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Original Research Article

Maternal and fetal outcomes in pregnancies complicated by renal disease: a single-centre observational study

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ABSTRACT

Background: Renal disease in pregnancy poses significant risks for both mother and fetus, with increased rates of maternal morbidity, fetal growth restriction, preterm delivery, and adverse neonatal outcomes. In India, women comprise nearly half the renal disease burden, and 3-5% of them conceive. This study evaluates the clinical profile, maternal, and fetal outcomes of pregnancies complicated by renal disease.
Methods: A retrospective observational study was conducted at a tertiary care hospital in Western India between February 2020 and July 2023. All pregnant women with documented renal disease or renal abnormalities were included. Data on demographics, comorbidities, renal parameters, obstetric outcomes, and complications were analysed.
Results: Of 44 screened women, 36 met inclusion criteria. Mean age was 29.2±4.7 years; 58.3% were multigravida. Hypertension (27.8%) and proteinuria >1000 mg/day (16.7%) were significant predictors of adverse fetal outcome ($p<0.05$). Maternal age >30 years and multigravida status were significantly associated with caesarean delivery ($p<0.05$). Preterm delivery occurred in 41.7%, and intrauterine growth restriction in 25%.
Conclusions: Pregnancies complicated by renal disease represent a high-risk group requiring multidisciplinary management. Preconception counselling, optimal blood pressure control, and close antenatal surveillance can improve outcomes. Larger multicentric studies are needed for more definitive guidance.

Keywords: Chronic kidney disease, Pregnancy, Maternal outcome, Foetal outcome, India, Preterm delivery, Proteinuria

INTRODUCTION

The renal functions are enhanced in pregnancy leading to increase in GFR by about 50%. The size of the kidney increases by 1 cm, along with hydro-uretero-nephrosis, the changes in the renal physiology are as per the needs of the pregnancy.[1,6,16] A compromised kidney or renal functions pose a challenge to the mother in meeting the demands of the pregnancy thus affecting the maternal and foetal outcomes. As the incidence of pregnancy in advanced age is increasing so is the prevalence of medical complications in pregnancy. The prevalence of chronic kidney disease (CKD) patients becoming pregnant is 3-5%. The disease progression may or may not occur during pregnancy depending on severity of disease and aetiology of CKD. Deteriorating kidney functions have an adverse impact on foetal outcomes like increase in incidence if IUGR, prematurity and stillbirth. Maternal effects are increase in need for dialysis, development of preeclampsia, increase in the existing proteinuria and disease progression may be permanent.[2] This study is an attempt to analyse pregnant women and their outcome over a period of 3 years who were in various stages of spectrum of kidney disease in a tertiary care centre. Our study spanned 3 years, our study population was 36 which accounted for 1.5% of our deliveries which included women with any renal disease.

A larger study population could give us better perspective. This study is an introspection of women with renal compromise and pregnancy.

METHODS

It was an observational study conducted at a tertiary care hospital in Western India. Study population included all pregnant patients who delivered in this hospital between February 2020 to July 2023 and had any renal disease.

Inclusion criteria

All pregnant patients who underwent normal vaginal delivery or caesarean section were included if-They had any known kidney disease or CKD (any stage), they had the following abnormalities in absence of established kidney disease, proteinuria->300 mg/day, urine sediment abnormalities, electrolyte and other abnormalities due to tubular disorders, abnormalities detected by renal biopsy histology, structural abnormalities detected by imaging and renal transplant recipients.

Exclusion criteria

Patients who underwent abortions, still births and patients unwilling to participate in study/lost to follow up were excluded.

Defining CKD

CKD was defined based on the KDIGO 2012 clinical practice guideline as any abnormalities of kidney structure or function, present for >3 months, with implications for health. Chronic kidney disease was classified into five stages based on GFR (ml/min/1.73 m^2)[1]-CKD stage 1-GFR ≥90 ml/min/1.73 m^2, CKD stage 2-GFR 60-89 ml/min/1.73 m^2, CKD stage 3-GFR ≥30-59 ml/min/1.73 m^2, CKD stage 4-GFR 15-29 ml/min/1.73 m^2 and CKD stage 5-GFR ≤15 ml/min/1.73 m^2.

Based on hospital protocol, all patients underwent detailed antenatal evaluation, follow ups and management as per standard guidelines. All patients of CKD underwent close monitoring for blood pressure, renal function tests, urine examination including 24 hours urine protein, regular ultrasound kidneys, and other investigations relevant to the primary etiology. The management was based on the decision by the treating gynaecologist and nephrologist. The electronic and hospital records of all patients were studied. Demographic parameters, clinical symptoms and signs, laboratory data, radiological data, details of renal disease, course of pregnancy, any complications, details of delivery, and the treatment undertaken was recorded for all patients. Requisite IEC approval was obtained.

