Original Article

The Study of Raised Renal Parameters and their Effect on Maternal and Foetal Outcome in Preeclampsia

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Abstract

Background: Pregnancy with raised renal parameters was considered high risk but the degree of this risk is unclear. Hence the present study was done to study the effect of raised renal parameters among women with pre-eclampsiaon adverse maternal and fetal outcomes**.**

Methodology: A Case -Control study was conducted among 100 patients of Pre-eclampsia,50 patients of Pre-eclampsia with raised renal parameters were included in the study group as cases and 50 matched preeclamptic patients with normal renal parameters were chosen as controls for the study. Matching was done with respect to certain variables like age group, gestational age, gravida and associated co-morbid condition (Pre-Eclampsia) to avoid bias, for a period of one year to study the effect of altered renal function test sonmaterna land fetal outcome in preeclampsia.

Results: Compared to women in the control group, women in the study group had 3.7 times increased odds of preterm delivery (OR, 3.7; 95% CI, 1.0-15.2) and 2.4 times increased odds of delivery via caesarean section (OR, 2.4; 95% CI, 1.09-5.4). Women in the study group was also associated with two-fold increased odds of low birth weight (OR, 2.1; 95% CI, 0.5-9.6). Raised renal parameters among pre-eclamptic women was not associated with increased risk of maternal death in the present study.

Conclusion: Raised / abnormal renal parameters in pregnancy is independently associated with adverse maternal and fetal outcomes when other variables and a comorbid condition (Pre-eclampsia)was controlled by matching.

Keywords: Pregnancy, Pre-eclampsia, decreased renal function, Cases, Controls, matching, maternal outcomes, fetal outcomes, preterm delivery, cesarean delivery, low birth weight.

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Introduction

Preeclampsia is a multisystem and multifactorial disease that affects both mother and the fetus by vascular dysfunction and by intrauterine growth restriction[1].It is characterized by development of high blood pressure (hypertension) and proteinuria after 20 weeks of gestation. It affects about 7-15% of all pregnancies.

Several complications have been reported with this disease and it remains a main cause of mother and fetal morbidity and mortality worldwide.

In preeclampsia the systolic BP is 140 mmHg and diastolic BP 90 mmHg in a woman with previously normal blood pressure and at least 2 occasions 4-6 hours apart with/ without proteinuria about 0.3 gm in a 24-hour urine collection or end organ damage.

Severe preeclampsia is associated with one elevated blood pressure 160 mmHg systolic, or 110 mmHg diastolic. The other functional symptoms are headache, hyper reflexia, oliguria, epigastric or right upper quadrant pain, impaired liver function, and thrombocytopenia (HELLP syndrome)[2]

The main cause of preeclampsia is vasoconstriction and thickening of vascular media which decreases vascular capacity and increases peripheral resistance. The precise etiology of preeclampsia is not still clearly known. It affects almost every organ like kidney, CNS, hematological system, and the liver.

Risk factors for preeclampsia include advanced maternal age >35 years, young and nulliparous women, gestational diabetes, obesity, chronic kidney disease, chronic hypertension, family history, and H/o preeclampsia in a previous pregnancy.

The hallmark renal lesion in preeclampsia characterized by swollen vacuolated intracapillary endothelial cells in the glomeruli called 'glomerular endotheliosis'. Acute renal failure in preeclampsia is most commonly due to acute tubular necrosis and rarely because of bilateral cortical necrosis.

Objectives

1. To identify alteredrenal function tests inpreeclamptic females.
2. To study the effect of alteredrenal function test sonmaternal and fetal outcome inpreeclampsia.

Methodology

Study Design- Case -Control study

Duration of the study- January 2021 to Ddecember2022(24 months)

Study Setting- GOVERNMENTGENERAL HOSPITAL, GUNTUR

Sample size-100 patients of Pre-eclampsia

Among 100 patients of Pre-eclampsia,50 patients of Pre-eclampsia with raised renal parameters were included in the study group as cases and50 matched preeclamptic patients with normal renal parameters were chosen as controls for the study. Matching was done with respect to certain variables like age group, gestational age, gravida and associated co-morbid condition (Pre-Eclampsia) to avoid bias.

Inclusion criteria

Study group consists of patients of preeclampsia with any of the following criteria:

1. Serum creatinine > 0.9mg/dl
2. Blood urea >26mg/dl
3. Raised Serum uric acid as per gestational age

Exclusion criteria

Patients of preeclampsia with any of the following are excluded

1. Chronic hypertension
2. Pre-existing Renal disease or vascular disease
3. Urinary tract infection and pyelonephritis
4. Multiple pregnancy, Rh incompatibility
5. With any other pre-existing comorbidities such as heart disease, Diabetes, anaemia, thyroid disorders, epilepsy.

