

**Prevalence and pattern of hearing loss in patients undergoing hemodialysis at
Muhimbili national hospital**

Aron Alex Kiberiti

MMed (Otorhinolaryngology) Dissertation
Muhimbili University of Health and Allied Sciences
August, 2020

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES



**PREVALENCE AND PATTERN OF HEARING LOSS IN PATIENTS UNDERGOING
HEMODIALYSIS AT MUHIMBILI NATIONAL HOSPITAL.**

Student: ARON ALEX KIBERITI, MD. Reg No. HD/MUH/T.165/2017

Supervisor

1. Dr. Henry Swai, MD, MMED, Otorhinolaryngology (ORL) Department Muhimbili National Hospital (MNH)

A dissertation submitted in partial fulfillment of the requirements for the degree of Master of
Medicine (Otorhinolaryngology) of
Muhimbili University of Health and Allied Sciences.

August, 2020

CERTIFICATION

We, the undersigned certifies that have read and hereby recommend for examination by Muhimbili University of Health and Allied Sciences a dissertation entitled, **“Prevalence and partten of hearing loss in patients undergoing hemodialysis at Muhimbili National Hospital”**, in partial fulfillment of the requirements for the degree of Master of Medicine (Otorhinolaryngology) of Muhimbili University of Health and Allied Sciences.

Signature _____ **Date** _____

Dr. Henry Swai.

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I, **Aron Alex Kiberiti** 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.

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Date_____

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ACKNOWLEDGEMENT

I would like to thank Almighty God for His abundant grace and blessings, for giving me strength, courage and wisdom during the pursuit of this study. I would like to express my sincere appreciations and gratitude to my supervisor, Dr Henry Swai for his efforts, valuable suggestions, comments and guidance towards the success of this study. Also Dr Francis Furia for his advice and guidance in Nephrology department. May God bless them.

I would like to express my special gratitude to my beloved father Alex Dindai Kiberiti for his unconditional love, encouragement, moral and financial support throughout my academic carrier.

I am very grateful to the Head of Department of Muhimbili University of Health and Allied Sciences, Dr Enica R. Massawe and Head of department of Muhimbili National Hospital, Dr Edwin Iiyombo for their valuable contributions and support during my academic life. I am also very grateful to the entire staff of the department of Otorhinolaryngology at Muhimbili University of Health and Allied Science for their guidance and valuable contribution throughout my academic life. Alongside, I would like to express my gratitude to my colleagues for their cooperation during the entire study period.

DEDICATION

To Almighty God

To my beloved parents

To all my family

This work is dedicated.

ABSTRACT

Background: Hearing loss in chronic kidney disease (CKD) patients undergoing hemodialysis (HD) is sensorineural and bilateral and occurs at high or low frequencies. Hearing loss in HD is caused by osmotic disorders, changes in fluid and electrolytes in the cochlea's endolymph, and possible exposure to membrane dialyzer. However the magnitude and pattern of hearing loss among patients undergoing hemodialysis at Muhimbili National Hospital is not known.

Objective: The broad objective of the study was to assess the prevalence, pattern of hearing loss among patients undergoing hemodialysis at Muhimbili National Hospital.

Methods: This study was hospital based cross sectional study whereby it was done at Muhimbili National hospital to patients undergoing hemodialysis. 106 patients enrolled who had completed three session of hemodialysis. History and physical examination to every patient to rule out anomalies associated with hearing loss was done. Then head and neck were examined, the mouth was examined using tongue depressor and inspected as well. Otoscope examination was done by using handheld otoscope to examine ear canal and tympanic membrane. Impacted cerumen and foreign bodies were removed before audiological examination if feasible and were referred to ORL department at MNH for any difficulties.

Laboratory results from each patient were recorded. The results recorded were; Creatinine levels, Hemoglobin concentration and Serum electrolytes (Potassium and Sodium). Blood pressure and Diuretics dosage were recorded. Audiological examination were carried out this test was performed using single channeled calibrated clinical audiometer with standard headphone. Examination were conducted in a quiet room to avoid background noise and measured at four frequencies 500HZ, 1000HZ, 2000HZ, and 4000HZ, at an intensity of 25dB for both ears separately. This was conducted after three cycle of hemodialysis.

Results: Hearing loss was found in 24.5% had hearing loss of which all of them (100%) were bilateral and of the sensorineural type with approximately twice the number of males as compared to females (M:F = 1.89:1). Hearing loss was common (31.3%) in those patients who were in the age group of 41-50 years. Among the 26 patients who had hearing loss, 61.5% had

mild hearing loss while 38.5% had moderate hearing loss. Mild hearing loss was more prevalent across all age groups except for those who were above 60 years in whom majority (75%) had moderate hearing loss. Among male patients with hearing loss, majority (70.6%) of them had mild hearing loss compared to female patients with hearing loss in whom moderate hearing loss was common (55.6%). Majority of the patients with hearing loss (n=26) had undergone dialysis for less than one month (61.5%), with 75% of this group having mild hearing loss. Majority of patients with over one month duration of dialysis had moderate hearing loss 57.2% and 66.7% for 1-6 months and more than 6 months respectively.

Most of the patients with hearing loss(n=26) had Hypertension and Diabetes Mellitus (46.2%), with majority in this group having moderate hearing loss (58.3%), all patient with Diabetes and HIV only had mild hearing loss while those with Hypertension only, majority(60%) had moderate hearing loss. The difference in severity of hearing loss amongst the comorbidities is statistically significant with a p value of 0.032 .

Conclusion:Hearing loss in CKD patients undergoing hemodialysis is prevalent among patients attending dialysis unit at Muhimbili National Hospital. The most pattern hearing loss was sensorineural, bilateral, and mild to moderate hearing threshold. Diabetes mellitus and hypertension were common comorbid diseases associated with hearing loss in CKD.

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LIST OF ABBREVIATION

CKD –chronic kidney disease

AKI –Acute kidney injury

ESRD-End stage renal disease.

SNHL-Sensorineural hearing loss.

MNH- Mumbili national hospital.

MUHAS-Muhimbili university health of allied science.

HIV-Human immune deficiency virus.

HL-Hearing impairment.

NCD- Non communicable disease.

CRF-Chronic renal failure.

ENT- Ear ,nose and throat.

SPSS-Statistical Package for social Sciences.

ORL-Otorhinolaryngology.

PI-Principle investigator.

MD-Medical Doctor.

MMED-Master of Medicine degree.

WHO-World Health Organization.

DEFINITION OF KEY TERM

End Stage Renal Disease (ESRD)-Also known as end stage disease is the final, permanent stage of chronic kidney disease, where kidney function has declined to the point that the kidney can no longer function on their own.

Audiometry-is a study of assessment of hearing acuity for variations in sound intensity and pitch and for tonal purity, involving thresholds and differing frequencies.

Sensorineural Hearing loss-is the hearing loss caused by damage to the inner ear or the nerve from the ear to the brain.

