened health care expenditure and limited health facilities.

RATIONALE OF THE STUDY

Microalbuminuria gives an important evidence of endothelial dysfunction in COPD patients. Determination of microalbuminuria is simple, inexpensive, non-invasive and less time consuming. Early detection of subclinical extra pulmonary co morbidities in COPD patients will help in reducing mortality and morbidity by providing early treatment of CVD.The results from this study will give an insight on the prevalence of microalbuminuria in black population of Tanzania with COPD. Hence, it will alert the clinicians to become more proactive in screening and treating extra-pulmonary co-morbidities in COPD patients.

HYPOTHESIS

Microalbuminuria may be prevalent in patients with Chronic Obstructive Pulmonary Disease.

OBJECTIVES

Broad Objective

To determine the prevalence of microalbuminuria and severity correlates in COPD patients attending the MNH pulmonology clinic Dar es Salaam Tanzania

Specific Objectives

1. To describe COPD severity by GOLD classification in COPD patients attending the MNH pulmonology clinic
2. To determine the prevalence of microalbuminuria in COPD patients attending the MNH pulmonology clinic
3. To determine the association between COPD severity and microalbuminuria in COPD patients attending the MNH pulmonology clinic

METHODOLOGY

Study design:

A cross-sectional hospital based study for 6 months (July 2016 to December 2016)

Study site:

The study site was at Muhimbili National Hospital Pulmonology Clinic in Dar es Salaam Tanzania. MNH is a tertiary hospital with specialised and super specialized services in Tanzania. It receives most of the referral cases from other tertiary hospitals across the country.

The pulmonology clinic is conducted every week on Tuesdays, Thursdays and Fridays from morning to afternoon. The clinic has a special unit (pulmonary function test laboratory) for Lung function test. This is operated by pulmonologists and a nurse trained to operate the spirometry machine. The pulmonary function laboratory is operating from Monday to Friday. Patients with clinical diagnosis of COPD based on history and physical examination are usually referred to Pulmonary Function Laboratory. The following are the main clinical features for the clinician to have suspicion of COPD;

- Chronic cough, productive or dry which may be daily or intermittent
- Exertion dyspnea which initially is intermittent and then becomes persistent
- Sputum production of any pattern
- Exposure to risk factors; cigarette/tobacco smoke, biomass fuels and dusts pollution

Study population:

Study participants were recruited from the MNH Pulmonology Clinic . All patients confirmed to have COPD by spirometry constituted a study population.

Inclusion criteria

1. Patients with COPD defined by FEV1/FVC<70%
2. Age 18 years and above

Exclusion criteria

1. Patients with Urinary Tract Infection (UTI)

Sampling method:

A consecutive sampling technique was used for recruitment of the study population. During each clinic visit, every patient with clinical diagnosis of COPD was enrolled for spirometry.

Study duration:

July 2016 to December 2016

Sample size:

Due to rarity of the COPD cases at clinic, a consecutive sampling was used whereby every patient with confirmed COPD diagnosis was included in the study

Sample size was estimated based on the formula $N=Z^2p\ (100-p)/d^2$

Whereby;

N = estimated sample size

Z = Standard deviation of 1.96 at 95%

P = prevalence of microalbuminuria in India at Sher-e-kashmir institute of medical sciences, Srinagar (India), the prevalence was found to be 20.6%

d = marginal of error on p, 0.07

$N = 1.96\times1.96\times20.6\times79.4/7^2$

Therefore estimated minimum sample size was 128

Study procedures

Study participants were recruited from the MNH Pulmonology Clinic. Patients with clinical diagnosis of COPD as done by the attending physician were enrolled in the study. Clinically COPD suspected patients underwent the pre bronchodilator spirometry and those who were confirmed to have COPD were enrolled in the study. Known COPD patients were also enrolled and those not seen at the clinic were contacted through their mobile phones and invited to participate. Known COPD patients had spirometry done without bronchodilator to confirm the earlier COPD diagnosis. In all patients, spirometry value of FEV1/FVC<70%confirmed COPD diagnosis.

A structured questionnaire was used to collect all important information from the study participants. These included history of symptoms suggestive of COPD; progressive dyspnea, chronic cough and chronic sputum production and history of cigarette smoking,

biomass fuel exposure (cooking using firewood, charcoal or kerosene) were taken. Also history of any associated co morbidities like known renal, cardiovascular diseases; hypertension and malignancy condition were obtained. Baseline physical features (blood pressure, respiratory rate, oxygen saturation, body weight, height and BMI) were measured.

Assessment of microalbuminuria

Patients with confirmed COPD diagnosis were then instructed and requested to collect clean voided urine into a clean and dry standard urine collector before leaving the pulmonology clinic. All urine samples were tested immediately after collection. The test was only done once for each urine sample and therefore could have posed a possibility of false positive results. The urine testing was done using CYBOW 12MACwhich was currently available in local market, manufactured by DFI CO., Ltd 542-1 Daman Ri, Jinrye-Myun Gimhae-City Gyung-Nam Korea. The reagent strip is a multistrip for rapid determination of 12 components including protein, microalbumin, creatinine, nitrite and leucocytes. CYBOW 12MACreagent strips are both qualitative and semi-quantitative dip strips. The CYBOW 12MAC test strip permits an immediate and reliable semi quantitative determination of low albumin concentrations in urine samples with an almost user-independent color interpretation.