Ethical Considerations:

The study was conducted after obtaining Institutional Ethics Committee clearance and approval from respective authorities.

Written informed consent was obtained from both families and patients.

All the patients of pre-eclampsia who are admitted in in-patient department were evaluated for renal parameters such as serum creatinine, blood

urea, serum uric acid and 24 hr urinary protein, in addition to routine investigations.

All the women were followed up regularly till delivery and renal parameters were measured in all the women during post-natal period. The renal parameters in the study and control groups were analyzed and correlated with the corresponding maternal and fetal outcomes.

Maternal outcomes included preterm delivery, delivery via cesarean section, length of stay in the hospital (>3 days) and maternal death. Fetal outcomes included infant death, IUGR, APGAR at 5 min, still births, IUD, and neonatal deaths.

Statistical Analysis

Data was collected using pre-tested semi structured questionnaire. Data was entered in the Microsoft excel spreadsheets. Descriptive statistics were used to summarize characteristics of women among cases and controls. Percentages were used for categorical data and means ± standard deviations were used for continuous data. Odds Ratio was used to test the association between study variables and corresponding maternal and fetal outcomes. We considered a finding to be statistically significant if the two-sided P-value was less than 0.05. Statistical analysis was done using SPSS software version 21.

Results

50 patients of Pre-eclampsia with raised renal parameters were included in the study group as cases and 50 matched preeclamptic patients with normal renal parameters were chosen as controls for the study. These women were matched 1:1 by race, with respect to certain variables like age group, gestational age, gravida and associated co-morbid condition (Pre-Eclampsia) to avoid bias, near matched with 50 women with pre-eclampsia with normal renal parameters.

The mean age was 28.66 ± 5.40 (standard deviation) years for the study population whereas it was 28.67 ± 5.39 years for controls.

In the present study, the mean gestational ages at delivery among women in the study group and among controls were 37.5 ± 2.5 weeks and 38.2 ± 1.8 weeks, respectively (p<0.001).

Normal range of serum creatinine in 1st trimester was 0.4 – 0.7 mg / dl,2nd trimester was 0.4 – 0.8 mg / dl and in 3rd trimester was0.4–0.9mg/ dl. Among study group all the women had raised serum creatinine levels and blood urea levels. Among control group, all the women had normal serum creatinine level and blood urea levels.

Normaluricacid levels in 1st trimester were 2 – 4.2 mg / dl, 2nd trimester was 2.4 – 4.9 mg/dl and in 3 rdtrimester was 3.1–6.3 mg/ dl. Among study group, all the women had raised uricacid levels. Among control group, all the women had normaluric acid levels.

In the whole population, there were 13 (13%) preterm deliveries,51 (51%) cesarean sections, 0 (0%) maternal deaths, 9 (9%) infants with low birth weight, 7 (7%) neonatal deaths.

Table 1 shows that Compared to women in the control group, women in the study group had 3.7 times increased odds of preterm delivery (OR, 3.7; 95% CI, 1.0-15.2), 2.4 times increased odds of delivery via caesarean section (OR, 2.4; 95% CI, 1.09-5.4) and 2.1 times increased risk of prolonged stay in the hospital. Women in the study group was also associated with two-fold increased odds of low birth weight (OR, 2.1; 95% CI, 0.5-9.6). Raised renal parameters among pre-eclamptic women were associated with increased risk of perinatal mortality among the babies (IUD, Still births, Neonatal deaths) in the present study. Raised renal parameters among pre-eclamptic women was not associated with increased risk of maternal death in the present study.

Table 2 shows distribution based on IUGR, 56% of the study population had IUGR babies whereas 40% among Controls had IUGR babies. Odds Ratio was found to be 1.9 with a Confidence Interval of 0.8- 4.2. There was 1.9 times higher risk of giving birth to IUGR babies among study population when compared with control groups.

Table 3 shows distribution based on APGAR scores, 37% had APGAR score of >7 whereas 63% has got APGAR score <6. Among study group, 26%had APGAR score of >7 whereas 74% has got APGAR score <6. Among controls,48% had APGAR score of >7 whereas 52% has got APGAR score <6. On applying Odds Ratio, it was found that there was 2.6

times higher risk of having APGAR <6 for the babies among study population when compared with control groups.

