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A Study of Acute Kidney Injury in the Pregnant Patient –Our experience at Rural centre

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Abstract

Pregnancy-related acute kidney injury (PR-AKI) causes significant maternal and fetal morbidity and mortality. Management of PR-AKI warrants a thorough understanding of the physiologic adaptations in the kidney and the urinary tract. Categorization of etiologies of PR-AKI is similar to that of acute kidney injury (AKI) in the nonpregnant population. The causes differ between developed and developing countries, with thrombotic microangiopathies (TMAs) being common in the former and septic abortion and puerperal sepsis in the latter. The incidence of PR-AKI is reported to be on a decline, but there is no consensus on the exact definition of the condition. The physiologic changes in pregnancy make diagnosis of PR-AKI difficult. Timely and correct diagnosis is essential for better maternal and fetal outcomes and treatment of underlying conditions such as sepsis, preeclampsia, and TMAs result in better outcomes. We present here our experience with PRAKI from rural tertiary care centrein western UP.

Keywords: *acute kidney injury, developingcountry, mortality,pregnancy, sepsis*

Introduction

Pregnancy-related, acute kidney injury (PRAKI) continues to be a major problem in developing countries, resulting in a high maternal and fetal mortality and morbidity.

Table –1: Frequency of PRAKI reported in India

Author (year)	Number	PRAKI as % of total AKI
Chugh (1987)[1]	1862	14.5
Prakash et al. (1995)[2]	59	13.9
Rani et al. (2002)[3]	82	12.2
Kilari et al. (2006)[4]	41	4.3
Najar et al. (2007)[5]	40	7

PRAKI: Pregancy-related acute kidney injury, AKI: Acute kidney injury

Causes of PRAKI can be categorized according to the gestational age in which the disease occurs i.e. in first, second & third trimester. ARF in pregnancy occurs with a bimodal distribution. A peak in early pregnancy is associated with infection, particularly septic abortion and hyperemesis gravidarum, while a third trimester peak is associated with late obstetric complications such as puerperal sepsis, preeclampsia, abruption placentae, post partum haemorrhage, amniotic fluid embolism and retained dead fetus [6]. Rare causes of PRAKI include acute fatty liver of pregnancy, HELLP Syndrome in the third trimester of pregnancy, and thrombotic microangiopathy in the postpartum period [2,3].

Aims & Objective

To evaluate the clinical profile and interventions in pregnancy related AKI, & to study the maternal and fetal outcome of of pregnancy related AKI.

Material and Methods

The present study was undertaken on pregnant women admitted in the Medicine ward of the UPRIMS &R hospital, Etawah between July 2013 to August 2014. A total of 53 patients with PRAKI were taken up for the study. Informed consent was obtained from all participants or their relatives, depending upon the condition of the patient.

Patient Selection:

Inclusion crieteria: Patients included in the study were healthy previously and had developed acute renal failure during pregnancy. Pregnancy Related Acute Kidney Injury (PRAKI) was diagnosed when there was sudden onset of oliguria (urine output <400ml/24hours) or anuria or, azotemia (serum creatinine>1.2mg%) with normal urine output.

Exclusion criteria: Evidence of renal disease prior to pregnancy (glomerulonephritis, renal insufficiency from any cause), history of hypertension or diabetes before gestation, history of renal stone disease,elevated serum creatinine prior to gestation

Study design: Prospective, Observational, Interventional.

Method: Detailed history, including antecedent obstetric, medical or surgical cause, which may lead to AKI was recorded in all patients. A thorough physical examination including pelvic examination was performed in all patients. Specific enquiries were conducted regarding the cause of Acute Kidney Injury (AKI), its clinical features, need for blood transfusion, any surgical intervention done. Age of the patients, education, socioeconomic status, occupation, details of residence whether urban or rural was also recorded. After undergoing complete history & clinical examination, detailed and necessary investigations were carried out. PRAKI was diagnosed when there was sudden-onset oliguria (urine output < 400 mL in 24 hours) or anuria with serum creatinine elevated to > 1.5 mg%.

