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DEPARTMENT OF INTERNAL MEDICINE, SCHOOL OF MEDICINE, COLLEGE OF HEALTH SCIENCES

ADDIS ABABA UNIVERSITY

CLINICAL CHARACTERSTICS AND OUTCOMES OFPATIENTS WITHDIAYLISIS REQUIRING ACUTE KIDNEY INJURY AT THE TIKUR ANBESSA SPECIALIZED HOSPITAL

A research project submitted to the department of internal medicine, school of medicine, college of health sciences, Addis Ababa University, for partial fulfillment of internal medicine specialty certificate

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November, 2019

ADDIS ABABA, ETHIOPIA

CLINICAL CHARACTERSTICS AND OUTCOMES OF PATIENTS WITHDIAYLISIS REQUIRING AKI AT THE TIKUR ANBESSA SPECIALIZED HOSPITAL

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November, 2019

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ACRONYMS

AAU	Addis Ababa University
AKI	Acute Kidney Injury
AKI-D	Dialysis requiring AKI
AGN	Acute Glomerulonephritis
ARF	Acute Renal Failure
ANA	Antinuclear antibody
BUN	Blood urea nitrogen
CI	Confidence Interval
CKD	Chronic Kidney Disease
CHF	Congestive Heart Failure
CLD	Chronic Liver Disease
COR	Coefficient of Odds Ratio
Cr	Creatinine
ESDR	End stage renal disease
GFR	Glomerular filtration rate
GN	glomerulonephritis
HD	hemodialysis

Hgb	Hemoglobin
HPF	High power field
ICU	Intensive Care Unit
K	potassium
Na	Sodium
OUP	Obstructive Uropathy
RBC	Red blood cells
RRT	Renal Replacement Therapy
SPSS	Statistical Package for Social Science Study
SPHMMC	Saint Paul Hospital Millennium Medical Colleague
TASH	Tikur Anbessa Specialized Hospital
U/A	urinalysis
UOP	Urine out put
WBC	White blood cells

Abstract

Background:

Acute kidney injury (AKI) in developing countries is the disease of the young and children while developed countries elderly patients with co morbid conditions predominate. The management of patients with acute kidney injury (AKI) is supportive, with renal replacement therapy (RRT) indicated in patients with severe kidney injury.

Even though, government run dialysis service is given in few centers in Ethiopia, data on epidemiological and clinical characteristics of dialysis requiring AKI patients and its outcome is sparse.

Objectives:

The objective of this study is to describe socio-demographic, clinical characteristics of patients with dialysis requiring AKI and their renal and hospital outcome at Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia.

Methods:

The study is an institution based retrospective chart review of patients with AKI who were hospitalized and had hemodialysis inTikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia from July 14, 2016 to September 2019. Data on socio-demographic characteristics, clinical profiles, and dialysis and hospital outcomes were collected using a structured questionnaire. Data entry and analysis was done on (SPSS) version 20. Frequency tables and odds ratio was used to explain and analyze the results. Factors found to be significantly associated with mortality on bivariate analysis (P-value< 0.05) were analyzed with a multivariate model using logistic regression to determine the predictors of in-hospital mortality. P values less than 0.05 were considered statistically significant.

Result

A total 275 patients underwent hemodialyis during the period, of which 130 patients, 71 females (54.6%) and 59 males(45.6%), with a median age of 34 were included in the study. The most common causes of AKI were sepsis (33.8%), glomerulonephritis(31.5%) and pregnancy related

causes (16.2%). A quarter of the patients (25.4%) did require ICU admission. The in hospital mortality was 26.2%. Sepsis, co morbid heart failure and age above 50 year were associated with increased mortality. In 12(9.2%) patients' glomerulonephritis as a cause of AKI increased the risk of dialysis requirement beyond 4 weeks.

<u>Conclusion</u>

In this setting the majority of patients with dialysis requiring AKI are young. We have observed a shift in the etiology of dialysis requiring AKI in the last two decades; from Malaria and septic abortion predominated to sepsis and glomerulonephritis.

Key words: Acute kidney injury, dialysis requiring AKI, AKI-D, Ethiopia

INTRODUCTION

1.1. BACKGROUND

Acute kidney injury (AKI) is defined as an abrupt decrease in kidney function occurring over 7 days or less (1). It is recognized that the epidemiology of AKI in developing countries differs from that of the developed world in many important ways .In developed regions elderly patients predominate while in developing countries, AKI is a disease of the young and children in whom volume-responsive “pre-renal” mechanisms and infectious causes are common.(2,3)

The management of patients with acute kidney injury (AKI) is supportive, with renal replacement therapy (RRT) indicated in patients with severe kidney injury. Most patients with ARF do not require renal replacement therapy (RRT). The decision to start RRT is made on an individual basis when a number of physiological parameters are considered in association with each other, and therefore is instituted at differing levels of glomerular filtration rate, uremia and urine output.

AKI increases the risk for the development or worsening of chronic kidney disease. Patients who survive and recover from an episode of severe AKI requiring dialysis are at increased risk for the later development of dialysis-requiring end-stage kidney disease.

Though it was not sustainable, hemodialysis was started in Ethiopia in June, 1981 at TASH. By then among adults with AKI, septic abortion and falciparum malaria were the leading causes of AKI and majority were dialysis requiring.(4)

There had not been a sustainable government run dialysis service in Ethiopia until the establishment of the Ethio-Egyptian Hemodialysis Unit in August of 2013 at SPHMMC. TASH is the second of its type to give 4week government run dialysis service for patients with presumed AKI.