Patient's urine was initially screened for urinary tract infection (UTI), and samples with features of UTI (positive for nitrites & leukocytes) were discarded and patients treated accordingly then re-invited after cure to bring another urine sample for testing. Samples with no features of UTI were further assessed for the presence of proteinuria (>300mg/L) and if positive, were recorded as positive for proteinuria or macroalbuminuria. Urine samples which were negative for proteinuria were further assessed for microalbuminuria using the same strip and the semi-quantitative value recorded which ranged from 10mg/L to150mg/L. Urine creatinine was also read using the same strip, which records values ranging from 0.9 to 26.5mmol/L. Albumin creatinine ratio (ACR) was then calculated to determine the level of albuminuria and expressed as mg/mmol. ACR <2mg/mmol for male and <2.8mg/mmol for female was defined as normoalbuminuria, ACR≥2.5-29.9mg/mmol for male and≥3.5-29.9mg/mmol for female were defined as microalbuminuria and ACR≥30mg/mmol for both male and female were defined as macroalbuminuria.

The quality assurance was observed during use of CYBOW 12MAC for microalbuminuria test by following all precaution stipulated on the user leaflet manual. These included, collecting urine sample in a clean container, read time should not exceed 60 seconds, urine to be kept under room temperature and the test strips bottle to be kept between 2-30C and away from sunlight. This was to ensure sustainable sensitivity and specificity of the test and test results reliability.

Assessment of Lung Functions

Lung functions were assessed by means of the Easy One™ spirometer available at the clinic. The Easy One™ spirometer (manufactured by nddMedizintechnik-Switzerland) complies with the 2005 ATS/ERS spirometry standards, which does not need daily calibration (25–28). The Easy One™ spirometer has been used before in several studies both locally and internationally (17,29,30). Thus pre testing of the tool was not required. The device is portable and not affected by environmental conditions.

The forced expiratory maneuvers, the within and between maneuver evaluation for acceptability as well as test result selection were done in accordance with the ATS/ERS guidelines (19). Spirometry was performed in the standing and sitting positions depending on patient's conformability. The forced expiratory maneuvers were explained and demonstrated to the participants before they underwent spirometry in order to ensure maximal effort from the participant when fully expired. The patientwas asked to demonstrate without the device, and when correctly demonstrated, then was allowed to perform on the spirometer. A maximum of 7 maneuvers were allowed per patient and the highest FEV1 and FVC from 3 acceptable maneuvers were used for comparison and analysis. This means that 3 acceptable maneuvers out of 7 were automatically recorded and analyzed in FEV1/FVC by spirometer. Spirometry was performed without a nose clip. Disposable mouthpieces (spirettes) were used and discarded after individual use. Parameters that were measured included FEV1 and FVC, andthen the ratio of FEV1: FVC% calculated.

COPD severity classification

COPD severity was done after pre-bronchodilator spirometry assessment on the same visit. Patients were given inhaled salbutamol of 400ug and then waited for 15-20minutes before

the repeat of spirometry (post-bronchodilator spirometry).COPD severity was classified according to the Global initiative for Obstructive Lung Disease (GOLD) guidelines 2015.Which have four severity categories:-

- *Stage I: mild COPD*: Characterized by mild airflow limitation ($FEV_1/FVC < 0.70$, $FEV_1 \geqslant 80\%$ predicted). Symptoms of chronic cough and sputum production may be present, but not always. At this stage, the individual is usually unaware that his or her lung function is abnormal.
- *Stage II: moderate COPD*: Characterized by worsening airflow limitation ($FEV_1/FVC < 0.70$, $50\% \leqslant FEV_1 < 80\%$ predicted), with shortness of breath typically developing on exertion and cough and sputum production sometimes also present. This is the stage at which patients typically seek medical attention because of chronic respiratory symptoms or an exacerbation of their disease.
- *Stage III: severe COPD*: Characterized by further worsening of airflow limitation ($FEV_1/FVC < 0.70$, $30\% \leqslant FEV_1 < 50\%$ predicted), greater shortness of breath, reduced exercise capacity, fatigue, and repeated exacerbations that almost always have an impact on patients' quality of life.
- *Stage IV: very severe COPD*: Characterized by severe airflow limitation ($FEV_1/FVC < 0.70$, $FEV_1 < 30\%$ predicted *or* $FEV_1 < 50\%$ predicted plus the presence of chronic respiratory failure or clinical signs of right heart failure (corpulmonale). Chronic respiratory failure is characterized by chronic hypoxia presenting as polycythemia or corpulmonale. Clinical signs of corpulmonale include elevation of the $jugula_r$ venous pressure and pitting ankle edema. Patients may have stage IV COPD even if their FEV_1 is greater than 30% predicted whenever these complications are present. At this stage, quality of life is very appreciably impaired and exacerbations may be life threatening(31).