Lateralization-Localization of function or activity on one side of the body in preference to the other can either be experienced on the right or left side in unilateral hearing loss. Hearing loss can be unilateral or bilateral regardless of the type.

Acute kidney injury-is a sudden episode of kidney failure or kidney damage that happens within a few hours or a few days.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Sensorineural Hearing Loss (SNHL) has been reported in chronic kidney diseases (CKD) patients with a prevalence of over 30% (1). In other cases Hearing loss has been reported in Acute Kidney Injury (AKI) cases. About 1.7 million deaths are thought to be caused by AKI annually (2). The increase in incidence of these diseases is reflected by increase in prevalence of precipitators like diabetes mellitus, cardiovascular diseases and human immunodeficiency virus (HIV) infection (1). These diseases are consuming a huge proportion of health care finances in developed countries, while contributing significantly to morbidity, mortality and decreased expectancy of life in the developing world (3).

Since the performance of dialysis in medical field, there have been observed side effects post dialysis. In 1950s hearing loss was first recognized after dialysis procedure and several investigations were launched (2). A study conducted by Kang (2018), indicated that; Sensorineural hearing loss is more prevalent in CKD patients than non-CKD patients after the performance of hemodialysis. The study went further and highlighted that; Renal failure might contribute to sensorineural hearing loss (SNHL) via factors such as the osmotic alterations caused by hemodialysis, similarities in antigenicity between the labyrinths and the kidney, uremic neuropathy and ototoxicity(4).

Meena (2012) conducted a study in India and observed that, the prevalence of hearing loss has increased from 14% to 22% from the year 2008 to 2011 for patients under hemodialysis (5). Irrespective of the tremendous epidemiological relevance very little is known about hearing loss among patients undergoing hemodialysis and no published studies on hearing loss among patients undergoing hemodialysis from Tanzania. This setting, lead to inadequate information concerning Hearing Loss among patients undergoing hemodialysis despite of its interference on quality and expectancy of life.

1.1.1 Etiology of hearing loss in patients undergoing hemodialysis

Akeem O Et al (2006)(3) mentioned that;the aetiopathogenesis reported included osmotic alteration resulting in loss of hair cells, collapse of the endolymphatic space, oedema and atrophy of specialized auditory cells (3). Antigenic similarity between basement membranes of glomeruli and striavascularis of the inner ear may explain this association to some extent. The use of ototoxic drugs, electrolyte disturbances, and hypertension have been implicated in various studies (6).

The role of hemodialysis in the causation of sensorineural hearing loss (SNHL) is controversial; some authors have reported a depression in hearing threshold after hemodialysis while others are of the opinion that there was no relation between the two (7) .This study intends to bridge this gap on knowledge of hearing loss among patients undergoing hemodialysis at Muhimbili National Hospital.

1.2 Problem Statement

Hearing Loss has been reported to manifest in patients undergoing hemodialysis at a magnitude of more than 30% (3). The distribution of Loss of hearing has a primarily even distribution in all patients undergoing the procedure. Ravinder S Et al (2011) (8) in India, conducted a case study and revealed that hearing for patients after hemodialysis diminished at scale of 73%. The study highlighted that most of hearing loss cases observed had a mild to moderate sensorineural hearing loss distribution.

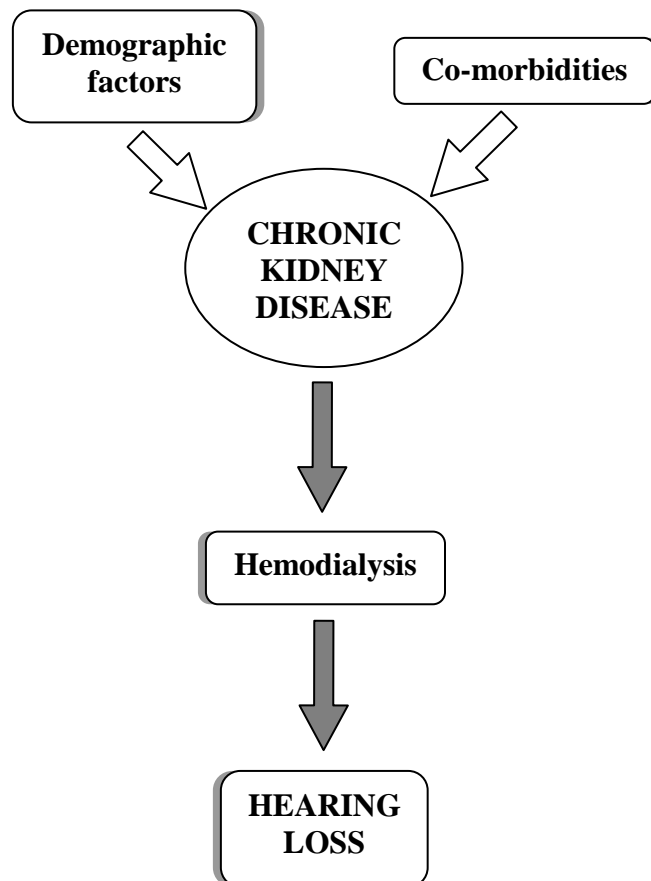
Akeem O Et al (2006) (3) in Nigeria identified the prevalence of hearing loss to be above 30% for hemodialysis patients. The study also stipulated that; there was a depression in the hearing threshold of patients with CRF following three sessions of hemodialysis. Hearing loss and clinical profile among patients with ESRD undergoing hemodialysis is unknown to most clinicians across various parts of the country. Thus, despite the multitude of studies regarding hearing loss in CKD, unanswered questions remain regarding the role of hemodialysis and duration of disease. We aimed to determine the prevalence and degree of hearing loss in CKD

patients on hemodialysis, and to identify the association between hearing loss and factors like duration of CKD and number of hemodialysis sessions (9).

For MNH there is inadequate information on the Prevalence of the disease, Lateralization and evaluation data of the disease before and after hemodialysis. This information gap leads to delayed care and management of patient with hearing loss undergoing hemodialysis. The delayed care and management for patients will induce the negative impacts on socio-economic aspects. The negative impacts on socio-economic aspects will go with paramount psychological and emotional break-down (10). It is therefore, critically important to conduct this study to cover the gap on; Prevalence, severity and lateralization of Hearing Loss in patients undergoing hemodialysis.

1.3 Conceptual frame work

Figure 1: Hearing loss in CKD conceptual framework



1.4 Rationale of the study

This study aimed on assessing the prevalence and pattern of hearing loss in patients undergoing haemodialysis at Muhimbili National Hospital. The study therefore has provided updates on the clinical profile of patients undergoing hemodialysis and who have developed hearing loss at MNH. It was important to investigate the demographic attributes and the associated risk factors for chronic renal failures for an effective treatment plans. Hearing loss being one of the side effects of hemodialysis, it was therefore necessary to understand the gravity of the situation and to recommend the necessary precautions. The result of reduction of CKD prevalence, will lead to less hemodialysis procedures reducing hearing loss resulting from the procedure. This study has provided statistical evidence and inference on the distribution of clinical profile for patient with hearing loss post hemodialysis.