Statistical methods

Quantitative data were presented in terms of mean and standard deviation. Qualitative or categorical data were presented as absolute numbers and proportions. Student's t-test was used for comparison of quantitative outcome parameters. $P<0.05$ is considered statistically significant. IBM SPSS version 21 was used for statistical analysis.

RESULTS

Demographic and clinical characteristics

Forty-four cases of pregnancy with renal disease were screened of which 8 were excluded and 36 were included as study population, as shown in Figure 1. The mean age was 29.19±4.66 years, with 15 (41.17%) being primigravida and 21 (58.3%) being multigravida, as given in Table 1. The 12 (33.3%) had history of one abortion while 02 (5.5%) had two abortions. Hypertension was seen in 10 (27.8%) individuals of which 10 (27.8%) were on one antihypertensive, 05 (13.9%) on 2 and 2 (5.5%) were or 3 or more drugs. Of these, 19 (52.8%) were on aspirin while 6 (16.7%) on immunosuppression and 05(13.9%) patients on ACE inhibitors, pre-conception (Table 1).

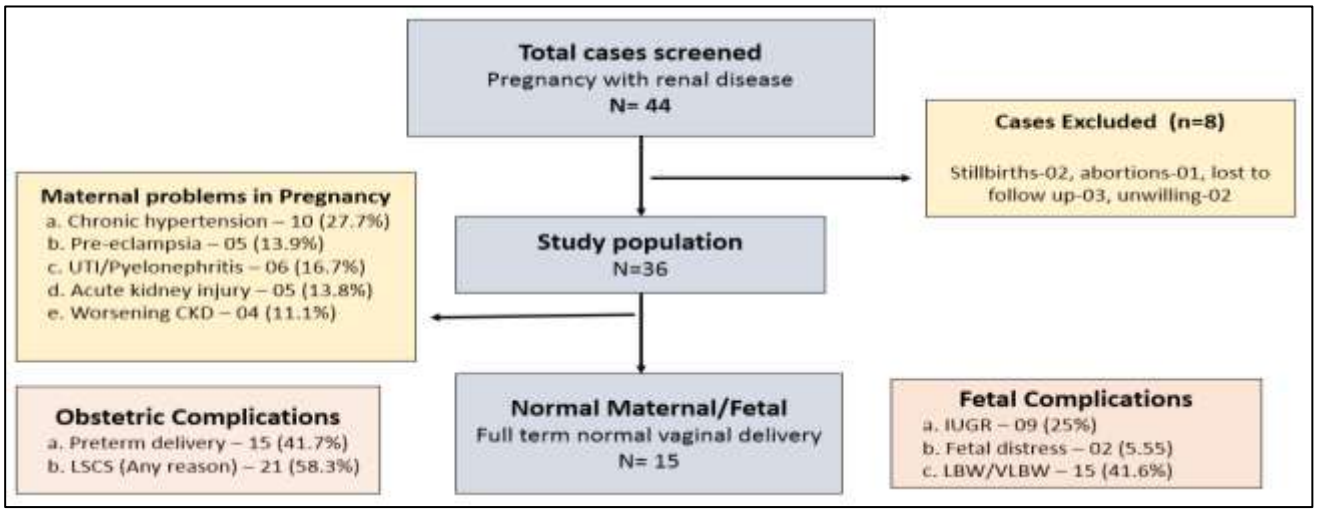

Figure 1: Study population of the details of complications and outcomes.

Three patients (8.3%) were in CKD stage 1, 5 (13,8%) in stage 2, 2 (5.5 %) in stage 3 and 04 (11.1%) in stage 4 (Figure 1), with mean eGFR of 60.93±23.1 ml/min. Raised serum creatinine of >1.3 mg/dL was seen in 15 (41.6%) with mean creatinine of 1.32±0.5 mg/dL, proteinuria >1000 mg/day was seen in 06 (16.7%) with mean proteinuria of 644.44±546.2 mg/day, and anaemia was seen in 30 (83.33%) with mean haemoglobin of 9.6±2.2 g/dL. Glomerular diseases comprised the largest group with 08 (22%) patients, while unilateral shrunken kidney comprised the commonest entity with 5 patients (13.9%). Study also included 4 (11.1%) renal transplant recipients. Noticeably all patients with CKD were multigravida whereas post renal transplant were primigravida.