1.2. Statement of the problem.

AKI in developing countries is the disease of the young and children while in developed countries elderly patients with co morbid conditions predominate. The management of patients with acute kidney injury (AKI) is supportive, with renal replacement therapy (RRT) indicated in patients with severe kidney injury. Despite intervention with RRT mortality is high and a number of AKI survivors will progress to CKD. Given adverse outcomes with progressive CKD, as well as the morbidity, mortality, and cost associated with ESRD, strategies that mitigate the progression of CKD after AKI and preventable causes of AKI should be a public health priority.

Therefore, dialysis requiring AKI is one of the important issues in Africa particularly Ethiopia where there is resource limitation at large and appreciation of its local pattern, causes and associated risk factors and outcomes of dialysis can help inform policy makers on its early prevention and management, and expansion of the service.

Even though, government run dialysis service is given in few centers in Ethiopia, epidemiological and clinical characteristics of dialysis requiring AKI patients and their outcome is sparse.

This study will assist in identifying epidemiological and clinical characteristics of dialysis requiring AKI patients and factors associated with their dialysis and hospital outcome which require due attention for better outcome of patients.

1.3 Significance of the study

The success of this research study will help the community at large and health personnel in partic ular to gain general understanding about the epidemiological and clinical pattern as well as outco mes of patients with dialysis requiring AKI in Tikur Anbessa Specialized Hospital. This will allo w for effective and timely measures towards the etiologies of dialysis requiring AKI and optimaz tion of dialysis services.

2. LITERATURE REVIEW

Acute kidney injury (AKI) is estimated to occur in about 20-200 per million population in the community, 7-18% of patients in hospital, and approximately 50% of patients admitted to the intensive care unit (ICU)(5,6). Importantly, AKI is associated with morbidity and mortality; an

estimated 2 million people worldwide die of AKI every year, whereas AKI survivors are at increased risk of developing chronic kidney disease (CKD) and end-stage renal disease (ESRD) conditions that carry a high economic, societal and personal burden.(7,8)

In a systematic review that included 154 studies and >3.5 million patients, among hospitalized patients, according to KIDGO definition, pooled incidence of AKI was 21.6% in adults, the equivalent of one in five hospitalized patients (9). In Nigeria teaching hospital, Out of the 121 cases of AKI, 62 (51.2%) received renal replacement therapy in the form of intermittent hemodialysis as part of their management. The hospital prevalence of dialysis-treated AKI was 1% of medical admissions, 8.4% of all kidney failure cases, and 51.2% of AKI patients (10).

In Ethiopia the exact incidence of AKI is not known. In a rural based hospital study from the group of patients who had a measurement of renal function the prevalence of AKI was approaching 20%. This may not be a true estimation of the actual prevalence given the large percentage of patient in whom renal function was not assessed and above all it is a single center based study(11). There are few studies on dialysis requiring AKI, a retrospective study a total of 151 cases and a prospective study on 136 AKI patients out of which 86% were dialysis requiring.(4,12)

Patients with AKI in developing countries are younger and healthier than patients with AKI from developed countries, who are older and have multiple co-morbid conditions (2,3,13). This also works for dialysis requiring AKI as described with mean age of 36.7 year and median age 38 year in Ethiopian and Rwandan studies respectively.(12,14) Most of the studies mentioned higher proportion of male unlike studies from our country where female took equal or higher proportion .(3,4,12)

Co morbid condition such as Hypertension, diabetes mellitus, CKD, HIV, malignancy, CHF, myocardial infarction, cerebrovascular diseases and connective tissue diseases were described as predictors of outcome which are part of Charlson Co morbidity Index.(15) These co morbid conditions were also mentioned in other sub-Saharan African studies though their impact on outcomes were not assessed.(12,16)

A systematic review on outcome of acute kidney injury in adults and children of sub-Saharan African countries oligouria(73.02%), hyperkalemia(28.6%) and metabolic acidosis(42.2%) were

indicated as common clinical presentation in adult patients. On the other hand studies from our country described oliguria (86.1 %), followed by edema (58.9 %) and encephalopathy (49 %) as common presenting features. (4,12)

In contrast to results from an ICU center in Morocco and that of three health boards in Scotland which has found refractory hyperkalemia, followed by metabolic acidosis, as the most common indication for dialysis uremic sign and symptoms and refractory fluid overload were described in dialysis center experience study from Ethiopia and Rwanda(12,14,17,18). Lack of blood gas analysis was described as limitation.(12)

In studies done among dialysis requiring AKI patients infectious causes (mainly sepsis and malaria), pregnancy related conditions, hypovoluemia and acute glomeruloneephritis were described as common causes in sub-Saharan Africa studies.(3,4,10,12,14)In one of the studies, the diagnosis of AGN was made clinically based on acute onset of oliguria followed by body swelling, with new onset of hypertension, glomerular hematuria and proteniuria.(12) Obstructive uropathy as cause of AKI was mentioned in some of them. (16,3)

It is recognized that it is frequently not possible to determine the cause, and often the exact cause does not dictate a specific therapy. However, the syndrome of AKI includes some patients with specific kidney diseases for which a specific treatment is available (1,19).

In developed countries renal recovery after AKI-D, is defined as RRT independence within 90 days after RRT initiation and survival for >4 weeks after RRT discontinuation.(20) In contrast in sub-Saharan countries renal recovery, defined as independence from dialysis, improvement in serum creatinine after acute kidney injury, or both, was reported in 17 studies of a systematic review. The pooled rate of renal recovery was 130 (55%) of 237 (six studies) in adult survivors and 667 (75%) of 886 (11 studies) in child survivors. The pooled rate of residual chronic kidney disease, defined as persistence of renal dysfunction but not needing dialysis at time of discharge, was 24 (13%) of 186 adults (three studies) and 68 (10%) of 676 children (five studies). These outcomes were not routinely reported or systematically defined, and some studies had substantial loss to follow-up, so the true rates remain unknown.(3) Although many patients with AKI recover kidney function sufficiently to be independent of RRT, discontinuation of RRT in AKI has received little attention in the literature. The mean duration of RRT in two recent large RCTs

was 12-13 days. (21, 22) Thus, daily assessment of both intrinsic kidney function and the ongoing appropriateness of RRT consistent with the goals of therapy for the patient are required. More than 50% of patients with severe AKI will not improve, despite appropriate therapy.(1)