The results of this study have highlighted the prevalence of Hearing loss for patients undergoing hemodialysis specifically in MNH. These results has indicated statistical relevance on the magnitude of hearing loss among patients undergoing hemodialysis. This study again has provided information on Lateralization of patients with hearing loss among patients undergoing hemodialysis. Having this information has added knowledge in pathophysiology supported by statistical evidence on the manifestation of hearing loss for patients undergoing hemodialysis.

This study also provided information on the relationship between type of renal failure and hearing loss to patients undergoing hemodialysis. This information contributed to preexisting strategies on management of patients with hearing loss undergoing hemodialysis. Generally, the results of this study also provide baseline information which is vital in establishing strategies which will help the community and health workers to help patients with hearing loss undergoing hemodialysis in the country. This information is vital towards ensuring availability of a comprehensive management and strategic plan to the Ministry for these patients attending Muhimbili National Hospital and other hospitals in general.

1.5 Research Questions

1. Is there hearing loss among CKD patients undergoing hemodialysis at Muhimbili National Hospital?.

Hypothesis

Null hypothesis :There is no hearing loss among CKD patients undergoing hemodialysis.

Alternative hypothesis:There is hearing loss among CKD patients undergoing hemodialysis.

1.6 Objectives

1.6.1 Broad Objective

The broad objective of the study was to assess the prevalence, pattern of hearing loss among patients undergoing hemodialysis at Muhimbili National Hospital.

1.6.2 Specific Objective

1. To determine prevalence of hearing loss among patients undergoing hemodialysis.
2. To evaluate lateralization of hearing loss among patients undergoing hemodialysis.
3. To determine severity of hearing loss among patients undergoing hemodialysis.
4. To determine severity of hearing loss with durations of hemodialysis.
5. To determine comorbidities associated with hearing loss among patients undergoing hemodialysis.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Prevalence

2.1.1 Prevalence of Chronic Kidney Disease

The incidence of chronic kidney disease (CKD) has increased significantly in the past few years, due to the huge rise in the number of people suffering from diabetes mellitus and systemic hypertension, which are major risk factors for CKD. Association of CKD with sensorineural hearing loss has been described by several studies in the past, although the basis for this has not been clearly established (11–13). Incidence and prevalence of End stage renal disease (ESRD) requiring renal replacement therapy are increasing worldwide. The prevalence of in sub Saharan Africa including Tanzania is reported to be less than 100 per million people CKD(1). However, the credibility of statistics from many developing countries is questionable, and the majority of experts suggest 150 per million populations is more a more realistic estimate of incidence of ESRD (1,14).

2.1.2 Prevalence of Hearing Loss for patients undergoing hemodialysis

The prevalence of hearing loss in CKD patients varies from 28 per cent to 77 per cent according to different studies. Notably, many older studies have shown higher prevalence of hearing loss, possibly due to large sample sizes (7).

A recent study conducted by Balasubramanian (2018)(13) observed that; hearing thresholds are abnormal at high frequencies in 77.5 per cent of CKD patients and at low frequencies in 27.5 per cent in the study. This is in contrast to the study by Gatland et al. who found 41 per cent hearing impairment in low frequencies and 53 per cent in high frequency range (3,15,16).

Moreover, Sensory–neural hearing loss has a considerable prevalence in CRF patients. The severity of hearing loss increases by increased duration of renal failure but it is not correlated with age and gender. This loss involves higher frequencies most commonly and does not affect discrimination score (11).

Hemodialysis has been reported to contribute to hearing loss in CKD. Studies on the impact of hemodialysis have produced contradictory results, with a sizeable number reporting that hemodialysis plays no role in hearing loss associated with CKD (17). Although chronicity of disease was found to have no association with hearing loss in many studies, a recent study demonstrated that the greater the duration of disease, the greater the hearing loss (18).

2.2 Lateralization

Hearing loss can be unilateral or bilateral regardless of the type. Considering lateralization the loss can either be experienced on the right or left side in unilateral hearing loss. There are few reports explaining hearing loss in patients with CKD or AKI with respect to lateralization. The study which was done 2007(15) in Italy, a prospective study of 40 patients with CKD stage 3 and 5, the patterns of hearing impairment shows bilateral, symmetric, sensorineural with high frequency hearing loss.

Another study carried out in Sakarya Turkey (2015) trying to study hearing loss in short term and long term to hemodialyzed patients to CKD patients 2016 a prospective study Seventy of the 91 patients (77%) were hearing loss (14unilaterally); 56 patients (61.5%) had cochlear hearing loss (in 12 unilateral), six patients (6.5%) had conductive hearing loss (in 2 unilateral), eight patients (9.0%) had mixed hearing loss (19).

Also in a study done in Greece about auditory function in young patients of which a total of 35 children and adolescents suffering from chronic renal failure were involved, 19 patients were found to have hearing loss (41.3%) hearing loss was bilateral and unilateral in seven children (50%) and did not signify or correlate with gender age and sex (20). Another study done in Nigeria in the nephrology department of the University college Hospital Ibadan to patients with CKD in 2006, showed that sensorineural hearing loss of which is bilateral with the prevalence of 67% among CKD Patients which related to the diseases duration (21).

2.3 Severity of hearing loss after hemodialysis.

The severity of hearing loss to patients with CKD and AKI are still controversial with respect to different studies as the hearing loss is either due to CKD and AKI or hemodialysis however various aetiological mechanisms have been suggested (22).

In 1924 Grahe proposed that the hearing loss was found in 82% of uraemic patients was caused by a central toxic effect of uraemia(23). This hypothesis was supported by Yassin in 1966 , whereby he produced data suggesting that hearing loss in uraemic patients correlated well with hyponatraemia and improved with correction of sodium balance (24). This has been supported by Wigand who found that hyponatraemia and glomerular filtration rate correlated best with hearing loss at 8 kHz (15).

These reports suggest that fluid and/or electrolyte disturbances in CRF may produce hearing loss (25). The present study has shown that the low frequency hearing loss found improved significantly after dialysis (5).

Auditory function in young and adolescent in 1997 , 46 patients were included where pre and post hemodialysisaudiological evaluation was performed, an ascending 5db and descending method was utilized to determine pure tone threshold three times ,at 250,500 ;1000;2000;4000,6000,and 8000HZ on a subgroup of nine patients ,it was found that 46.6% in the hemodialysis group were having sensorineural hearing loss (12). Although it has been suggested that even a single cycle of hemodialysis can influence hearing function diminishing or improving it , no significant change in the audiometric before and after hemodialysis in the study were seen in the study (26).

