

# STUDY OF RENAL FUNCTION DURING PREGNANCY AND PUERPERIUM

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## SUMMARY

Renal function studies had been carried out in 55 cases including 10 nonpregnant control, 20 cases of normal pregnancy during different period of gestation, 15 cases of normal puerperium and 10 cases of toxæmia of pregnancy 6 weeks after delivery by clinical, biochemical methods and by radioisotope renography. Glomerular filtration rate was found to be increased and serum urea and creatinine concentration was reduced in 1st and 2nd trimester of normal pregnancy. Renography was normal in 1st trimester but different in 2nd trimester of normal pregnancy. In normal puerperium one case (6.6%) and in puerperium following toxæmia of pregnancy four cases (40%) showed abnormal renogram.

### Introduction

Accurate determination and interpretation of renal functional status is difficult during normal pregnancy due to the physiological changes in urinary tract.

In toxæmia of pregnancy, there may be some associated renal lesion which can be ascertained only by a careful study of renal function during puerperium.

The present study was undertaken to know the functional status of kidney during normal pregnancy and to investigate for the possible renal abnormality in cases of toxæmia of pregnancy.

### Material and Methods

The study was done at Seth Sukhlal Karnani Memorial Hospital, Calcutta. A

total of 55 cases were studied. The control group consisted of 10 normal nonpregnant women. The group of normal pregnancy consisted of 20 cases, 7 in first trimester and 13 in second trimester. These cases were undergoing termination of pregnancy for social reason. Normal puerperium group consisted of 15 cases which included 10 cases followed up 6 weeks after termination of normal pregnancy and 5 cases of normal fullterm pregnancy 6 weeks after normal delivery. 10 cases of toxæmia of pregnancy were studied 6 weeks after delivery and these included 5 cases of mild preeclampsia, 4 cases of severe preeclampsia and 1 case of eclampsia. Classification criteria for toxæmia were those recommended by American Committee on maternal welfare (1952).

Besides clinical examination, routine examination of urine, water concentration and water dilution test, serum urea and

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serum creatinine concentration, urea clearance test (McIntosh, Moller and Vanslyke, 1928) and radioisotope renography were performed in each case for assessment of renal function. The tracer used in radioisotope renography was hippuran  $I^{131}$ . The dose was 30 microcurie, introduced intravenously, position of the patient was sitting. To compare the renogram of all patients studied, the following segments of the curve were measured.

1. Duration of 1st phase or vascular phase in minutes.
2. Duration of 2nd phase or secretory phase in minutes.
3. Half time of excretory phase—It is the time in minutes from time 0 to a point on 3rd phase which is half the maximum height.

### Observations

Age of the patients studied varied between 18 to 36 years and parity between second and sixth. In normal pregnancy group, the gestational period in 1st trimester varied between 6 to 12 weeks, average 10 weeks and in 2nd trimester between 14 to 20 weeks, average being 17 weeks. In all groups, oedema was absent and blood pressure was within normal range. Routine examination of urine revealed no abnormality. Water concentration and water dilution test was normal.

Urea clearance test—of different groups is shown in Table I.

In most of the cases, the rate of urine flow was more than 2 ml per minute. In 1st trimester of normal pregnancy, the

TABLE I

Urea Clearance Test (Expressed in Percentage of Average Nonpregnant Normal) of Different Groups Corrected to Standard Body Surface Area of 1.73 Sq. Meter

Group of cases	No. of cases	Average	Range		Standard Deviation	Test value
			Min.	Max.		
1. Control (non-pregnant)	10	102.3	97	109	± 4.11	
2. Pregnancy	7	123.0	115	131	± 6.14	7.7825**
(a) First trimester						p < 0.001
(b) Second trimester	13	142.3	130	154	± 7.26	16.7243**
						p < 0.001
3. Puerperium						
(A) Normal puerperium						
(a) 6 weeks after termination of pregnancy	10	104.0	100	109	± 2.87	1.0724
						p < 0.30
(b) Following normal pregnancy	5	102.6	98	108	± 3.97	0.6516
						p < 0.60
(B) Puerperium following toxæmia	10	103.3	95	111	± 2.58	0.1660
						p < 0.90

\*\* Denotes highly significant results as compared to controls.

P = Probability of drawing an incorrect conclusion.

average urea clearance, showed an increase of 20.7% above the average non-pregnant control value. This was statistically significant. In the 2nd trimester of normal pregnancy the average urea clearance was increased 40% above the non-pregnant control mean. The rise was statistically significant. In this series, urea clearance attended a maximum value at 2nd trimester, registering a rise of 19.3% over 1st trimester value ( $t=7.6250$   $p < 0.001$ ) which was statistically significant. Urea clearance was not different from control value during puerperium.

