ORIGINAL ARTICLE

Acute renal failure in pregnancy: Tertiary centre experience from north Indian population

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ABSTRACT

Background: Obstetrical acute renal failure ARF is now a rare entity in the developed countries but still a common occurrence in developing countries. Delay in the diagnosis and late referral is associated with increased mortality. This study aimed to evaluate the contributing factors responsible for pregnancy-related acute kidney failure, its relation with mortality and morbidity and outcome measures in these patients. **Materials and Methods:** Total 520 patients of ARF of various aetiology were admitted, out of these 60 (11.5%) patients were pregnancy-related acute renal failure. **Results:** ARF Acute renal failure occurred in 32 (53.3%) cases in early part of their pregnancy, whereas in 28 (46.7%) cases in later of the pregnancy. Thirty-two (53.3%) patients had not received any antenatal visit, and had home delivery, 20 (33.4%) patients had delivered in hospitals but without antenatal care and eight (13.3%) patients received antenatal care and delivered in the hospitals. Anuria was observed in 23 (38.3%) cases, remaining 37 (61.7%) cases presented with oliguria. Septicemia was present in 25 (41.7%), hypertensive disorder of pregnancy in 20 (33.3%), haemorrhage in eight (13.3%), abortion in 5 (8.3%), haemolysis elevated liver enzymes low platelets counts (HELLP) syndrome in one (1.67%) and disseminated intravascular coagulation in one (1.67%). (61.7%) patients were not dialyzed, 33 (55%) recovered normal renal function with conservative treatment. Complete recovery was observed in 45 (75%) patients, five (8.4%) patients developed irreversible renal failure. Maternal mortality was nine (15%) and foetal loss was 25 (41.7%). **Conclusion:** Pregnancy-related ARF is usually a consequence of obstetric complications; it carries very high morbidity and mortality.

Key words: Acute renal failure, hemodialysis, partial recovery, pregnancy

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INTRODUCTION

Acute Renal Failure (ARF) related to pregnancy refers to a spectrum of prognosis ranging from potentially preventable to fatal. This entity has received a major boost in terms of prevention due to improving obstetric care with special emphasis on abortion. Unfortunately, the efforts have found results in high income countries while the low income countries are still lagging behind. The most probable reason for this is better management of obstetric and prenatal stages as well as lesser incidence of abortion. The decline in the prevalence of pregnancy-related acute renal failure (PRARF) has been dramatic, especially from 1970.[1] Nearly 15-20% of ARF in India between 1970 and 1980 was attributable to obstetrical complication while latest status is approximately 9-13%.[2] The current scenario shows a wide gap between the developed and under developed countries, and hence, the scope for improvement in obstetric measures to reduce morbidity and mortality associated with PRARF.

The aim of this study was to evaluate the magnitude of PRARF in Northern India, contributing factors responsible for pregnancy related acute kidney failure, its relation with morbidity and mortality and outcome in these patients.

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MATERIALS AND METHODS

This prospective observational study was conducted from over a period of one year, Nephrology unit in collaboration with department of Obstetrics and Gynaecology, King George's Medical University, Lucknow Uttar Pradesh, India. After informed consent and ethical clearance from Institutional ethics committee, a total 520 patients of ARF were screened, out of these 60 (11.5%) women suffering from PRARF were enrolled and analyzed. Patients with

end-stage kidney disease, prior hypertension, diabetes mellitus, history of renal stone, small size echogenic kidneys and recent history of urological intervention were excluded from the study.

For each case, a detailed history, thorough physical examination including obstetric and pelvic examination was done by gynecologist. Physical examination like temperature, pulse rate, blood pressure, fluid intake and urine output was recorded. Relevant laboratory investigations such as complete hemogram, blood urea, serum creatinine, electrolytes, coagulation profile, liver function test, 24-hour urinary protein, and ultrasound abdomen were carried out. Blood culture and vaginal swab were taken for culture and sensitivity, only in patients with septicemia. Few specialised investigations like renal ultrasonography and renal biopsies were performed in selected cases where recovery was delayed for more than 3 weeks. ARF was diagnosed when there was a history of sudden oliguria (urine output <300 ml over 24 hours), or anuria with a sudden increase in serum creatinine to more than 1.5 mg/dl or an increase in S. creatinine of more than 0.5 mg/dl per day from base line. Hemodialysis was done when indicated. All women were followed until they were discharged from the hospital. Maternal outcome was recorded as full recovery, partial recovery, end stage renal failure or death. Complete recovery from ARF was declared when renal function returned to normal range. Partial recovery was suspected when renal functions showed improvement but did not return to normal even after 12 weeks. End stage renal disease was defined as patients with impaired renal functions for more than 3 months and requiring hemodialysis. The fetal outcome was recorded as alive or dead.