Further study done in Nigeria in april 2016 reported as a case report of a 31-year old military officer who had an end stage renal disease due to chronic glomerulonephritis and with a baseline good social hearing. He was not previously diagnosed with hypertension or diabetes and no family history of renal disease or deafness and developed profound hearing loss immediately after the first session of hemodialysis. Clinical evaluation of the ear was done(3).

Pure tone audiometry and full audiological evaluation was conducted. Ear examination revealed unremarkable outer ear/otoscopic findings. Tuning fork test showed no perception to both Rinne's and Weber's test. Pure tone audiometry (PTA) revealed profound bilateral

sensorineural hearing loss (SNHL) with pure tone average (at 500, 1000, 2000, 4000Hz) of 93dBHL and 88dBHL in the right and left ear respectively (27).

2.4. Severity of hearing loss with duration of hemodialysis and other Comorbid conditions

Duration of hemodialysis and other comorbid conditions reported to have a role in patients with CKD with association to hearing loss, it has been shown in different studies, the increase duration of hemodialysis increase the threshold of hearing loss to patient undergoing hemodialysis however there are still a debate either CKD or hemodialysis causes hearing loss however it has been prostrated the cochlea and kidney have similar physiological mechanism, namely active transport of fluid and electrolytes achieved by the striavascularis in the cochlea and grumeruli in the kidney. It was previously confirmed that the cochlea is affected by the systemic metabolic, hydroelectrolytic and hormomal alterations that are associated with CKD(4)(22).

Several variabes may contribute to the etiopathogenetic mechanisms of hearing loss in CKD including factors related to the severity and duration of disease, duration of hemodialysis ototoxic ,drugs, age, cormobid conditions such as diabetes mellitus, hypertension and hemodialysis(16).

CHAPTER THREE

3.0 METHODOLOGY

3.1 Study design

This study was hospital based cross sectional study.

3.2 Study Setting

This study was conducted at Muhimbili National hospital dialysis unit. The Unit is well equipped with 47 beds and 47 dialysis machines. The unit has a capacity of attending 100 Patients in three shifts per day.

3.3 Study population

The study population included all patients newly diagnosed with AKI and CKD who are undergoing hemodialysis.

3.4 Study duration

This study was done from June to December 2019.

3.5 Sample size

Considering the study power of 93%, a random error is estimated to be 0.07. The sample size of 106 patients new diagnosed with end stage renal disease attending MNH will be the sample size studied. The estimation based on a study done by Balasubramanian (2018)(13) in India. In that study the prevalence of hearing loss among patients undergoing hemodialysis was 80%. The sample size will be calculated from Fischer's formula:

$$n = Z^2 P (1-P) / \varepsilon^2 \text{ where}$$

n=Minimum required sample size

Z = 1.81 at 93% Confidence Interval which will be assumed for the study

P = Proportion of those with the characteristic of interest of which it's the estimated proportion of CRF and AKI of which is 80%

ϵ = Margin of error which is 0.07

Sources of error;

-Confounding factors like Diabetes Mellitus, Ototoxic drugs, chronic renal failure and HIV, can cause hearing loss before the patient attends to hemodialysis. Therefore the minimum sample estimated sample size (n) is thus taken to be 106 patients.

3.5. Sample selection.

Convenience sampling was used to include samples in this study to establish the sample population by taking into account the following criteria.

Inclusions criteria.

- All patients who underwent physical examination and medical investigation with a diagnosis of end stage renal diseases.
- Consented to participate in this study.

Exclusion criteria.

- Chronic external ear disease.
- Acute and chronic middle ear disease.
- Patients with altered mental status.

3.6 Data collection and technique

Patients undergoing hemodialysis and meeting inclusion criteria were enrolled in the study. After getting permission from the head of departments, unit and administration, the letters were distributed to the respective departments. By using non probability sampling all patients were selected with chronic renal failure eligible for renal replacement therapy whereby 106 patients enrolled who had completed three session of hemodialysis. The principal investigator (PI) and three trained staffs performed physical examination to every patient to rule out anomalies associated with end stage renal diseases. The head and neck were examined, the mouth was examined using tongue depressor and inspected as well. Otoscopic examination was done by

using handheld otoscope to examine ear canal and tympanic membrane. Impacted cerumen and foreign bodies were removed before audiological examination if feasible and were referred to ORL department at MNH for any difficulties.

Laboratory results from each patient were recorded. The results recorded were; Creatinine levels, Hemoglobin concentration and Serum electrolytes (Potassium and Sodium). Blood pressure and Diuretics dosage were recorded.

3.7 Audiological Examination procedure:

Audiological examination were carried out by PI in collaboration with an audiologist from ORL department of MNH, this test was performed using single channeled calibrated clinical audiometer with standard headphone. Examination were conducted in a quiet room to avoid background noise and measured at four frequencies 500HZ, 1000HZ, 2000HZ, and 4000HZ, at an intensity of 25dB for both ears separately, for those who have completed three session of hemodialysis and those had not completed three session their Names, file number and phone number were recorded for follow up and recruitment. The results were recorded as PASS if respond obtained at three out of the four screened frequencies and REFER if no respond was obtained at two or more screened frequencies. Audiologist made interpretation in audiogram to obtain the type, severity and lateralization. Prevalence was calculated by taking all patients confirmed to have HL as a numerator divided by all screened patients during the study period to patients undergoing hemodialysis.

3.8 Data collection tools

After taking proper consent and permission from management and patients, data were collected using questionnaire which included biographic data, clinical examination findings, and audiology results.

3.9 Data Analysis

Data analysis refers to the computation of the certain measures along with searching for patterns of relationship that exist among data groups. Descriptive statistics was used to present

the finding from the study. SPSS computer software version 20 and the data were managed electronically in the computerized software program after cross checking the filled questionnaires for quality control of data which will be obtained from the selected patients who will have met the inclusion criteria. Quantitative variables will be analyzed using mean, median and percentages. A two-tailed P-value <0.05 will be considered significant.

3.10 Description of study variables

Independent variables were the risk factors of developing hearing loss to patients undergoing hemodialysis considering -age ,sex ,hypertension,Dibetes mellitus,HIVand Autoimmune diseases.

Dependent variables was hearing loss, variants was enquired from patients with such an outcome variable.

3.11 Ethical considerations and Approval

The proposal was presented to the Department of Otorhinolaryngology of the Muhimbili University of Health and Allied Sciences. Ethical clearance shall be sought from the Research and Publication Committee of the School of Medicine and from the Senate Research and Publications Committee of the Muhimbili University of Health and Allied Sciences. Administrative permission to conduct the study was obtained from Muhimbili National Hospital as per the hospital management protocols.

A written informed consent among patients with end stage renal diseases participating in the study was obtained from parents/care takers before enrolment of each patient into the study.

3.12 Validity and reliability of the data

Validity issue: The validity of constructed questionnaire was administered and reviewed by audiologist, to acquire standard setting that was corresponding to the required objective. The test-retest method was used to estimate the reliability of the instruments before proceeding with the hearing loss screening. These was to ensure the reliability of the data.