Worldwide, AKI-related mortality is estimated at 21% and can be as high as 45% in stage 3 AKI patients(23). While 2 studies from Africa on dialysis requiring AKI indicated mortality of 29% and 34%.(12,14) In addition systematic review on outcome of AKI in sub-Saharan countries described a pooled mortality in those who received dialysis as 30% in adults.(3)The lower dialysis mortality in sub-Saharan Africa compared with elsewhere might reflect the relative absence of patient co morbidities and more frequent community-acquired acute kidney injury. Frequent premature discontinuation of dialysis because of cost and assessment of in hospital mortality only were indicated for the lower overall mortality rate.(3,10,12,14) Recent findings suggest that the association between AKI and mortality is likely influenced by several factors including the presence of underlying CKD, the duration and severity of AKI, and the degree of recovery of kidney function. (24)

A multicenter, prospective cohort study evaluated the natural history and predictors of mortality in 618 critically ill patients with AKI, 64 percent of who required renal replacement therapy (RRT). Multivariable logistic regression analysis revealed that; age, sepsis, adult respiratory distress syndrome, liver failure, thrombocytopenia, blood urea nitrogen (BUN), serum creatinine were predictors of mortality at 60 days. (25)

An understanding of the clinical characteristics that appear to most strongly affect mortality among patients with AKI may help direct supportive care to those most likely to benefit. A variety of factors have been associated with increased mortality, including male sex, race, older age, oliguria, cardiovascular and cerebrovascular events, overall severity of illness, and quality of life after recovery from AKI. (25-27)

3. OBJECTIVES

3.1. General objective

The purpose of this study is to describe the socio-demographic characteristics, clinical profiles and outcome of patients with dialysis requiring AKI(AKI-D patients) in TASH, Addis Ababa, Ethiopia, from July 14,2016 to September,2019.

3.2 Specific objectives

- To describe socio-demographic characteristics
- To describe the aetiologies of AKI in AKI-D patients
- To assess the hospital outcomes of AKI-D patients
- To evaluate the renal outcome of AKI-D patients
- To assess the ICU related outcome of AKI-D patients admitted to ICU.

4. METHODS

4.1 Study area

It was conducted in Tikur Anbessa Hospital, Addis Ababa, Ethiopia. Tikur Anbessa is the largest,~800-bed, teaching hospital for Addis Ababa University, School of Medicine in Ethiopia which is visited by many patients a year. Currently it has 3 nephrologists and 1 fellow of nephrology. It is tertiary center for patients from all walks of life and from all over the country.

4.2 Study design

A retrospective study of medical records of patients with dialysis requiring AKI at TASH

4.3Study Period

This study was conducted on patients hospitalized from July 14, 2016 to September 2019.

4.4 Source Population

The source population included all patients who received hemodialysis service in TikurAnbessa Specialized Hospital, Addis Ababa, Ethiopia, from July 14, 2016 to September 2019.

4.5 Study Population

The study population consisted of patients who took hemodialysis for dialysis requiring AKI in TikurAnbessa Specialized Hospital

4.6Eligibility criteria

4.6.1 Inclusion criteria

- Age > or = 13
- Diagnosis of AKI made by attending nephrologists or renal fellow.

- Took haemodialysis for at least one session.

4.6.2 Exclusion criteria

- patients <13 years old
- ESRD
- Dialysis for overdose of dialyzable drugs
- Unavailable or missing data

4.7 Sample size determination and Sampling strategy

Using convenient time sampling medical records of all patients with AKI that were dialyzed that At TASH from July14, 2016 to September 2019 was included in the study

4.8 Study variables

Dependent variable

- renal outcomes
- hospital outcome

Independent variables

- Age
- Gender
- Residence
- Clinical setting
- Co-morbidities
- Laboratory values
- Clinical diagnosis
- indications for dialysis

4.9 Operational definitions

- AKI-D:

  A patient who has been diagnosed to have AKI using the KDIGO criteria and received at least one session of hemodialysis after a nephrologist's decision.

- Baseline laboratory data: is the last laboratory data recorded before the first session of dialysis.

- Aetiology of AKI: the cause of AKI documented in the medical record of a patient as decided by the managing team based on clinical, laboratory and imaging evidence.

- Absconder: defined as someone who went against medical advice.

- Outcome

  Renal outcome

  i. Recovery: a nephrologist has decided that the patient no longer requires dialysis support, based on assessment of urine output and biochemical data with 4 weeks of imitation.

  ii. No recovery: A nephrologist has decided that there is not sufficient kidney function recovery to discontinue dialysis within 4 weeks and the patient needs to continue dialysis beyond the 4 weeks period.

  Hospital outcome

  i. Death: A death certificate signed by a physician is attached to the medical records of a patient.

  ii. Discharge: A documented discharge summary in the medical records of a patient indicating the patient is discharged alive irrespective of the renal or other clinical outcomes.

4.10 Study tool

Structured questionnaire was used, to reach the objectives. It was developed and adapted from other related research in a way that will address the objectives of the study.

4.11Data quality management

Questionnaire was prepared in English version adopted and modified from different literatures was used to collect data from patient charts. Patient medical record number was taken from HMIS books and was given to chart room staffs to get patient charts. The data was collected by medical residents. Information on variables such as demographic characteristics, clinical profile, laboratory values and dialysis and hospital outcome was collected. Continuous follow up and supervision was done by the advisor. In order to check if the questionnaire is clear and addressing the objective, questionnaire was pre-tested on a 5% of samples. The collected data was checked for completeness before execution of any data entry process.