Post bronchodilator spirometry was used to classify COPD severity. Only the 46 new COPD patients underwent this severity classification. The other previous COPD patients did not undergo COPD classification.

Bronchodilator reversibility testing is best done as a planned procedure, as it is time consuming. For new patients on no therapy, post-bronchodilator spirometry can be done on

the first visit. For previous COPD patients, short-acting bronchodilators needed to be withheld for at least 4 hours prior to testing, and long-actingbronchodilators for at least 12 hours. This process require two visits or well planned arrangement example; which medication should be stopped, when, and for how long before the procedure. In case of inhaled glucocorticosteroids use could reduce the test because the pre-bronchodilator FEV1may improve significantly withinhaled glucocorticosteroids(3I).

Data Analysis

The collected data were entered in Epi Data 3.1 sheet and cleaned. Statistical Package for Social Sciences (SPSS) version 20was used for data analysis. The results were expressed as percentages or mean plus or minus standard deviation (SD).A p-value of <0.05 was taken as a statistical significant.

Ethical Clearance

Ethical clearance for the study was obtained from MUHAS Senate Research and Publication Committee and permission to conduct the study was obtained from MNH. Informed consent was obtained for all participants in the study. Confidentiality was observed in all study participants. Patients identified with risk of extra pulmonary co morbidity were referred to an appropriate discipline for further management.

RESULTS

A total of 104 participants aged 18 years and above out of 117 assessed met the inclusion criteria and were enrolled for the study. Of these, 58 were known COPD on follow up clinic and 59 were new clinically diagnosed COPD cases. All previously diagnosed COPD patients underwent repeated spirometry without bronchodilator to re-confirm COPD diagnosis. The new clinically diagnosed COPD patients did a pre and post bronchodilator to confirm COPD diagnosis of which 13 patients did not meet the criteria for COPD diagnosis and were excluded. Therefore 46 new cases were confirmed to have COPD. In these 46 new cases, their COPD severity was done according to the GOLD criteria. Hence at the end, a total of 104 confirmed COPD cases were enrolled for the study and analyzed, (Figure 1).

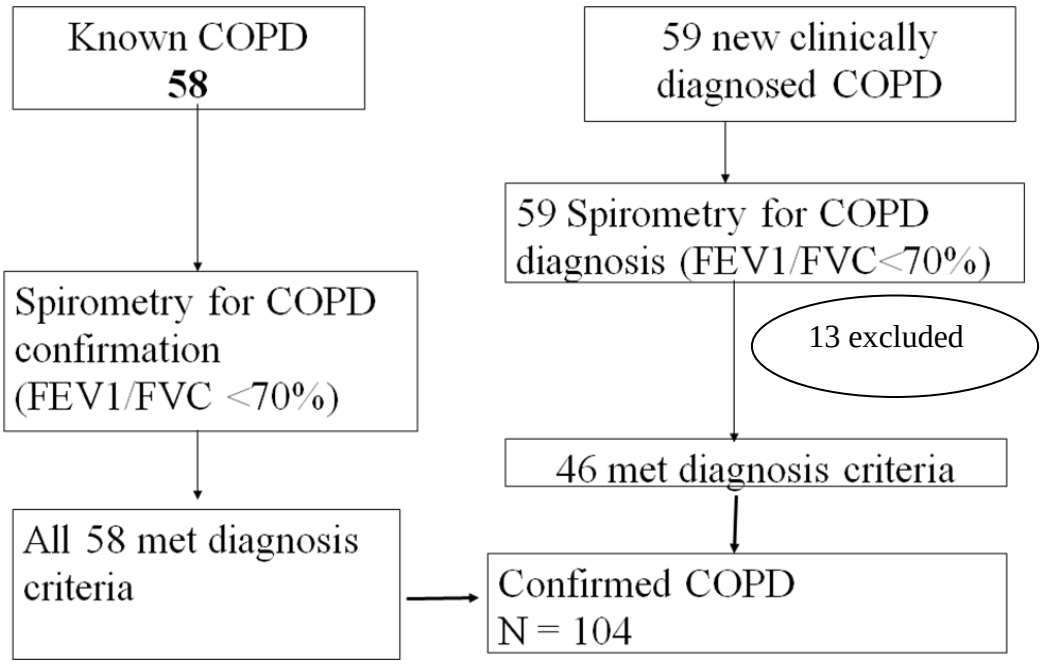

Figure 1: Flow Chart showing participants enrolment during the study

The age group (43- 83 yrs.) comprised more than two third (87%) of the study population. The mean (SD) age was 58.6±14.2 years and male constituted 56.7% of the study population. Majority of study participants were married (79%) and 97% had formal education. Peasants constituted 41.3% while domestic or office workers were 38.5% while industrial workers were 19.2% of the study population. More than half 56(53.8%) of study

population were smokers. Among smokers a large proportion 60.7 % had smoked for >10 pack year. Significant number of participants were exposed to firewood and kerosene as biomass fuel used for cooking; 40(38.5%) and 63 (60.6%) respectively, (Table 1).