Reliability issue: To insure reliability of the data and procedures in this study, the Hearing Loss findings will be reviewed by restudying and reinterpreting the results to confirm the

reports produced during the study. In any case in this study where ambiguity was rise, the findings were discussed by ENT specialists for settlement.

3.13 Study limitations and Mitigations

This study involved the utilization of several equipment and procedures; therefore the availability of equipment is of paramount importance. On other cases, some patients who are very sick was another limiting factor. Therefore, early arrangements and inquiries was made to obtain required instruments and considering the inclusion criteria of this study.

3.14 Research dissemination

The results of this study were presented to the Department of Otorhinolaryngology at Muhimbili University of Health and Allied Sciences and shall also besubmitted to the Research and Publication committee of Muhimbili University of Health and Allied Sciences and also to the Director of Muhimbili National Hospital as well as to the heads of respective departments where data were collected. Finally, a manuscript for publishing the study will be prepared and handled to the Office of the Director of Postgraduate Studies before the award of Masters of Medicine in Otorhinolaryngology.

CHAPTER FOUR

4.0 RESULTS

4.1 Demographic profile of study participants

In this study we enrolled 106 participants who were eligible for hemodialysis and audiometric testing at Muhimbili National Hospital. The age of the participants ranged between 25 to 75 years with a mean age of 48.8 ± 11.97 years and most (30.2%) of the participants being in the 41-50 years age group. There was a male predominance with a male to female ratio of 1.16:1 (Table 1).

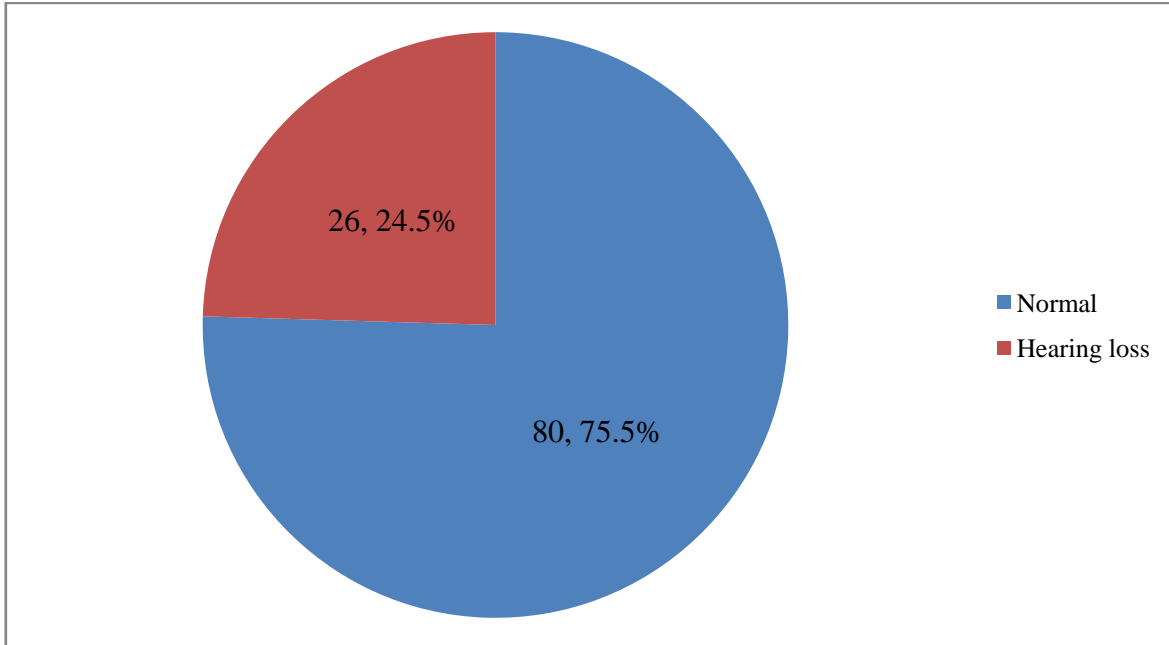
Table 1: Demographic characteristics of study participants (N=106)

Variables	n (%)
A. Age (years)	
21-30	10 (9.4)
31-40	21 (19.8)
41-50	32 (30.2)
51-60	24 (22.6)
>60	19 (17.9)
B. Sex	
Male	57 (53.8)
Female	49 (46.2)

4.2 Hearing status of study participants

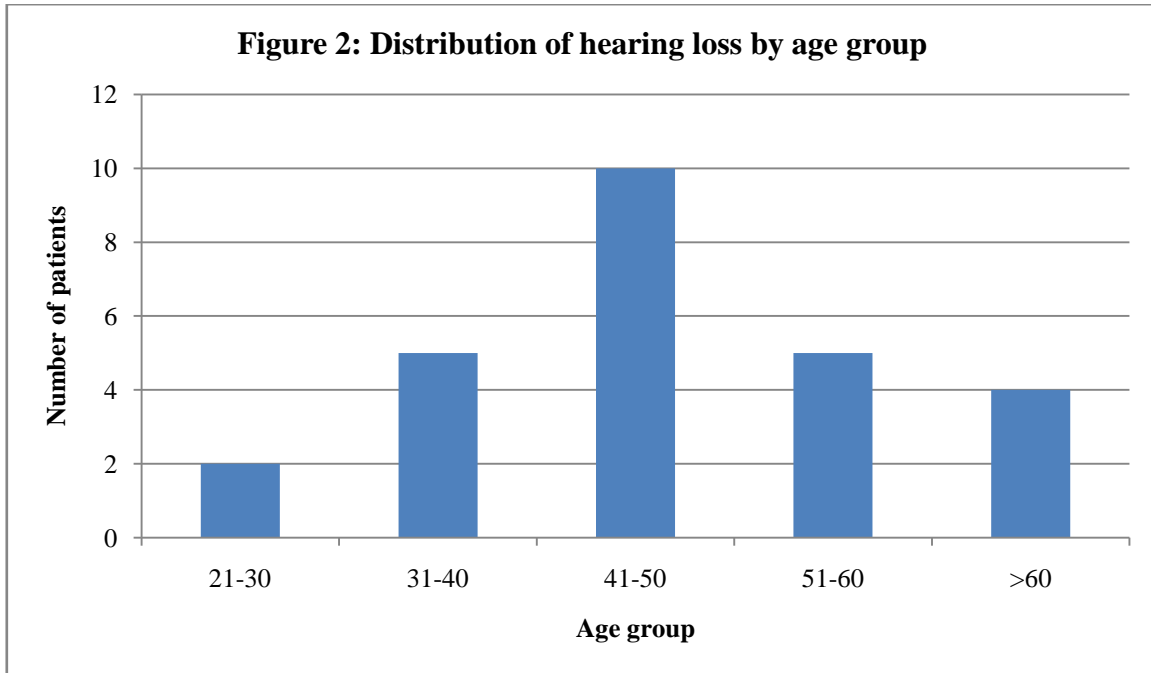
Among the study participants, 24.5% had hearing loss (Figure 1) of which all of them (100%) were bilateral and of the sensorineural type with approximately twice the number of males as compared to females (M:F = 1.89:1).

