

SAINT PAUL'S HOSPITAL MILLENNIUM MEDICAL COLLEGE



ASSESSMENT OF PREVALENCE AND OUTCOMES OF
ACUTE KIDNEY INJURY DUE TO OBSTETRIC REASONS IN
FEMALE PATIENTS ADMITTED TO SAINT PAUL'S
HOSPITAL MILLENNIUM MEDICAL COLLEGE FEMALE
MEDICAL WARD.

BY: SHEWANGZAW HAILU (INTERM)

STUDENT RESEARCH PROJECT SUBMITTED TO THE
DEPARTMENT OF PUBLIC HEALTH, SAINT PAUL'S
HOSPITAL MILLENNIUM MEDICAL COLLEGE IN PARTIAL
FULFILLMENT OF THE REQUIREMENT FOR THE DEGREE IN
DOCTOR OF MEDICINE.

AUGUST, 2018

ADDIS ABABA, ETHIOPIA

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Acknowledgment

First of all I would like to thank GOD. It is my pleasure to express my appreciation and special gratitude to my advisor Dr.Teferi Abegaz (MPH, PhD) and Mr. Anduamilak Gizaw for their support to do this research. I treasure their advices which have contributed a great deal to the success of this paper.

I would like also to thank my friends who help me by giving materials and suggestions to collect data and analyze the study, till writing this paper.

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Acronyms and Abbreviations

AKI- Acute Kidney Injury

ANC- Antenatal Care

A.A- Addis Ababa

APH- Antepartum Hemorrhage

E.C- Ethiopian Calendar

HELLP- Hemolysis Elevated Liver Enzyme and Low Platelet

HMIS- Health Management Information System

ICU- Intensive Care Unit

PPH- Postpartum Hemorrhage

SPSS- Statistical Package for Social Sciences

SPHMMC-Saint Paul's Hospital Millennium Medical College

Abstract

Background: Acute kidney injury is a clinical syndrome characterized by an abrupt decline in glomerular filtration rate sufficient to decrease the elimination of nitrogenous waste products and other uremic toxins (1, 2). Acute kidney injury is one of the most challenging and serious complications of pregnancy resulting in significant maternal morbidity/mortality and fetal loss. AKI in pregnancy bears a high risk of development of bilateral renal cortical necrosis and, consequently, of chronic kidney disease (5).

Objective: to assess the prevalence and describe outcomes of AKI due to obstetric reasons admitted to female medical ward from September 11, 2015- February 8, 2018, SPHMMC, Addis Ababa, Ethiopia.

Methods: in a hospital-based retrospective study, clinical records were reviewed study the prevalence and outcomes of AKI due to obstetric causes admitted to SPHMMC female medical ward from September 11, 2015- February 8, 2018.

Results: a total of 79 patients were having AKI due to obstetric cause out of 1083 female patients in the reproductive age group (7.3%). The mean age in the study population was 27.4 ± 5.9 SD; ranging between 16-45 yrs. Most of them were aged between 26-30 yrs. The patients came with several different clinical presentations; of these decreased urine output is the most common clinical presentation accounting more than three-quarter of the presentations (82%). By far pre-eclampsia /eclampsia was the most common identified cause of AKI presenting about 80% followed by HELLP syndrome. The mean creatinine level at admission was 6.4 ± 3.4 SD (ranging 1.6-17.7) while at discharge was 2.2 ± 1.2 SD (ranging 0.45-7.2). 54 patients underwent hemo-dialysis which is about 68% of them. The mean number of session of dialysis that the study population underwent was calculated to be 4.4 ± 2.7 (ranging 1-13); most of the patients had three session of dialysis. There only one maternal death; the immediate cause of death being respiratory failure secondary to pulmonary edema plus aspiration pneumonia. 31 of them had fetal loss which is about 39%.

Conclusion: hypertensive disorders of pregnancy (preeclampsia/eclampsia), which can be easily prevented be early recognition and early intervention, are the most causes of pregnancy related AKI despite the increased antenatal care from the national coverage. The may implicate the poor quality of antenatal care to detect early enough these disorders.

1. Introduction

1.1. Background

Acute kidney injury (AKI) is a clinical syndrome characterized by an abrupt decline in glomerular filtration rate (GFR) sufficient to decrease the elimination of nitrogenous waste products and other uremic toxins (1, 2).

Causes of AKI can be pre-renal, renal (intrinsic) or post-renal. Common causes of prerenal AKI are volume loss (GI loss, renal loss, and blood loss), heart failure, liver failure drugs like ACEIs and NSAIDs; the intrinsic causes of AKI mostly follow untreated prerenal causes include sepsis, ischemia, cytotoxic drug use, reno-vascular problems etc. Post-renal causes include stone disease, stricture, tumors, and others which cause obstruction to the urinary tract. Common clinical presentation AKI include body swelling, decreased urine output, reddish discoloration of urine, fever, shortness of breath, and in severe cases there could be change in mentation. The management principle of AKI depends on the cause. For prerenal azotemia correcting volume loss with crystalloids and holding the drugs listed above are the mainstay of management and for post-renal cases removing the obstructing cause surgically is important. In case of intrinsic, the general principle is correcting electrolyte and volume abnormalities and avoiding cytotoxic agents. These may involve dialysis, medical management of hyperkalemia. Major indications of dialysis are refractory hyperkalemia, hypervolemia and metabolic acidosis to medical management, uremia. Complications of AKI include uremia (coagulopathy, pericarditis, and encephalopathy), hyperkalemia, metabolic acidosis, hypervolemia, later progression to chronic kidney disease (2).