Table 4 shows distribution based on Perinatal mortality, out of 31 cases died,19.4%had IUD,58.1% had still birth and 22.6% had Neonatal death Among study group, out of 18 cases 11.1% were IUD, 61.1% were Still birth, 27.8% were Neonatal deaths. Among controls, out of 13 cases 30.8% were IUD, 53.8% were Still birth, 15.4% were Neonatal deaths.

On calculating Odds Ratio, it was found that there was 1.6 times higher risk of perinatal mortality among study population when compared with control groups.

Table 5 shows distribution based on Maternal Morbidity, 6.3% had Pulmonary embolism and Renal failure, 18.8% had Abruptioplacentae, 25% had PPH, 31.3% had Eclampsia, 12.5% had Eclampsia+ Abruptioplacenta among the study population. On calculating Odds Ratio, it was found that there was 5.5 times higher risk of maternal morbidity among study population when compared with control groups.

On calculating Odds Ratio, it was found that there was 2.4 times higher chances of undergoing LSCS, Vaccum and Forceps among study population when compared with control groups.

Compared to women in the control group, women in the study group had 2.4 times increased odds of delivery via cesarean section than women in control group. (odds ratio [OR], 2.4; 95% confidence interval [CI], 1.09- 5.4). The study group were more likely to undergo delivery via cesarean sections compared to women in the control group. There was no difference in the length of stay in the hospital. No maternal deaths have been observed in thes

Table 1: Maternal and Fetal Outcomes in Women

Outcomes	CASES	CONTROLS	ODDSRATIO(CI)
Preterm	10(20%)	3(6%)	3.7(1.0-15.2)
Delivery via Caesarean	20(40%)	31(62%)	2.4 (1.09- 5.4)
LOS in hospital > 3 days	8(16%)	4(8%)	2.1(0.6-7.8)
Gestational age at delivery (wk)	37.5 ± 2.5 weeks	38.2 ± 1.8 weeks	
Low birth weight, ie<2500 g	6 (12%)	3(6%)	2.1(0.5-9.06)
IUGR	28(56%)	20(40%)	1.9(0.8-4.2)
APGAR at 5 min score <6	37(74%)	26(52%)	2.6(1.1 – 6.09)
PERINATAL MORTALITY			
Neonatal deaths	5(10%)	2(4%)	1.6(0.6 – 3.7)
IUD(Intra Uterine Death)	2(4%)	4(8%)	
Still births	11(22%)	7(14%)	

Table 2: Distribution of study participants based on presence of IUGR

Perinataloutcome IUGR	CASES	CONTROLS	Total	Odds Ratio
Present	28(56%)	20(40%)	48(48%)	1.9 CI= (0.8-4.2)
Absent	22(44%)	30(60%)	52(52%)	
Total	50(100%)	50(100%)	100(100%)	

Table 3: Distribution of study participants based on APGAR score of the baby at 5min

APGAR	CASES	CONTROLS	Total	Odds Ratio
<6	37(74%)	26(52%)	63(63%)	2.6 CI (1.1 – 6.09)
>7	13(26%)	24(48%)	37(37%)	
Total	50(100%)	50(100%)	100(100%)	

Table 4: Distribution of study participants based on Perinatalmortality

Perinatal mortality	CASES	CONTROLS	Total	Odds Ratio
Present	18(36%)	13(26%)	31	1.6 CI= (0.6 – 3.7)
Absent	32(64%)	37(74%)	69	
Total	50(100%)	50(100%)	100(100%)	

Table: 5 Distribution of study participants based on Maternalmorbidity

Maternal Morbidity	CASES	CONTROLS	Total	Odds Ratio
Present	13(26%)	3(6%)	16	5.5 CI= (1.4 – 20.7)
Absent	37(74%)	47(94%)	84	
Total	50(100%)	50(100%)	100(100%)	

Table 6: Distribution of study participants based on Modeofdelivery

Modeofdelivery	CASES	CONTROLS	Total	Odds Ratio (CI)
Normal Vaginal Delivery	30(60%)	19(38%)	49(49%)	2.4 (1.09- 5.4
LSCS+ Vaccum+ Outletforceps	20(40%)	31(62%)	51(51%)	
Total	50(100%)	50(100%)	100(100%)	

Discussion

The present study showed that pre-eclampsia with raised renal parameters was associated with adverse maternal and fetaloutcomes. Our study confirms other findings from previous studies done by Piccoli et al. 2010; Nevis et al. 2011; Fischer et al. 2004; Bramham et al. 2011; Fink etal.1998; and Holley et al 1996;.[3-9]

In the present study it was observed that on calculating Odds Ratio, there was 5.5 times higher risk of maternal morbidity among study population when compared with control groups and 1.6 times higher risk of perinatal mortality among babies born to study population when compared with control groups.