Figure 1: Hearing status among the study participants



4.3 Distribution of hearing loss by age groups:

Hearing loss was common (31.3%) in those patients who were in the age group of 41-50 years (Figure 2).



4.4 Severity of hearing loss of the study participants

Among the 26 patients who had hearing loss, 61.5% had mild hearing loss while 38.5% had moderate hearing loss (Table 2).

Table 2: Severity of hearing loss of study participants

Hearing loss severity	n (%)
Mild hearing loss (20-40 dB)	16 (61.5)
Moderate hearing loss (41-55 dB)	10 (38.5)
Total	26 (100)

4.5Hearing loss severity by age:

Among patients with hearing loss, mild hearing loss was more prevalent across all age groups except for those who were above 60 years in whom majority (75%) had moderate hearing loss. However, this difference in proportion was statistically insignificant since the p-value was 0.499 (Table 3).

Table 3: Hearing loss severity by age

Age group	Hearing loss severity		Total
	Mild	Moderate	
21-30	1 (50.0%)	1 (50.0%)	2 (7.7%)
31-40	4 (80.0%)	1 (20.0%)	5 (19.2%)
41-50	6 (60.0%)	4 (40.0%)	10 (38.4%)
51-60	4 (80.0%)	1 (20.0%)	5 (19.2%)
>60	1 (25.0%)	3 (75.0%)	4 (15.4%)
Total	16 (61.5%)	10 (38.5%)	26 (100.0%)

4.6 Hearing loss by sex

Among male patients with hearing loss, majority (70.6%) of them had mild hearing loss compared to female patients with hearing loss in whom moderate hearing loss was common (55.6%). However, this difference in proportion was statistically insignificant since the p-value was 0.234 (Table 4).

Table 4: Hearing loss severity by sex

Sex	Hearing loss severity		Total
	Mild	Moderate	
Male	12 (70.6%)	5 (29.4%)	17 (65.4%)
Female	4 (44.4%)	5 (55.6%)	9 (34.6%)
Total	16 (61.5%)	10 (38.5%)	26 (100.0%)

4.7 Duration of hemodialysis.

Majority of the patients recruited to this study (52.8%) had undergone dialysis for a period of less than one month with the least (12.26%) having a duration of more than 6 months (Fig: 3).

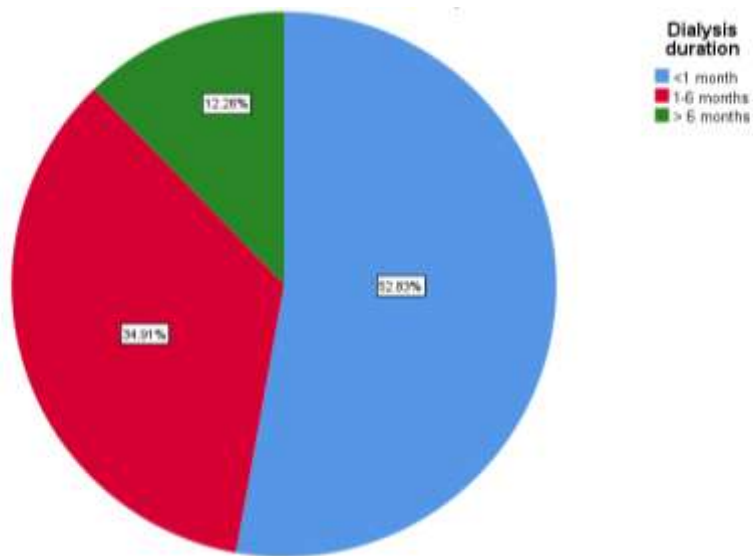


Fig 3: Duration of dialysis

4.8 Duration of Dialysis by severity of hearing loss.

Majority of the patients with hearing loss (n=26) had undergone dialysis for less than one month (61.5%), with 75% of this group having mild hearing loss. Majority of patients with over one month duration of dialysis had moderate hearing loss 57.2% and 66.7% for 1-6 months and more than 6 months respectively.

The difference in these groups was however not statistically significant with a p value of 0.163(Table 5).

Table 5: Duration of Dialysis by Severity of Hearing Loss.

		Severity of Hearing Loss		Total
		Mild	Moderate	
Duration of Dialysis	<1 month	12(75%)	4 (25%)	16(61.5%)
	1-6 months	3(42.8%)	4(57.2%)	7(26.9)
	> 6 months	1(33.3%)	2(66.7%)	3(11.5%)
Total		16	10	26

4.9Comorbidities by Severity of hearing loss

Most of the patients with hearing loss(n=26) had Hypertension and Diabetes Mellitus (46.2%), with majority in this group having moderate hearing loss (58.3%), all patient with HIV and Diabetes only had mild hearing loss while those with Hypertension only, majority(60%) had moderate hearing loss. The difference in severity of hearing loss amongst the comorbidities is statistically significant with a p value of 0.032 (Table 6)

Table 6: Comorbidities by Severity of hearing loss

		Severity of hearing loss		Total
		Mild	Moderate	
Comorbidities	HIV	4(100%)	0	4(15.4%)
	Hypertension	2(40%)	3(60%)	5(19.2%)
	Diabetes Mellitus	5(100%)	0	5(19.2%)
	Hypertension and Diabetes Mellitus	5(41.7%)	7(58.3%)	12(46.2%)
Total		16(61.5%)	10(38.5%)	26(100%)

CHAPTER FIVE

5.0 DISCUSSION

Chronic kidney disease (CKD) is a silent disease that causes slow, progressive, and irreversible loss of the kidney function. Nowadays, it is considered to be a public health problem. Early diagnosis is important to delay the progression of the disease, to prevent complications and adequately prepare renal replacement therapy. Hearing loss has been identified in renal patients since the past century. Some authors have observed that large number of hemodialysis (HD) sessions or repeated kidney transplants may result in electrolyte, biochemical, immunological, osmotic, and vascular changes that may disturb the function of the inner ear(3).These changes may cause hearing symptoms, such as loss of perception of treble frequencies, vestibular symptoms or even cause complete hearing loss over the course of the disease as reported by Zeigelboim et al(24).