Obstetric outcomes

The obstetric outcomes of the study are discussed in Table 2. Vaginal delivery was done in 15 (41.7%), while elective LSCS was done in 21 (58.3%) and emergency LSCS in 12 (33.3%), with 15 (41.7%) being preterm deliveries. IUGR was seen in 09 (25%) while low birth weight was seen in 15 (41.7%) cases, with mean fetal weight being 2.55±0.5 kg. The mean time of delivery was 35.9±2.0 weeks.

Table 1: Baseline characters and clinical presentation of the study population.

Characteristics	n=36
Age group (in years)	
20-30	21 (58.3%)
30-40	15 (41.7%)
Obstetric history	
Primigravida	15 (41.7%)
Multigravida (total)	21 (58.3%)
G2	12 (33.3%)
G3	09 (25%)
≥1 abortions in past	14 (38.8%)
Underlying medical comorbidities	
Hypertension	10 (27.8%)
Overweight (BMI > 25 kg/m^2)	06 (16.7%)
UTI/Pyelonephritis	04 (11.1%)
Etiology of renal disease	
CAKUT (solitary, ectopic or shrunken kidney)	07 (19.4%)
Renal calculous disease	05 (13.8%)
Glomerular diseases	08 (22.2%)
Tubular interstitial diseases	05 (13.9%)
Inherited diseases (ADPKD)	01 (6.7%)
Chronic pyelonephritis	06 (16.6%)
Renal transplant recipient	04 (11.1%)
Treatment modalities during pregnancy	
Aspirin	19 (52.8%)
Oral hematinics	33 (91.7%)
Parenteral iron	12 (33.3%)
Inj EPO	14 (38.9%)
Sodium bicarbonate	06 (16.7%)
Immunosuppressants	07 (19.4%)
ACEI (Pre conception)	05 (13.9%)
≥1 antihypertensives	17 (47.2%)

Most patients with CKD stage 4 and renal transplant recipient had to be terminated early in view of pre-eclampsia and fetal growth retardation. Most CKD patients did not have significant deterioration of GFR, with 04 patients showing a >25% decline in eGFR during pregnancy. All transplant patients had a stable graft function during pregnancy and were continued on steroids, azathioprine and tacrolimus, after stopping mycophenolate before pregnancy. However, patients with treated pyelonephritis had good maternal and foetal outcome. Patients with renal and ureteric calculi two of them had to undergo stenting to relieve them of symptoms and preserve their renal complications, their foetal outcome were good.

Factors predisposing to fetal complications

The study population were divided into those with or without fetal complications. Various predisposing factors

were compared between 2 groups (Table 3). It was seen that a prior history of abortions (OR 8.80, 95% CI 11.11-40.33, p=0.005), presence of hypertension (OR 11.680, 95% CI 2.40-56.73, p=0.002), and proteinuria >1000 mg/day (OR 7.0, 95% CI 0.74-66.21, p=0.08) statistically significant contributing factors.

Table 2: Obstetric outcomes in the study population.

Characteristics	n=36
Term/preterm	
Term	21 (58.3%)
Preterm	15 (41.7%)
Type of delivery	
Vaginal	15 (41.7%)
Elective LSCS	14 (38.8%)
Emergency LSCS	07 (19.4%)
Birth weight (in kg)	
>3	08 (22.2%)
2.5-3.0	13 (36.1%)
LBW <2.5	14 (38.9%)
VLBW <1.5	01 (2.7%)
Maternal/fetal complications	
Chronic hypertension	10 (27.7%)
Pre-eclampsia	05 (13.9%)
IUGR	09 (25%)
UTI	06 (16.7%)
Fetal distress	02 (5.5%)
Acute kidney injury	05 (13.8%)
Worsening CKD	04 (11.1%)
Fetal sex	
Male	17 (47.2%)
Female	19 (52.8%)
Mean±SD	
Time of delivery wks	35.9±2.0
Fetal weight kg	2.55±0.5

Table 3: Comparison of associated factors in patients with normal fetal outcomes versus those with any form of fetal complications/abnormalities.