As with other organs kidney undergoes normal anatomic and physiologic changes during pregnancy so as to accommodate maternal and in utero fetus physiological demand. The size of kidney increases by 1.0-1.5cm in length. The collecting system, including renal pelvis, calyces and ureter become dilated due to tissue hypertrophy, renal vascular and interstitial expansion. Near to 90% of normal pregnant women have mild hydronephrosis, more pronounced on the right kidney due to dextrorotation of uterus and dilation of right ovarian venous plexus.

Due to these changes, there will be urinary stasis and creating better environment for bacterial overgrowth and hence increased risk of urinary tract infection. These anatomic changes can stay up to 12 weeks post-partum before returning to pre-pregnancy state. In addition to these anatomic changes, there are renal hemodynamic changes during pregnancy, such as increase in renal blood flow, increased GFR, decrement in serum creatinine (0.4-0.8mg/dl) and urea. So, creatinine level of >1.0 mg/dl may signify renal impairment, even though normal range in general population, in pregnant population and prompt further investigation (3, 4, 5).

Acute kidney injury (AKI) is one of the most challenging and serious complications of pregnancy resulting in significant maternal morbidity/mortality and fetal loss. AKI in pregnancy has a high risk of development of bilateral renal cortical necrosis and, consequently, of chronic kidney disease if not corrected timely and appropriately. As do other diseases, the incidence of obstetric AKI varies between the developed and developing nations, which was reported to be 1-2.8% and 9-25%, respectively (4).

The causes of AKI in pregnancy and post-partum period could be septic abortion, ante-partum hemorrhage, post-partum hemorrhage, pre-eclampsia and eclampsia, HELLP syndrome, puerperal sepsis; a patient can have more than one obstetric cause of AKI. Distribution of AKI during pregnancy had two peaks in developing countries with first peak being between 8 and 16 weeks of gestation in association with septic abortions, whereas late peak is associated with obstetric complications such as pre-eclampsia/eclampsia, abruption placentae, uterine hemorrhage, and puerperal sepsis (6).

Pregnancy complications play a crucial role in the pathogenesis of AKI. Pre-eclampsia is considered to have placental insufficiency leading to inadequate oxygen delivery to the placenta and the release of mediators of endothelial injury; resulting in deficiency of vascular growth factor activity which contribute to hypertension, proteinuria, and renal injury. Pre-eclampsia is also attributed to an excess of vasoconstrictor over vasodilator impacting systemic circulation which would be expected to lower the glomerular perfusion rate. Examination of placenta the pre-eclamptic women showed conspicuous endothelial cellularity in most cases. Renal biopsy showed thickening of glomerular capillary walls related to mesangial interposition and prominent subendothelial hyaline deposits leads to glomerular filtration impairment (3, 7, 8).

1.2. Statement of the problem

AKI during pregnancy and postpartum period is common in developing countries, like Ethiopia. Common causes of AKI during this period are preventable causes like hypertensive disorders so knowing the common causes and outcomes of AKI during this period is essential for minimizing maternal and fetal complications, either by early recognition and transfer to the renal unit or strengthening preventive measures. In my three month internship stay in internal medicine, there were many female patients admitted to medical ward with assessment of AKI due to obstetric cause, most of them are in 20s –early 30s. There was only one recently published study related to this title in this study area which was limited to those who underwent hemodialysis in this study area; so this study addressed the burden of pregnancy related AKI and the common preventable causes with their outcomes including who did not undergo dialysis and hence generalization would be reliable to the source population. Besides this, feto-maternal complications had been addressed as these are public health and governmental priorities in Ethiopia.

1.3. Significance of the study

As introduced above, pregnancy related AKI is common public health problem in developing countries like Ethiopia; and hence addressing this topic to care takers is paramount important. This study entails about the fetomaternal outcomes and the common cause which are preventable so that obstetrics /gynecology department will take part on how to prevent these causes and also nephrology department will also act accordingly so as to decrease mortality once AKI has developed. SHMMC is center of Ethiopian kidney transplantation and hence there is high renal patient load in the medical ward, so doing this study in this institution may be representative of the country in general.

2. Literature review

The incidence of obstetric AKI in high income countries was about 1 to 2.8% and where as in low income countries, like Ethiopia was about 9 to 25% (4, 6).

According to retrospective, single centered research done in Zhangzhou Affiliated Hospital of Fujian Medical University, China from January 2008- June 2015 the prevalence of pregnancy and puerperium related AKI was about 0.81%. In this study the median age was 29 and AKI was most common during the third trimester of pregnancy. Most common causes were preeclampsia/eclampsia and postpartum hemorrhage; most patients have more than one cause especially in the third trimester of pregnancy. Besides; in this study rupture of ectopic pregnancy was the leading cause of AKI during the first trimester of pregnancy. In women with pregnant complications, patients with HELLP syndrome had the highest incidence (60%) of AKI followed by fatty liver of pregnancy (20%), preeclampsia/eclampsia (17%), and postpartum hemorrhage (5%).The study also included comorbid conditions like pneumonia, chronic kidney disease; cardiac disease and diabetic keto-acidosis. The study assessed the outcome and showed that maternal mortality in AKI during pregnancy and puerperium was about 4%; amniotic fluid embolism and postpartum hemorrhage were leading causes of maternal mortality followed by hemorrhagic shock from a ruptured ectopic pregnancy, whereas prenatal mortality was about 17%, which is four times higher. Perinatal outcome of pregnant women with AKI during the second trimester was worse than the third trimester of pregnancy. Most of the patients with AKI achieved complete recovery (9).