This study aimed at assessing the prevalence and pattern of hearing loss among patients undergoing hemodialysis at MNH. In this study, we enrolled 106 participants who were eligible for hemodialysis and audiometric testing. The age of the participants ranged between 25 to 75 years with a mean age of 48.8 ± 11.97 years and most (30.2%) of the participants were in the 41-50 years age group. There was a male predominance with a male to female ratio of 1.16:1. This was similar to a study done by Sun –Myoungkang et al (2018)(28)in Korea with a study population size (n=22)which also reported a similar mean age (49.9 ± 11.7 years) (26). Another study by Balasubramanian et al (2018)(13) in India to patients undergoing hemodialysis reported a mean age of 48.5 years and a male predominance similar to our study. Similar study in India by RavinderSharma et al(8) showed the mean age 36.84 with chronic renal failure different from our study. Also another study done by AkeemO.Lasisi et al (2006)(3) in Nigeria on the effect of hemodialysis on the hearing function of patients with chronic renal failure who have completed three sessions showed , the mean age of $45.30(SD 16.20)$.The difference in the mean age in our study compared to others, may be due to the population structure between developed and developing countries whereby

in developed country the disease presents earlier compared to developing country. Also life style , environmental and unknown factors may contribute to this age discrepancy.

The peak age was 41-50 years both for male and female, while least age group affected was 21-30 and above 60 years. This presentation is similar to other studies done on chronic kidney disease with hearing loss post hemodialysis(8)(13).A similar study done by Al maliki et al (2018) in Iraq with same peak age of(30-50) aimed at determining the effect of hemodialysis on the hearing threshold in patient with chronic renal failure found male predominance and there were no significant relation was found between age and sex(27).A study done in Northern Tanzania by J.egger et al (2015) showed the same peak age group Among a randomly-selected, community-based sample in Northern Tanzania, observed a high prevalence of CKD in the context of concomitant NCDs; however, NCDs accounted for only a modest proportion of the significantly higher prevalence of CKD among urban residents compared to their rural counterparts(14)(29).

Furthermore among the study participants, 24.5% had hearing loss of which all of them (100%) were bilateral and of the sensorineural type with approximately twice the number of males as compared to females (M:F = 1.89:1).Comparatively, a study done in Ghana the prevalence rates of hearing loss among CKD patients were ranging from 28 to 67%(30).This is similar to another study done by R.rahman et al and Balasubramanian et al in India which found sensorineural type and bilateral hearing loss. However, there were difference in prevalence whereby that of India was 42%,this difference can be due to small sample size and geographical distribution and others unknown factors as compared to our study(11)(13).Similar study done in India as well by Gautam et al (2011)on hearing evaluation in patients with CKD comparing with duration of hemodialysis and diseases sensorineural was present in majority of the patients hearing worsening as the duration of diseases increases(8)(4).Another similar study done in Ghana projected rise in the prevalence of hearing loss in CKD and in sub-Saharan Africa due to rise in conditions such as diabetes and hypertension.The aetiopathogenetic mechanisms reported included osmotic alteration resulting in loss of hair cells, collapse of the endolymphatic space, oedema and atrophy of specialized

auditory cells and in some, complications of hemodialysis have been hypothesized . The role of hemodialysis in the causation of sensorineural hearing loss (SHL) is controversial; some authors have reported a depression in hearing threshold after hemodialysis while others are of the opinion that there was no relation between the two(3)(31).The prevalence of 24.5% in our study can be due to other cofounding factor like diabetesmellitus,hypertension, ototoxicity,HIV and autoimmune diseases.

Severity of hearing loss among the 26 patients who had hearing loss, 61.5% had mild hearing loss while 38.5% had moderate hearing loss.Among patients with hearing loss, mild hearing loss was more prevalent across all age groups except for those who were above 60 years in whom majority (75%) had moderate hearing loss similar to other studies. However, this difference in proportion was statistically insignificant.In a study done by E.Bendo et al in Greece on hearing evaluation in patients with CKD, all patients had SNHL of mild to moderate and some had severe hearing loss of high frequency range, which was bilateral and symmetrical. However moderate hearing loss was observed more above 60 years who have completed three sessions of hemodialysis of which the incidence and degree of hearing loss increased with the number of hemodialysis as compared to our study(9).Another similar study done by Haider k saeed et al(2018) in Iraq on sensorineural hearing loss in patient with chronic renal failure on hemodialysis found same finding mild to moderate hearing loss and there were no significant relation was found between age group however severity increases with increase of age and duration of hemodialysis (21).Similar study in Ghana done by J.Boateng et al(2019) on hearing impairment among chronic kidney disease patients on hemodialysis at tertiary hospital in Ghana, only sensorineural hearing loss was identified among the cases and no significant association was observed between hearing loss and duration of Chronic kidney disease , age and sex in patients with hearing loss , with respect to duration of Chronic kidney disease and degree of hearing loss was similar to our study(30).

More over among male patients with hearing loss, majority (70.6%) of them had mild hearing loss compared to female patients with hearing loss in whom moderate hearing loss was common (55.6%). However, this difference in proportion was statistically insignificant.

Duration of hemodialysis has been mentioned in association with hearing loss .In our study majority of the patients recruited to this study (52.8%) had undergone dialysis for a period of less than one month with the least (12.26%) having a duration of more than 6 months.Majority of the patients with hearing loss (n=26) had undergone dialysis for less than one month (61.5%), with 75% of this group having mild hearing loss. Majority of patients with over one month duration of dialysis had moderate hearing loss 57.2% and 66.7% for 1-6 months and more than 6 months respectively. The difference in these groups was however not statistically significant with a p value of 0.163.This is similar to a study done by Aliasgharpeyvandi et al done India(2012) about hearing loss in CKD to patients undergoing hemodialysis found hearing loss increases by severity with prolonged duration of hemodialysis.This is due to accumulation of uremic toxins and prolonged hemodialysis will affect almost every tissue, including auditory system .Also in Chronic dialysis results to accumulation amyloid materials in many tissues including inner ear Aluminum toxicity that is seen in chronic dialysis patients also may have a role in hearing loss(32)(22).

Furthermore another study done in India (2016)by RezwanurRahman and Nayareen et al similar to our study found that hearing loss is more prevalent in patients who are getting hemodialysis for < 1 months (52%) compared to those who are getting hemodialysis between 1-6 months (24%) and > 6months (24%). Our finding that hearing loss is more prevalent in patients who are getting hemodialysis for < 1 months (52%) is interesting as it suggests a possible beneficial association between increasing number of dialysis sessions and hearing loss(11).

In our study we found most of the patients with hearing loss (61.5%) had normal diastolic blood pressure. Amongst those with stage II hypertension, most (55.6%) had mild hearing loss but this was not statistically significant with a p value of 0.502.Based on our finding and a similar study by Akeem et al and other studies the role of hypertension as the confounding factor which leads to CKD and ultimately hearing loss as a complication , there was however, no significant correlation between post hemodialysis and change in diastolic blood pressure(8)(33).