After initial assessment, resuscitative measures were taken as indicated. All details were noted down over the standard proforma. All patients were initially managed on full conservative management of causes as well as complication of AKI. Conservative management included strict input - output record, intravenous fluids, blood transfusion, dopamine infusion, broad spectrum antibiotics, sodium bicarbonate & calcium gluconate, and other measures as & when required. Hemodialytic support was provided as & when indicated as per following criteria: anuria > 48 hours, blood urea >150 mg/dl, serum creatinine> 6 mg/dl,Metabolic acidosis with

plasma bicarbonate level <15 mEq/litre, hyperkalemia refractory to medical management ($S.K^+$ >6.5mEq/L), systemic complications like pulmonary edema, uremic encephalopathy & uremic pericarditis. Pre and post dialysis assessment of the patients done regarding general condition, blood pressure, pulse, respiratory rate, and total amount of fluid removed during dialysis (ultrafiltration). All the women were followed until they were discharged from the hospital. They were advised to come for follow up in gynae OPD and to attend Medicine OPD as well. Outcome of mother and fetus were recorded in antenatal patients. Perinatal outcome was noted in terms of live or dead baby, term or preterm, apgar score, birth weight.

Processing of data

All the observations in this study were evaluated statistically. The mean, standard deviation and other factors were calculated mainly with the help of an electronic scientific calculator. Chi-Square & t test were carried out to detect statistical significance.

Observation &Results

Total 53 patients of pregnancy related acute renal failure (PRAKI) were enrollred for the study. Six patients were excluded from the study. Out of which, 2 were having chronic kidney disease and 4 lost to follow up. A total of 47 patients with pregnancy related acute kidney injury were followed upto the final outcome.

