European Journal of Molecular & Clinical Medicine
ISSN 2515-8260 Volume 07, Issue 02, 2020

Clinical Profile of Pregnant Patients With Acute Kidney Injury; Single Center Study

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Abstract: Background: A sudden decline of renal function occurring during pregnancy or postpartum is defined as Pregnancy-related acute kidney injury (PRAKI) includes all the causes not only the obstetric one. The incidence and etiology of PRAKI varies greatly between different regions. Data for the prevalence and prognosis cannot be interpreted without taking into account the geographic and economic context of the country in which they have been obtained. In developed countries, obstetric AKI has become a rare complication of pregnancy. However, in developing countries, AKI remains a frequent and grave complication of pregnancy. Aim: to demonstrate the demographic, clinical and laboratory characteristic of the pregnant women with AKI. Materials and Methods: A Cross-sectional study was carried out among pregnant women who were admitted to obstetrics & gynecology department in collaboration with nephrology unit in internal medicine department during a six months. This study is a part of a large study on the prevalence and outcome of AKI in pregnancy by the same authors in the same center that will be published soon. The demographic, clinical and laboratory data was obtained and analyzed

Results: During the period of the study, a total of 4130 obstetric cases were admitted to the hospital. In total, 33 patients met the diagnostic criteria of pregnancy related acute kidney injury. The mean age of the patients was 29 ± 4.58 years, and gestational age was 31.46 ± 6.34 weeks. Eleven of the 33 women (21%) were primiparous and twelve of them (79%) were multipara. There was a significant findings between the patients who were suffering from hypertensive disorders of pregnancy (Group 1) and who didn't suffer (Group 2) as regarding low hemoglobin level and low arterial blood pressure and in group 2, while group 1 showed higher uric acid level and low albumin level with a significant finding.

Keywords: AKI, Pregnancy, pregnancy related hospitalization.
Abbreviations: AKI (acute kidney injury), PRAKI (pregnancy related acute kidney injury)

1. INTRODUCTION

Acute kidney injury in pregnancy (P-AKI) deserves special attention because it involves a risk to two lives (mother and fetus) and, it is largely due to potentially preventable obstetric complications. Compared with developing countries, the socioeconomic and environmental factors are responsible for the huge differences in the incidence, causes, and outcome of PAKI in developed countries**. (1)**

A sudden decline of renal function occurring during pregnancy or postpartum is defined as Pregnancy-related acute kidney injury (PRAKI) includes all the causes not only the obstetric one. The incidence and etiology of PRAKI varies greatly between different regions **(2).**
In the past, AKI was considered to be a completely reversible syndrome**.(3)** However, in recent years, several studies have indicated that AKI may increase the risk of developing chronic kidney disease (CKD), resulting in permanent kidney damage**.(4)** The physiologic changes in pregnancy make the diagnosis of AKI during pregnancy a diagnostic challenge. Timely identification of "at-risk" individuals and treatment of underlying conditions remains the cornerstone of management of AKI in general. Understanding of the dynamics of AKI in pregnancy resulted in better management strategies **(5).**
One of the important issue is that AKI in pregnancy bears a high risk of bilateral renal cortical necrosis and consequently chronic renal failure. Obstetric complications that are the most common cause of renal cortical necrosis include abruptio placentae, septic abortion, preeclampsia, postpartum hemorrhage and puerperal sepsis..**(6)** The presence of AKI increases the mortality associated with any primary disease.,**(7)** the overall mortality rate associated with AKI is 20%, and those requiring renal replacement therapy (RRT) have a mortality rate approaching 50%. It has traditionally been thought that patients who do survive ultimately recover renal function; however, population-based studies suggest that a strikingly large percentage of patients who have AKI require permanent RRT or do not fully recover renal function **(8)**
To support the developing fetus, there are many changes in circulatory system, renal, and urinary collecting systems. **(9)** Due to the physiological changes, that occur secondary to hyperfiltration there is a decrease in serum creatinine concentration by an average of (0.4 mg/dl). Thus normal creatinine levels range around 0.4 mg/dL to approximately 0.8 mg/dL during pregnancy. Also, Blood urea nitrogen (BUN) levels decrease during pregnancy as well to levels of approximately 8–10 mg/dL **(10).**

2. SUBJECTS AND METHODS

A Cross-sectional study was carried out among pregnant women who were admitted to obstetrics & gynecology department in collaboration with Nephrology unit at Zagazig university hospitals from December 2018 to May 2019. The study was approved by the Institutional Ethics Committee and conformed to the Helsinki Declaration. This study is a part of a large study (that clarify the prevalence and outcome of AKI in pregnancy within one year by the same authors) that will be published soon. The aim of the study was explained, and informed consent obtained from all subjects. All pregnant women who are admitted during the period of the study either by obstetric related problem or not were screened for criteria of AKI.