Characters	Fetal complication, n=15	Normal fetus, n=21	OR 95% CI	P value
Age > 30 years	09 (60%)	08 (38.09%)	2.43 (0.62-9.47)	0.19
Multigravida	11 (73.33%)	09 (42.85%)	3.66 (0.87-15.38)	0.07
History of abortions	11(73.33%)	05 (23.80%)	8.80 (11.11-40-33)	0.005
Glomerular diseases	05 (33.33%)	03 (14.28%)	2.00 (0.40-9.77)	0.39
Stage 3 or stage 4 CKD	04 (26.66%)	02 (9.09%)	3.45 (0.45-22.03)	0.18
Presence of hypertension	11 (73.33%)	04 (19.04%)	11.68 (2.40-56.73)	0.002
Proteinuria > 1000 mg/day	05 (33.33%)	01 (4.76%)	7.0 (0.74-66.21)	0.08

Factors predisposing to caesarean section

The study population were divided into those with or without cesarean section for delivery. The various predisposing factors were compared between the two groups, as shown in Table 4. It was seen that a maternal age>30 years (OR 4.37, 95% CI 1.02-18.62, p=0.04), multigravida state (OR 6.66, 95% CI=1.50-29.62, p=0.01), and presence of HTN (OR 4.40, 95% CI 0.95-20.27, p=0.05) were statistically significant contributing factors.

Table 4: Comparison of associated factors in patients with normal vaginal delivery versus those with caesarean delivery.

Characters	Caesarean delivery, n=22	Vaginal delivery, n=14	OR 95% CI	P value
Age >30 years	14 (63.6%)	04 (35.71%)	4.37 (1.02-18.62)	0.04
Multigravida	16 (76.19%)	04 (35.71%)	6.66 (1.50-29.62)	0.01
History of abortions	11 (50%)	05 (31.78%)	1.80 (0.45-7.12)	0.40
Glomerular diseases	06 (27.27%)	02 (14.28%)	2.25 (0.38-13.16)	0.36
Stage 3 or stage 4 CKD	05 (22.72%)	01 (5.0%)	3.82 (0.39-36.8)	0.24
Presence of hypertension	12 (54.5%)	03 (41.6%)	4.40 (0.95-20.27)	0.05
Proteinuria >1000 mg/day	06 (27.2%)	01 (5.0%)	4.87 (0.51-45.79)	0.16

DISCUSSION

The present study assessed the maternal and fetal outcomes of 36 patients with pregnancy in patients with spectrum of renal disease over a period of three and half years. In our experience full term normal vaginal delivery with no materno-fetal complications was observed in 41.6% (15) patients.

Our study population was relatively younger with most patients in the age group of 20-30 years with a mean age of 29.19±4.66 years, portraying predominantly younger population detected with renal disease, who opted for pregnancy and were managed successfully in our centre. While most studies have majority of patients above 30 years as in studies by Piccoli et al from Italy and Cagliari et al.[3,8] In our patients, the predominant renal disease were of glomerular pathology (22%) and tubule-interstitial disorders (19%), which were similar to other data (Italian data-52% tubule interstitial disease and 17% glomerular disease in Cagliari et al). In our study 35% had one or more abortions prior to their present conception thus stressing that impact of renal disease on early pregnancies needs to be studied further.

Our study group mainly consisted of stage 2 and stage 3 of CKD; we did not observe any significant worsening of the renal functions as observed in TOCOS study or in prospective study by Imbasciatti et al.[5] Majority of the patients in our study were in stage 2 (41%) of CKD followed by stage 4 (30%) while Torino-Cagliari observational study (TOCOS) study in Italy published in 2015 had maximum patients in stage 1 with a large cohort. Further comparing the patients in our study, the mean serum urea of the patients was 42.6±21.8, the mean serum creatinine was 1.3±0.5 mg% the mean 24 hours urine protein was 644 mg the EGFR by MDRD was 60.93, where as in the meta-analysis in the TOCOS study the mean creatinine of Turin group and Cagliari group was 0.62 and 0.7 mg/dl respectively.[3]

Our obstetric outcomes are similar to other studies. Caesarean section was seen in 60% of our study population (Mostly elective) which was similar to other data, as in 54% by TOCOS study and 64% by Bharati et al.[3,11] The mean gestational age among our patients was 35.4±2 weeks which was comparable to that in the TOCOS study 36.9±2 weeks, mean birth weight been 2555±55 gm compared to the mean weight of 2,803±728 gm.

Our patients 59% could be delivered by term that's a significant number compared to developed countries data. The term pregnancies only emphasise the maternal care could be provided to prolong the pregnancy without compromising their renal functions or the maternal outcomes. In our study about 41% were preterm deliveries while 38% of the pregnancies had a factor of fetal growth restriction, while Kamakura et al in their Japanese study of 89 women had 31% preterm deliveries and 14% growth restricted fetues.[9] Maternal complications observed by Kamakura et al were preeclampsia, superimposed preeclampsia, unscheduled cesarean section.[9] As various studies the maternal and foetal outcome was determined by the GFR and the proteinuria in the mothers.