Fig. 1 Age Wise Distribution Of Cases

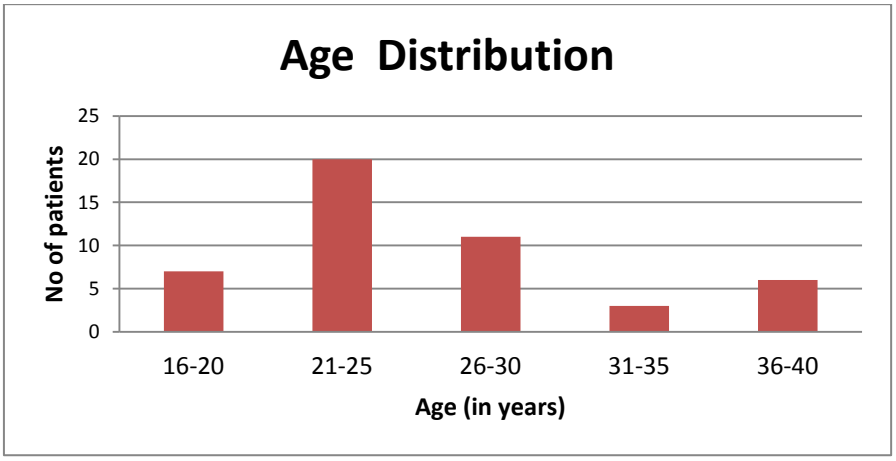

Fig. 2 Parity Distribution Of Cases

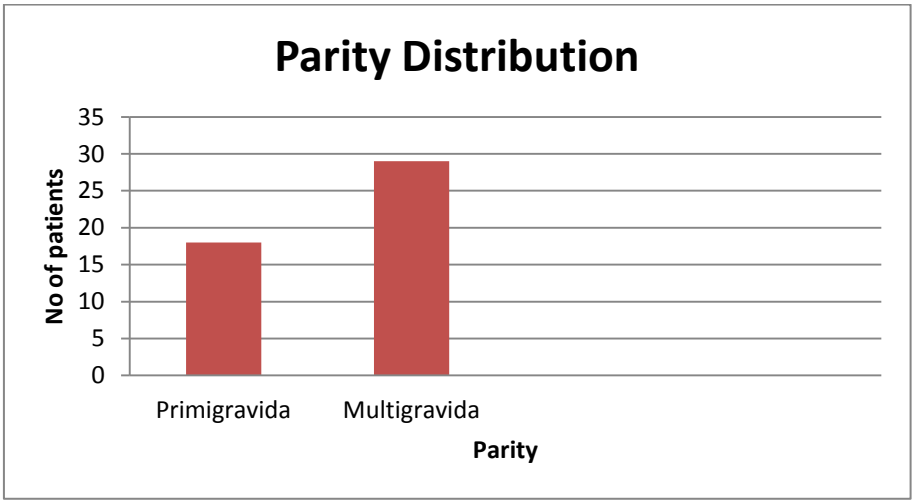

Fig. 3 Distribution Of Booked &Unbooked Cases

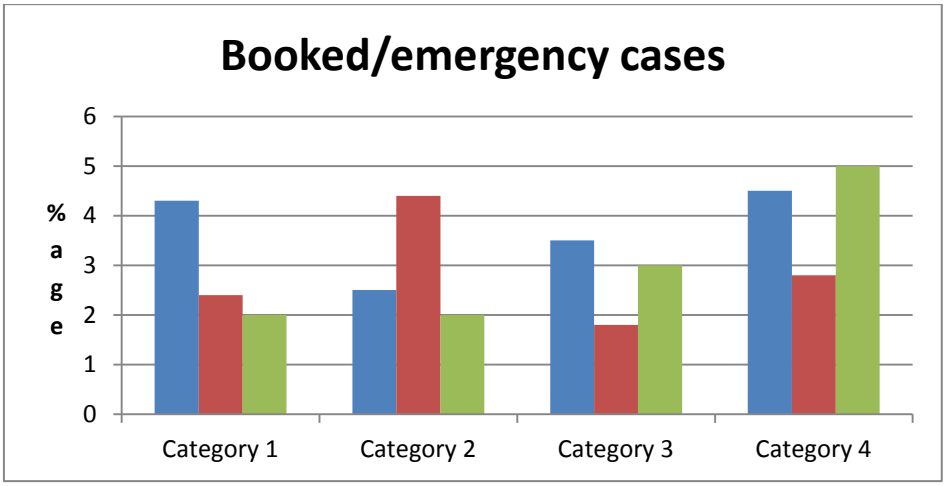

Table-2: Demographic Characteristics (n=47)

Character	No.	%
Literate	16	34.0
Illiterate	31	66.0
Hindu	33	72.1
Muslim	14	29.8
Rural	38	80.8
Urban	9	19.1

Table-3: Socio-Economic Status (n=47) (Modified Prasad's classification 2004)

Socio-Economic status	No	%
Grade-1(>10,000) Upper high	0	0
Grade-2(5000-9999) High	0	0
Grade-3(3000-4999)Upper middle	0	0
Grade-4(1500-2999) Lower middle	20	42.6
Grade-5(500-1499) Poor	24	51.0
Grade-6(<500) Very poor or Below poverty line (BPL)	3	6.4

Table-4: Trimester Wise Distribution Of Cases (n=47)

Period	No.	%
1st Trimester	5	10.6
2nd Trimester	4	8.5
3rd Trimester	30	63.8
Puerperium	8	17.0

Fig. 4: Distribution Of Patients According To Age Of Gestation

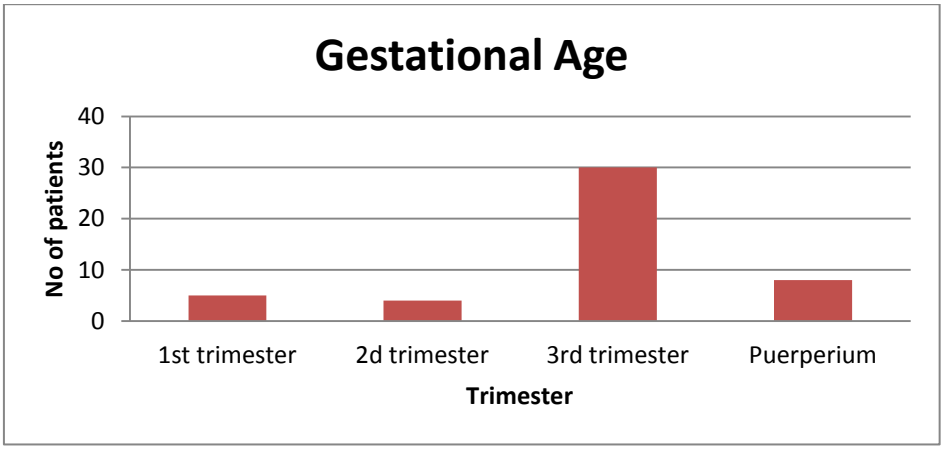

Table-5: Route& Place Of Delivery/Abortions (n=47)

Cases		No	%
Home (n=6) (12.8%)	Delivery	3	6.4
	Abortion	3	6.4
Hospital (outside) (n=9) (19.1%)	Vaginal delivery	2	4.3
	Cesarean section	3	6.4
	Abortion	3	6.4
	Laparotomy for ruptured ectopic	1	2.1
Our Tertiary care centre (n=32) (68.0%)	Vaginal	22	46.8
	Caesarean section	6	12.8
	Caesarean hysterectomy	2	4.3
	Undelivered	2	4.3