Criteria
Increase in SCr by 50% within 7 days, or Increase in SCr by 0.3 mg/dl within 2 days, or Oliguria (urine output of less than 0.5 mL/kg per hour for 6 h).

Patients who were enrolled in this study once AKI was diagnosed according to:

- **The definition of KDIGO AKI guidelines diagnostic criteria (11)**
- **Or absolute sCr more than 1.1mg/dl at baseline on admission.**
- **Patients who need Hemodialysis**

Exclusion criteria All patients with history or evidence of Chronic Kidney Disease (functional or structural abnormalities persistent for 3 months before presentation).

- Demographic data inform of (age, parity, time of abortion, gestational age and residence) Clinical data inform of (blood pressure measuring, hypertension history, diabetes history and other co morbidities). Laboratory data inform of (Complete blood count, urea, creatinine (serial until discharge), complete urine analysis, urinary protein/creatinine ratio, uric acid, full electrolytes (Na, K, Ca, Mg,), transaminases, bilirubin, and ultrasound of the kidneys).

- Our patients were classified into two groups, Group 1 (patients with pregnancy related hypertensive disorders (preeclampsia/ eclampsia and/or gestational hypertension) Group 2 (patients without hypertensive disorders of pregnancy)

Statistical analysis

We used the statistical package of social signs (SPSS, version 16) to perform the analysis. Categorical data were presented as number and percentages and continuous variables as means ± standard deviation (SD). Correlation between the two groups of patients was done by simple **t** test and **MW** test

3. RESULTS

Demographic, clinical data and Laboratory data

Our study showed that 33 patients from total 4130 women with pregnancy related hospitalizations who met the diagnostic criteria of Acute Kidney injury during the study period of six months. All demographic (Table 1) that demonstrated a mean age 29 ± 4.58 of studied patients with a mean gestational age of 31.46 ± 6.34, and about 33.3% of the patients were primigravida while 67.7% of the patients were multigravida. Near the half of the patients (48.9%) give a history of abortion.

Our study showed that mean arterial blood pressure was 112.6 ± 21.65, with a history of chronic hypertension in 21.1% of patients. On the other hand, 9.1% of the patients give a history of diabetes: while 12.1%, 9.1% and 39.4% of the patients suffered from gestational hypertension, HELLP syndrome and preeclampsia/Eclampsia (Table 2). As regarding the other less common co morbidities, three patients were suffering from valvular heart disease due to old history of rheumatic fever and one patient with evidence of ischemic heart disease.

The laboratory investigations showed mean hemoglobin concentration of 9.59 ± 1.52 gm/dl, the mean total leukocyte count was 13.79 ± 3.73 $x10^3$ /mm^3, the mean platelet count seen was 117.24 ± 98.34 $x10^3$ /mm^3. There were variations with a range of serum creatinin on presentations as following 1.2 – 5 mg/dL (with median 1.8 mg/dL), the mean uric acid level was (6.32 ± 1.93).

The mean serum albumin (1.93 ± 0.92 gm/dl), the mean serum Ca (8.31 ± 0.29 mg/dl), the mean serum Na (133.76 ± 2.60 mg/dl), the mean serum K (4.22 ± 0.75 mEq/L) Alanine Aminotransferase (ALT) ranged from 7.8 to 640 IU/L, whereas Aspartate Aminotransferase (AST) ranged from 8.3 to 412 IU/L, total bilirubin ranged from 0.06 to 3 mg/dl. In urine analysis, the pus cells ranged from 2 to 45 (WBCs/HPF) , the RBCs ranged from 2 to 50 (RBCs/HPF). **(Table 3)**.

Correlation

We classified our studied patients into two groups, Group 1 (patients with pregnancy related hypertensive disorders (preeclampsia/ eclampsia and/or gestational hypertension)) and Group

2 (patients without hypertensive disorders of pregnancy). There was a significant finding between two groups as regarding low hemoglobin level and low arterial blood pressure in group 2, while group 1 showed higher uric acid level and low albumin level with a significant finding.
(Table 4 & 5).