Table 1: Social demographic features of COPD patients at the MNH pulmonology clinic, June 2016 to January 2017 (N = 104)

VARIABLES	**n (%)**
Age groups (yrs.)	
28 – 41	11 (10)
42 – 55	33 (32)
56 – 69	35 (34)
70 – 83	22 (21)
>84	3 (3)
Mean Age (SD)	58.63±14.192
Sex	
Females	45 (43.3)
Males	59 (56.7)
Marital Status	
Single	10 (10)
Married	82 (79)
Divorced	1 (1)
Widow/Widower	11 (10)
Education	
Informal	3 (3)
Formal	101 (97)
Occupation	
Domestic/office work	40 (38.5)
Farmers/peasants	43 (41.3)
Industry	20 (19.2)
Others	1 (1.0)
Cigarette smoking Yes	56 (53.8)
Pack year ≤ 10 pack year	22 (39.3)
> 10 pack year	34(60.7)
Biomass fuel exposure; Fire wood	40 (38.5)
Charcoal	34 (32.7)
Kerosene	63 (60.6)

Chronic cough and progressive dyspnea were the most mentioned COPD related symptoms; 102(98.1%) and 46(44.2%) respectively. Chronic sputum production was the least mentioned symptom 13(0.13%). A small proportional of study population had co morbid cardiovascular diseases 16(15.4%).

A large proportion of study participants had normal weight50 (48.1%), overweight32(30.8%) and 12(11.5%) were obese. The proportion of study participants with elevated systolic and diastolic blood pressure was 21 (20.18 (17.3) respectively. Majority of study participants had normal systolic and diastolic blood pressure All study participants had normal oxygen saturation >92%, (table 2).

Table 2: Clinical characteristics of COPD patients at the MNH pulmonology clinic Dar es Salaam Tanzania. (N = 104)

VARIABLES	Categories	n (%)
History of suggestive of COPD	Progressive dyspnea	46 (44.2)
	Chronic cough	102 (98.1)
	Chronic sputum production	13 (0.13)
History of Co-morbid CVDs	Hypertension	1 (0.96)
	Cardiovascular diseases	16 (15.4)
Body Mass Index (BMI)	Underweight (<18.8)	10 (9.6)
	Normal weight (18.5-24.9)	50 (48.1)
	Overweight (25-29.9)	32 (30.8)
	Obesity (>30)	12 (11.5)
Blood pressure: Systolic BP	Elevated (>140)	21 (20.2)
Diastolic BP	Elevated (>90)	18 (17.3)
Oxygen saturation %	Normal (92-100)	104 (100)

COPD SEVERITY

A total of 46 new COPD patients were classified according to GOLD criteria for COPD severity. A large proportional of study participants had moderate COPD 60.9% (95%CIs 46.1–73.9) and severe COPD 30.4% (95%CIs, 17.9-49.0). (Table 3)

Table 3: Post bronchodilator Spirometry assessing COPD severity of the 46 newly diagnosed COPD

VARIABLES (FEV1)	n (%)	95%CI
Mild (FEV1 ≥80%)	2 (4.3)	0-10.4
Moderate (50≤ FEV1 <80%)	**28 (60.9)**	46.1-73.9
Severe (30≤ FEV1 <50%)	**14 (30.4)**	17.9-49.0
Very severe (FEV1 <30%)	2 (4.3)	0-14 7

Logistic regression analysis of the clinical characteristics

In logistic regression analysis, participants with smoking history had 11.5 times greater odds of having severe and very severe COPD than participants without smoking history. The association was statistically significant between smoking history and COPD severity (p = 0.026).Study participants with <10 pack year smoking had 0.5 times lesser odds of having severe and very severe COPD than participants with heavy smoking; > 10 pack year. The association was not statistically significant. Participants with CVD had 2.2 times greater odds of having severe and very severe COPD than participants without CVD. However, there was no statically significant association between CVD and COPD severity (table 4)

Table 4: Logistic regression showing the prediction of clinical characteristics to COPD severity (severe and very severe COPD categories)

VARIABLES	COPD Severity (%)	OR (95%CI)
Smoking history		
Yes	15(46.9)	11.5 (1.337 – 98.394)
No	1(7.1)	1
Heavy smoker		
Yes	13(50)	0.5 (0.078 - 3.223)
No	2(33.3)	1
CVD		
Yes	4(50)	2.2(0.462 - 10.162)
No	12(31.6)	1

ALBUMINURIA

All 104 study participants underwent dipstick urinalysis test using CYBOW 12MAC strips. Out of 104 participants, 5 (4.8%) tested positive forproteinuria and they were considered to have macroalbuminuria. The99 participants, who tested negative for proteinuria, were further tested for microalbumin and urine creatinine, and then ACR was calculated and categorized. Twenty five of them (24.0%) had microalbuminuria, (ACR>3.5<30mg/mmol), 26 (29.8%) macroalbuminuria (ACR >30mg/mmol) and 48(46.2%) had normoalbuminuria, (ACR ≤3.5mg/mmol). No urine sample had urinary tract infections, (Figure 2).

