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Comparative Study on Renal Function Parameters During Normal Pregnancy and Preeclampsia

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ABSTRACT

Pre-eclampsia is a disease of pregnancy that affects many system in the body, characterized by elevated blood pressure with protein in urine after 20 weeks of pregnancy in pregnant women with no history of hypertension or proteinurea in previous pregnancy.

The aim of the current study is to determine the renal function parameters as blood urea and serum creatinine levels in preeclamptic patients and to compare it with the normal pregnant women.

This case-control study was conducted among the pregnant women visiting AL-Batool Maternity Teaching Hospital and AL-Khansa Hospital, Mosul, Iraq. Total 150 participants were evaluated out of which 75 were normotensive pregnant women (control group) and 75 were enrolled as preeclamptic group (study group). Serum creatinine and urea levels were measured using standard procedures.

Results indicate a significant rise in the mean concentration of serum urea (4.72 ± 1.01 mmol/L vs. 2.48 ± 0.62 mmol/L), serum creatinine (88.8 ± 12.49 µmol / L vs. 56.61 ± 8.2 µmol/L), as compared to that of normotensive pregnant women($P < 0.0001$). The findings of the present study are consistent with previous studies, suggesting increased level of serum creatinine and urea in preeclamptic group.

Proper history tacking, examination and estimation of serum urea and creatinine may be helpful for management of pre–eclampsia in order to prevent fetal and maternal complications.

Introduction

Pregnancy induced hypertension (PIH) is an increase in blood pressure more than 140/90 mm of Hg or elevation in systolic blood pressure > 30 mm of Hg or diastolic blood pressure > 15mm of Hg than normal after 20 weeks of gestation associated with protein in urine ≥ 300 mg / 24 hrs. or ≥ 1+ or 100 mg /dl by dipstick response [1,2].

Pre-eclampasia occurs mainly in primgravida, it can occur in multigravida and gestational diabetes [3]. it's a major cause of perinatal morbidity and death. The etiology is still unknown , It affects many systems in the body [4], the origin of preeclampsia may be the placenta but it's also enhanced by maternal factors such as obesity, diabetes, and preexisting hypertension [5]. A number of toxic substances is released by the ischemic placenta into maternal circulation which result in women when pregnancy complicated by hydatid form mole, multiple pregnancies, generalized maternal endothelial dysfunction [6,2].

Factors which are included in the pathogenesis of pre-eclampsia involving genetic, immune, vascular and oxidative stress, due to significant increase in the production of lipid peroxides, free radicals and species of reactive oxygen [7].

Usually in pre-eclampsia, the increase in blood pressure and protein in urin is also accompanied with disturbed coagulation system, disturbances of the liver function, renal function and cerebral ischemia [8].

Glomerular endotheliosis is the typical histopathological renal changes, which is characterized by deposition of fibrin, swelling of endothelium associated with loss of capillary space [9].These renal changes lead to decrease in the renal perfusion and glomerular filtration so the excretion of urea and creatinine are decreased [10].

In preeclampsia, the plasma renin activity (PRA) and plasma renin concentration (PRC) are decreased if compared with normal pregnancy while the level of circulating angiotensin II is normal during preeclampsia [11].

Other studies found that the decrease in uteroplacental perfusion pressure could enhance the renal sensitivity to angiotensin II by several factors ,a reduction in (nitric oxide) NO or synthesis of prostacyclin or by increase formation of TXA2 and endothelin [12]. The net result of such an enhanced responsiveness to angoiotensin II leads to a significant rise in total peripheral resistance and marked reduction in renal blood flow [13].

The decrease in renal perfusion in women with PIH, by an average of 20% and decrease in GFR by an average of 32% in comparison with normal pregnant women near term [19],[12] lead to reduction in the excretion of urea and creatinine, leading to increase in serum creatinine and blood urea [14].

Recent studies found that, in preeclampsia, the elevation in serotonin level and increase sensitivity to serotonin leads to systemic and renal vasoconstriction. Other researchers also showed that the mono amino oxidase (MAO) activity is lower and serotonin concentration is higher in the placental tissue from women with pre-eclampsia in comparison with placental tissue from normal pregnant women [15].

Materials and methods

This study represents a comparative study in AL-Batool Maternity Teaching Hospital and AL-khansa Hospital, Mosul, Iraq. A total 150 participants were enrolled in this study, blood pressure (BP) was measured and on the basis of BP, all the participants were divided into two groups:

Group 1- Control Group: include 75 pregnant women, aged (26-37) years, pregnant women with normal blood pressure (106/71 ± 2/1.6 mmHg) at third trimester of pregnancy, without any evidence of pre-eclampsia signs, renal disorders, hematological abnormalities.

