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RESEARCH ARTICLE

Acute renal failure in the obstetric population

Neeta Sarma

Corresponding author: Dr. Neeta Sarma, Assistant Professor, Department of Obstetrics and Gynaecology, Silchar Medical College and Hospital, Assam, India; Email : sarma_neeta@rediffmail.com

ABSTRACT

Objectives: The objective of the study is to determine the aetiology and maternal outcome of acute renal failure in pregnancy and postpartum period. **Methods:** The study was conducted over a period of five years from August 2014 to July 2019. 38 previously healthy women who developed acute renal failure (ARF) during pregnancy or postpartum period were included in the study. Those with known renal disease, diabetes, chronic hypertension, history of renal calculi or urological intervention were excluded. The cases were followed up for a period of six months. **Results:** 38 patients with pregnancy related ARF were included. The age range was 18 to 39 years (mean 27±4.1years). 2(5.3%), 16(42.1%) and 20(52.6%) women were in the second trimester, third trimester and puerperal period respectively. The different aetiologies were preeclampsia 7(18.4%), antepartum haemorrhage 4(10.5%), postpartum haemorrhage 8(21%), puerperal sepsis 12(31.6%), intrauterine foetal death 3(7.9%), acute fatty liver of pregnancy 1(2.6%), hyperemesis gravidarum 1(2.6%) and septic abortion 2(5.3%). Maternal mortality was 5(13.2%). Of the 33(86.8%) women who survived, 17(44.7%) had complete recovery of renal function and 14(36.8%) had partial recovery. **Conclusion:** Pregnancy related ARF may have adverse maternal outcome. Approach to each clinical condition leading to it must be individualized and appropriate therapeutic decision is to be taken.

Keywords: Acute renal failure, pregnancy, postpartum.

Acute renal failure during pregnancy and the postpartum period is clinically challenging. It often leads to serious consequences upon the mother and the foetus. The condition may be specific and unique to pregnancy or may be coincidental with pregnancy. The causes in early pregnancy include septic abortion, hyperemesis gravidarum; causes in the later part of pregnancy include haemorrhage, particularly abruptio placentae, severe preeclampsia, acute pyelonephritis, DIC following intrauterine foetal death, acute fatty liver of pregnancy whereas puerperal sepsis, haemolytic uremic syndrome, idiopathic postpartum ARF are the causes during the puerperal period. The incidence of pregnancy related ARF is 1-2.8% in developed countries and 4.2-15% in developing countries [1-3]. The current incidence of acute kidney injury in pregnancy has shown a declining trend [4] but still it accounts for 5-20% of total AKI population [5-7]. Nearly 15-20% of ARF in India between 1970 to 1980 was attributable to obstetrical complication while latest status is 9-13% [8]. The incidence has reduced over the last few years because of lesser number of septic abortion cases, improved antenatal care and early diagnosis and prompt management of maternal conditions like preeclampsia and acute pyelonephritis. ARF often leads to renal cortical necrosis which has high morbidity and mortality. Renal biopsy can help to differentiate renal cortical necrosis from acute tubular necrosis which has a better prognosis [9]. This study was

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conducted with the aim to determine the aetiology and maternal outcome of acute renal failure in pregnancy and postpartum period.

Material and methods

This prospective observational study was conducted at tertiary care hospital over a period of five years from August 2014 to July 2019. 38 women who were previously healthy but developed acute renal failure (ARF) during pregnancy or postpartum period were included in the study. The cases were diagnosed on the basis of having oliguria (urine output<400mL in 24 hours) and raised serum creatinine levels, that is >2mg/dl. A detailed history was taken and a thorough clinical examination was done to determine the cause of ARF and the requirement of dialysis was considered. Those with known renal disease, diabetes or chronic hypertension or with history of renal calculi or urological intervention were excluded. Baseline biochemical investigations were carried out in all patients which included complete blood count, random blood sugar, liver function tests, renal function tests, routine examination of urine and ultrasonography of the abdomen. Selected patients were subjected to investigations like culture and sensitivity tests of blood, urine or vaginal swab, blood coagulation profile etc. as required. The cases were followed up for a period of six months. Those with full recovery of renal function were categorized to have complete recovery, those with impaired renal function but not dialysis dependent were categorized to have partial recovery and those with impaired renal function requiring dialysis even after three months were considered to have end stage renal disease. Percentages were calculated for qualitative (categorical) variables whereas mean ± SD were calculated for quantitative (continuous) variables.