By far this study is the representative of the developed nations in most aspects and this study has merit of large source population and long duration of study.

Drawback of the study is it includes comorbid conditions where by it is difficult to comment on outcome; the cause of death is whether AKI or the comorbidities and the study relates the outcome only to the obstetric cause of AKI; did not comment on initial creatinine level, duration of illness, etc.

Another prospective, single-center study done from January to December 2010 in India showed that from 580 patients with AKI seen during the study period, 57 (9.8%) had pregnancy related AKI. In this study the mean age was 26.4 ± 5.1 years and the most common age group affected was 20–25 years and only 43.8% had antenatal care, 40% had home delivery/abortion and 59.6% had hospital delivery. More than half of the patients were multigravida and most were on their puerperal period while developing AKI. The mean interval between the onset of symptom and coming to hospital was around one week; ranging 1-30 days. The clinical features at presentation included fever (82.45%), edema (82.45%), breathlessness (73.68%), oliguria (64.9%), vaginal bleeding (33.33%), anuria (21%), altered level of consciousness (19.2%) and convulsions (14%). Patients had more than one presenting symptom in association with decreased or no urine output. The study revealed that the most common cause of AKI was puerperal sepsis (63%) followed by pre-eclampsia/eclampsia (33%), post-abortion sepsis (15.7%), APH (14%), hemorrhage in early pregnancy (8.7%), PPH (8.7%), disseminated intravascular coagulation (8.7%), malaria (5.2%). The mean serum creatinine was 6.54. All patients received medical therapy for infection in addition to dialysis, if required. For those who need dialysis the mean number of dialysis sessions required per patient was around 7 (range 0–20), each of 4 h duration; mostly hemodialysis. Maternal mortality was about 16%; septicemia the most cause of death (44%), and preeclampsia (33%). Fetal mortality was 49%; which is quadrupled. This study included most parameters, but it was in short period and small sample size (10).

There was observational prospective study conducted in the nephrology department of Hassan II University Hospital (Fez, Morocco), between February 01, 2011 and January 31, 2012; according to the study the prevalence of AKI was near 0.66% which is far from most studies done in low income countries. Two-third of the patients were on their third trimester of pregnancy. Nearly 40% of patients had normal spontaneous vaginal, 40% had cesarean section and 19% had abortion. Clinical presentation at admission were hypertension (56%), oliguria (39%) and seizure occurred in 14% of the cases. The other striking and unlikely result of this study was septic abortion was not found as cause of AKI; despite it is the principal infectious cause of AKI and a major public health problem in developing countries. The main cause of AKI associated with pregnancy was preeclampsia (66.7%), with eclampsia (13.5%), HELLP syndrome (58.3%) and hemorrhage (25%); which is comparable to other literatures in the developing.

This study also discussed on the outcome revealed that dialysis was required during hospitalization in 16% of patients, complete recovery of renal function was observed in 76% and partial recovery in 16% and only two patients remained dependent on dialysis but didn't say any about perinatal outcome and maternal mortality. According to the study factors associated with unfavorable outcome were older ages, elevated creatinine level at admission and severe AKI; the etiology was not associated with unfavorable outcome (11).

There was only one published research, related to this topic, in our country Ethiopia. The study was a hospital-based retrospective medical record review of the clinical profiles and outcomes of all women with pregnancy-related AKI who underwent hemodialysis at SPHMMC, Addis Ababa, Ethiopia, between August 1, 2013, and July 31, 2015. In this study the prevalence was 13%. Most women were aged between 21–30 years; most were parous. Almost all women had prenatal care follow-up. Most women (88%) presented in the third trimester and more than half the women delivered by spontaneous vaginal delivery. It also assessed the common symptoms at presentation showed that oliguria was most common (88%), followed by edema (74%), hypertension (67%), and convulsions (36%). The most common cause of AKI was preeclampsia/eclampsia (74%) followed by puerperal sepsis (14%), PPH (7%) and septic abortion (2%). Most of the patients have more than four session of dialysis and refractory fluid overload being the most indication more than 80% of the dialyzed; of these more than three-fourths were discharged improved and about 12% died. The study was limited to those who underwent dialysis as drawback (12).

To summarize, most studies showed that preeclampsia/eclampsia being most common cause and most studies relate maternal and perinatal mortality only to the obstetric cause of AKI.

3. Objectives

General objectives

- To assess the prevalence and describe outcomes of AKI due to obstetric reasons admitted to female medical ward from September 11, 2015- February 8, 2018 SPHMMC, Addis Ababa, Ethiopia.

Specific objectives

- To assess the prevalence of AKI due to obstetric reasons admitted to female medical ward SPHMMC, Addis Ababa, Ethiopia, during September 11, 2015- February 8, 2018.
- To assess clinical profile of obstetric patients admitted to SPHMMC female medical ward with the assessment of AKI, during September 11, 2015- February 8, 2018.
- To describe outcomes of AKI due to obstetric reasons admitted to female medical ward SPHMMC, Addis Ababa, Ethiopia, during September 11, 2015- February 8, 2018.