1. Table 1 show the demographic data of the studied patients:

	No	**%**
Age (Years) **Mean± SD**	29 ± 4.58	
Gestational age **Mean± SD** **Median (Range)**	31.46 ± 6.34 33.5 (6 – 39)	
Parity **Primi** **Multi**	11 22	21% 79%
Abortion **Yes** **No**	17 16	40.3% 59.7%
Trimester **1st** **2nd** **3rd** **postpartum**	2 3 19 9	6.1% 9.1% 57.6 % 27.3%

2. Table 2 show the Clinical data of studied patients:

	No	**%**
MABP (mmHg) **Mean± SD**	112.6 ± 21.65	
Chronic Hypertension	7	21.2%
Gestational Hypertension	3	9.1%
HELLP	4	12.1%
Diabetes	3	9.1%
Other Co morbidities **Valvular heart disease** **Ischemic heart disease**	**4** 3 1	**12.1%** 9.1% 3.03%
Preeclampsia/Eclampsia	**13**	**39.4%**

3. Table 3 show the laboratory data of studied patients:

WBC ($x10^3/mm^3$) **Mean± SD**	13.79 ± 3.73
Hemoglobin (g/dl) **Mean± SD**	9.59 ± 1.52
Platelet count ($x10^3/mm^3$) **Mean± SD**	117.24 ± 98.34
Uric acid (mg/dL) **Mean± SD**	6.32 ± 1.93
Creatinine (mg/dl) **Median (Range)**	1.8 (1.2 – 5)
ALT (U/L) **Median (Range)**	18 (7.8 – 640)
AST (U/L) **Median (Range)**	19 (8.3 – 412)
Albumin (g/dL) **Mean± SD** **Median (Range)**	1.93 ± 0.92 2.4 (2.05 – 3.1)
Total Bilirubin (mg/dl) **Median (Range)**	0.31 (0.06 – 3)
Ca (mEq/L) **Mean± SD** **Median (Range)**	8.31 ± 0.29 8.12 (7 – 8.8)
Mg (mEq/L) **Mean± SD** **Median (Range)**	2.1 ± 0.37 1.9 (1.7 – 3.4)
Na (mEq/L) **Mean± SD** **Median (Range)**	133.76 ± 2.60 135 (130 – 142)
K (mEq/L) **Mean± SD** **Median (Range)**	4.22 ± 0.75 3.9 (3.7 – 6.2)
PUS (WBCs/HPF) **Median (Range)**	8 (2 – 45)
Red cells (RBC/HPF) **Median (Range)**	2 (0 – 50)
ACR (mg/g) **Median (Range)**	1245 (243 – 11589)

4. Table 4 show the correlation between the two groups of the patients as regarding the demographic and clinical data:

	Group 1 (n=20)	Group 2 (n=13)	Test	P

	No	%	No	%		
Age (Years) Mean± SD	25.90 ± 3.20		27.21 ± 5.60		**t** -1.01	0.32 (NS)
Gest Age (Weeks Mean± SD	32.85 ± 6.14		31.2 ± 3.67		**t** 1.90	0.161 (NS)
MAP (mmHg) Mean± SD	116.10 ± 15.66		87 ± 18.81		**t** -6.58	<0.0001 (S)
Hospital stay Median (Range)	6 (3 – 15)		7 (2 – 18)		**MW** 0.38	0.537 (NS)

5. Table 5 show the correlation between both group of the patients as regarding the laboratory data:

	Group 1 (n=20)		Group 2 (n=13)		Test	P
	No	**%**	**No**	**%**		
WBC ($x10^3/mm^3$) Mean± SD	12.12 ± 5.27		14.63 ± 7.49		**t** 2.07	0.043 (S)
Hemoglobin (g/dl) Mean± SD	11.99 ± 2.45		9.73 ± 2.1		**t** -3.86	**0.0003** (S)
Albumin (g/dL) Mean± SD	2.78 ± 0.4		3.06 ± 0.59		**t** 2.17	**0.034 (S)**
Uric acid (mg/dL) Mean± SD	6.93 ± 1.71		5.20 ± 1.53		**t** -4.19	**0.0001** (S)
Ca (mEq/L) Mean± SD	8.19 ± 0.36		8.23 ± 0.43		**t** 0.40	0.69 (NS)
Mg (mEq/L) Median (Range)	2.1 (1.8 – 2.4)		2.05 (1.7 – 4.4)		**MW** 0.9	0.369 (NS)
Na (mEq/L) Mean± SD	135.17 ± 1.79		135.91 ± 3.14		**t** 1.11	0.27 (NS)
K (mEq/L) Median (Range)	3.8 (3.2 – 6)		4 (3.2 – 6.3)		**MW** 1.17	0.244 (NS)