4.12 Data management and Statistical analysis

SPSS 20 was used for data processing. The different aspects of the analysis such as Frequencies and percentage of different variables was computed for description. Binary logistic regression and odds ratio was done for associated factors. P-values of less than 0.05 and confidence level of 95% by two sided test is considered to indicate statistical significance.

4.13 Ethical consideration

An ethical clearance was obtained from the department of internal medicine Research committee & IRB of the college of health sciences. The study was started following endorsement by the IRB. As the study was conducted by reviewing individual patient's document, data was collected anonymously and was kept confidential. No personal identifiers were used on the data collection form.

5. Result

5.1 Selection and enrollment

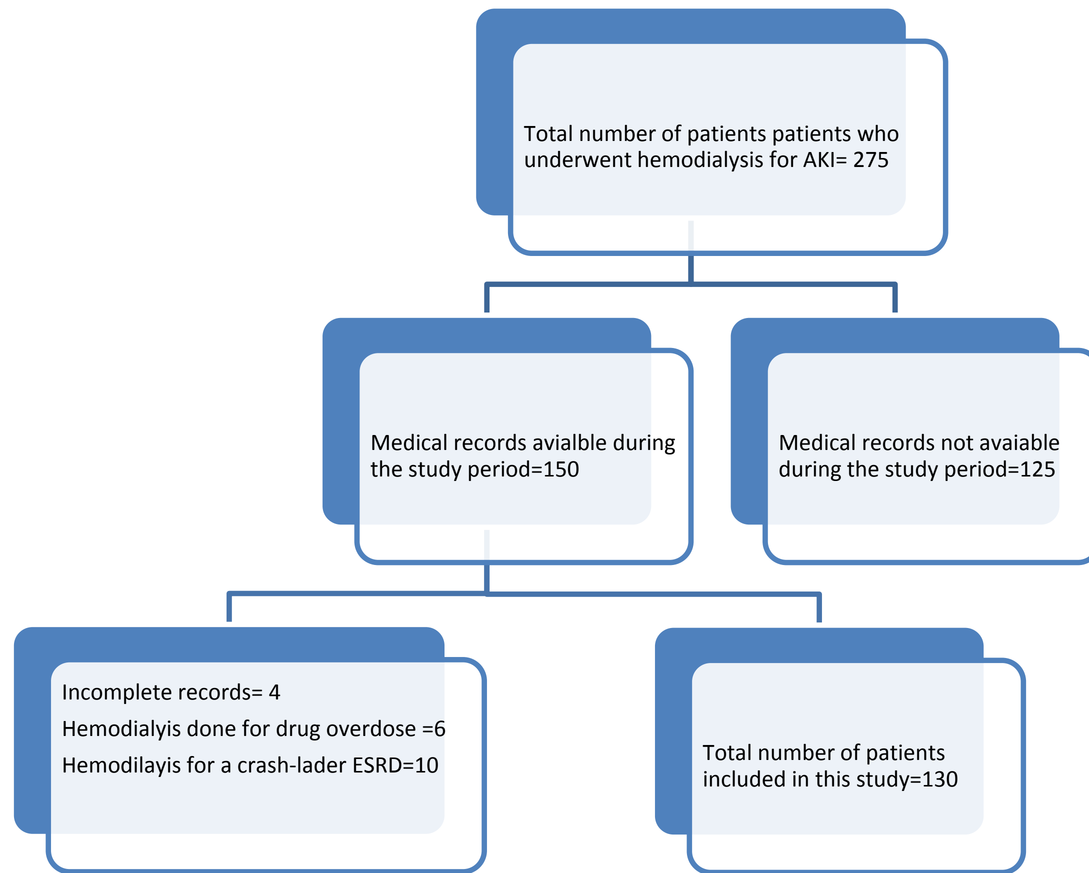

Figure 1 selection and enrollments

5.2Socio-demographic characteristics

Over the study period a total 275 patients underwent hemodialysis for different indications. Among these, a total of 130 adult patient records were included in the study. Patients who were dialyzed for drug overdose (6 patients for phenobarbital overdose), who had incomplete medical records or missing , with ESRD dialyzed for life threatening conditions till transferred to chronic dialysis centers which are private-owned(10 patients) and under the age of 13 were excluded from the study.

Male to female ratio is comparable (1:1.2) with slight female predominance (54.6%) which is attributed to pregnancy and related conditions.

The majority of patients were under the age of 50 years with the age group of 20-29 years housing the largest proportion. Median age of the study AKI-D cases was 34 year (IQR 25-50).

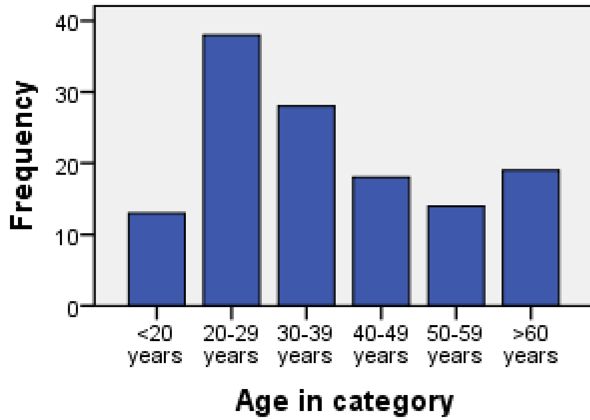

Figure 2 age distribution

About 70% of patients came from many corners of the country with almost a third (30%) coming from the capital city Addis Ababa where TASH nephrology unit is located.