A recent systematic review found that in pregnancy with kidney disease, the overall risk of adverse maternal events was five-fold higher and adverse fetal events was two-fold higher than in women without kidney disease.[3]

However, the authors did note that the existing literature has several limitations. In most studies study sample was small, did not use comparison groups, did not clearly define the maternal and fetal outcomes, and did not adjust for important confounding factors. Only one other study has examined the risk of kidney disease in many pregnancies (>21,000) but they did not clearly define kidney disease or adjust for other confounding variables.[5]

A key strength of our study was the we were able to include 50 patients of Pre-eclampsia with raised renal parameters as study group(cases) and 50 matched preeclamptic patients with normal renal parameters were chosen as controls for the study. These women were matched 1:1 by race, with respect to certain variables like age group, gestational age, gravida and associated co-morbid condition (Pre-Eclampsia) to avoid bias, near matched with 50 women with pre-eclampsia with normal renal parameters.

Hence, our study is one of the first to compare pregnancies in those with Pre-eclampsia having raised renal parameters with that of 50 matched preeclamptic patients with normal renal parameters and find an independent association of raised renal parameters on adverse maternal and fetal outcomes.

Compared to women in the control group, women in the study group had 2.4 times increased

odds of delivery via cesarean section than women in control group. (odds ratio [OR], 2.4; 95% confidence interval [CI], 1.09- 5.4).

Compared to women in the control group, women in the study group had 3.7 times increased odds of preterm delivery (OR, 3.7; 95% CI, 1.0-15.2), 2.4 times increased odds of delivery via caesarean section (OR, 2.4; 95% CI, 1.09-5.4)

Similar findings were reported in a study by Fink et al.[11] found that women with kidney disease had a higher risk of preterm delivery and caesarean section compared to women without kidney disease. Even though they did adjust for age, diabetes, hypertension, and smoking, they were unable to adjust for other maternal risk factors that may affect pregnancy outcomes.

In the present study, women in study group had 2.1 times increased risk of prolonged stay in the hospital. Similar findings were reported in a study by Fink et al.1998; where women with kidney disease did have a higher risk of longer length of stay.[8]

Interestingly, to our knowledge, these are the only two studies examining length of stay following delivery in women with and without kidney disease. Further studies are needed to determine if women with kidney disease are requiring more resources and incurring more hospital charges than women without kidney disease.

No maternal deaths have been observed in the study.

Women in the study group was also associated with two-fold increased odds of low birth weight (OR, 2.1; 95% CI, 0.5-9.6). Similar findings were reported in a study done by **Jessica Kendrick et al.2016;[10]** Infants born to women with kidney disease had a two-fold increased odds of low birth weight.

Raised renal parameters among pre-eclamptic women were associated with increased risk of perinatal mortality among the babies (IUD, still births, Neonatal deaths) in the present study. Raised renal parameters among pre-eclamptic women was not associated with increased risk of maternal death in the present study. Similar findings were reported in a study done by **Jessica Kendrick et al. 2016;[10]** where high rate of adverse fetal outcomes was seen among women with kidney disease.

Holley et al.1996; performed a matched control study of 40 women with kidney disease and found they had a higher risk of fetal death, prematurity and low birth weight compared to women without kidney disease.[9] However, they did not adjust for diabetes, hypertension or other comorbid conditions. We were able to match pregnant women with and without kidney disease for important maternal factors that are associated with kidney disease.

Similar to our findings, **Fink et al.1998;** found that women with kidney disease had a higher rate of premature infants independent of age, race, smoking, parity hypertension and diabetes.[8] A drawback of Fink's study was the inability to adjust for other important maternal confounders which we were able to do in our study. Our findings give a more complete account of the role of raised renal parameters toward fetal and maternal outcomes.

In conclusion, our data indicate that raised renal parameters was a significant and independent risk factor for adverse maternal and fetal outcomes. Considering the potential for adverse outcomes, women with raised renal parameters who want to become pregnant should have preconception counselling. Our results should aid the healthcare provider in counselling women with kidney disease about pregnancy. A multidisciplinary approach involving obstetricians and nephrologists is needed to improve pregnancy outcomes in women with raised renal parameters with Pre-eclampsia. Future research should focus on dedicated interventions and education programs to improve pregnancy outcomes in women with raised renal parameters with Pre-eclampsia.

Ethical Clearance: Institutional Ethics Committee clearance and approval from Guntur Medical College,Guntur. Ref no GMC/IEC/100/2021 Dated:15/07/21.

Conflict of Interest: Nil

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