

# MATERNAL BLOOD UREA AND UMBILICAL CORD BLOOD UREA IN TOXAEMIA OF PREGNANCY

by

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## *Introduction and Review*

Toxaemia of pregnancy is not always manifested with conventional triad of oedema, hypertension and albuminuria and in an occasional case the blood pressure may remain normal until eclampsia supervenes. Urea is the most important end product of protein metabolism and depends for its excretion on adequate renal function. It is therefore not surprising that this product may be raised in blood in cases of toxaemia of pregnancy and its serial estimation may reflect kidney function in toxaemia. The umbilical cord blood urea may also likewise increase in these cases with deteriorating kidney function due to increasing severity of toxaemia of pregnancy.

## *Material and Method*

The present study was undertaken with the aim of estimating the maternal blood urea and the umbilical cord blood urea of toxaemic mothers to determine its relationship with the degree of toxaemia, duration of gestation and the birth weight

of the babies and to compare the results with those of normal pregnancies.

## *Selection of Cases*

Blood urea estimation was done in the venous blood of 40 normal healthy non-pregnant females, 40 normal healthy pregnant mothers and 46 cases of toxaemia of pregnancy and in the umbilical cord blood of infants born to these normal healthy and toxaemic mothers.

The non-pregnant females were selected from the medical students, nursing staff and the healthy relations of indoor patients of UISE Maternity Hospital, Kanpur. The cases of normal and toxaemic pregnancy were taken from the indoor patients. In cases of normal pregnancy women in the third trimester, mostly in the last two weeks preceding delivery, were selected for study. The cases of toxaemia were those who were admitted in the third trimester near term. In all the cases a detailed case history and thorough physical examination was done, blood pressure and period of gestation in weeks was recorded in each case. Length of the infants from head to heel in cm. and the birth weight of the infants in gms. was recorded soon after the delivery in both normal healthy and toxaemic cases.

Cases of toxaemia of pregnancy were

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divided into the following three groups according to severity and the classification was based on the criteria described by the American Committee on Maternal Welfare.

#### Group A. Mild Pre-Eclampsia

When the case presented with one or more of the following signs—

Oedema, blood pressure upto 159/100 mm of Hg., albuminuria—excretion of 0.1 to 1.99 gm of albumin in urine in 24 hours.

#### Group B. Severe Pre-Eclampsia

When the case presented with two or more of the following signs—

Oedema—weight gain of 1.4 kg/week.

Blood pressure over 160/100 mm of Hg. albuminuria—excretion of 3 gm or more of albumin in 24 hours.

Severe pre-eclampsia was also diagnosed when the cases presented with one of the following signs.

1. Generalised oedema.
2. Blood pressure over 180/100 mm of Hg.
3. Albuminuria of 5 gm or more/24 hours.

#### Group C. Eclampsia

When the cases presented with varying degree of hypertension, oedema and proteinuria with convulsions.

#### Investigations

In each case Hb% and complete urinalysis was done, albumin when present in urine by the heat test was estimated quantitatively in gm/24 hours urine volume by Esback's albuminometer. Blood urea was determined by the urea Nesslerisation method described by King (1956).

#### Observations

##### Blood Urea in Normal Healthy Non-Pregnant Females

The blood urea in normal healthy non-pregnant females ranged from 18 to 30 mg ml, with a mean value of  $25.08 \pm \text{S.D. } 4.79$ .

##### Blood Urea During Normal Pregnancy

The blood urea in normal pregnant females ranged from 13.31 mg/100 ml with a mean value of  $19.75 \pm \text{S.D. } 5.4$  mg/100 ml.

In order to establish whether any relation existed between the parity of the mother and the level of blood urea in normal healthy pregnant mothers in the present study, the patients were divided into various groups on the basis of the parity.

No significant difference was found in blood urea levels between various groups of normal pregnancy classified on the basis of parity.

The cases were further classified on the basis of gestation period and no significant difference was found between the mean value among the various groups classified according to the period of gestation.

##### Blood Urea Estimation from Venous Blood of The Umbilical Cord

The blood urea levels in the venous blood of the umbilical cord in 40 normal deliveries of normal healthy pregnant mothers ranged from 14.30 mg/100 ml, with a mean value of  $19.98 \pm \text{S.D. } 5.18/100$  ml.

Further study was carried out on birth weight of 40 normal healthy infants born of normal pregnancy. It ranged from 2530 to 4020 grams with a mean value of  $2891.8 \pm \text{S.D. } 356.3$  gm. The length of the babies as measured from head to heel



ranged from 48-51 cm, with a mean value of 49.1 cm. Only those cases of normal pregnancy in the present series were studied where the birth weight of the baby was above 2500 gms. This deliberate inclusion of the normal babies in the present series was done to avoid any deviation of the blood urea figures due to underweight infants.

The mean birth weight and the length was found to rise with increase in the period of gestation but cord urea figures did not show any significant difference with different birth weight and length with increasing period of gestation.