The majority of the study participants were admitted to the medical wards, 81(62.3%). About a quarter of patients were admitted to ICU 33(25.4%), mechanical ventilation support were provided to 24 (18.5%) and vasopressor support 17(13.1%)

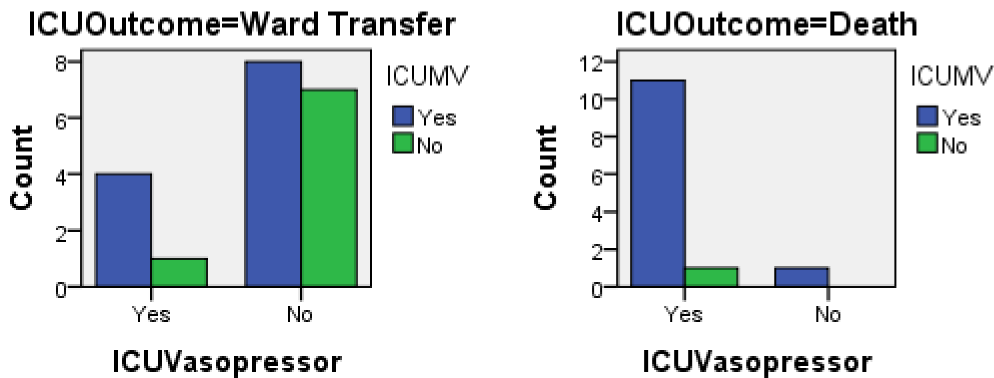

Figure 3 ICU supportive care

Table 1 socio-demographic characteristics of patients

Variables		Frequency	Percentage (%)
Gender	Male	59	45.4
	Female	71	54.6
Age	<50 years	97	74.6
	>/=50 years	33	25.4
Region	Addis Ababa	39	30
	Afar	1	0.8
	Amhara	21	16.2
	Gambella	1	0.8
	Oromia	49	37.7
	SNNPR	17	13.1
	Somali	2	1.5
Clinical Setting	Ward	97	74.6
	ICU	33	25.4

5.3 Clinical characteristics

Co morbid conditions

The most common co morbid condition identified was CKD (24.2%). Other co morbid conditions identified were Diabetes (9.2%), malignancy (9.2%), Heart failure (11.5%), liver disease (2.3%) and HIV infection (4.6%).

Table 2. Co morbid conditions

Co morbid conditions	CKD	32	24.2
	CHF	15	11.5
	AIDS	6	4.6
	Malignancy	12	9.2
	DM	12	9.2
	CLD	3	2.3

Causes of AKI

The commonest causes of AKI were sepsis (33.8%); followed by glomerulonephritis(31.5%); pregnancy related causes (16.2%), Hypovolemia (9.2%) either gastrointestinal loss (in the form of diarrhea or vomiting)or blood loss and obstructive uropathy (10.8%)

Other causes include malaria (2.3%), malignant hypertension (3.1%), nephrotoxic drugs (3.1%), interstitial nephritis (3.1%) and tumor lysis syndrome (1.5%).

Baseline laboratory profiles

The mean pre-dialysis creatinine was 10.9(SD+/- 5.88)mg/dl and the urea was 219.65(SD +/- 93.18). Hyperkalmia (serum potassium ≥5.5mmo/l) was found in 42.3% of the patients. Urine dipstick protein of +1 and higher was seen in 75.4% of patients.

The median creatinine value was 9.3 mg/dl (IQR: 6.38-14.33) and median urea was 208.5 mg/dl (IQR: 160.25-269.00).

Table 3. Etiology and pre-dialysis laboratory profiles

Variables		Frequency	Percentage (%)
Cause	Sepsis	44	33.8
	GN	41	31.5
	Pregnancy related	21	16.2
	Hypovolemia	12	9.2
	Malaria	3	2.3
	OUP	14	10.8
Lab parameters			
Hgb	<8 g/dl	32	24.6
	8-12 g/dll	75	57.7
	>12 g/dl	22	16.9
WBC	<4,000	4	3.1
	4,000-11,000	41	31.5
	>11.000	85	65.4
Platelet	<100,000	20	15.4
	>/=100,000	107	84.3
Serum Na	<135	60	46.2
	135-145	54	41.5
	>145	15	11.5
Serum K	<3.5	12	9.2
	3.5-5.5	82	47.7

	5.6-6.5	33	25.4
	>6.5	22	16.9
Urine Dipstick Protein	Nil	19	14.6
	+1	24	18.5
	+2	36	27.7
	+3	38	29.2
Hematuria	<5	18	13.8
	>/=5	94	72.3

Table 4 indications for dialysis

	Variables	Frequency	Percentage (%)
Indication	Uremic signs & symptoms	63	48.5
	Refractory fluid overload	39	30
	Hyperkalemia	26	20
	Metabolic acidosis	12	12.3

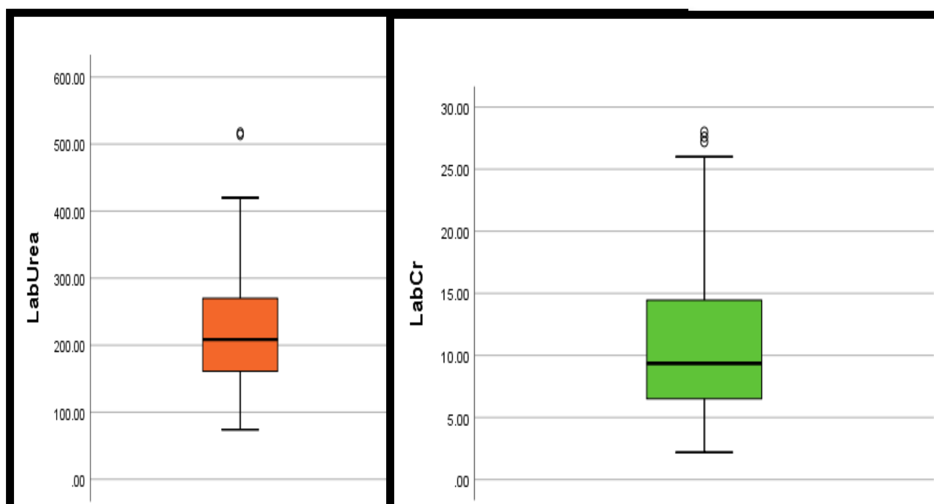

Figure 4 laboratory result, RFT

Dialysis and related complications

The number of dialysis sessions per patient ranged from one to nineteen with an average of 5.4 sessions, and median dialysis session of 4 (IQR: 3-7).The most common indications for dialysis were uremic signs and symptoms(48.5%), followed by refractory fluid overload primarily manifesting as pulmonary edema (30%)and refractory hyperkalemia (20%). Some patients had multiple indications for urgent dialysis.