Serum urea concentration was reduced in 1st trimester of normal pregnancy ( $16.31 \pm 1.06$  mg per 100 ml.) as compared to average control value of  $20.49 \pm 1.44$  mg per 100 ml. It was statistically significant ( $t = 5.5928$   $p < 0.001$ ). In 2nd trimester of normal pregnancy (average value  $14.45 \pm 0.92$  mg per 100 ml) it was reduced further which was statistically significant ( $t = 10.9151$   $p < 0.001$ ). In puerperium serum urea concentration was not different from control value.

Serum Creatinine Concentration—was reduced in 1st trimester of normal pregnancy (average  $0.63 \pm 0.04$  mg per cent) as compared to average control value of  $0.72 \pm 0.03$  mg per cent. It was statistically significant ( $t = 5.0275$   $p < 0.001$ ). In 2nd trimester of normal pregnancy (average value  $0.59 \pm 0.02$  mg per cent) it was reduced further. Which was also statistically significant ( $t = 11.8181$   $p < 0.001$ ). In puerperium serum creatinine concentration was not different from control value.

#### Renography

*Control group*—all cases showed normal renogram curve.

*Normal Pregnancy Group*—1st trimester—renogram was normal in 6 cases only

1 case showed delayed excretion both sides.

*2nd trimester*—The average duration of 2nd phase was increased both sides in 3 cases. Half time of excretory phase was delayed in right side in 5 cases and in both sides in 1 case. The right kidney was significantly more, delayed than left ( $t = 11.6201$   $p < 0.001$ ).

#### Normal Puerperium

(a) Six weeks following termination of pregnancy renogram became normal. The average duration of 2nd phase and half time excretory phase now approximate control level.

(b) Six weeks following normal pregnancy and normal delivery—one patient showed abnormal renogram where 2nd phase of both sides were depressed and delayed and half time of excretory phase was delayed in both sides. Other cases had normal renogram.

*Puerperium following toxæmia of pregnancy*: A total of 4 patients showed abnormal renogram. Two cases had delayed and depressed 2nd phase both sides and 2 cases had delayed and depressed 2nd phase and delayed excretory phase both sides. In other cases, renogram was normal. Among 15 cases of normal puerperium, one case showed abnormal renogram (6.6%) and in toxæmia of pregnancy 6 weeks postpartum 4 cases showed abnormal renogram (40%). In this series, the abnormal renographic findings were distributed evenly and no accumulation of pathological findings in patients with severe toxæmia were observed.

#### Discussion

The result of urea clearance and serum urea and creatinine concentration in pregnancy and puerperium obtained in

this study were similar to the results obtained by Sims and Krantz (1958). Urea clearance is directly related to glomerular filtration rate. In normal subjects, when the urine flow is greater than 2 ml per minute, urea clearance is about 3/5th of the glomerular filtration rate (Dewardenner 1974). Raised glomerular filtration rate during 1st and 2nd trimester of normal pregnancy as obtained in the present study may be functional due to the physiological changes in circulatory system (Assali *et al*, 1959). Increased secretion of hormones during pregnancy particularly aldosterone (Rinsler and Rigby 1957) and placental lactogen (Sims, 1968) may also have a role. Increased glomerular filtration rate in normal pregnancy entails increased clearance of urea and creatinine and accounts for the fact that plasma level of these substances are decreased in pregnancy (Chesley 1960). Water concentration and water dilution test was normal in the present study. Similar results were obtained by Merchant 1978. Renographic findings in 1st and 2nd trimester of normal pregnancy obtained in this study were similar to those of Rudolph and Wax 1967. The findings of impaired secretory function and delayed excretion during 2nd trimester of normal pregnancy were probably functional due to physiological hydronephrosis of pregnancy, since renogram was found to be normal in the follow up cases 6 weeks after termination of pregnancy. In normal puerperium, 1 case (6.6%) and puerperium following toxemia of pregnancy 4 cases (40%) showed abnormal renogram. In this series, abnormal renographic findings were distributed evenly in whole series and no accumulation of

pathological findings in patients with severe toxemia was observed. These observations were similar to those of Pystynen and Laitinen 1976.

In puerperium following toxemia of pregnancy, clinical and routine biochemical tests of renal function revealed no abnormality, but abnormal renogram with renal functional impairment was found in 40% cases. Actual significance of these abnormalities is difficult to evaluate. A further follow up study might reveal the evidence of any persistence of renal dysfunction.

Classic or pure toxemia of pregnancy is usually known to be a completely reversible process. This study suggests that more carefully the patients are examined, the less so called classic or pure toxemia can be observed.

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