Group 2- Study Group: 75 pregnant women, aged (25-38) years with symptoms and signs of PE, the mean of their blood pressure at admission was 157/103 ± 4/2 mmHg, and urinary protein (by dipstick) averaged from(+2 to +3).

Inclusion criteria: All pregnant women in the third trimester (gestational age of 32-40 weeks) as determined by last menstrual period or ultrasound scan, irrespective of parity and gravida.

Exclusion criteria: Pregnant women with previous history of renal, liver disease, diabetes, dyslipidemia and pre-existing hypertension before pregnancy were excluded from this study in both control and study groups. In addition, subjects taking medication known to affect lipid metabolism such as diuretics, beta- blockers, and lipid lowering drugs) were also excluded.

The demographic and the clinical characteristics of the study groups are summarized in **(**Table1).

Table 1: The demographic and the clinical characteristics of the study groups.

Characteristics		Normotensive pregnant (n=75)	Pre-ecamptic pregnant (n=75)
Maternal age, years		27.9 ± 5.62	33.4 ± 5.54
Weight Kg		74.5 ± 3.2	82.5 ± 6.19
Gavida	Primi	46	53
	Multi	29	22
Gestational age, weeks		37.3 ± 0.7	34.9 ± 0.6
Systolic B.P, mmHg		106 ± 1.6	157 ± 4
Diastolic B.P, mmHg		61 ± 1.6	103 ±2
Urine Protein by dipstick		0	+ 2→ + 3
Past medical history of PIH	Present	0	16
	Absent	75	59
Family history of PIH	Present	0	58
	Absent	75	17

Sample collection and preparation

Peripheral blood samples were collected from all participants (5ml) and transferred into plain tubes. The specimens are allowed to clot, by leaving at room temperature for 15 minutes then centrifuged for 5 min at 3000 rpm to separate the serum which were then collected in plain tubes labeled and stored at -20^{o} C. The stored serum samples were analyzed at weekly intervals for renal parameters using standard kits.

Results and discussion

PIH are common and form one of the deadly triad along with hemorrhage and infection that lead greatly to maternal morbidity and death [16]. The reduction in renal clearance due to reduction in glomular filtration rate and enhanced reabsorption, as a result of glomerular endothelial injury lead to rise in the concentrations of serum urea and creatinine [13].

Many studies showed increased concentrations of serum urea and creatinine in in preeclampsia. While very few studies give a border line value for urea and creatinine in anticipating PIH like Padma et al., [17].

The study suggests that the levels of plasma creatinine was increased significantly ($p<0.001$) in preeclamptic as compared with control group (table 2).

Table 2: Comparison (Mean± SD) of serum creatinine levels between normotensive pregnant women and preeclampsia.

Parameters	Mean± SD		P-values
	Normotensive pregnant (n=75)	Preeclamptc pregnant (n=75)	
S.Urea	2.48 ± 0.6 mmol/L	4.72 ± 1.01	<0.001
S.Creatinine	56.61 ± 8.2 µmol/L	88.8 ± 12.49	< 0.001

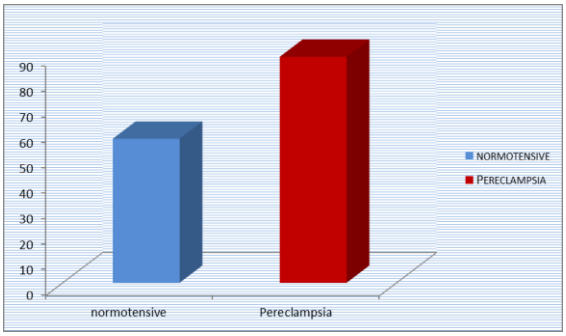

Fig. 1: Difference in the means of serum creatinine results between normotensive pregnant women and preeclampsai

The current study was consistent to the studies by Vyakaranm et al. [18] that showed an elevation in the mean creatinine value among preeclamptic patients. The raised concentration of creatinine may be as a result of reduction in urinary clearance due to decrease in glomerular filtration rate and enhanced reabsorption as a result of reduction in renal perfusion [19].

These results were compatible with the observations of Bhagwan et, al [20] and Karar et al, [14] that S. Creatinine level increase in preeclamptic patient compared to control was 1.21 ± 0.47, which was statistically significant P<0.0001 While Salako et al., [21] found the variation in the serum levels of creatinine (93.70 +/- 10.08 micromol/L) not significant (p>0.05).

Table 3: The results of means of S. creatinine levels in other studies in pre-eclampsia patient

Study	S. creatinine	P value
Vyakaranm et al.	83.11 ± 22.98 µmol/L	p< 0.001
Bhagwan et al.	106.98 ± 41.55 µmol/L	P< 0.0001
Tarig et al,	57.72 ± 18.69 µmol/L	P< 0.0001
Salako et al.	93.70 ± 10.08 µmol/L	P>0.05

Regarding serum urea, our present data revealed a significant increase in pre-eclamtic group as relative to control group (P<0.001) as shown in table (2).