Though incomplete documentation on complications related to vascular access sites, six patients were diagnosed with catheter site infection and 2 of them had culture growth result. Upon removal of catheter tip pus was documented in one patient. In five patients catheter related thrombosis was documented by Doppler ultrasound.

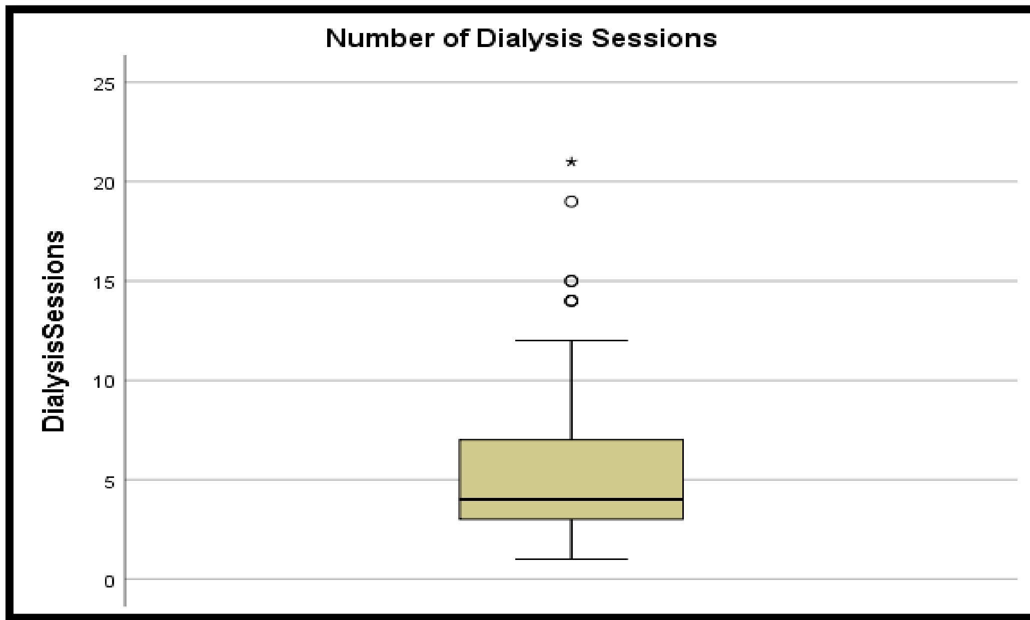

Figure 5number of dialysis Session

Table 5 Outcome table

Variables		Frequency	Percentage (%)
ICU outcome	Transfer to ward	20/33	60.6
	Death	13/33	39.4

Renal Outcome	Renal Recovery	70	53.8
	Dialysis dependent	15	11.5
	Undetermined course	45	34.6
Hospital outcome	Discharge	79	60.8
	Death	34	26.2
	Absconder	17	13.1

5.4 Hospital and dialysis Outcomes

With regard to the hospital outcome, 60.8% of patients were discharged home; in-hospital mortality was 26.2% and 13.1 %(n= 17) of patients absconded treatment.

Among the patients who underwent dialysis 53.8% recovered from their AKI-D and became dialysis free, whereas 11.4% of patients became dialysis dependent beyond 4 weeks.

It was difficult to define the dialysis outcome in 34.6% of patients because of death while on treatment and absconding from treatment.

Among ICU admitted patients, 60.6% were transferred to wards and 39.4% died.

Table 6 Mortality in hospital bivarite analysis

Variables		Frequency	Percentage (%)	P value	COR(95% CI)
Gender	Male	59	45.4	0.018	2.766(1.194-6.406)
	Female	71	54.6		
Age	<50 years	97	74.6		
	>/=50 years	33	25.4	0.001	4.851(1.962-11.990)
Clinical Setting	Ward	97	74.6		
	ICU	33	25.4	0.005	3.488(1.465-8.307)

Co morbid conditions	CKD	32	24.2	0.502	
	Heart failure	15	11.5	0.004	5.625(1.718-18.415)
	AIDS	6	4.6	0.264	
	Malignancy	12	9.2	0.005	0.095(0.019-0.489)
	DM	12	9.2	0.026	4.038
	Liver disease	3	2.3		
Cause	Sepsis	44	33.8	P < 0.00001	7.384(2.992-18.226)
	AGN	41	31.5	0.018	0.282(0.099-0.809)
	Pregnancy related	21	16.2	0.048	0.125(0.016-0.985)
	Hypovolemia	12	9.2	0.156	
	Malaria	3	2.3	0.999	
	OUP	14	10.8	0.126	
Lab parameters					
Hgb	<8 g/dl	32	24.6	0.098	
	8-12 g/dll	75	57.7	0.496	
	>12 g/dl	22	16.9		
WBC	<4,000	4	3.1		
	4,000-11,000	41	31.5		
	>11.000	85	65.4	0.38	
Platelet	<100,000	20	15.4	0.199	
	>/=100,000	107	84.3		
Na	<135	60	46.2	0.902	
	135-145	54	41.5		
	>145	15	11.5		
K	<3.5	12	9.2	0.935	