Table-6: Route Of Delivery & Other Obstetric Management In Our Hospital

Route	No.	%
Vaginal	22	73.3
Caesarean section	6	12.8
Caesarean hysterectomy	2	4.3
Evacuation for septic abortion	4	8.5
Evacuation for puerperal sepsis	3	6.4
Laparotomy with hysterectomy	1	2.1
Resuturing for burst abdomen	2	4.3

Table-7: Etiological Classification Of Pregnancy Related Acute Kidney Injury (N=47)

Causes	No.	%
IUD	20	42.6
Falciparum &/Vivax malaria	16	34.0
Eclampsia/Preeclampsia	11	23.4
Acute gastroenteritis	9	19.1
Septic abortion	7	14.9
Postpartum haemorrhage	7	14.9
Antepartum haemorrhage	5	10.6
Puerperal sepsis	4	8.5
DIC	3	6.4
Typhoid	2	4.3

Fig. 5: Pie Chart Showing Etiological Distribution Of Cases

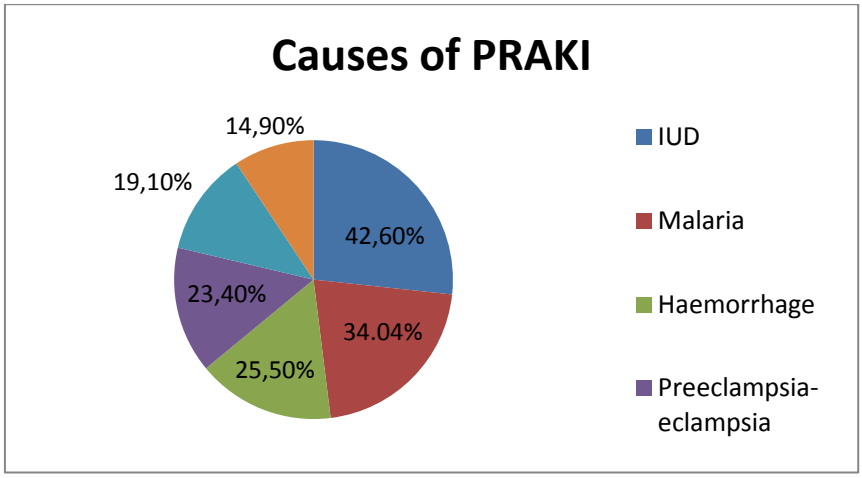

Fig. 6: Presenting Features Of PRAKI

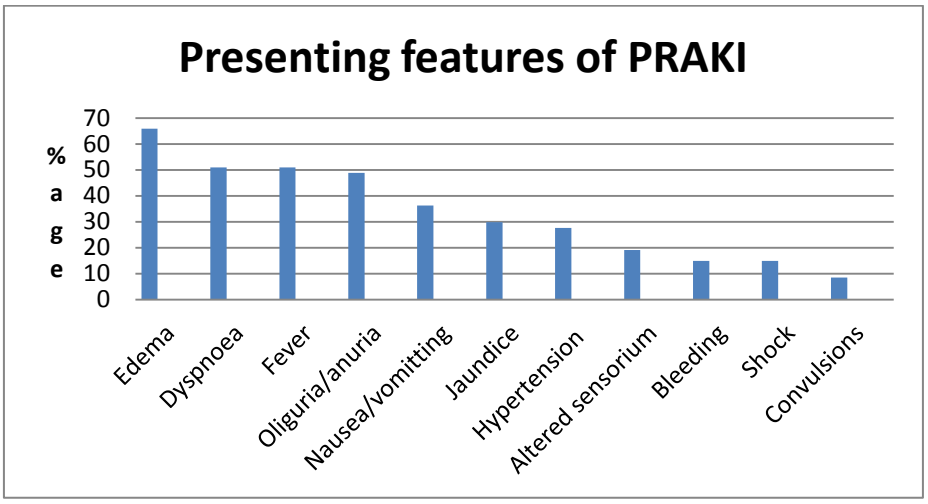

Table-8: Laboratory Results (N=47)