Therefore the prevalence of microalbuminuria was 24%and that of macroalbuminuria was 29.8%, (Table 4).The proportion of macroalbuminuria was significantly higher in COPD patients with history of co morbid cardiovascular diseases than those without history of co morbid CVD; (13/16(81.2%) versus18/88(20.5%) $p < 0.001$). On the other hand microalbuminuria was significantly lower in those with CVD than those without CVD; 22/88(25.0%) versus3/16(18.8%) $p< 0.001$, (Table 5).

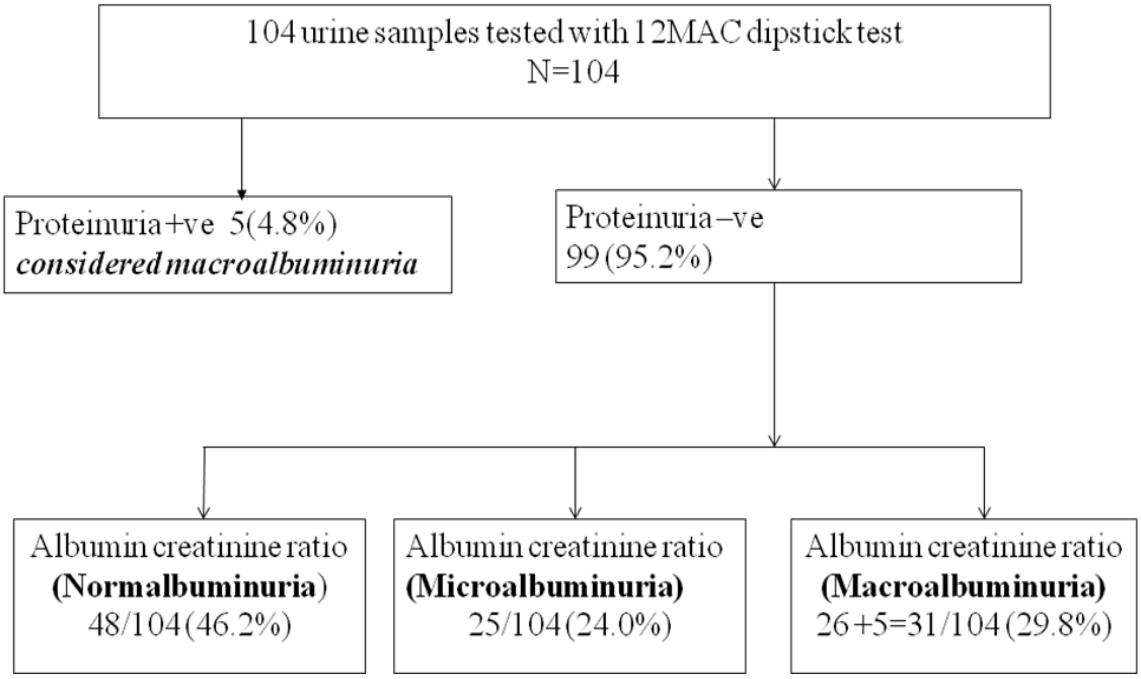

Figure 2: Flow chart showing study participants who underwent urinary albumin test

Table 5: Prevalence of albuminuria (ACR) andco morbid CVDof COPD patients at the MNH pulmonology clinic.(N = 104)

Variable		**Albuminuria (ACR)**			
	Total n (%**)**	**Normalbuminuria**	**Microalbuminuria**	**Macroalbuminuria**	
		48(46.2)	25(24)	31(29.8)	
		CI (36.2-55.5)	CI (17-33)	CI(21.5-37.5)	
Co morbid	Yes 16(100)	0(0.0)	3(18.8)	13(81.2)	p<0.001
CVD	No 88(100)	48(54.5)	22(25.0)	18(20.5)	

COPD SEVERITY AND MICROALBUMINURIA

Microalbuminuria increased significantly with COPD severity or with the lower level of FEV1% predicted, (p=0.049). A large proportion of patients with microalbuminuria and macroalbuminuria were significant in moderate to very severe COPD categories while normoalbuminuria occurred only in those with mild to moderate COPD categories. (Table 6)

Table 6: Association between microalbuminuria and COPD severity of the newly diagnosed COPD patients (N = 46)

VARIABLES	Total n (%)	Albuminuria **Normal n(%)**	**Micro n(%)**	**Macro n(%)**	**P-value**
MildFEV1≥80%)	2(4.3)	1(50.0)	0(0.0)	1(50.0)	
Moderate 50 ≤FEV1<80%)	28(60.9)	12(42.9)	12(42.9)	4(14.3)	**0.049**
Severe(30 ≤FEV1<50%)	14(30.4)	0(0.0)	10(71.4)	4(28.6)	
Very severe (FEV1<30%)	2(4.3)	0(0.0)	2(100.0**)**	0(0.0)	
TOTAL n (%)	46	13	24	9	46

DISCUSSION

This was a cross section descriptive study of 104 black Africans patients with COPD determining the prevalence of microalbuminuria and its correlation with COPD severity. Microalbuminuria prevalence was 24 % (95% [CI], 17.0-33.0) regardless of history of co morbid cardiovascular diseases.