	3.5-5.5	82	47.7		
	5.6-6.5	33	25.4	0.452	
	>6.5	22	16.9	0.669	
Urine Dipstick Protein	Nil & +1	43	33.1		
	+2 or +3	74	56.9	0.653	
Hematuria	<5	18	13.8		
	>/=5	94	72.3	0.256	0.26(0.077-0.849)

Table 7. Dialysis Outcome bivariate analysis

Variables		Frequency	Percentage (%)	P value	OR(95% CI)
Co morbid conditions	CKD	32	24.2	0.405	
	CHF	15	11.5	0.032	7.846(1.191-51.677)
	AIDS	6	4.6	0.999	
	Malignancy	12	9.2	0.999	
	DM	12	9.2	0.999	
	CLD	3	2.3		
Cause	Sepsis	44	33.8	0.093	
	AGN	41	31.5	0.002	7.0(2.022-24.230)
	Pregnancy related	21	16.2	0.998	
	Hypovolemia	12	9.2	0.999	
	Malaria	3	2.3	0.999	
	OUP	14	10.8	0.999	

Hgb	<8 g/dl	32	24.6	0.677	0.68(0.11-4.18)
	8-12 g/dl	75	57.7	0.936	0.933(0.174-5.009)
	>12 g/dl	22	16.9		

Regression analysis For the analysis of the primary objective factors related to in hospital mortality, patients who abscondnt their treatments were not included. On bivariate analysis, age above 50 (P value 0.001, COR=4.851,95% CI 1.962-11.990), being male(P value =0.018 COR=2.766 95% CI 1.194-6.406), requiring ICU admission(P value 0.005, COR=3.488,95% CI 1.465-8.307), sepsis (P value 0.000014, 95% CI 0.055-0.334),and co morbid CHF(P value 0.004,COR=5.625,95% CI 1.718-18.415) have shown significant association with in-hospital mortality.On multivariate analysis, age above 50 year (P value=0.013;COR=4.06,95%CI(1.34-12.29), sepsis (P value= 0.003, COR-5.2,95% CI(1.78-15.18) and co morbid CHF (P value 0.011; COR-6.99, 95% CI(1.56-31.23) have shown significant association with in-hospital mortality.

Table 8 Multivariate analysis for in hospital mortality

	Sig.	Exp(B) COR	95% C.I.for EXP(B)	
			Lower	Upper
Gender(male)	.118	2.245	.814	6.189
ICU Admitted	.127	2.317	.787	6.821
CHF	.011	6.994	1.566	31.231
Cause Sepsis	.003	5.199	1.780	15.185
Age >50	.013	4.060	1.341	12.297

For secondary objective of dialysis requirement beyond 4 weeks, AGN has shown significant association on bi-variate analysis with P value of 0.002, COR=7, 95% CI 2.022-24.23).

For the analysis of the secondary objectives, patients whose dialysis outcomes were undetermined because of death or absconding treatment were not included in the analysis.

For tertiary objective of ICU outcome, factors associated with mortality in ICU, vasopressor requirement (P=0.002; COR 36, 95% CI (3.692-351.002) and sepsis (P value = 0.045; COR 5, 95% CI(1.040-24.034) have shown significant association with ICU mortality.

6. Discussion

The result from our study showed that acute kidney injury requiring hemodialysis (AKI-D) primarily affected young adults (median age 34 years), a finding that is unlike reports from Western countries where the most frequently affected people is the elderly (2). On the other hand, a study from one our country's dialysis centers reviewing two years' experience showed mean age of 36.7 year and other Sub-Saharan African countries, similar to our findings, that showed AKI-D affects younger individuals with mean age of occurrence being 41.3 year in Nigerian study and median of 38 year in Rwandan study (10,12,14). The young age of AKI-D patients in this study may simply be reflective of the demographics of the Ethiopian population and 12 patients(9.2%),who were under the age of18 years, were included in the study because of the hospital system classifies adults based on age greater than 13 years. Patients aged 50 and above accounted for 23.8% of cases in this study.

As opposed to other African studies including one systematic review which showed male dominance , comparable male to female ratio (1:1.2) with slight female predominance was noticed in our study which is supported by the figure described in SPHMMC study.(3,4,12). This may reflect the impact of pregnancy related conditions (16.2%). The number of dialysis sessions per patient ranged from one to nineteen with an average of 5.4 sessions, which is comparable with studies from other sub-Saharan countries.(10,14)

The most common indications for dialysis were uremic signs and symptoms and refractory fluid overload in this study, which was similar to the dialysis experience study from Rwanda and Ethiopia. These results are in contrast to those from an ICU center in Morocco and that of three health boards in Scotland, which mentioned the most common indications to be refractory

hyperkalemia, followed by metabolic acidosis (17,18). One possible explanation may be the difficulty in accurately diagnosing metabolic acidosis due to lack of blood gas analysis in the Ethiopian setup. (10)

The majority of the study participants were admitted to the medical wards, 81(62.3%) in total, and 16(12.3%) patients were admitted to surgical wards. 33(25.4%) patients were admitted to ICU for supportive care with mechanical ventilation (24 patients), vasopressor (17 patients) and close monitoring. Multiple studies have shown that AKI occurs frequently among hospitalized patients and contributes significantly to increased morbidity and mortality, prolonged hospital stay, and healthcare costs including increased needs for critical care (5,6,7,8)

Understanding the proximate causes of AKI and potentially modifiable etiologies and predictors of outcome continues to be the focus of research (28).