4. DISCUSSION

Acute kidney injury (AKI) encompass a group of clinical syndromes that primarily manifest as a rapid decline in the kidney function in association with the accumulation of metabolic waste products.**(13)** The diagnosis and treatment of AKI occurring during pregnancy is a

clinical challenge for obstetricians and nephrologists. The incidence and etiology of PRAKI varies greatly between different regions**.(2)**
During the period of this study, a total of 4130 pregnant related hospitalizations were admitted to zagazig university hospitals including (obstetrics & gynecology department incollaboration with nephrology unit in internal medicine department). In total, 33 patients met the diagnostic criteria of acute kidney injury in pregnancy that according to the definition of KDIGO AKI guidelines diagnostic criteria or absolute increase in serum creatinin more than (1.1mg/dl).

Our cohort study reported that the majority of our cases was occurred in the third trimester (57.6%) and postpartum (27.3%) periods, which is close to what was reported (69.2%) by **Hildebrand et.al. 2015. (14)** While, a study that was done in a nearby country (Moroco) reported that 52% of the patients with pregnancy related AKI were in the postpartum period**. (15)**
Regarding the age of the patients in our study, the mean age of the studied patients is 29 (± 4.58) year old; which is to some extant is similar to what was reported by **Khamis et.al. 2015, (16)** who demonstrate that the mean age of the studied patients was (30.27± 4.29) year old.
Elwven of the 33 patients (21%) in our study were primiparous, while 22 (79%) were multigravida. **Prakash et al. 2010, (17)** also reported in their study that the majority of the patients were multigravida unlike **Gopalakrishnan N et al., 2015, (18)** who mentioned that the majority of patients were primigravida.
In our study seven patients (24.2%) were suffering from chronic hypertension; this was not corresponding with **(Arrayhani et al., 2013) (19)** study as hypertension was present in (55.6%) of patients. Also another study which revealed that most women (54%) had hypertensive disorders during pregnancy. **(Gurrieri C et al. (2012)**.**(20)** It is well known that, hypertension is one of the important risk factor for development of AKI rather than it carry a high risk to develop hypertensive disorders of pregnancy.
In our study three patients (9.1%) were suffering from pre-existing diabetes, while in a study that was done by **Khamis S et al., 2015 (16)** the percentage of diabetic patients between P-RAKI group patients was 30.6%. In our study the etiology of acute kidney injury during pregnancy was mainly due to hypertensive disorders of pregnancy (preeclmpsia/Eclampsia and/or gestational hypertension) unlike what was reported by **Prasath et al. 2010 (17)** who demonestrate that the cause of PRAKI was mainly due to sepsis.
In our study, the patients who suffered from hypertensive disorders of pregnancy showed lower albumin level and higher level of serum uric acid with significant finding (**Table 5),** while other group of patients showed lower hemoglobin level with a significant that explained by ante partum and postpartum hemorrhage which is the main cause in this group. This finding explained as the cause of the AKI in group 1 mainly due to preeclampsia/ eclampsia that characterized by higher uric acid level in serum and loss of albumin in urine while, in group 2 the cause mainly due to obstetric related hemorrhage with low MAPB and hemoglobin.

5. CONCLUSION:

AKI during pregnancy poses a challenge for physicians. In view of the multifaceted problems that potentially complicate pregnancy in women with AKI. Fortunately, with ongoing improvements in obstetrical care, multi- disciplinary approaches comprising nephrologists, obstetricians and neonatologists and new insights into the diagnosis and management of associated conditions such as preeclampsia, maternal and perinatal mortality in this setting

are largely avoidable. Therefore early recognition by early diagnosis, close monitoring in high risk cases, early referral and a multi- disciplinary team management could potentially prevent progression to higher stages of PRAKI and reduce morbidity and mortality.

Conflict of interest
No conflict of interest.