In a prospective cohort study conducted in India by *Mehmood K et al.* On microalbuminuria and hypoxemia in patients with COPD in 97 COPD smokers versus 94 non COPD smokers as a controls over a period of two years; microalbuminuria was found to be more frequent in COPD smokers compared to smokers without COPD (20.6%versus 7.4%p=0.007). The confounding co morbidities like renal diseases, diabetes and cardiovascular diseases were excluded using laboratory biomarkers and relevant history. In the current study co morbid CVD, renal and diabetes were excluded by history only and hence this might explain the differences in microalbuminuria prevalence between the two studies. Also differences in the study design might explain this prevalence discrepancy.

The study done in Spain by *Ciro Casanova et al*. on microalbuminuria and hypoxemia in COPD patients (129 COPD cases versus 51 controls); found that the prevalence of microalbuminuria was 24% in patients with COPD smokers versus 6% in non COPD smokers control; (p=0.005). This parallel the prevalence in the current study despite of different methodologies used with more less similar sample size of COPD participants.

In the current study; macroalbuminuria was significantly higher in COPD patients with history of co morbid cardiovascular diseases than those without history of CVD co-morbid (13/16(81.2%) versus18/88(20.5%), p<0.001). However it was found that microalbuminuria was significant lower in those with CVD than those without CVD (22/88(25.0%) versus3/16(18.8%), p<0.01) which could be probably because of small number of those with microalbuminuria and CVD.

The commonest COPD extra pulmonary co-morbidities identified through history was cardiovascular diseases. Of 104 study participants, 16 (15.5%) had CVD diseases, of whom12 participants had coronary arterial diseases, 3 had history of resolved stroke and 1

hypertensive heart disease. More extra pulmonary co morbidities could have been detected if laboratory markers were also used, which was not the case in the current study.

Regarding COPD severity in the current study, a large proportional of study participants had moderate to severe COPD according to GOLD classification; 60.9% (95% [CI], 17.9-49.0] and 30.4% 95% [CI], 46.1-73.9) respectively. In a study by *Mehmood K et al.* the COPD which was also classified according to GOLD criteria and majority of study participants were in stage III (severe) and above; 55.7%. These differences can be accounted by characteristics of study population between the two studies. In the current study the proportion of cigarette smoking was 53.8% while in the study by Mehmood K et al. all study participants were heavy smokers of >10pack year.

Regarding the COPD severity and microalbuminuria in the current study; the risk of microalbuminuria increased significant with COPD severity or the lower level of FEV1% predicted, (p=0.049). All COPD patients with normalbuminuria had GOLD stage I (mild) and II (moderate). A 12-year follow-up study in Norway by *Solfrid Romundstad et al.* on COPD and microalbuminuria in 53,129 patients showed that the risk for microalbuminuria increased significantly at lower levels of FEV1 % predicted (p=0.001). Majority (95.3%) of COPD patients without microalbuminuria had less severe COPD stages (GOLD stage of I and II) which is comparable to the findings of the current study where normalbuminuria was also found in less severe stages of COPD.

Despite of limited published data of similar studies elsewhere in the world with no one in Africa, but still the association between COPD and CVDs has been clearly shown. Regardless of different study designs this current study in black population does not differ much with other studies done among Orientals and Caucasians population. Microalbuminuria is a novel marker for detecting subclinical CVDs in COPD patients when other conditions that gives microalbuminuria has been cleared ruled out.

CONCLUSION

A large proportion of study participants had moderate and severe COPD. Abnormal albuminuria (53.8%) i.e. microalbuminuria (24%) and macroalbuminuria (29.8%) was prevalent in COPD patients, regardless of coexisted co morbid CVD. The microalbumin risk increased significant with COPD severity or with the decreased level of FEV1% predicted. A few study participants had co morbid CVD presumably because only medical history was used to ascertain the presence of the co morbid presence.

As in other reports microalbuminuria seems also to be an important biomarker for prediction of extra pulmonary diseases in Tanzanian COPD patients. Microalbuminuria significantly predicted extra-pulmonary COPD as it has been shown in the previous studies in non Africans.

RECOMMENDATION

The findings from this study should be utilized by clinician to screen for the risk of COPD extra pulmonary manifestations especially cardiovascular diseases. This will help to individualize their management in a holistic way and offer a chance of reducing morbidity and mortality associated with COPD extra pulmonary manifestation.

STREGTH OF THE STUDY

The study addressed important aspect of non-communicable disease prevention and appropriate management. Non communicable diseases are a rapidly growing problem in developing world making the double impact on the already existing infectious diseases. This study involved black Africans; hence it forms a platform comparison with previous studies done in Orientals and Caucasians.

STUDY LIMITATIONS

COPD severity classification was done only in newly diagnosed patients. The logistics to do the same for the previous COPD patients was limited in this study as it has been described earlier.

The use of history alone to describe existence of co morbidity in the COPD patients could have under estimated the existence of other conditions that gives microalbuminuria of

which could have been ruled out by laboratory markers. The budget for the study was insufficient to cover for such costs.

COPD can cause endothelial dysfunction and results into CVDs but on the other hand CVDs can precede COPD.