Laboratory value	Mean ± Standard Deviation
Hb (g/dL)	6.0 ± 1.7
TLC (mm^3)	12535.0 ± 8602.5
Platelet (µL)	113488.9 ± 64522.9
Blood urea (mg/dL)	94.4 ± 47.7
Serum creatinine (mg/dL)	4.3 ± 2.6
Serum Na^+ (mEq/L)	135.0 ± 6.3
Serum K^+ (mEq/L)	4.4 ± 1.1

Table-9: Blood Urea Levels In Patients

Blood urea (mg/dL)	No	%
50 – 79	25	53.2
80 – 109	9	19.1
110 – 139	6	12.8
140 – 169	4	8.5
170 – 199	1	2.1
200 – 229	0	0
230 – 259	1	2.1
>260	1	2.1

Table-10: Serum Creatinine Levels In Patients

Serum creatinine (mg/dL)	No	%
1.5 – 3.4	24	51.0
3.5 – 5.4	8	17.0
5.5 – 7.4	11	23.4
7.5 – 9.4	2	4.3
9.5 – 11.4	1	2.1
>11.5	1	2.1

Fig. 7: Pie Chart Showing Severity Of Anaemia In The Study Cases

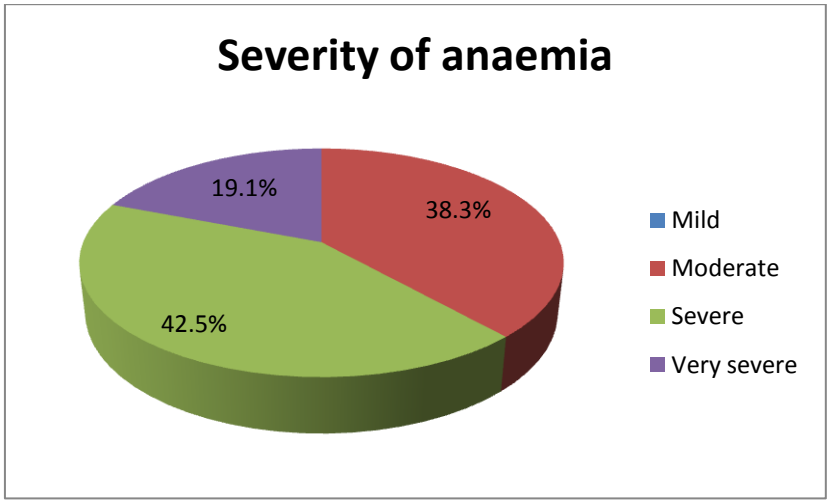

Table-11 (a) Maternal Outcome Of PRAKI (n=47)

Outcome	Without dialysis (n=35) (74.5%)	With dialysis (n=12) (25.5%)
Survivors	20 (57.1%)	5 (41.7%)
Expired	8 (22.9)	6 (50%)
Referred higher centre	0	1 (8.3%)
LAMA/Absconded	7 (20%)	0

Table – 11(b): Requirment Of Dialysis

Dialysis	No of patients	%
Not required	26	55.3
Required	21	44.7
Done	12	25.5
Refused by relatives	6	12.8
Not done as patients expired	3	6.4

Table-11(c): Overall Materal Outcome (n=47)

Outcome	No	%
Survivors	25	53.2
Expired	14	29.8
LAMA/absconded	7	14.9
Referred	1	2.1

Table-12: Comparison Of Survivors &Nonsurvivors Obstetric Patients With Acute Kidney Injury (n=47)

Parameter	Conservative (n=35)			Dialysis (n=12)		
	Survivors (n=20)	Expired (n=8)	*P*	Survivors (n=5)	Expired (n=6)	*P*
Age (years)	23.7± 3.29	27.5± 6.69	2.1	30.8± 5.80	27.0±5.44	1.1
Hospital stay (days)	10.4± 7.76	7.4± 11.51	0.8	15.8± 6.18	9.5± 2.88	2.3
Pregnancy related hypertension	6 (30%)	2 (25%)	0.07	0	1 (16.7%)	0.9
Sepsis	2 (10%)	3 (37.5%)	2.9	4 (80%)	4 (66.7%)	0.2
Sevanaemia	10 (50%)	5 (62.5%)	0.36	3 (60%)	5 (83.3%)	0.7
Leukocytosis	5 (25%)	1 (12.5%)	0.53	4 (80%)	2 (33.3%)	2.4
Malaria	10 (50%)	3 (37.5%)	0.36	0	1 (16.7%)	0.9
Hyperbilirubinemia	6 (30%)	3 (37.5%)	0.15	0	2 (33.3%)	2.0
Thrombocytopenia	8 (40%)	3 (37.5%)	0.01	4 (80%)	5 (83.3%)	0.02
Shock	3 (15%)	3 (37.5%)	1.7	2 (40%)	2 (33.3%)	0.05
Oliguria	6 (30%)	4 (50%)	1.0	5 (100%)	4 (66.7%)	2.0
Hyperkalemia	5 (25%)	2 (25%)	0	3 (60%)	2 (33.3%)	0.78