#### *Blood Urea in Toxaemia of Pregnancy*

Maternal blood urea was estimated in 46 cases of toxaemia of pregnancy within 24 hours of admission. Thereafter both the maternal and umbilical cord blood urea were estimated at the time of delivery.

In the present series the cases were divided into mild pre-eclampsia 18 cases, severe pre-eclampsia 16 cases, eclampsia 12 cases.

The statistical analysis showed that the slight rise occurring in the cases of mild pre-eclampsia was not significant as compared to normal levels of maternal and umbilical cord blood urea, while in severe pre-eclampsia and eclampsia there was a highly significant rise.

Levels of second maternal blood urea reading (simultaneously determined) and umbilical cord blood urea in cases of toxaemia of pregnancy were  $32.12 \pm 12.5$  mg/100 ml and  $32.1 \pm 12.6$  mg/100 ml respectively. On statistical analysis there was no significant difference between the simultaneously drawn specimens of maternal blood urea and umbilical cord blood urea.

Further study was done to correlate birth weight of infants, gestation period and cord blood urea in toxaemia of pregnancy.

The cord blood urea was not found to be related to period of gestation. On statistical analysis done between birth weight and severity of toxaemia no significant difference was observed between the birth weight in mild pre-eclampsia and severe pre-eclampsia, but was highly significant difference was found between mild pre-eclampsia and eclampsia and between severe pre-eclampsia and eclampsia.

#### *Discussion*

Blood urea in normal healthy non-pregnant females, was determined in the venous blood of 40 normal healthy non-pregnant females. The blood urea in these individuals ranged from 18 to 38 mg/100 ml. with a mean value of  $25.08 \pm$

TABLE I

*The Relation of Maternal and Cord Blood Urea According to Height of Systolic Blood Pressure*

No. of Cases	Height of sys. blood pressure	Maternal blood urea levels gm/100 ml.		Umbilical cord blood urea levels mg/100 ml.	
		Range	Mean	Range	Mean
18	Upto 159	14-20	22.66	16-28	22.22
19	Between 160-179	24-56	34.9	23-61	33.00
5	Between 180-199	34-52	43.6	34-44	40.2
4	200 and over	46-60	52.0	46.65	57.0



S.D. 4.79 mg/100 ml. Its relation with age was determined on statistical analysis by computer the differences in the mean value were insignificant. Our mean value of 25.08 mg/100 ml clearly resembles the mean value of 25.68 mg/100 ml reported by Dieckmann (1952).

The blood urea during normal pregnancy in 40 cases was found to rise between 13.31 mg/100 ml with a mean value of  $19.75 \pm \text{S.D. } 5.4$  mg/100 ml and no significant difference was found between the average blood urea figures at different gestation period with parity, average maternal blood urea value during normal pregnancy was therefore found to be significantly lower than the average maternal normal of 25.08 mg/100 ml observed in normal healthy non-pregnant females. A number of reports in the literature for blood urea levels during pregnancy give support to our observation, Riedel (1963) who found blood urea value of 16 mg/100 ml during pregnancy, Dieckmann (1952) and Cadden and Farris (1936) observed mean blood urea nitrogen levels of 12 mg per 100 ml.

The umbilical cord blood urea determined in 40 normal delivery cases ranged from 14-30 mg/100 ml with a mean value of  $10.98 \pm \text{S.D. } 5.18$  mg/100 ml. Maternal blood urea range in these cases was 13-31 mg/100 ml with a mean value of  $19.75 \pm \text{S.D. } 5.4$ . It is evident from these data that the maternal blood urea and umbilical cord blood urea resemble closely with each other and no significant differences have been reported by Harry *et al* (1959) whose maternal blood urea is ranging 15-39 mg/100 ml with a mean value of 23.8 mg/100 ml and umbilical cord blood urea figures vary from 16.40 mg/100 ml with a mean value of  $23 \pm 5$  mg/100 ml.

#### *Blood Urea in Toxaemia of Pregnancy*

Maternal blood urea and umbilical cord blood urea were determined in 46 cases of toxaemia of pregnancy in the present series. These cases included 18 cases of mild pre-eclampsia, 16 cases of severe pre-eclampsia and 12 cases of eclampsia.

Out of the 46 cases, 32 (69.6%) belonged to the age group between 15-25 years and 14 (30.4%) to the age group between 26-35 years. Regarding parity maximum number of cases were primi para (71.7%) followed by 2nd para (17.4%) third para (8.7%) and 4th para (2.2%). Pankammas *et al* (1957) have also reported highest incidence of toxemia of pregnancy in cases of primi para.

#### *Incidence and Severity of Oedema, Hypertension and Albuminuria Oedema*

Oedema was the presenting feature in all the cases. It was localised to lower limbs in 34 cases and generalised in 12 cases.

#### *Hypertension*

Out of 46 cases of toxaemia of pregnancy 18 (39.1%) had systolic blood pressure below 159 mm of Hg., 19 (41.3%) between 160-180 mm of Hg., 5 (10.9%) between 180-200 mm of Hg. and 4 (8.7%) over 200 mm of Hg. Our findings differ with that of Pankammas *et al* (1957) who have found the highest incidence of blood pressure below 160 systolic in their cases.