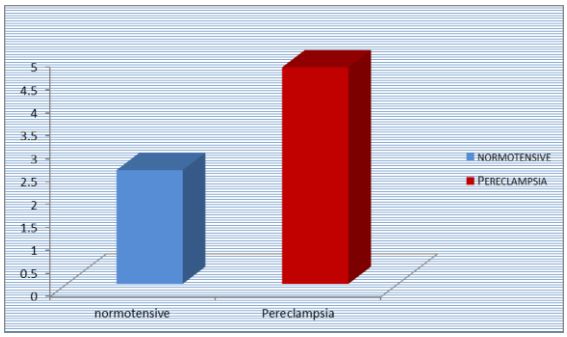

Fig. 2: difference in the mean values of serum urea between normotensive pregnant women and preeclampsa

The results of this research are in line with that of Hayashi et al., [9] who reported that , the decreased urea clearance in preeclampsia, resulting in excess absorption of urea.

Also**,** Ilanchezhian et al. [5] confirmed that, there is statistically significant elevation of serum urea, creatinine, levels as compared to the control ones. Furthermore Seow et al., [22] and Karar et al, [14] observed significant elevation in serum urea level in pre-eclamptic when compared to normotensive women.

These studies confirm that there is significant rise in serum urea and creatinine in pregnant women with pre-eclampsia compared to normotensive pregnant

While in the study of Manjareeka et al.,[23] the elevation in the level of serum urea in pre-eclamptics was a statistically insignificant (4.7 ± 0.8) compared to normotensives 4.4 ± 0.5).

Table 4: The results of means of S. urea levels in other studies in pre-eclampsia patient.

Study	S. urea	P- value
Ilanchezian et al.,	11.08 ± 2.5 mmol /L	P<0.0001
Karar et al.,	3.7± 1.6 mmol/L	P<0.0001
Manjareeka et al	4.6 ± 0.8 mmol/L	P<0.068

The ureamia and the deterioration in renal function is mainly due to arterial vasoconstriction, swelling of glomerular endothelium and intravascular accumulation of fibrin [16].

Conclusion

Many studies have concluded that serum urea and creatnine levels increase significantly in pre-eclampsia patients but few studies showed that there is no correlation between the rise in serum urea , creatinine and the pre-eclampsai. There is need for further study that will be done on large sample size to conformed these facts so that these parameter can be used in pre-eclampsia to reduce maternal and neonatal morbidity and mortality.

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دراسة مقارنة على معلمات وظائف الكلى أثناء الحمل الطبيعي وتسمم الحمل

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المستشفى الجمهوري التعليمي ، الموصل ، العراق

الملخص

ارتفاع ضغط الدم المحرض بالحمل هو اضطراب متعدد الأنظمة للحمل, يتميز بارتفاع ضغط الدم مع وجود البروتين في الادرار بعد الاسبوع العشرين من الحمل في النساء الحوامل ذوات ضغط الدم الطبيعي. هذا الارتفاع بالضغط مرتبط بتخلف النمو داخل الرحم والولادة قبل الأوان وخطورة موت الأمهات والاطفال بعد الولادة.

الهدف من الدراسة الحالية هو قياس معلمات وظائف الكلى مثل اليوريا والكرياتينين في مصل الدم لدى مرضى قبل التشنج الحملي ومقارنته مع النساء الحوامل العاديات. أجريت هذه الدراسة على النساء الحوامل اللاتي كن يراجعن مستشفى البتول التعليمي ومستشفى الخنساء في الموصل. اجريت الدراسة على150 مشاركا من بينهم 75 امرأة حامل ذوات ضغط دم طبيعي (المجموعة الضابطة) و 75 امرأة حامل مصابة بقبل التشنج الحملي (مجموعة الدراسة). تم قياس مستويات الكرياتينين واليوريا في المصل باستخدام الإجراءات القياسية. تشير النتائج إلى زيادة معنوية في متوسط مستويات اليوريا في المصل (4.72 ± 1.01 مللي مول / لتر مقابل 2.48 ± 0.62 مللي مول / لتر)، والكرياتينين في الدم (88.8 ± 12.49 مايكرومول/ لتر مقابل 56.61 ± 8.2 مايكرومول/ لتر)، بالمقارنة مع النساء الحوامل اللواتي يعانين من ارتفاع ضغط الدم (P <0.0001).

نتائج الدراسة الحالية تتفق مع الدراسات السابقة ، مما يشير إلى زيادة مستوى اليوريا والكرياتينين في المصل في مجموعة قبل الحمل التشنجي. قد يكون من المفيد فحص اليوريا والكرياتينين في المصل في علاج قبل الحمل التشنجي من أجل منع حدوث مضاعفات الأم والجنين.