Statistical analysis

Continuous data were summarized as Mean ± SD while discrete (categorical) in %. Continuous variables were compared by one way analysis of variance (ANOVA) and the significance of mean difference between the groups was done by Tukey's *post hoc* test after ascertaining the normality and homogeneity of variances by Shapiro Wilk test and Levene's test, respectively. Groups were also compared by independent Student's *t* test. Categorical variables were compared by Chi-square (χ^2) test. A two-sided ($\alpha = 2$) $P < 0.05$ was considered statistically significant. All analyses were performed on STATISTICA statistical software (Windows version 6.0).

RESULTS

Total 520 cases of acute renal failure with different etiologies were screened. Out of these 520 patients, 60 (11.5%) patients were of obstetric related ARF. The age of the patients were between 20 and 41 years with a median age 28 years. 28 (46.7%) women were multi para and 32 (53.4%) women were primigravida. Acute renal failure occurred in 32 (53.3%) patients in early part of their pregnancy and in 28 (46.7%) patients, in later half of pregnancy and puerperium. There were 10 (16.7%) patients who had undergone major surgical procedures, (caesarian section) whereas 45 (75%) had vaginal deliveries. Majority of the patients, 32 (53.3%) had not received any antenatal care at any stage of their pregnancy and had undergone traditional birth attendant assisted home delivery, 20 (33.4%) patients had delivered in the hospitals but without antenatal care and 8 (13.3%) patients received some sort of antenatal care and their deliveries were carried out in the hospitals. 18 (30%) cases were residents of urban area and the remaining 42 (70%) were from village community. Anuria was observed in 23 (38.3%) cases, remaining 37 (61.7%) cases presented with decreased urinary output or oliguria [Table 1].

Out of 60 patients, septicemia was present in 25 (41.7%), hypertensive disorders of pregnancy, in 20 (33.3%), hemorrhage, in 8 (13.3%) patients, abortion, in five 5 (8.3%) patients. HELLP syndrome one 1 (1.67%) and disseminated intravascular coagulation was reported in 1 (1.67%) patient [Table 2]. In the present study, 23 (38.33%) patients required hemodialysis while 37 (61.7%) were

Table 1: Demographic profile of the patients

Age (years)	27.70±6.30
Gestational age (weeks)	33±4.9
Gravida	3±1.2
Parity	2.6±1.8
Pulse (minute)	94±12
Systolic blood pressure (mmHg)	126±27
Diastolic blood pressure (mmHg)	72±20
Primigravida (%)	32 (53.4)
Multipara (%)	28 (46.7)
Without antenatal care(%)	32 (53.3)
Rural (%)	42 (70)
Urban (%)	18 (30)
Hospital delivery (%)	28 (46.7)
Home delivery (%)	32 (53.3)
Normal delivery (%)	45 (75)
Caesarean section (%)	10 (16.7)
Conservative management (%)	37 (61.7)
Hemodialysis (%)	23 (38.3)

Table 2: Aetiology of pregnancy related acute renal failure

Aetiology	Number (%)
Postpartum sepsis	25 (41.7)
Hypertensive disorder	20 (33.3)
Abortion	5 (8.3)
Postpartum haemorrhage	4 (6.6)
Antepartum haemorrhage	4 (6.66)
HELLP syndrome	1 (1.7)
DIC	1 (1.7)

HELLP – Haemolysis elevated liver enzymes low platelets counts; DIC – Disseminated intravascular coagulation

treated conservatively. However, both the groups showed significant ($P < 0.001$) improvements (either lower or higher) in all biochemical variables and Urine output at post treatment as compared to pre treatment except Na^+ and K^+ in Dialysis group. Improvement in blood urea, S. creatinine, Na^+, K^+ and urine output were 24.4%, 46.5%, 2.4%, 5.0% and 15.2%, respectively, higher in dialysis group as compared to conservative group. Though the improvements in all variables were statistically similar in two groups but clinically stated to be significant [Tables 3 and 4]. While managing the patients, 37 (61.7%) were not dialysed, 33 (55%) patients recovered normal renal function with conservative treatment. Four patients of them were suffering from multiorgan dysfunction and in a state of shock. Complete recovery was observed in 45 (75%) patients out of 60 pregnancy related ARF patients. 5 (8.4%) patients developed irreversible renal failure, whereas 1 (1.7%) patient developed partial recovery but not dialysis dependent. In our study maternal morbidity and mortality both were higher in dialysis group as compared to conservative group though statistically not significant [Table 5]. 9 (15%) patients were expired (maternal deaths) and fetal loss was found in 25 (41.7%) patients [Table 6].