4. Methods and Materials

4.1. Study area

This study was conducted at female medical ward, SPHMMC, Addis Ababa, Ethiopia. SPHMMC is found in Gulele sub city, A.A, Ethiopia; the institution which has several faculties and provides many services. These include internal medicine, surgery ,pediatrics, obstetrics and gynecology, ophthalmology, dermatology, anesthesia, radiology, ENT, psychiatry, emergency medicine, dentistry, forensic medicine, community health, cardiology nephrology, hematology, gastroenterology etc. Internal medicine is one of the faculties, which has wards divided to female and male sides and medical ICU. The female medical ward comprises of 24 beds. It is one of the rapidly growing institution owning first Ethiopian kidney transplantation center and dialysis unit. Most of the clients come from Oromia region besides the residents of Addis Ababa.

4.2. Study design

A retrospective, descriptive study design by conducting medical chart review had been used to get secondary data to study the prevalence and outcomes of AKI due to obstetric causes admitted to SPHMMC female medical ward from September 11, 2015- February 8, 2018.

4.3. Population

4.3.1. Source population

All women admitted to SPHMMC female medical ward during the period of September 11, 2015- February 8, 2018.

4.3.2. Study population

All women between the ages of 15-49 years admitted to SPHMMC female medical ward during the period of September 11, 2015- February 8, 2018.

4.4. Study unit

The study units were individuals in the study population who were pregnant, or aborted and within 42 days of post-delivery admitted to SPHMMC female medical ward with assessment of AKI during the study period picked under direct observation of document from which the data was collected.

4.5. Sample size determination and sampling technique

4.5.1. Sample size determination

The size of study population was all women aged between 15-49 years admitted to SPHMMC female medical ward during the period of September 11, 2015 - February 8, 2018. As the sample was selected from small population ($N < 10,000$), sample size was determined using the formula

d- Degree of accuracy

N- Source population


$$n = \frac{\frac{Z^2 p (1 - p)}{d^2}}{1 + \frac{1}{N} \left(\frac{Z^2 p (1 - p)}{d^2} - 1 \right)}$$

From HMIS $N=1,579$, from the previous related research, $P=13\%$

And from 95% confidence interval, $\alpha=0.05$ and $d = 0.04$, $Z = 1.96$; $n = 271.5531/1.1713=231$

Therefore; the determined sample is approximately 231.

But, since the study is retrospective period prevalence study only individuals pregnant, or aborted and within 42 days of post-delivery admitted with assessment of AKI during the study period were included in the study i.e. 79 patients.

4.5.2. Sampling technique and sampling procedure

It was by direct counting and studying every woman in the study population fulfilling inclusion criteria from their clearly documented medical record at SPHMMC, department of internal medicine during the study period; so no sampling technique was used.

4.6. Eligibility criteria

4.6.1. Inclusion criteria

The populations included in this study were all women aged 15-49 years admitted to SPHMMC female medical ward. Data was collected from those patients who were pregnant, or aborted and within 42 days of post-delivery admitted with assessment of AKI.

4.6.2. Exclusion criteria

- ✓ Evidence of renal disease of any cause prior to pregnancy.
- ✓ History of hypertension or diabetes mellitus before gestation
- ✓ History of renal stone disease
- ✓ Renal scarring on ultrasound
- ✓ Elevated serum creatinine and presence of small sized kidney prior to gestation.
- ✓ Previous urological surgery

4.7. Data collection and quality assurance

Data was collected by using direct observation of the medical records. Using HMIS the card number of those patients fulfilling the inclusion criteria were recorded and collected from SPHMMC records room. Those charts already seen were marked with pen or special staining material to avoid double counting. As the data was collected data by one investigator the completeness of information was ascertained at the due time.

4.8. Operational definitions and other definitions

AKI: is a decline in kidney function during 48 hours as demonstrated by an increase in serum creatinine of more than 0.3 mg/dl, an increase in serum creatinine of more than 50 % or the development of oliguria (AKIN, 2007). For those with first determination of serum creatinine the diagnosis of AKI is based on the presence of oliguria (urine output <400 mL/d) and/or mounting azotemia [serum creatinine (SCr) >2 mg/dl].

Oliguria: urine output of < 400ml/d

Anuria: urine output of <100ml/d (2, 3, 13).

Complete renal recovery: SCr of <1.2mg/dl

Partial renal recovery: renal function improved but serum creatinine did not return to normal range and patient was dialysis.

NO renal recovery: need for permanent renal replacement therapy

The first trimester: from conception to the 13th week.

The second trimester: 14th until the 28th week.

The third trimester: 28th week until delivery.

Puerperium: 6 weeks post-delivery or post-abortion

Preeclampsia: BP: ≥ 140 mmHg /90mmHg, a previously normotensive woman and proteinuria more than 300mg in 24h after 28 week of gestation.

Eclampsia: generalized convulsions and/or loss of consciousness occurring during pregnancy or postpartum in preeclampsia patients, ruling out other causes.

HELLP: hemolysis (characteristic peripheral blood smear, serum lactate dehydrogenase 600U/L, total serum bilirubin 1.2mg/mL), elevated liver enzymes (serum aspartate aminotransferase >70IU/l) and low platelet count (100,000/mm³).