In this study the use of history alone was inadequate to explain this. A single urine sample was used to make a diagnosis of microalbuminuria and therefore this could give false positive results.

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APPENDICES

Appendix 1: Questionnaire

S/N……..

Interviewer Name .....Date of Study.....

A. SOCIODEMOGRAPHIC CHARACTERISTICS:

1. Name of the respondent…….
2. Age……years
3. Sex

1 = Male ☐

2 = Female

4. Marital Status

1=Single

2 = Married ☐

3 = Cohabiting

4 = Divorced

5 = Widow/Widower

5. Education level:

1=Formal education

2= Informal education ☐

Occupation:

1= Domestic/office work

2= Agriculture

3= Industry ☐

4= others……..

6. Mobile contacts: …….
7. Residence: ……

B. HISTORY, RISK FACTORS AND PHYSICAL EXAMINATION:

8. History of symptoms suggestive of COPD:

1= Progressive dyspnea ☐

2= Chronic cough ☐

3= Chronic sputum production ☐

9. History of Smoking

1= Ever smoker ☐

2= Never smoker

If option 2 go to qn no 14

10. If ever smoker;

1= Current smoker ☐

2= Former smoker

11. Numbers of sticks per day…….

12. Smoking duration; years……months……

13. Estimated smoking pack year;

1=<10 pack year ☐

2=>10pack year

14. History of biomass fuel exposure:

1. Fire wood ☐
2. Charcoal ☐
3. Kerosene ☐

15. Medical history of;

a. Diabetes Mellitus 1 = Yes 2 = No ☐
b. Hypertension 1 = Yes 2 = No ☐
c. Renal diseases 1 = Yes 2 = No ☐
d. Cardiovascular diseases 1 = Yes 2 = No ☐
e. Malignancy 1 = Yes 2 = No ☐

C. PHYSICAL MEASUREMENTS:

1. Height……meters
2. Weight……Kg

3. BMI……Kg/m^2
4. SBP……mmHg
5. DBP……mmHg
6. Pulse rate; (beats/minute)……
7. Respiratory rate; RR (breath/minute)……
8. Oxygen saturation ……..%

D. SPIROMETRY

9. FEV1….
10. FVC ……
11. FEV1/FVC ……

12. POST BRONCODILATOR SPIROMETRY FEV1

1. FEV1 ≥80% predicted ☐
2. 50≤FEV1<80% predicted ☐
3. 30%≤FEV1 <50% predicted ☐
4. FEV1<30% predicted ☐

E: URINARY TEST – Dip stick urinalysis

13. Nitrites ☐
14. Leukocytes ☐
15. Protein ☐
16. Glucose ☐

F: Urinary Albumin test:

17. Micro albumin level (mg/L) ……
18. Creatinine level (mmol/L)…….
19. Albumin Creatinine Ratio (mg/mmol) ……..
20. For male: - 1= ACR < 2

    2= ACR ≥ 2.5

    3= ACR ≥30 ☐

For female: -

1= ACR <2.8

2= ACR ≥ 2.5

3= ACR ≥30

Appendix 2: Informed Consent Form (English Version)

PULMONARY FUNCTION AND MICROALBUMINURIA IN PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD)

Greetings,

I am Dr. Festo Kasmir Shayo from Muhimbili University of Health and Allied Sciences (MUHAS) and Muhimbili National Hospital (MNH). I am doing a research on the prevalence of urinary microalbumin in COPD patients at MNH. I will let you know about this research and then requesting for your participation. In case of any hesitation, please feel free to ask, I am available to respond to any question(s).

Research purpose

This study aims at quantifying the prevalence of urinary microalbumin and lung functions severity among COPD patients. The significance of urinary microalbumin is for prediction of COPD extrapulmonary comorbidities so that early preventive strategies can be used in holistic management of COPD patients.

What is to be done?

If you accept to participate in this study; you will be asked to respond to a number of questions including, presenting symptoms, history of cigarette use, biomass exposure, occupation, education level and others. Other information will be obtained from their case files. Weight, height, blood pressure, oxygen saturation will be measured. Spirometer will be used to measure their lung functions. This test is not invasive and the anticipated test duration is 10 minutes.

You will also be instructed to collect and bring early morning urine for measurements o urine protein will also be collected for those with abnormal spirometry test. About 10mls of urine will be collected from mid-voided sample using urine container. Those who will be found to have abnormal urinary microalbumin, their management will be reviewed for proper holistic approach.

Confidentiality: Confidentiality will be highly considered in all the information taken in this study. The information will be used only for this study and health implementation services

Advantages and Disadvantages: As a participant you will be provided with the results of lung functions and urinary microalbumin. Advice is free of charge granted from Investigator regarding your test results. No financial compensation shall be granted for participation. We hope that the study results will help to improve management of COPD in affected individuals.

Spirometry test is an effort procedure and hence may give you subtle discomfort; however no harm is anticipated from this procedure. It is assured and internationally standardized procedure for diagnosis of abnormal lung function.