It has been evidenced from various studies that the prevalence as high as 28% to 79% of patient CKD are suffering from other conditions like hypertension, Diabetic mellitus, Autoimmune diseases, and HIV. This study found association between hearing loss post hemodialysis and other comorbid like diabetes mellitus and hypertension(25)(34)(26). In our study most of the patients with hearing loss(n=26) had Hypertension and Diabetes Mellitus (46.2%), with majority in this group having moderate hearing loss (58.3%). All patients with HIV and Diabetes mellitus only had mild hearing loss while those with Hypertension only, majority(60%) had moderate hearing loss. The difference in severity of hearing loss amongst the comorbidities is statistically significant with a p value of 0.032. This can be explained as cochlea and kidney have similar physiological mechanism, namely active transport of fluid and electrolytes achieved by the striavascularis in the cochlea and grumeruli in the kidney. It was previously confirmed that the cochlea is affected by the systemic metabolic, hydroelectrolytic and hormonal alterations that are associated with CKD(4)(22).

CHAPTER SIX

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusion of the study.

1: Hearing loss in CKD patients undergoing hemodialysis is prevalent among patients attending dialysis unit at Muhimbili National Hospital.

2:The most patternof hearing loss is sensorineural, bilateral, and mild to moderate hearing threshold.

3:Diabetes mellitus and hypertension were common cormorbid diseases associated with hearing loss in CKD.

6.2 Recommendations

1:Findingsrevealed that most of the CKD on hemodialysis patients were diagnosed late stage where the disease has already developed with complication. Therefore, this study recommends that general public should be educated on the importance of regular check- ups so that and be aware of their health status. This may help specifically the CKD Patients to be diagnosed in the early stage and take appropriate measures to prevent the complications.

2: All patients with symptoms related to CKD should be evaluated to ensure early diagnosis and treatment of hearing loss and audiological test during hemodialysis.

3:Communityawareness campaign should be conducted to educate on clinical presentation and risk factors for early health seekingbehavior.

4:Future studies should focus on hearing loss before and after hemodialysis in CKD patients undergoing hemodialysis, considering duration of diseases and other co-morbid conditions and factors that might be associated with hearing loss to establish the cause and effects so as the patients can attend earlier ENT clinics.

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Appendices

Appendix 2: Work plan

Activity	November 2018 to March 2019	April- May 2019	June to December 2019	January to March 2020	April-June 2020
Proposal development and Ethical Clearance					
Data collection					
Data processing					
Data analysis					
Report writing and submission					

Appendix 3: Questionnaire (English version)

Title: Hearing loss among patients undergoing hemodialysis at Muhimbili National Hospital

A. DEMOGRAPHIC DATA

PTID	
AGE	
SEX	<input type="checkbox"/> Male <input type="checkbox"/> Female
RESIDENTIAL AREA	
OCCUPATION	

B. CLINICAL DATA

CLINICAL	RESPONSE
Do you experience any Hearing Loss?	<input type="checkbox"/> Yes <input type="checkbox"/> No If YES please indicate for how Long _____
Are you diabetic	<input type="checkbox"/> Yes <input type="checkbox"/> No
Are you Hypertensive?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Do you have any known Renal Disease?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Current Blood Pressure	(Indicate)_____

C-1 LABORATORY FINDINGS

Parameter	Result
Hemoglobin	
Serum Urea	
Serum Creatinine	

Electrolytes	[Sodium] _____ [Potassium] _____ [Others] Indicate _____
--------------	----------------------------------------------------------------

C-2 MEDICATION

[Please indicate the medication taken by the patient and the respective dosage as instructed]

Medication	Dosage

D. AUDIOLOGICAL FINDINGS

After Dialysis	Audiological Findings	Type of Hearing Loss	Conclusion [Please indicate the type of Hearing Loss]	Lateralization
Before Hemodialysis	Pitch _____ [Hz] Loudness _____ [dB]	<input type="checkbox"/> Normal [<20dB] <input type="checkbox"/> Mild Hearing Loss [20-40 dB] <input type="checkbox"/> Moderate Hearing Loss [40-55dB] <input type="checkbox"/> Moderate severe hearing Loss [55-70 dB] <input type="checkbox"/> Severe Hearing Loss [70-90 dB] <input type="checkbox"/> Profound Hearing Loss [90-120 dB]	_____ _____ _____	<input type="checkbox"/> Unilateral <input type="checkbox"/> Bilateral
After Hemodialysis	Pitch _____ [Hz] Loudness _____ [dB]	<input type="checkbox"/> Normal [<20dB] <input type="checkbox"/> Mild Hearing Loss [20-40 dB] <input type="checkbox"/> Moderate Hearing Loss [40-55dB] <input type="checkbox"/> Moderate severe hearing Loss [55-70 dB] <input type="checkbox"/> Severe Hearing Loss [70-90 dB] <input type="checkbox"/> Profound Hearing Loss [90-120 dB]	_____ _____ _____	<input type="checkbox"/> Unilateral <input type="checkbox"/> Bilateral

Appendix 4: Informed Consent Form (English version)

Serial Number.....

Title: Hearing loss among patients undergoing hemodialysis at Muhimbili National Hospital

To the Patients/Parents/Guardians

Foreword

Greetings! I am Dr. Aron Kiberiti working on this research project with the aim of determining the hearing loss among patients undergoing hemodialysis at Muhimbili National Hospital.

Purpose of the Study

This study aims on seeking the patterns of hearing loss in patients undergoing hemodialysis attending Muhimbili National Hospital. We need to know this information so that we can be able to understand the magnitude of this condition in this country and educate patients and society at large to get familiarized with the associated symptoms for early health seeking. The result of this study will also help the government planning the better interventions for this condition through our recommendations so kindly be honest and free to participate.

How to participate

The interviewer will be asking you questions while he/she will be completing a questionnaire. The next procedure will be ENT examination and later the patient will be sent for hemodialysis and the ENT examination will be repeated again.

Risks

We do not expect any harm during the course of your participation. The ENT examination might make you feel uncomfortable but we will make sure it is done under greater observation.

Confidentiality

We would like to assure you that all the information that you will provide will remain confidential and will be used for research purpose only. No one will be allowed to see or go through your answers except the principal investigator only.

Right to withdraw and alternatives

Taking part in this study is purely voluntary. You can stop participating at any time even if you have already given your consent. Refusal to participate or withdrawal will neither affect the quality of your treatment nor involve a penalty.

Person to contact in case of questions or any clarifications regarding this research:

Dr. Aron Alex Kiberiti, Principal Investigator

P.O.Boxxxx Dar Es Salaam,

Phone: +255766 656 935

E-mail: xxx,

OR

Directorate of Research and Publication,

Muhimbili University of Health and Allied Sciences,

P.O.Box 65001,

Phone +255685217272

Consent

I have read/read to me, and understood the explanation of the study. I accept to participate in the study.

Name and Signature/thumb print (if the patient is illiterate on semi or unconcious) of the patient/parent/legal guardian: _____.

Name and signature of a witness ifthe patient is illiterate on semi or unconcious

Name and siganture of the Investigator: _____

Date.....