APH: vaginal bleeding after 28 week of gestation.

PPH: Vaginal bleeding after the delivery of fetus till 6 weeks of post-partum.

Abortion: pregnancy loss prior to 28 week of gestation.

4.9. Study variables

Prevalence of AKI

Outcomes of AKI

Condition at discharge, death, the need of dialysis

Socio-demographic status of the women

Age

Region

Religion

Residency

Level of education

Other variables

Parity

ANC follow up

Site and mode of delivery

Mode of admission

Duration of illness before admission and after hospitalization

Presenting symptoms at admission

Identified cause of AKI

4.10. Data processing and analysis

Data was analyzed by using SPSS 20 and manually. Data exploration was done to visualize the general feature of the data. After exploration, descriptive analysis was performed step by step to describe the outcomes and characterize clinical profiles of obstetric patients admitted with assessment of AKI

4.11. Ethical consideration

Ethical clearance was obtained from ethical review committee of SPHMMC, Department of Public Health. During observation of the cards confidentiality and medical privacy of each woman was assured through their name and identification was not taken during data collection process.

4.12. Dissemination of findings

Finally the findings are to be communicated and distributed to SPHMMC, department of Public Health and also for potential stakeholders such as SPHMMC, department of OB-GYN and department of nephrology.

5. Result

5.1. socio-demographic characteristics

The study was conducted in two years and five months period; during this time a total of 1,579 female patients had been admitted to saint Paul's hospital millennium medical college female medical ward; of these 1,083 patients were aged between 15-49 years again from these 79 were either pregnant or aborted or in the postpartum period fulfilling inclusion criteria and included in this study; and hence showed that prevalence of AKI due obstetric reasons was about 7.3%. The mean age in the study population was 27.4 ± 5.9 SD; ranging between 16-45 yrs. Most of them were aged between 26-30 yrs (**table1**). These women came from different parts of Ethiopia; more than half of them came from Oromia region followed by Amhara region (30.4%) while the residency is comparably the same distribution. More than half of the women orthodox Christians; followed by protestant Christians. More than three-fourth of women are educated; about half are educated to primary school.

TABLE 1: Socio-demographic characteristics of obstetric patients in SPHMMC female medical ward during sept. 2015-Feb. 2018 (N=79)

Characteristics	N (%)
Age ,yrs	
15-20	12 (15.2)
21-25	22 (27.8)
26-30	24 (30.4)
31-35	14 (17.7)
36-40	6.0 (7.6)
41-49	1.0 (1.3)
Residency	
Urban	40 (50.6)
Rural	39 (49.4)
Region	
Oromia	45 (57)
Amhara	24 (30.4)
SPNN	8.0 (10.1)
others	2.0 (2.5)
Religion	
Orthodox	45 (57)
Protestant	18 (22.8)
Muslim	15 (19)
Others	1.0 (1.3)
Level of education	
Illiterate	18 (22.8)
1-8	37 (46.8)
9-12	17 (21.5)
College	7.0 (8.9)

5.2. Obstetric Variables

Except one patient all others were in the post-partum period. Most of them delivered at hospital (84.8%) and six patients delivered at home. About two-third (51/79) of patients delivered via spontaneous vertex delivery and only one patient had instrumental delivery; the rest gave birth via cesarean section. About 72% of patients are referred from other hospital post-partally; the rest were just transferred from SPHMMC maternity ward.

The mean parity of the studied population is 2.4 ± 1.8 SD ranging between 1-7 and majority of them were mono-parous (43%) and only three patients were para-seven; in addition 17 patients were grand-multiparous (17.8%). Most of the patients (82.3%) have antenatal care at nearby health institution (**table2**).

TABLE 2: obstetric characteristics in SPHMMC female medical ward, Sept. 2015-Feb. 2018 (N=79)

Characteristics	N (%)
Pregnant	1 (1.3)
Parity	
One	34 (43)
Two	19 (24)
Three	8.0 (10)
Four	4.0 (5)
Five	7.0 (9)
Six	4.0 (5)
seven	3.0 (4)
ANC	65 (82.3)
Mode of delivery	
Spontaneous vertex delivery	51 (64.6)
Cesarean delivery	27 (34)
Instrumental delivery	1.0 (1.3)
Site of delivery	
Hospital	67 (84.8)
Health center	6.0 (7.6)
Home	6.0 (7.6)
Mode of admission	
Transferred from SPHMMC	22 (28)
Referred from other health institution	57 (72)

5.3. Clinical Presentation and Obstetric Causes of AKI

The mean duration of illness before admission to medical ward was 4.8 ± 3.5 SD (ranging between 1 day and 18 days). The patients came with several different clinical presentations; of these decreased urine output is the most common clinical presentation accounting more than three-quarter of the presentations (82%).

In this study obstetric causes of AKI were identified from the patients' medical charts; by far pre-eclampsia /eclampsia was the most common identified cause of AKI presenting about 80% followed by HELLP syndrome (table 3). 31 patients had both pre-eclampsia/eclampsia and HELLP syndrome; and hence only 2 patients had an isolated HELLP syndrome. Of sixty patients who had pre-eclampsia/eclampsia forty-nine of them had developed hospital acquired pneumonia (62%). Sepsis was responsible for about 20% (16/79) of cases; septic abortion accounts for 10% cases. Five of them had both sepsis and pre-eclampsia/eclampsia. A patient could have had more than one identified obstetric cause.