Fig. 8: Pie Chart Showing Outcome Of PRAKI Of The Study Cases

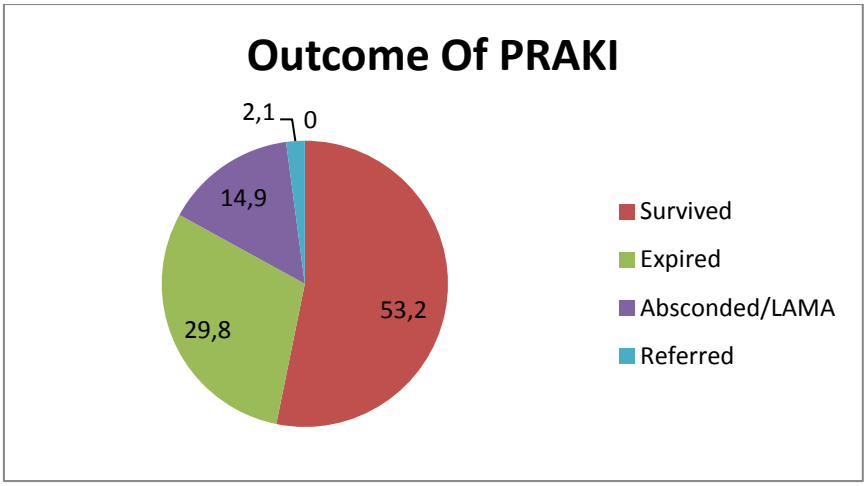

Table-13: Cause Of Death (n=14)

Cause	No.	%
Complicated AKI	11	78.6
Septicemia	8	57.1
Shock	4	28.6
Aspiration peumonitis	3	21.4
Haemorrhage	3	21.4
Uremic encephalopathy	3	21.4
Eclampsia	2	14.3
Pulmonary edema	2	14.3
Complicated malaria	2	14.3
DIC	2	14.3
Hepatorenal shutdown	2	14.3
Pneumonia	1	7.14

Flow Chart Showing Details Of Deaths Depending Upon Requirement Of Dialysis & Cause Of Death