Our study reflected a 41% of preterm whereas the TOCOS study revealed 33% and AIIMS study showed 57.5% preterm deliveries respectively. Gupta et al in their study of 51 patients published in 2022 observed preterm delivery (42.85%) and small for gestational age babies.[12] Abdulkareem Alsuwaida et al in Saudi Arabia while analysing 98 pregnant women with CKD observed 38.5% with growth retarded foetuses and 31.2% preterm deliveries in stage 2 of CKD patients[7]. Zichun Feng et al in 2015 in their study found a significant difference in the rate of preterm deliveries among the mild CKD and severe CKD patients 41% and 81% respectively.[13] Snoek et al in their study also observed the preterm deliveries were due to worsening renal functions or superimposed preeclampsia .They emphasised the need of pre-conceptional counselling to improve the outcome at same time ,observed that deterioration of kidney function could occur in pregnancy and which could affect the patients long term outcome.[17]

Our study as well as larger studies revealed better foetal outcome in patients in early stage of CKD, with well controlled BP. Rise in BP and proteinuria played a vital role in the termination of pregnancy prematurely as well as the mode of termination. Barrett et al in their

metanalysis found significant association between patients with CKD having preeclampsia and GDM and significant adverse outcomes.[15]

Schwarz et al in their 2022 publication with respect to 67 post-transplant pregnant women after second trimester observed 90.5% Live births with preterm deliveries and low birth weight babies[16]. Maternal complications of pregnancy were preeclampsia 24% (graft loss 1, fetal death 3), graft rejection 5.4% (graft loss 1), hemolytic uremic syndrome 2% (graft loss 1, fetal death 1), maternal hemorrhage 2% (fetal death 1), urinary obstruction 10%, and cesarean section. (76%) were reported as compared to our small subset of 4 patients post renal transplant all had cesarean section 3 (75%) developed preeclampsia and 3 (75%) were preterm deliveries.[16] Women after kidney transplantation who became pregnant with a low eGFR of >25 to <50 mL/min/1.73m^2 had a marked decline of renal function compared to a matched non-pregnant control group as per the study by Schwarz et al.[15] However, patients with renal transplant having good renal functions had good maternal and fetal outcome.

Patients with pyelonephritis in our study were mostly in their second trimester as in the study by Grette et al the antenatal women had favourable outcome in our study as compared to the systematic review by Grette et al. In their study 49% of women developed sepsis and 10% acute kidney injury, foetal outcome was also good in our study whereas the quoted study had 23% preterm delivery.[18] Our patients were on suppressive dose of antibiotics till term; however, our sample size was much smaller as compared to the other studies.

Patients with renal stones were 5% of the total sample and two required stenting for ureteric calculi, all mothers and babies had good outcome, the study published by Julleba-Jones et al deliberated on the need and approach of antenatal women with calculi.[19]

Our study was an attempt to analyse the care provided in the tertiary care set up for pregnant women with kidney disease and to kidney disease patients who become pregnant. A larger multicentric study with larger number of study population can give a more comprehensive outlook.

Drawbacks of study-our study spanned three and half years with a study population of 36 which accounted for 1.5% of our deliveries, it's a study with a small study population. A larger study population could give us the better perspective.

CONCLUSION

Pregnancy in women with chronic kidney disease remains a high-risk condition, with outcomes influenced primarily by baseline renal function, blood pressure control, and degree of proteinuria. In our cohort, hypertension, prior abortions, and heavy proteinuria were the strongest predictors of adverse fetal outcomes, while older maternal age and multigravidity increased the likelihood of caesarean delivery.

Women with advanced CKD, renal transplant recipients, and those with recurrent urinary tract infections require particularly close surveillance. However, favourable outcomes are possible in treatable renal conditions such as pyelonephritis and renal calculi when managed promptly and effectively.

These findings reinforce the importance of: Pre-conception counselling to optimise blood pressure, control proteinuria, and address modifiable risk factors. Multidisciplinary antenatal care, ideally involving nephrologists, obstetricians, and neonatologists. Tailored delivery planning, with consideration of early intervention in cases of worsening renal function, uncontrolled hypertension, or fetal compromise.

Early diagnosis, vigilant monitoring, and timely intervention can help preserve maternal renal function and improve perinatal outcomes, even in women with significant baseline renal compromise.

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