DISCUSSION

Obstetrical ARF is now a rare entity in the developed countries. Its incidence is less than 1:20000 of all gestations.[3,4] Statistics from other developing countries showed that pregnancy related acute renal failure (PRARF) were in Bangladesh, Nigeria, Ethopia and Pakistan, 11%, 25.7%, 55.0% and 18% respectively.[2,5-7] In India recent studies done by other authors reported the prevalence of pregnancy related acute renal failure was 4.3%, 7.6%, 9.06%, 7.0% respectively.[8-11] In our study pregnancy related ARF was reported, 11.5%. This discrepancy might be due to literacy rate, antenatal checkup, mode and place of delivery.

The aetiology of obstetrical ARF has also changed over the last few decades. Abortion was the main cause of obstetrical ARF in late seventies.[1] The proportion of ARF secondary to septic abortions has decreased from 33.3% to 1.8% over the past 20 years.[12] In our study septicemia was present in 25(41.7%) which was compatible to other Indian study, (47.41%, 39.02%).[8-13] This discrepancy in aetiological factors of obstetrical ARF between various studies conducted in developing countries might be due to difference in antenatal care, decrease incidence of obstetrical hemorrhages and early detection of eclampsia-preeclampsia.

Sepsis induced PRARF as a cause of maternal morbidity and mortality is a major concern in low-resource countries. In the present study, 5 women experienced ARF following abortion. In most cases abortion had been performed in unhygienic conditions by untrained rural practitioners. Although, the relative contribution of ARF following

Table 3: Comparison of biochemical parameter and urine output, pre-dialysis and post-dialysis

Variables	Groups	Periods		*P* value	% Change
		Pre-dialysis	Post-dialysis		
B. Urea (mg%)	Dialysis	197.30±92.43	110.86±51.40	<0.001	−78.0
	Conservative	174.49±83.32	113.65±86.65	<0.001	−53.5
	P value	0.716	0.999	–	–
S. Creatinine (mg%)	Dialysis	8.22±4.81	3.27±1.91	<0.001	−151.2
	Conservative	7.10±4.64	3.47±5.39	<0.001	−104.7
	P value	0.788	0.999	–	–
S. Na^{++} (mEq/L)	Dialysis	135.09±8.12	137.87±3.47	0.093	−4.9
	Conservative	130.14±6.26	137.57±7.03	0.927	−0.4
	P value	0.297	0.998	–	–
S. K^{++} (mEq/L)	Dialysis	4.30±0.87	4.15±0.63	0.719	−3.6
	Conservative	3.90±0.58	3.59±0.61	0.035	−8.6
	P value	0.114	0.011	–	–
Urine output (ml)	Dialysis	171.30±130.19	1843.48±1300.55	<0.001	90.7
	Conservative	535.27±618.66	2189.73±1229.14	<0.001	75.6
	P value	0.480	0.523	–	–

Table 4: Improvement in biochemical parameters and urine output of two groups

Variables	Dialysis (*n*=23)	Conservative (*n*=37)	*t* value (DF=58)	*P* value
B. Urea (mg%)	−86.44±114.65	−60.84±53.86	1.17	0.247
S. Creatinine (mg%)	−4.95±4.90	−3.63±2.33	1.41	0.166
S. Na^{++} (mEq/L)	2.78±7.79	−0.57±3.69	2.25	0.028
S. K^{++} (mEq/L)	−0.15±0.98	−0.31±0.37	0.90	0.373
Urine output (ml)	1672.17±1316.95	1654.46±1403.55	0.05	0.961

Table 5: Frequency distribution of maternal outcome of two groups

Outcome	Dialysis (*n*=23) (%)	Conservative (*n*=37) (%)	χ^2 value (DF=2)	*P* value
Expired	5 (21.7)	4 (10.8)	3.14	0.209
Improved	17 (73.9)	33 (89.2)		
Partial recovery	1 (4.3)	0 (0.0)		