TABLE 3: clinical presentation and causes of AKI, SPHMMC female medical ward, Sept. 2015-Feb. 2018 (N=79)

Characteristics	N (%)
Clinical presentation	
Decreased urine output	65 (82.3)
Body swelling	34 (43)
Abnormal body movement	22 (27.8)
Shortness of breath	19 (24.1)
Reddish discoloration of urine	17 (21.5)
Change in mentation	14 (17.7)
Symptoms of anemia	14 (17.7)
Fever	9.0 (11.4)
Vaginal bleeding	7.0 (8.9)
Causes of AKI	
Preeclampsia/eclampsia	60 (75.9)
Hospital acquired pneumonia	49 (62)
HELLP	33 (41.8)
Sepsis	16 (20.3)
Puerperal	6.0 (7.6)
septic abortion	8.0(10.1)
others	2.0 (2.5)
PPH	15 (19)
APH	9.0 (11.4)
others	16 (20.3)

5.4. Laboratory Measurements and Outcome Variables

The laboratory parameters were analyzed as mean value plus or minus the standard deviation at admission and discharge (table 4). The mean creatinine level at admission was 6.4 ± 3.4 SD (ranging 1.6-17.7) while at discharge was 2.2 ± 1.2 SD (ranging 0.45-7.2).

For these patients different modalities of interventions had been provided; 47% of the patients (37/79) had been given intravenous antibiotics either for sepsis or aspiration pneumonia and 41 patients were given diuretics; mostly frusemide. Fifty-four patients underwent hemo-dialysis which is about 68% of them.

The mean number of session of dialysis that the study population underwent was calculated to be 4.4 ± 2.7 (ranging 1-13); most of the patients had three session of dialysis. The study also included fetal and maternal outcomes of these patients in regard to fetal loss, maternal death and maternal clinical and renal condition. There only one maternal death; the immediate cause of death being respiratory failure secondary to pulmonary edema plus aspiration pneumonia. 31 of them had fetal loss which is about 39%. Almost all had symptomatic improvement (77 patients) as documented on the discharge summary; one patient was self-discharged and the other was not having discharge summary attached to her chart.

About 24% of the patients had complete renal recovery, 68% had partial renal recovery and 5% had no renal recovery (still require dialysis). The mean duration of hospital stay was 18 ± 9.2 SD days ranging between 3-47 days.

TABLE 4: laboratory investigations, SPHMMC female medical ward, Sept.2015- Feb. 2018 (N=79).

Measurement	Value (mean $\pm$ SD)
White blood cell, 10 ³ /ml	
Admission	17.55 $\pm$ 9.46
Discharge	10.08 $\pm$ 4.10
Hemoglobin, g/dl	
Admission	9.10 $\pm$ 2.25
Discharge	9.57 $\pm$ 2.81
Platelet, 10 ³ /ml	
Admission	183.03 $\pm$ 160.05
Discharge	394.54 $\pm$ 174.03
Creatinine, mg/dl	
Admission	6.4 $\pm$ 3.4
Discharge	2.23 $\pm$ 1.27
Urea, mg/dl	
Admission	137 $\pm$ 62
Discharge	69.88 $\pm$ 34.60
Potassium, meq/l	
Admission	5.0 $\pm$ 1.20
Discharge	3.90 $\pm$ 0.80
Sodium, meq/l	
Admission	131 $\pm$ 11.53
Discharge	134 $\pm$ 16.60
SGOT	
Admission	177.27 $\pm$ 343.86
Discharge	34.80 $\pm$ 22.0
SGPT	
Admission	112.0 $\pm$ 180
Discharge	26.0 $\pm$ 18.6
Alkaline phosphatase	
Admission	184 $\pm$ 195
Discharge	114 $\pm$ 80
Total bilirubin, umol/l	
Admission	2.9 $\pm$ 4.5
Discharge	2.0 $\pm$ 6.60
Direct bilirubin, umol/l	
Admission	2.0 $\pm$ 3.0
Discharge	1.0 $\pm$ 1.74

SGPT- serum glutamate pyruvate transaminase; SGOT- serum glutamate oxalate transaminase

TABLE 5: outcome variables and interventions done, SPHMMC female medical ward, Sept. 2015-Feb.2018 N=79

Characteristics	N (%)
Interventions	
Intravenous antibiotics	41 (52)
Diuretics	37 (46.8)
Dialysis	54 (68.4)
Outcome variables	
Symptomatic improvement	76 (96)
Complete renal recovery	18 (23)
Partial renal recovery	55 (69.8)
No renal recovery	4.0 (5.)
Maternal death	1.0 (1.3)
Fetal loss	31 (39)

6. Discussion

6.1. Prevalence and Sociodemographic characteristics

In this study of two years and five months duration there were 1,083 patients in the reproductive age group admitted to Saint Paul's hospital millennium medical college female medical ward; of these 79 of them had AKI fulfilling the inclusion criteria and were reviewed in the study and showed that the prevalence of pregnancy related AKI was 7.3%; which implicates still the high burden of the disease. During the study period there were around 183 patients in the reproductive age group were diagnosed to have AKI; of these 79 were due to obstetric reasons.

