

# CORRELATION BETWEEN URIC ACID LEVELS AND GESTATIONAL AGE

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Determination of foetal maturity has gained wide acceptance. Estimation of amniotic uric acid alone or in conjunction with amniotic creatinine and cytological examination is an important method of determining the maturity.

The presence of uric acid in amniotic fluid was first demonstrated by Uyendo in 1919. Subsequent workers (Cantarow *et al*, 1933; Doran *et al*, 1970), however gave conflicting reports regarding the levels of uric acid at different periods of gestation and therefore its significance was not clearly established.

Wolf *et al* (1970) in a small series demonstrated that the level of uric acid rose with increased gestational age. Enlander (1972) was the first to advocate the estimation of amniotic uric acid level as an

index of foetal maturity. Other workers (Teoth *et al*, 197v; Vij *et al*, 1979) agreed with the above findings but Harrison (1972) differed from these workers and thought that the uric acid level was raised due to extraneous causes like ingestion of diuretics and raised maternal levels.

This study was undertaken to establish a relation between the amniotic uric acid level and gestational age (as established by other parameters), and also to find the relationship, if any, between the maternal serum uric acid level and gestational age.

## Material and Methods

One hundred cases attending Kamala Nehru Memorial Hospital, Allahabad form the basis of this work. These were delivery cases or those coming for M.T.P. Amniotic fluid was collected in early pregnancy during M.T.P. procedures (hysterotomy and during intra amniotic Betenesol injections) and in late pregnancy by amniotomy or during caesarean sections. Contaminated samples were discarded.

The cases were divided in 2 groups — (i) 81 normal pregnancy cases (Group I) and (ii) 19 cases of pregnancy with toxæmia (Group II).

In addition to a detailed antenatal

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checkup and routine investigations, the following special investigations were done:

- A — Amniotic fluid estimation for uric acid by Caraway's method (Varley, 1969).
- B — Serum uric acid estimation by the same method.
- C — Clinical examination of baby after birth
  - (i) Apgar's score
  - (ii) Physical and neurological examination of the baby within 24 hours.

#### Observations

Table I shows the amniotic uric acid levels at different gestational age in both

groups. The increase in level was highly significant when the level of 35-37-42 weeks was compared with the pre 32 week level. However, when two week level were compared with the next fortnightly level, the rise was not significant. In Group II, though the rising trend was present, it was not significant.

Table II shows the relationship between amniotic uric acid with head circumference. The uric acid increased correspondingly with an increase in the head circumference, which however was not significant. In Group II, the level increased significantly when the head circumference increased from 25-30 cms to 33.1-36 cms.

TABLE I  
*Relation of Amniotic Uric Acid With Period of Gestation*

Groups	Gestation in weeks	No. of cases	Uric acid level in mg%	Statistical Comparison		
				Groups comp.	t	P
Normal	1. 32	13	3.12 ± 0.74	1 & 2	1.03	>.05
	2. 32-34	4	4.67 ± 2.58	2 & 3	0.03	>.05
	3. 35-36	8	4.72 ± 0.87	3 & 4	0.72	>.05
	4. 37-40	42	4.96 ± 0.60	4 & 5	1.8	>.05
	5. 41-42	14	5.36 ± 0.77	1 & 3	4.2	<.001
				1 & 4	8.36	<.001
				1 & 5	10.6	<.001
Toxaemia	1. 32	—	—	—	—	—
	2. 32-34	3	5.0 ± 1.5	2 & 3	0.31	>.05
	3. 35-36	3	5.5 ± 1.7	3 & 4	0.21	>.05
	4. 37-40	1	5.76 ± 1.01	2 & 4	0.62	>.05
	5. 41-42	12	5.4 —	—	—	—

TABLE II  
*Relation of Amniotic Uric Acid With Head Circumference*

Groups	Circumference in cms	No. of cases	Uric acid level in mg%	Statistical Comparison		
				Groups comp.	t	P
Normal	1. 25-30	4	4.05 ± 1.17	1 & 2	0.65	>.05
	2. 30.1-33	26	4.59 ± 0.94	2 & 3	3.55	<.001
	3. 33.1-36	37	5.21 ± 0.63	1 & 3	1.73	>.05
Toxaemia	1. 25-30	3	4.33 ± 0.76	1 & 2	2.14	>.05
	2. 30.1-33	8	5.8 ± 1.19	2 & 3	0.01	>.05
	3. 33.1-36	8	5.82 ± 0.97	1 & 3	2.32	<.01



The level of amniotic fluid uric acid increased with an increase in birth weight in both groups (Table III). The levels increased significantly from 4.6 mg% to 5.12 mg% and subsequently to 5.35 mg% when the birth weight increased from 1 to 4 Kg. in Group I. Similarly, there was a significant increase when the birth weight increased from 2.51 to 3 Kg. in Group II.

Table V shows the relationship of amniotic uric acid level with foetal maturity. A level of 3.5 mg% meant majority of children in both groups were pre-term. At a level of 4.5 mg% majority of babies were term in Group I. 50% of babies were term at this level in Group II. Above this critical level of 4.5 mg% majority of babies were term.