Sepsis, glomerulonephritis and obstetric complications were the leading causes of AKI-D in alignment with other studies from developing countries.(4,10,12,14,)

Pregnancy related conditions associated with severe renal injury requiring renal replacement therapy were attributed for 16.2% AKI-D cases. Pregnancy related AKI is one of the top causes of mortality among young women in low and middle income countries, while the condition is uncommon in the developed world (29).The associated conditions seen were preeclampsia, eclampsia, post partum hemorrhage, puerperal sepsis and septic abortion. In alignment with our findings, previous studies on AKI in sub-Saharan Africa have reported obstetric complications as an important cause of AKI.(29)

Only one case of AKI requiring dialysis related to septic abortion was seen, which was described as one of the leading cause of AKI in previous study in our country done about two decades back described septic abortion attributed to 71 of 136 patients (4). The fact that abortion was partly-legalized based on a number of indications was followed by a substantial decrease in the percentage of septic abortion related acute renal failure in several developing countries.(30)These conditions are frequently a measure of the quality of obstetric care in the locations where they occur, and thereby improving access to and promoting services appropriately, which may have prevented some of these events in our study.

AKI-D due to malaria was documented in 3 of 130 of our patients, which is also much lower than previous study of our country 29 of 136 patients where 86% of the studied patients required dialysis.(4).

Though difficult to accurately diagnose in our setup due to lack of availability of renal biopsy, glomerulonephritis (31.5%), diagnosed through clinical means, was found to be a common cause of AKI requiring dialysis corresponding to previous reports that AGN appears to be higher in developing countries, as evidenced by the high burden in countries like, Nigeria, Turkey and Northern Africa. (10,12,29)

Renal recovery, defined as independence from dialysis, improvement in serum creatinine after acute kidney injury, or both, was reported in 17 studies of a systematic review on an outcome of acute kidney injury in children and adults in sub-Saharan Africa. The pooled rate of renal recovery was 130 (55%) of 237 (six studies) in adult survivors and 667 (75%) of 886 (11 studies) in child survivors (5). This is consistent to our study, renal recovery defined as independence from dialysis, which is in 53.8% of patients.(3)

It is recognized that it is frequently not possible to determine the cause, and often the exact cause does not dictate a specific therapy(1). However, the syndrome of AKI includes some patients with specific kidney diseases for which a specific treatment is available, as AGN was associated significantly with dialysis requirement beyond 4 weeks(P value=0.002; COR 7,(2.02-24.230), the need for specific therapy tailored to the cause comes into view in addition to supportive treatments like dialysis.(19)

Requirement of ICU care in the treatment of AKI-D was found to be significantly associated with in-hospital mortality on bivariate analysis (P value=0.005; COR=3.488, 95%CI(1.465-8.307). Among ICU admitted patients, vasopressor requirement was associated with high in ICU mortality when it was seen on bivariate analysis with ICU outcome. Similar studies showed that in severe septic shock, the need for renal replacement therapy (RRT) contributes to increasing the risk of death from less than 40% in septic shock without AKI, to over 60% in the forms associated with severe AKI requiring (31)

The mortality rate of 26.2 % in our study is much lower than the data from a global meta-analysis of studies done across the globe which has shown a pooled AKI-associated mortality

rate 49.4 % for those requiring dialysis(15) but it is consistent with mortality rate with similar previous study in Sub-Saharan African countries.(3,10,14)

Sepsis, age ≥ 50 year, CHF, ICU admission and male sex has shown association on bivariate analysis with in hospital mortality. Multivariate regression analysis revealed sepsis, age above 50 and co morbid condition CHF significant association with in hospital mortality. Sepsis and old age are shown to be important predictors of outcome in dialysis requiring AKI patients in some prospective studies.(25-27)Sepsis related AKI is common in developing countries and may be attributable to multiple factors including late onset of presentation with infection, poor adherence to treatment protocols, adverse effects of treatments offered, and limited critical care capacity.(3,14)

The lower dialysis mortality in Sub-Saharan Africa compared with elsewhere might reflect the relative absence of patient co morbidities and more frequent community-acquired acute kidney injury, despite frequent premature discontinuation of dialysis because of cost.(32) Thus considering the fact that this study did not assess survival post discharge, it is difficult to predict that all 79 patients who were discharged will have good long term prognosis as research from other parts of the world showed that in AKI, a stable survival rate is not achieved until after 30-60 days post recovery (33)

Furthermore, the fate of 13.8% of patients is unknown as they absconded and were discharged against medical advice and similar to discharged patients who required dialysis beyond 4 weeks. Numbers of patients lost to follow-up or leaving against medical advice were high in other studies also, showing the challenges of patient care and clinical research in sub-Saharan Africa.(3)

7. Conclusion

In this setting the majority of patients with dialysis requiring AKI are young. We have observed a shift in the etiology of dialysis requiring AKI in the last two decades; from Malaria and septic abortion predominated to sepsis and glomerulonephritis**.** Sepsis is a common cause of dialysis requiring AKI which is also associatedwith high in hospital mortality along with CHF as co morbid condition and older age.

8. Recommendation

We recommend the study to be done as prospective and asses post hospital discharge outcome of discharged patients true survival and recovery from AKI. We also recommend another study to asses' pitfalls in the management of patients with sepsis in order to improve outcome of patients.

9. Limitation of the study

Our study had several limitations. Being a retrospective study, quality of data was dependent on accuracy of documentation by patient care providers. The patients in our study may not be reflective of all patients with AKI in our facility as the focus is only on dialysis requiring patients. Furthermore, the etiologies and associated conditions in patients with AKI requiring HD may be different from those who do not require RRT. The diagnosis of AKI might be difficult in some cases because of not having base line creatinine value and as the decision was made by the attending nephrologists' which might not avoid some subjectivity. Our patients, seen at a tertiary facility where more severe cases are referred, may not be representative of those at lower level health facilities within Ethiopia. Failure to asses post hospital outcome because of loss from follow up of many patients and a change in hospital data recording system from manual to computer system created inconvenience to address their outcome as true recovery and survival is also another limitation of the study.

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