The Right to Terminate Participation: You are not forced to participate in this research and thus you are free to quit it at any time. Your decision to quit will not jeopardize any of good relationship you have established including your rights to health care and services in any health facility.

In Case of Injuries Due to Participation**: We** do not anticipate any injury in your participation but in case it happens appropriate care and treatment will be provided accordingly.

For further information contact:-

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Dar Es Salaam,
Tanzania
Mobile; +255 755 651 760
OR
Professor, J. Lutale, (Supervisor) –MUHAS

OR

Professor S. Aboud,

Chairperson, Senate Research and Publication – MUHAS

P.O.BOX 65001

Tel 2150302-6

Dar es Salaam.

I……(name option)…, have understood the above information concerning this research and thus have agreed to participate.

Participant's signature _____ Tel No:_____

Research assistant's signature _____

Signature of witness _____

Date: __/__/_____ 2016

Appendix 3: Informed Consent Form (Kiswahili Version)

FOMU YA RIDHAA KWA AJILI YA KUSHIRIKI KWEENYE UTAFITI

Utangulizi

Ndugu Mshiriki, Salamu,

Naitwa Dk. Festo Kasmir Shayo. Natokea hospitali ya Muhimbili na Chuo Kikuu cha Tiba Muhimbili. Nafanya utafiti protini kwenye mkojo kwa wagonjwa wenye shida ya upumuaji katika mapafu. Baada ya kusoma maelezo yaliyopo katika fomu hii, nitakuomba ushiriki wako katika utafiti huu. Kama utakuwa na swali au dukuduku yoyote jisikie huru kunihoji.

Lengo kuu la Utafiti

Lengo letu ni kutathmimi idadi ya wagonjwa wenye protini kwenye mkojo kati ya walio na shida ya upumuaji katika mapafu. Ugunduzi wa protini kwenye mkojo itasaidia kuimarisha matibabu kwa wagonjwa wa namna hii wenye shida ya upumuaji katika mapafu.

Utaratibu

Kwa watakaokubali kushiriki katika huu utafiti, wataulizwa baadhi ya maswali hasa kuhusiana na ugonjwa wao. Pia taarifa nyingine zitakusanywa kutoka ktika faili zao. Uchunguzi wa mwili utafanyika ikiwa ni pamoja na kupima uzito na urefu, presha na joto la mwili.

Ufanisi wa upumuaji wa mapafu utapimwa na kifaa kiitwacho ‘Spirometer’. Mshiriki atapatiwa maelekezo na kuoneshwa ya namna ya kutumia hicho kifaa kabla ya kupimwa. Mshiriki atahitajika kupumua kwa kutoa hewa yote kwenye mapafu kupitia mdomo kwenda kwenye hicho kifaa-spirometer mara 3. Kipimo hiki kinahataji ushirikiano mkubwa kutoka kwako, ambapo kinategemewa kuchukua kama dakika 10.

Pia mkojo utakusanywa kwa wale watakaokuwa na shida ya mapafu baada ya kipimo cha spirometer. Mkojo utakusanywa kutoka katika mkojo wa kati wajkati wa kukojoa kwa kutumia kikopo kidogo utakachopewa.

Watakaogundulika wana protini katika mkojo watapatiwa ushauri na matibabu ya ziada ili kupunguza madhara ya tatizo la mapafu kuenea kwenye mifumo mingine ya mwili.

Usiri

Taarifa na utambulisho wako katika huu utafiti zitawekwa kuwa siri. Matokeo ya utafiti yatasaidia katika kuongeza ubora wa matibabu kwa wagonjwa wa namna hii.

Faida na Hasara

Mwishoni mwa mahojiano, utapewa matokeo ya vipimo na ushauri kutoka kwa mtafiti mkuu namna nzuri ya matibabu ya ugonjwa wako. Hakuna fidia ya kifedha kwa kushiriki katika huu utafiti.

Ni matumaini yetu kwamba matokeo ya utafiti huu yatasaidia kuimarisha utoaji wa matibabu kwa wagonjwa wenye shida ya upumuaji katika mapafu. Kwa kushiriki katika utafiti huu, utakuwa umechangia manufaa ya jamii yako.

Unaweza ukasikia vibaya kidogo wakati wa kupuliza hewa lakini ni zeozi salama ambalo halina hatari yoyote muhimu kwa afya yako na limethibitishwa kimataifa.

Haki ya Kujitoa Ushiriki

Kushiriki katika utafiti huu ni kwa hiari yako. Unaweza kukataa kushiriki wakati wowote. Hata hivyo kukataa kwako hakutaondoa au kupunguza haki yako ya kupata huduma ya afya au matibabu katika kituo chochote cha afya.

Kuumia kutokana na kushiriki

Hatutarajii kuumia kwa aina yeyote kwa kushiriki katika utafiti huu, na endapo ikitokea huduma stahiki ya matibabu itatolewa ipasavyo.

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Mimi _____ (jina hiari)_____nimesoma na kuelewafomu hii ya idhini, nanimekubali kushiriki katika utafiti huu.

Sahihi:_____ Simu:_____

Mtafiti _____

Shahidi _____

Tarehe __ / __ / _____