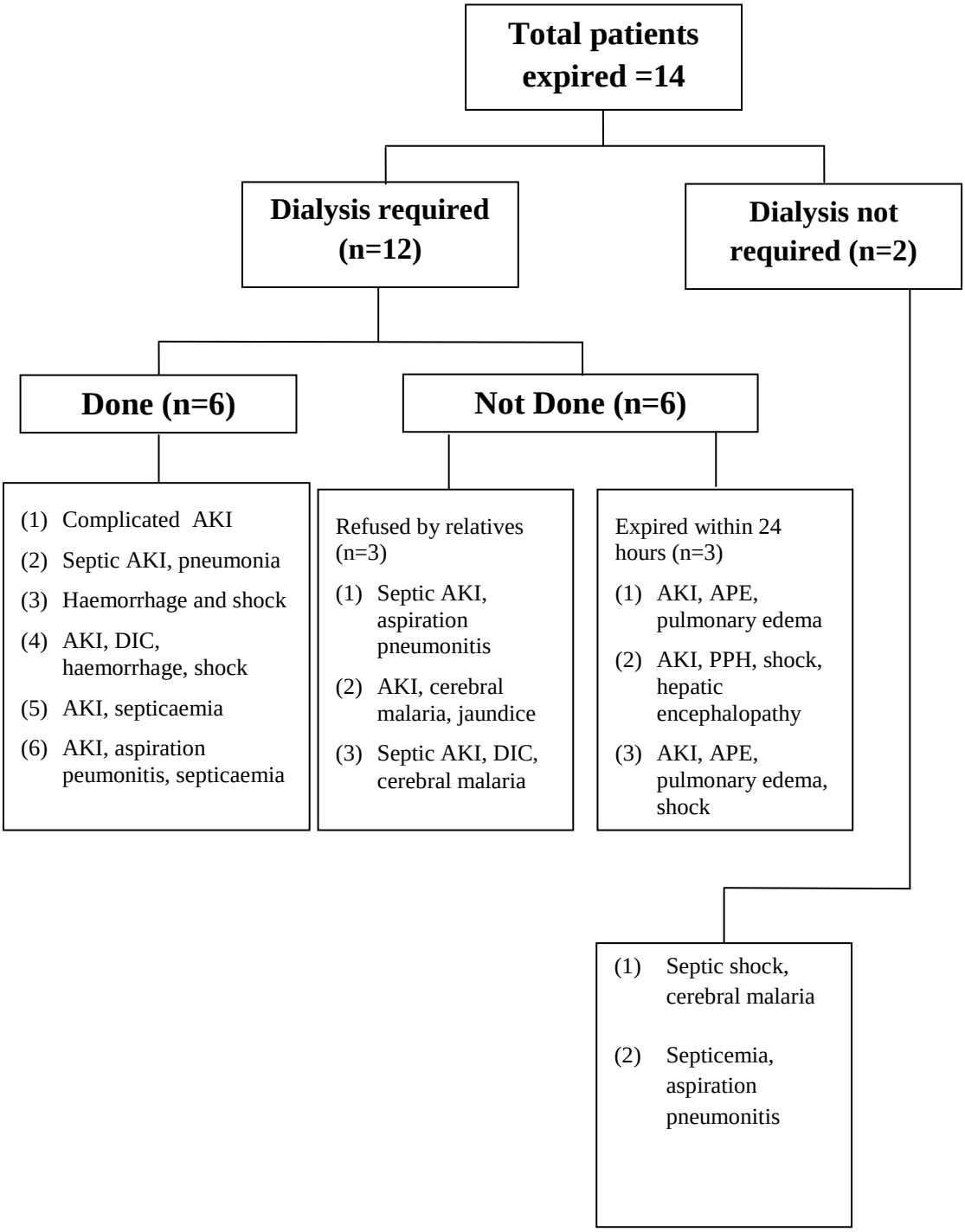

Table-14: Fetal Outcomes Of Pregnancy Related Acute Kidney Injury (n=47)

Fetal outcome	N	%
Intrauterine death	22	46.8
Live birth	15	31.9
Early neonatal death	2	4.3
Undelivered	1	2.12
Outcome not known	1	2.12
Abortion	5	10.6
ectopic	1	2.12

Results

Our study was conducted on a total of 47 patients with pregnancy related acute kidney injury (PRAKI). The aim of the study was to see the clinical features, interventions and outcomes of pregnancy related acute kidney injury. After analyzing various factors, the results are summarized below:

Maximum cases were seen in the age group of 21-25 years i.e. 42.5% (n=20) with a mean maternal age of 26.85 ± 5.76 years. Parity wise, most of the cases seen were multigravida i.e. 61.7% (n=29).Only 8.5% (n=4) patients had antenatal visits during pregnancy & out of them only one received antenatal care (ANC) in our hospital. Most of the cases i.e. 91.5% (n=43) did not received any antenatal care in their pregnancy. 66.0% (n=31) were illiterate & only 34.0% (n=16) were literate. Most common factor associated with PRAKI in our study is intrauterine death (IUD) in 42.6% (n=20), followed by malaria in 34.04% (n=16), haemorrhage in 25.53% (n=12) patients with antepartum haemorrhage in 10.6% (n=5) cases & postpartum haemorrhage in 14.9% (n=7). Eclampsia & preeclampsia accounted for 23.4% (n=11) cases followed by acute gastroenteritis in 19.1% (n=9), septic abortion in 14.9% (n=7), & puerperal sepsis in 8.6% (n=3), and DIC in 6.4% (n=3) cases. In our study, oliguria or anuria was present in 48.93% (n=23) patients, & rest 24 patients had nonoliguric renal failure. Other presenting features were edema in 65.9% (n=31), fever &dyspnoea in 51% (n=24), nausea & vomiting in 36.2% (n=17), jaundice in 29.78% (n=14), altered sensorium in 19.1% (n=9), hypertension in 27.6% (n=13), shock in 14.9% (n=7), uterine bleeding in 14.9% (n=7) cases & convulsions in 8.51% (n=4). All of the patients in our study were anaemic with a mean Hb concentration of 6.0 ± 1.7 gm%. The mean total leukocyte count (TLC) was 12535.0 ± 8602.5 mm^3.The mean platelet count seen was 113488.9 ± 64522.9 µL. There was a large variation in serum urea level among participants ranging from 58 – 285 mg/dL (mean 94.4 ± 47.7 mg/dL). In serum creatinine levels too, there were variations with a range of 1.5 – 12.7 mg/dL (mean 4.3 ± 2.6 mg/dL). Mean serum sodium was 135.0 ± 6.3mEq/L & the mean serum potassium was 4.4 ± 1.1 mEq/L. Mean stay of the patients in hospital was 12.9 days. Three patients expired after 2 hours, 9 hours & 12 hours of admission. Twenty six patients (55.3%) did not require dialysis. Dialysis was required in 44.6% (n=21), but couldn't be done in 6 because of refusal by relatives & three patients expired after few hours of admission. Dialysis was done in 12 patients out of which 6 expired, 5 improved & one was referred to higher centre. Four of those expired had septicemia along with PRAKI. Overall 25 women (53.2%) survived, 14 (29.8%) expired, seven (14.9%) went LAMA or absconded, and one was referred to higher centre who was deteriorating inspite of 6 HD. Most of the patients i.e. 42.5% (n=20) recovered without dialysis while 10.6% (n=5) recovered after dialysis. Maternal mortality was high i.e. 29.8% (n=14) and causes were multifactorial. Severe anaemiawere present in all the expired patients. Complicated AKI accounted for most of the deaths i.e. 78.6% (n=11). Second most common factor associated with maternal deaths was