Results

38 patients with pregnancy related ARF were included. The age range was 18 to 39 years (mean 27+/-4.1years). 2(5.3%), 16(42.1%) and 20(52.6%) women were in the second trimester, third trimester and puerperal period respectively. 26(68.4%) belonged to the rural background; 29(76.3%) of the cases were unbooked (table1).

The different aetiologies were preeclampsia 7(18.4%), antepartum haemorrhage 4(10.5%), postpartum haemorrhage 8(21%), puerperal sepsis 12(31.6%), intrauterine foetal death 3(7.9%), acute fatty liver of pregnancy 1(2.6%), hyperemesis gravidarum 1(2.6%) and septic abortion 2(5.3%) (table 2).

Table 1: Demographic profile of the patients

Parameter	Range (Mean ±SD)	Number (percentage)
Age (years)	18 – 39 (27 ± 4.1)	
Parity		
Primigravida	0 – 4 (2.6 ± 1.3)	16 (42.1%)
Multigravida		22 (57.9%)
Gestational period at presentation (weeks)		
First trimester		2 (5.3%)
Second / Third trimester		16 (42.1%)
Puerperium		20 (52.6%)
Rural		26 (68.4%)
Urban		12 (31.6%)
Booked		9 (23.7%)
Unbooked		29 (76.3%)
Hospital delivery		34 (89.5%)
Home delivery		4 (10.5%)

Table 2: Aetiologies of obstetric ARF

Aetiologies of obstetric ARF	Number (percentage)
Puerperal sepsis	2 (31.6%)
Postpartum haemorrhage	8 (21%)
Preeclampsia- Eclampsia	7 (18.4%)
Antepartum haemorrhage	4 (10.5%)
DIC following intrauterine foetal death	3 (7.9%)
Septic abortion	2 (5.3%)
Acute fatty liver of pregnancy	1 (2.6%)
Hyperemesis gravidarum	1 (2.6%)

Table 3: Laboratory parameters of the cases

Laboratory parameter	Number	Percentage	Mean value
Haemoglobin<10g/dL	34	89.5	7.2 ± 0.6g/dL
Leucocytosis	14	36.8	17800 ± 220/cu.mm
Thrombocytopenia	7	18.4	92000 ±1350/cu.mm
Serum creatinine>2mg/dL	38	100	6.25 ± 2.71mg/dL
Hyperkalaemia	19	50	5.6 ± 1.2mEq/L
Hypokalaemia	12	31.6	3.01 ± 1.12mEq/L
Hypernatremia	7	18.4	137.11 ± 1.26mEq/L
Hyponatremia	9	23.7	124.12 ±2.13mEq/L
Metabolic acidosis	7	18.4	7.2 ± 0.6
Hyperbilirubinemia	5	13.2	5.2 ± 0.8mg/dL
Raised FDP	4	10.5	11µg/dL

Table 4: Management of the cases

Management	Number (Percentage)
Mode of delivery	
Vaginal delivery	29 (76.3%)
Caesarean section	9 (23.7%)
Treatment offered	
Conservative treatment	21 (55.3%)
Haemodialysis	17 (44.7%)

The laboratory parameters of the study group have been demonstrated in table 3. All the patients had raised serum creatinine values. 89.5% had Hb<10g/dL, 50% had hyperkalaemia, 36.8% had leucocytosis, 31.6% had hypokalaemia. 29(76.3%) patients of the study group underwent vaginal delivery while the rest had caesarean section. 21(55.3%) women were treated conservatively whereas 17(44.7%) required haemodialysis (table 4).

Table 5: Maternal outcome

Maternal Outcome	Number (percentage)
Survivors	33 (86.8%)
Complete recovery	19 (50%)
Partial recovery (not requiring regular dialysis)	9 (23.7%)
End stage renal disease (requiring regular dialysis)	5 (13.2%)
Death	5 (13.2%)

Maternal mortality was 5(13.2%). Of the 33(86.8%) women who survived, 19(50%) had complete recovery of renal function, 9(23.7%) had partial recovery whereas 5(13.2%) had end stage renal disease (table 5).