In most previous studies pregnancy related AKI more prevalent in low socio-economic nations than developed nations (4, 6). This may be explained by poor antenatal care in the developing nations. In retrospective, single centered research done in Zhangzhou Affiliated Hospital of Fujian Medical University, China; the prevalence was 0.8% (9) while another prospective, single-center in India showed that from 580 patients with AKI seen during the study period, 57 (9.8%) had pregnancy related AKI (10). An observational prospective study conducted in the nephrology department of Hassan II University Hospital (Fez, Morocco) showed that the prevalence of AKI was near 0.66% (11). There was a hospital-based retrospective medical chart review study on clinical profiles and outcomes of all women with pregnancy-related AKI who underwent hemodialysis at SPHMMC, Addis Ababa, Ethiopia, which showed that the prevalence was 13% (12).

This low prevalence compared to the previous studies done in low income nations, despite the study area is center of dialysis unit and referral center, is primarily attributed to the missed charts of the patients from the medical records room; and improved antenatal care.

Consistent with young marital age among Ethiopian women, estimated to be 17.1 years (from population-based census), most of the study women were aged between 21-30 years (14). This is again consistent with most of the Studies done in low income countries like Ethiopia, Morocco, and India (10,11,12). Since proximity of the study area to the Oromia region most clients are from Oromia.

6.2. Obstetric variables

As the medical ward is reserved for those who had medical illness and the study area is center of dialysis except one patient all others are on post-partum period; most of the time reason for transfer or referral from other hospitals is for the purpose of dialysis. Most patients in this study are primiparous women; which supports that preeclampsia/eclampsia is common in primigravids than multigravidas-as this the most common identified obstetric cause of AKI in this study and other previous studies.

About 82% of women had antenatal care at nearby health institution; which is higher than the overall antenatal care coverage of Ethiopia (62%) (14). This is in favor of less prehospital stay before seeking medical care at nearby health institution, which is less than a week in most of the patients.

Especially, most patients transferred from SPHMMC had short duration of illness before admission to medical ward (less than three days) as there is interdepartmental consultation. Most patients had delivery at health institution; only six (7.6%) patients had home delivery which is comparable the previous study done in this study area (12). This could be due to most come to hospital as they are sick and to high antenatal care coverage. According to EDHS 2016 (even though it is population-based census) , only 28% of births were delivered by a skilled provider and in a single centered study done at India showed antenatal care coverage was 44% and 40% of the patients had home delivery (10). In this study, most gave birth via spontaneous vaginal delivery and 34% delivered by cesarean section, which is comparable to the study done in Morocco (11). Form standard text books it is stated that when pre-renal causes of AKI are not managed early they progress to intrinsic AKI which requires longer period to resolve; which implicates that when prehospital stay is longer it's high likely to be intrinsic AKI (2). In this study most of patients come to medical ward with in less than one week ranging 1 day to 18 days which shorter compared to study done in India (1-30days) (10).

6.3. Clinical Presentation and Obstetric Cause of AKI

Most of studies had assessed common clinical presentations of patients. In a retrospective study done in this study area showed that oliguria was most common (88%), followed by edema (74%), hypertension (67%), and convulsions (36%) (12).

In this study decreased urine output (82%), body swelling (43%) and abnormal body movement (28%). Mostly in history taking decreased urine output is the most common chief complaint of patients who had renal problem.

As per definition of preeclampsia presence of hypertension is paramount except in atypical cases. In addition those patients with abnormal body movement had eclampsia as per definition. About 18% of patients had change in mentation mostly due to uremic encephalopathy, and 24% had shortness of breath mostly due to uremia, pulmonary congestion or aspiration pneumonia (3).

In most studies, hypertensive disorder of pregnancy is by far the most common obstetric cause pregnancy related AKI. In a retrospective study done in same study area, preeclampsia/eclampsia accounts for 74% of the cases followed by puerperal sepsis (14%), PPH (7%) and septic abortion (2%) (12). In the present study, preeclampsia/eclampsia is the most common identified cause accounting for about 76% of cases followed by HELLP syndrome (42%), sepsis (20%), PPH (19%). Isolated HELLP syndrome was responsible for only 2.5% of cases; most text books consider HELLP syndrome as spectrum of preeclampsia as in this case.

Septic abortion was accountable to 10%, puerperal sepsis (7.6%); there were three patients who developed sepsis due to iatrogenic intra-abdominal urinary bladder injury and one patient ureteral injury in those who gave birth by cesarean section. There were three patients who had acute fatty liver of pregnancy, which is very lethal condition in pregnancy and need intensive care unit admission (all of them had been admitted). There were also two patients with fulminant viral hepatitis; a patient with complicated malaria; one women with diagnosis of acute glomerulonephritis and another women with nephrotic syndrome.

Sixty-two percent of the patients were diagnosed to have hospital acquired pneumonia; which is mostly attributed to aspirating gastric content during convulsion and altered mentation, anesthesia effect, longer hospital stay.

6.4. Outcome Variables and Interventions Done

The women included in the study were managed with diuretics, intravenous antibiotics and dialysis. In the study area protocol of dialysis and in most under developed nations, there are few specific indications for dialysis: hyperkalemia refractory to medical management, uremia, hypervolemia refractory to medical management, metabolic acidosis refractory to other management (2).