septicaemia seen in 57.1% (n=8) cases. Other causes were shock (28.6%), aspiration pneumonitis (21.4%), and haemorrhage (21.4%). Complicated malaria, hepatorenal shutdown, eclampsia, pulmonary edema and DIC each were seen in 14.3% cases. Pneumonia as a cause of death was present in one patient (7.14%). Perinatal mortality is 53.2% & most of them were preterm IUD deliveries.

Discussion

Over the past few decades, the overall incidence of PRAKI has decreased in Western societies as a result of improved antenatal care and obstetric practices, but in less developed countries like India, the incidence is still high. It is associated with substantial maternal and fetal mortality & bears a high risk of bilateral renal cortical necrosis and consequently of chronic renal failure. There are only a few studies in our country addressing this issue. Delay in diagnosis and late referral is associated with increased mortality. The present study was conducted to explore the causes, management, and outcomes of pregnancy related acute kidney injury.

Pregnancy-related, acute kidney injury (PRAKI) continues to be a major problem in developing countries, resulting in a high maternal mortality. The frequency distribution of PRAKI is bimodal in relation to the period of gestation [9,10]. The first peak is seen between seven and 16 weeks, mainly due to septic abortion, while toxemia of pregnancy, hemorrhage, and puerperal sepsis account for the second peak which is seen between 34 and 36 weeks [1,7].The worldwide incidence of PRAKI has deceased markedly in the past 50 years from 20 to 40% in the 1960s to < 10% in more recent series, largely due to the legalization of abortion and improved antenatal and obstetric care. No case of PRAKI was observed in 12000 and 20000 live births in two recent studies [8,11].Recent epidemiological studies have also confirmed the decreasing incidence of PRAKI in India, with a decrease from 14.5% in 1987 to 4.3% in 2005[1,4]. Frequency of PRAKI reported in India is shown in Table- 1. This too is due to the legalization of abortion and better antenatal care. There has been a marked decline in PRAKI at the international and national levels, yet it continues to be static in rural population, largely due to an insignificant decline in septic abortion. Hence, there is a need for education and improvement in ante- and postnatal care, especially in the rural areas, and the practice of illegal abortions by untrained personnel has to be stopped. The mortality related to PRAKI has declined to < 10% in Europe and North America [7], while the reported mortality rate of PRAKI has decreased from 56% in 1987 to 24.39% in 2005 in India[1,4].The mortality rate was 29% in our study, which is in accordance to current trends in India but still significantly higher compared to the developed countries.

Conclusion

The development of AKI in pregnancy is a major clinical challenge because it is necessary to consider 2 patients (mother and fetus) and can be caused by specific pregnancy dis- eases not yet fully understood. It is essential to focus on the prevention and periodic evaluation of pregnant women to improve maternal and perinatal outcomes. The complexity of the AKI in pregnancy requires a multidisciplinary approach where the nephrologist plays an important role.

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