Discussion

Pregnancy leads to both anatomical and physiological changes in renal and systemic hemodynamics. The kidneys increase in size by about 1–1.5 cm due to renal vascular and interstitial space volume expansion [4]. The physiological hydronephrosis of pregnancy characterized by a dilation of the calyces, renal pelvis, and ureter occurs in over 90% of pregnant women [10]. The dilatation of the urinary system is due to the hormonal effects of progesterone, external compression by the gravid uterus, and morphological changes in the ureteral wall. The renal vascular resistance decreases under the effects of maternal hormones like relaxin and progesterone. Renal plasma flow can increase up to 85% in the second trimester of pregnancy and the GFR can reach 40%–50% of baseline throughout pregnancy [4] which is responsible for the fall in serum creatinine levels and urinary protein excretion upto 300 mg/day. Systematic vasodilation leads to the stimulation of antidiuretic hormone, resulting in a decrease in plasma osmolality and plasma sodium by 4 –5 mEq/L [10]. Minute ventilation increases due to progesterone-induced stimulation of the central respiratory centre in the brain. This results in a decrease in pCO_2 and a mild chronic respiratory alkalosis, which is compensated for renal excretion of bicarbonate [4].

ARF in pregnancy is variably defined as serum creatinine level more than 0.8 mg/dL or doubling of serum creatinine to dialysis requirement.

The most common aetiology of ARF in the present study was puerperal sepsis which accounted for 31.6% of the cases. The other aetiologies were PPH (21%), preeclampsia (18.4%), APH (10.5%), IUFD (7.9%), septic abortion (5.3%), hyperemesis gravidarum (2.6%) and AFLP (2.6%). Goplani et al [1] and Aggarwal et al [9] have also found puerperal sepsis as the commonest aetiology, i.e. 61.42% and 40% respectively. In the study by Goplani et al [1], DIC (32.5%), preeclampsia-eclampsia-HELLP (28.5%), PPH (24.28%), post-abortal sepsis (20%), APH (14.28%) were the other aetiologies. Whereas the other aetiologies in the study by Aggarwal et al [9] were preeclampsia-eclampsia-HELLP (34%), APH (24%), PPH (10%), septic abortion (6%) and DIC (4%). The aetiologies of ARF as found by Hassan et al [14] in their study were haemorrhage (53.8%) [PPH 37.2%, APH 18.6%], puerperal sepsis (27.1%), preeclampsia-eclampsia-HELLP (11.6%), DIC (9.3%), HUS (2.3%) and hypotension following hyperemesis gravidarum (2.3%).The aetiologies reported by Patel et al [12] were septicaemia (41.7%), hypertensive disorders (33.3%), haemorrhage (13.3%), abortion (8.3%), HELLP (1.67%) and DIC (1.67%).

Management is clinically challenging as both maternal and foetal aspects need to be taken into consideration. Moreover, the altered cardiovascular and renal physiology during pregnancy adds to the complexity of diagnosis and management necessitating a multidisciplinary approach. The key points in management include stabilization of the patient by maintaining airway, breathing, circulation, treating any underlying cause if apparent, preventing progression of kidney disease by maintaining adequate renal perfusion, monitoring urine output and pulmonary function, stopping or adjusting nephrotoxic drugs, providing supportive care like treating hyperkalaemia, metabolic acidosis, anaemia, or renal replacement therapy/ dialysis and optimizing foetal health, but with priority to maternal health

In our study group, 55.3% women were treated conservatively whereas 17(44.7%) required haemodialysis. In the study by Patel et al[12], 61.7% and 38.3% had conservative management and haemodialysis respectively. Najar et al [13] in their study group reported conservative treatment in 40% cases, haemodialysis in 32.5%, peritoneal dialysis in 15% and both in 12.5%.

The maternal mortality of obstetric ARF in our study was 13.2%. In other studies, the maternal mortalities reported were 18.5%, 12% , 15%, 16.2%, 9-55%, 20%, 18% and 12.5% [1, 9, 12, 14-18]. In our study, 86.8% patients survived and 50% had complete renal recovery, 23.7% had partial recovery, 13.2% suffered from end stage renal disease. In the study by Aggarwal et al [9], 88% patients survived of which 58% recovered completely whereas 30% were dialysis dependent. Similarly, in Hassan et al's study [14], there were 83.7% surviving patients of which 41.4% had complete recovery of renal function, 27.9% had partial recovery whereas 13.9% required chronic dialysis. In the study by Patel et al [12], 75%, 1.7% and 8.33% had complete recovery, partial recovery and end stage renal disease respectively.

Conclusion

Pregnancy related ARF may have adverse maternal outcome. It is important to understand the physiological changes in renal function during pregnancy. Approach to each clinical condition leading to it must be individualized and appropriate therapeutic decision is to be taken keeping in consideration both maternal and foetal interest.

Conflict of interest: None. **Disclaimer:** Nil.

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Neeta Sarma[1]

[1] Assistant Professor, Department of Obstetrics and Gynaecology, Silchar Medical College and Hospital.