Study done in this area showed refractory fluid overload was the most common indication, in 83% of cases (12). In this study specific indication was not assessed as it was difficult find clear documentation on the patients' medical records. About 68% of women underwent dialysis; most of them underwent three session of hemodialysis.

In the previous study done in this study area showed most of the patients had more than four sessions of dialysis (12). In prospective observational study in morocco, only 16% of the patients underwent dialysis (11). This high number of patients dialyzed, in this study, is highly likely due to study area is huge center of dialysis in Ethiopia and reason for referral from other center is for the purpose of dialysis; it may signify also severity of disease.

Almost all patients had symptomatic improvement as documented on discharge summary. There were only one maternal death in this study. This patient was having puerperal sepsis and preeclampsia as the cause AKI and the immediate cause of death being type one respiratory failure secondary to non-cardiogenic pulmonary edema after three weeks of hospital stay. Studies done Morocco and SPHMMC showed most of the patients were discharged improved (11,12). Complete renal recovery was ascertained in 76% of the patients, partial renal recovery in 16% of patients and there were only two patients dependent on dialysis (11). In a retrospective study in the present study area showed maternal mortality was 12% (12); where as in a single centered study done in India revealed that maternal mortality and fetal mortality was 16% and 49%, respectively (10). The present study revealed that complete renal improvement was seen in 23% of the patients, partial recovery in 70% of cases and four patients still rely on dialysis, and maternal mortality is 1.3%, while perinatal mortality was 39%. The decline in maternal mortality in the present study is high likely attributed to increased antenatal care and early presentation to health institution in addition to the hemodialysis.

7. Limitation of the Study

The study used secondary data to reach to conclusion for the source population. The study is hospital-based study so it may not be representative to the general population. Missing of the medical records of patients may have affected the prevalence. During the data collection there was poor documentation of patient profile on the HMIS (only diagnosis AKI was written, no documentation on pregnancy status of the women) and hence it was very difficult to pick those obstetric patients from the HMIS. While reviewing the charts of the patients there was trouble in finding laboratory investigations in order due to lack of investigation summary and there were different diagnoses made to the same patient by different physicians at the same time period. The research didn't address the indications for dialysis as per poor documentation of procedure information on the medical records. This research was conducted in short period relatively.

8. Conclusion and Recommendation

In conclusion, hypertensive disorders of pregnancy (preeclampsia/eclampsia), which can be easily prevented by early recognition and early intervention, are the most causes of pregnancy related AKI despite the increased antenatal care from the national coverage. This may implicate the poor quality of antenatal care to detect early enough these disorders. Prevalence of pregnancy related AKI in this study is 7.3%, lower than the previous studies done in developing nations. By far decreased urine output was most common clinical presentation and most of the patients had partial renal improvement at the time of discharge.

Recommendations:

1. The treating physicians should inform the patient at the time of discharge about the **recurrence of hypertensive disorders in the subsequent pregnancies** and should seek early ANC follow up at the nearby health institution.
2. The patients should be informed at the time of discharge that when they have decreased urine output and body swelling during subsequent pregnancies, they should go to nearby health institution early as it could be more likely renal problem and the disease condition is reversible if treated early.
3. The referring institutions especially, **health center nurses** should be trained and aware about hypertensive disorders of pregnancy and the need of early referral of those women to higher institutions and increase frequency of antenatal visit.
4. Documenting the patient profile on the HMIS should be complete in such a way that the pregnancy status of the patient and full diagnosis including the additional diagnosis should be documented.
5. The laboratory investigations of each patient should be organized in order by the investigation summary.
6. The medical records room should design an option to get the charts well-arranged and easily accessed.

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10. Annex

Data abstraction check list from medical chart review

1. Sociodemographic variables

Age

Level of education

Residency: rural

Urban

Region

Religion

2. Obstetric variables

Parity

Pregnant: yes/no

ANC follow up

If delivered:

Mode of delivery 1). Spontaneous vertex delivery

2). Cesarean section

3). Instrumental delivery ✓

Site of delivery 1). Home

2). Hospital

3). Health center

3. Other variables

- ❖ Mode of admission: transferred from SPHMMC obstetrics ward

Referred from other hospital

- ❖ Duration of illness before admission.....

- ❖ Clinical presentation at presentation

- ✓ Decreased urine output
- ✓ Reddish discoloration of urine
- ✓ Body swelling
- ✓ Hypertension/hypotension
- ✓ Fever
- ✓ Shortness of breath
- ✓ Change in mentation
- ✓ Abnormal body movement
- ✓ Vaginal bleeding
- ✓ Symptoms of anemia: pallor, light headedness, vertigo...

- ❖ Identified obstetric causes of AKI

- ✓ Sepsis
- ✓ Pre-eclampsia/eclampsia
- ✓ HELLP
- ✓ APH
- ✓ PPH
- ✓ Others

- ❖ Investigations

- ✓ Laboratory: complete blood count, renal function tests, serum electrolyte, liver enzymes and bilirubin level

- ❖ Interventions done
 - ✓ Antibiotics: yes/no
 - ✓ Dialysis: Yes/no
 - If yes number of sessions of dialysis
 - ✓ Diuretics: yes/no
- ❖ Condition in the hospital course
 - ✓ Death: cause of death
 - ✓ Condition at discharge
 - Symptomatic improvement
 - Complete renal recovery
 - Partial renal recovery
 - No recovery
 - ✓ Fetal loss
- ❖ Duration of hospital stay