Table 6: Maternal and neonatal outcome

Maternal outcome	No. of patients (%)
Complete recovery	45 (75)
Partial recovery	1 (1.7)
Dialysis dependent	5 (8.3)
Expired	9 (15)
Neonatal outcome	
Alive	35 (58.3)
Death	25 (41.7)

abortion was still lower than reported by others, but still alarming.[2,10,14] This might be due to legalization of abortion, increased public awareness about the complications of illegal abortion, and more important is the availability of better reproductive healthcare facilities especially through the National Rural Health Mission in India.[15] Its incidence could be reduced further by preventing unplanned and unwanted pregnancies through increased use of regular contraception, backed-up method and use of emergency contraception.[16]

Hypertensive disorders of pregnancy (Preeclampsia-eclampsia of pregnancy) was found in 20 (33.3%) patients, similarly reported by other Indian authors (47.41%, 39.02%).[8,13] Pre-eclampsia/eclampsia remains a major cause of PRARF. In southern India, the most common cause of PRARF has changed from hemorrhage to hypertensive disorders of pregnancy over the past 20 years.[17] Majority of the studies have reported eclampsia-preeclampsia as a major cause of obstetrical ARF in developed countries.[18]

In our study hemorrhage as a cause of PRARF was found in 8 (13.3%) patients which was compatible to other Indian study (18.6%, 9.76%).[8,13] The fact that eclampsia accounted for most (53.3%) of the PRARF in hypertensive disorders group indicates that this condition was not adequately managed in its initial stages. According to the 2005-2006 National Family Health Survey,[19] only 50% of pregnant women in India had at least 3 antenatal check-ups. Incomplete coverage of prenatal care could be an important underlying factor with these complications being missed in their initial stages.

While managing patients with obstetrical ARF, majority of the patients require haemodialysis as a renal replacement therapy. In the present study, 23 (38.33%) patients required haemodialysis while 37 (61.7%) were treated conservatively. However, both the groups showed significant ($P < 0.001$) improvements (either lower or higher) in all biochemical variables and urine output at post treatment as compared to pre treatment except Na^+ and K^+ in dialysis group. Improvement in blood urea, S. creatinine, Na^+, K^+ and urine output were 24.4%, 46.5%, 2.4%, 5.0% and 15.2%, respectively, higher in dialysis group as compared to conservative group. Though the improvements in all variables were statistically similar in two groups but clinically stated to be significant [Tables 3 and 4]. In study by M.S. Najar[11] hemodialysis was given to 32.5%, peritoneal dialysis in 15%, and both modality to 12.5%, while conservative treatment in 40%. This difference might be due to general condition of patient, severity of renal dysfunction.

In our study maternal mortality was decreased by 20%, 9 (15%), as reported (18.57%) by other Indian authors.[10] Although maternal mortality due to PRARF has decreased recently,[2,12] but it is still high.[10,17,20] The high mortality in present study could be due to various reasons such as poor prenatal care, inadequate emergency obstetric care at peripheral hospitals and late referral of women with severe complication.

Recovery of renal function found in 76.66%, with full recovery in 75% cases. The majority of the remaining patients (1.7%) had partial recovery, not requiring renal replacement therapy. Only 8.33% of the patient had dialysis dependent chronic kidney disease. The better results reported in various studies from developed world might be due to good literacy rate, better health care facilities and postnatal care.

Sepsis accounted 55.6% (5 out of 9 patients), pulmonary edema in 22.2%, HELLP syndrome 1 (11.1%) and disseminated intravascular coagulation 1 (11.1%). Other study[21] reported in their study of 10 year period, irreversible renal damage in 11.6% out of which 26.3% cases were of preeclampsia and eclampsia. We found fetal loss in 25 (41.7%) as compared to 44-55% in other studies.[22,23]

Thus this study showed that eclampsia-preeclampsia, sepsis, obstetrical haemorrhages and DIC are the predominant causes of acute renal failure. Fifteen percent 15% of the patients lost their lives and majority had complete recovery. Approximately 50% of the mothers lost their babies. These are very alarming figures but we can change this threatening scenario by providing good antenatal care and health facilities in the far-flung areas.

CONCLUSION

PRARF is usually a consequence of obstetric complications. In our study, most common aetiological factors was septicaemia, therefore, preventive measures should be directed to addressing the lacunae of existing maternity

care. It is a dangerous complication of pregnancy which carries very high morbidity and mortality. Dialysis may improve the outcome if given at an appropriate time. Thus, priorities in management of ARF include early recognition, institution of appropriate preventive measures, optimization of fluid balance, identification and treatment of cause, timely initiation of renal replacement therapy. In addition, the twin approaches of improving early referral and communication systems at the periphery and establishing more obstetric critical-care units with facilities for providing multidisciplinary services at the tertiary level may reduce mortality due to PRARF.

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