TABLE III  
*Relation of Amniotic Uric Acid Level With Birth Weight*

Groups	Birth weight in Kg.	No. of cases	Uric acid levels in mg%	Statistical Comparison		
				Groups comp.	t	P
Normal	1.1-2.5	28	4.6 ± 0.93	1 & 2	2.6	<.01
	2.2.5-3	25	5.12 ± 0.56	2 & 3	1.04	>.05
	3.3.01-4	15	5.35 ± 0.77	1 & 3	2.88	<.01
Toxaemia	1.1-2.5	9	5.0 ± 1.22	1 & 2	2.60	<.05
	2.2.51-3	6	6.2 ± 0.40	2 & 3	0.31	>.05
	3.3.1-4	4	5.97 ± 1.23	1 & 3	1.16	>.05

Crown heel length was also related to the amniotic uric acid level (Table IV). An increase was observed in uric acid levels with an increase in crown heel length. The levels increased significantly when the length increased from 40.1 cms to 50 cms in Group I. A similar more significant rise was also observed in Group II.

#### *Maternal serum uric acid*

No significant change was seen in the serum uric acid level in relation to age and parity of the mother and gestational age of the foetus. Serum uric acid level were slightly higher in primigravida and young toxaemia patients

TABLE IV  
*Relation of Amniotic Uric Acid With Crown Heel Length*

Groups	Crown heel length in cms	No. of cases	Uric acid levels in mg%	Statistical Comparison		
				Groups comp.	t	P
Normal	1. 35-40	4	4.67 ± 2.0	1 & 2	0.12	>.05
	2. 40.1-45	47	4.82 ± 0.69	2 & 3	3.44	<.001
	3. 45.1-50	16	5.44 ± 0.60	1 & 3	0.7	>.05
Toxaemia	1. 35-40	4	4.37 ± 0.62	1 & 2	3.2	<.05
	2. 40.1-45	12	5.91 ± 1.14	2 & 3	0.11	>.05
	3. 45.1-50	3	5.86 ± 0.41	1 & 3	3.38	<.50

TABLE V  
Relation of Amniotic Uric Acid With Foetal Maturity

Uric Acid in mg%	Foetal Maturity by clinical examination (Group I)		Foetal Maturity by clinical examination (Group II)	
	Pre-term (No. of cases)	Term (No. of cases)	Pre-term (No. of cases)	Term (No. of cases)
3.5	13	—	1	—
4.0	6	7	—	—
4.5	2	11	2	4
5.0	1	12	1	—
5.5	1	19	—	1
6.0	1	3	—	5
6.5	—	1	—	1
7.0	1	3	1	3

### Discussion

Uric acid levels in amniotic fluid increase with advancing pregnancy because of urinary excretion by the foetus and the development of large mass of muscles (Wolf *et al*, 1970).

Mean uric acid levels in amniotic fluid was found to be  $3.12 \pm 0.74$  mg% at less than 32 weeks in Group I. A gradual rising trend was seen directly proportional to the period of gestation in Group II. During 37-40 weeks it was found to be  $4.96 \pm 0.60$  mg% in Group I while the corresponding level in Group II was  $5.76 \pm 1.01$  mg%. At a critical level of 4 mg%, 53.84% of babies were term. A rise in the critical level to 5 mg% raised the percentage of term babies to 89.74% in Group I. There was no specific level after which all babies were term. These findings are in agreement with the observations of Contarow *et al* (1933); Teoth *et al* (1973) and Vij *et al* (1979). Higher values in toxemia cases have been reported by Weiss *et al* (1974) as also observed by us. Higher levels in normal cases have been reported by Enlander (1972) and Weiss *et al* (1974). The wide scatter seen in amniotic uric acid levels at

different periods of gestation have also been reported by Doran *et al* (1970).

### Relation with birth weight

A significant rising trend of uric acid levels with the birth weight was seen, till a maximum peak at 3 Kg. Weiss *et al* (1974) have also observed a rising trend reaching its peak at 2.5 Kg birth weight. A similar rising trend was seen in cases of toxemia. The levels in Group II were significantly higher when same birth weight babies were compared, specially in the range of 2.51-3.0 Kg.

### Relation with maturity of foetus

The rising tendency in amniotic fluid uric acid levels was also seen with increasing maturity of foetus. All babies were preterm below the level of 3.5 mg% in both groups. At level of 4 mg%, 53.84% babies were term in normal pregnancy. If this level increased to 5 mg% then 90.47% babies were term with a false positive pick of 32.14%.

In toxemia group, at a critical level of 4.5 mg%, 77.77% babies were term. With an increase in the level to 5.5 mg%, 90.9%



babies were term with a false pick of 28.57%. Teoth *et al* (1973) with a critical level of 5 mg%, predicted the age correctly in 41.5% cases with a false positive pick of 3.3%. Weiss *et al* (1974) with a critical level of 10 mg% predicted the gestational age correctly in 85% cases with a false pick of 3.6%.

#### *Maternal serum uric acid relation with gestational age*

No relationship between maternal serum uric acid level and gestational age (as assessed by the above parameters) could be found in both normal pregnancy and toxæmia cases.

#### *Conclusions*

(i) Amniotic uric acid levels showed a rising trend with increasing gestation, birth weight and crown heel length in both normal pregnancy and toxæmia cases.

(ii) The rise was more marked in cases of toxæmia as compared to normal pregnancy of the same gestation.

(iii) 90% babies were term at critical level of 5.0 mg% in normal cases and 5.5 mg% in toxæmia cases. However, the

false positive pickup rate was 32.14% and 28.57% respectively.

(iv) The sensitivity of uric acid estimation in the amniotic fluid as an index of foetal maturity decreased due to its wide scatter at different periods of gestation and high percentage of false positive pickup.

(v) No relationship between maternal serum uric acid level and period of gestation could be found.

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