#### *Albuminuria*

Two (4.35%) cases in the present series did not have albuminuria. Diagnosis of toxaemia in these cases was made by the presence of oedema and mild hypertension developing in the third trimester of pregnancy. Our observation revealed that 15 (32.6%) cases in the present series had albuminuria upto



1.99 gm/24 hours, 25 (54.35%) between 2 gm to 4.99 gm and 4 (8.7%) had 5 gm or higher amount of albuminuria in their urine per 24 hrs.

#### Blood Urea in Toxaemia of Pregnancy

In present study we did not find significant difference between the maternal blood urea and umbilical cord blood urea levels in toxaemia of pregnancy when the blood for these estimation is collected simultaneously at the time of delivery, but in cases of mild pre-eclampsia maternal blood urea and umbilical cord blood urea are slightly raised above the normal value. There is significant rise of maternal blood urea and umbilical cord blood urea levels in cases of severe pre-eclampsia as compared to normal control and their levels ranged from 24 to 40 mg/100 ml with a mean value of 31.63 mg/100 ml and 23 to 44 mg/100 ml with a mean value of 31.19 mg/100 ml respectively. Our findings in severe pre-eclampsia confirmed the observation of Dieckmann (1952) and Kishore and Tandon (1965) who have reported elevated blood urea levels in severe pre-eclampsia.

Further in cases of eclampsia urea levels in maternal blood and umbilical

cord blood urea raised to more than double the average normal value observed in normal pregnancy and their levels range from 38 to 60 mg/100 ml with a mean value of 49.08 mg/100 ml and from 34 to 65 mg/100 ml with a mean value of 48.08 mg/100 ml respectively. Further it was seen that reported estimations of maternal blood urea are helpful in judging the prognosis of cases of toxaemia of pregnancy, the blood urea levels being increased with clinical deterioration and decreased with clinical improvement in majority of instances.

In our study the mortality rate in toxaemia of pregnancy for mother is 4.3% and for infants 45.6% including 6.52% of still births and maximum number of deaths occur in cases of eclampsia. We agree with Menon (1969) who has stated that maternal deaths in toxaemia are mainly due to eclampsia. In order to study whether the birth weight in toxaemia of pregnancy is lowered due to lowered gestation period or due to direct effect of toxaemia a comparative study of infants birth weight with the same gestation period in the normal and the toxic cases was made, the results of this comparative study are presented in the following table.

TABLE II

Showing comparative study of gestation period and mean infant birth weights in normal and toxæmic cases

Gestation period in weeks	Normal cases		Toxaemia of pregnancy	
	Mean birth weight (gms)	Mean umbilical cord blood urea (mg/100 ml)	Mean birth weight in gms	Mean umbilical cord blood urea (mg/100 ml)
34	—	—	1673.0	45.6
35	—	—	2255.7	33.0
36	—	—	2273.7	33.0
37	2633.33	20.33	2323.86	30.71
38	2763.75	19.69	2343.5	30.0
39	2901.66	19.83	2550.0	20.0
40	3204.00	21.20	2402.0	32.8
41	3582.5	19.0	—	—

It is obvious from the above table that in the gestation periods between 37 and 40 weeks where cases were available in both normal and toxæmic group there is significant reduction in the mean birth weight in the toxæmic group as compared to the normal controls. It is also clear from Table II that no direct co-relation exists between the umbilical cord blood urea and gestation period in normal pregnancy as well in cases of toxæmia of pregnancy. This finding of ours is in agreement with the observations of Kilpatrick and McKay (1965) who have not found any significant association between blood urea concentration and gestation period in their cases of toxæmia of pregnancy.

#### Conclusion

The following conclusions emerged from present study.

1. The blood urea levels fall during normal pregnancy and range from 13 to 31 mg/100 ml with a mean value of  $19.75 \pm \text{S.D. } 5.4$  mg/100 ml and the fall is statistically significant.

2. No statistical difference was found between the maternal and umbilical cord blood urea levels in cases of normal pregnancy.

3. The highest incidence of toxæmia of pregnancy occurs in primi para and between 16-25 years of age.

4. There is significant rise of maternal blood urea and umbilical cord blood urea levels in cases of severe pre-eclampsia as compared to normal controls.

5. The rise of maternal blood urea and umbilical cord blood urea levels above the values observed in normal controls,

in cases of severe pre-eclampsia and eclampsia, is statistically highly significant and therefore their estimations are helpful in the diagnosis of severe pre-eclampsia and eclampsia.

6. Repeated estimations of maternal blood urea are helpful in judging the prognosis of cases of toxæmia of pregnancy the blood urea levels being increased with clinical deterioration and decreased with clinical improvement in majority of instances.

7. The mortality rate in toxæmia of pregnancy for mothers 4.3% and for infants 45.6% including 6.5% of still birth and the maximum number of deaths occur in cases of eclampsia.

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