REFERENCES

[1] **Prakash, J., Prakash, S., & Ganiger, V. C. (2019).** Changing epidemiology of acute kidney injury in pregnancy: A journey of four decades from a developing country. Saudi journal of kidney diseases and transplantation : an official publication of the Saudi Center for Organ Transplantation, Saudi Arabia, 30(5), 1118–1130. https://doi.org/10.4103/1319-2442.270268 preeclampsia. Am J Obstet Gynecol, 155:263-265.

[2] **Bouaziz M, Chaari A, Turki O, et al., (2013):** Acute renal failure and pregnancy: a seventeen-year experience of a Tunisian intensive care unit. Ren Fail 35: 1210-1215.

[3] Belayev, L. Y., & Palevsky, P. M. (2014). The link between acute kidney injury and chronic kidney disease. *Current opinion in nephrology and hypertension*, *23*(2), 149–154. https://doi.org/10.1097/01.mnh.0000441051.36783.f3

[4] **Rifkin, D. E., Coca, S. G., & Kalantar-Zadeh, K. (2012**). Does AKI truly lead to CKD?. *Journal of the American Society of Nephrology: JASN*, *23*(6), 979–984. https://doi.org/10.1681/ASN.2011121185

[5] **Bentata Y, Housni B and Mimouni A, (2012):** Acute kidney injury related to pregnancy in developing countries: etiology and risk factors. Journal of Nephrology; 25(5): 764-75.

[6] **Goplani KR, Shah PR, Gera DN, et al., (2008):** Pregnancy-related acute renal failure: a single-center experience, Ind. Journal of Nephrol, 18(1): 17–21.

[7] **Murugan R and Kellum JA, (2011):** Acute kidney injury: what's the prognosis? Nat Rev Nephrol; 7(4): 209-17.

[8] **Metnitz PG, Krenn CG, Steltzer h, et al., (2002):** Effect of acute renal failure requiring renal replacement therapy on outcome in critically ill patients.

[9] **Chinnappa V, Ankichetty S, Angle P, et al., (2013):** Chronic kidney disease in pregnancy. Int J Obstet Anesth; 22: 223-30.

[10] **Koetje PM, Spaan JJ, Kooman JP, et al., (2011):** Pregnancy reduces the accuracy of the estimated glomerular filtration rate based on Cockroft Gault and MDRD formulas. Reprod. Sci. 18: 456–62.

[11] **Mehta RL, Kellum JA, Shah S V, et al., (2007):** Acute Kidney Injury Network: report of an initiative to improve outcomes in acute kidney injury. Critical Care.11 (2): 31.

[12] **Srisawat N and Kellum JA. (2011):** Acute kidney injury: definition, epidemiology, and outcome. Curr Opin Crit Care 17: 548-555.

[13] **Hildebrand AM, Liu K, Shariff SZ, et al., (2015):** Characteristics and outcomes of AKI treated with dialysis during pregnancy & the postpartum period. J Am Soc Nephrol; 26: 3085-91.

[14] **Kabbali, N., Tachfouti, N., Arrayhani, M., et al., (2015).** Outcome assessment of pregnancy-related acute kidney injury in Morocco: A national prospective study. *Saudi journal of kidney diseases and transplantation : an official publication of the Saudi Center for Organ Transplantation, Saudi Arabia*, *26*(3), 619–624. https://doi.org/10.4103/1319-2442.157426

[15] **Khamis S, Emara M, EL Naggar M, et al.,(2015):** Peripartum Acute Kidney Injury. Nat. Sci.; 13(3):1-10.
[16] **Prakash J, Niwas SS and Parekh A, (2010):** Acute kidney injury in late pregnancy in developing countries. Ren Fail; 32(3): 30913.
[17] **Gopalakrishnan N, Dhanapriya J, Muthukumar P, et al., (2015):** Acute kidney injury in pregnancy: a single centre experience. Ren Fail; 39(9):1476-1480.
[18] **Arrayhani M, El Youbi R and Sqalli T, (2013):** Pregnancy-related acute kidney injury: experience of the nephrology unit at the university hospital of Fez,
[19] **Gurrieri, C., Garovic, V.D., Gullo, A. et al**. **(2012)**: Kidney injury during pregnancy: associated comorbid conditions and outcomes. Arch Gynecol Obstet 286, 567–573 https://doi.org/10.1007/s00404-012-2323-5