AN EVALUATION OF FOETAL MATURITY BY CREATININE ESTIMATION

by

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The increased awareness of the value of correct estimation of foetal maturity, specially in the so called 'high-risk' pregnancies, is of great importance to the obstetrician.

Various parameters have been tried for evaluation of foetal maturity. Radiography (Christte, 1949) has been discarded because of misleading results and radiation hazards. Gluck *et al* (1971) established a relationship of Lecithin: Sphingomyelin ratio with lung maturity. O'Leary and Bezjian (1971), Sinha and Sinha (1981) have determined maturity by doing amniotic fluid studies like creatinine, cytology and bilirubin estimations. Campbell and Newman (1971) studied the foetal maturity by ultrasonic measurements.

The present work evaluates the correlation between amniotic fluid creatinine level and foetal maturity as established by different parameters.

Material and Methods

One hundred cases admitted for confinement or medical termination of pregnancy in Kamala Nehru Memorial Hospital, Allahabad during 1980 have been selected for the study. The cases were divided in two groups:

Group I of 81 cases of normal pregnancy.

Group II of 19 cases of toxaemia of pregnancy.

Apart from a detailed antenatal check up and routine investigations, the following special investigations were done.

A—Amniotic fluid examination: The samples were obtained in early pregnancy during hysterotomy for M.T.P. or by intraamniotic betnesol injections. In late pregnancy as the samples were obtained by amniocentesis or by amniotomy during labour. Samples were also collected at the time of Caesarean section.

The physical appearance of the fluid was noticed. Creatinine estimation was done by modified Folin-Wu's method (Varley, 1969).

B—Serum Creatinine estimation: It

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was done simultaneously by the same method.

C—Clinical examination of the baby after birth.

(a) Apgar score

(b) Physical and neurological examination of the baby within twenty-four hours of delivery.

D—Examination of the Placenta for any abnormality.

Observations

Amniotic fluid was obtained by amniocentesis in 30 cases, amniotomy in 52 cases, Caesarean section in 10 cases, hysterotomy in 7 cases and during betnesol injection in 1 case. There was no complication following the procedure. The failure rate was 5%.

The age of the patients ranged from 15-35 years. The maximum number of cases were between 21-35 years.

There were 17 and 4 primipara cases in the two groups respectively. The rest were either second para or more.

The physical nature of the amniotic fluid changed with the duration of gestation as shown in Table I.

TABLE I

Relationship Between Period of Gestation and Physical Appearance of Amniotic Fluid

Gestation in weeks	No. of samples	
	Clear	Opalescent/ floccular
>31	13	—
32-34	5	2
35-36	3	8
37-40	4	50
41-42	2	13

The amniotic fluid creatinine level increased with the increase in gestational age in both the normal cases as well as cases of toxaemia (Table II). This trend was most marked in Group II, specially at 37-40 weeks gestation.

The amniotic fluid creatinine level increased with an increase in birth weight in both the groups. The increase in creatinine level in Group II was significantly higher as compared to Group I (Table III).

The amniotic fluid creatinine level showed a corresponding increase with an increase in head circumference and crown heel length in both the groups.

TABLE II

Relationship of Creatinine Level With Period of Gestation

Groups	Gestation in weeks	No. of cases	Creatinine level in mg%	Statistical Comparison		
				Groups comp.	t	P
Normal	1. <32	13	0.81 ± 0.25	1 & 2	7.37	<.001
	2. 32 — 34	4	1.4 ± 0.08	2 & 3	3	<.05
	3. 35 — 36	8	1.52 ± 0.07	3 & 4	10	<.001
	4. 37 — 40	42	1.72 ± 0.14	4 & 5	4.51	<.001
	5. 41 — 42	14	1.92 ± 0.5	—	—	—
Toxaemia	1. 32	—	—	—	—	—
	2. 32 — 34	3	1.72 ± 0.42	2 & 3	0.02	>.05
	3. 35 — 36	3	1.73 ± 0.32	3 & 4	1.39	>.05
	4. 37 — 40	12	2.05 ± 0.29	2 & 4	1.1	>.05
	5. 41 — 42	1	2.1 ± 2	—		

TABLE III

Relationship of Amniotic Creatinine Level and Birth Weight

Groups	Birth Wt. in Kgs.	No. of cases	Creatinine level in mg%	Statistical Comparison		
				Groups comp.	t	P
Normal	1. 1 — 2.5	28	1.58 ± 0.13	1 & 2	10.5	<.001
	2. 2.5 — 3	25	1.79 ± 0.14	2 & 3	1.6	>.05
	3. 3 — 4	15	1.87 ± 0.21	1 & 3	5.8	<.001
Toxaemia	1. 1 — 2.5	9	1.17 ± 0.07	1 & 2	7.5	<.001
	2. 2.5 — 3	6	2.15 ± 0.15	2 & 3	0.4	>.05
	3. 3 — 4	4	2.22 ± 0.26	1 & 3	3.46	<.01

However, the increase was more in Group II (Tables IV and V).

The ratio of amniotic fluid creatinine level to the maternal serum creatinine level increased with the duration of pregnancy in both groups. It was 1.41 mg% when pregnancy was less than 32 weeks and increased two times at term. It further increased to 2.97 mg% at 40-42 weeks (Table VI).

TABLE IV

Relationship of Head Circumference With Amniotic Fluid Creatinine Level

Groups	Circumference in cms.	No. of cases	Creatinine level in mg%	Statistical Comparison		
				Group comp.	t	P
Normal	1. 25— 30	4	1.4 ± 0.08	1 & 2	4.6	<.001
	2. 30.1—33	26	1.63 ± 0.15	2 & 3	5.3	<.001
	3. 33.1—36	27	1.79 ± 0.02	1 & 3	9.75	<.001
Toxaemia	1. 25 —30	3	1.49 ± 0.11	1 & 2	4.09	<.01
	2. 30.1—33	8	1.94 ± 0.24	2 & 3	1.46	>.05
	3. 33.1—36	8	2.13 ± 0.29	1 & 3	5.33	<.001

TABLE V

Relationship of Amniotic Creatinine Level With Crown Heel Length

Group	Crown heel length in cms	No. of cases	Creatinine level in mg%	Statistical Comparison		
				Group comp.	t	P
Normal	1. 35 - 40	4	1.4 ± 0.08	1 & 2	9.0	.001
	2. 40.1- 45	47	1.76 ± 0.16	2 & 3	3.0	.01
	3. 45.1- 55	16	1.88 ± 0.18	1 & 3	9.6	.001
Toxaemia	3. 35 - 40	4	1.51 ± 0.10	1 & 2	6.58	.001
	2. 40.1- 45	12	2.39 ± 0.38	2 & 3	0.5	.05
	3. 45.1- 50	3	2.23 ± 0.15	1 & 3	6.5	.01

TABLE VI

Relationship of Period of Gestation With Mean Amniotic Creatinine/Maternal Serum Creatinine Ratio

Group	Gestation in weeks	No. of cases	A.F./M.S. ratio	Statistical Comparison		
				Group comp.	t	P
Normal	1. 32	13	1.41 ± 0.50	1 & 2	3.26	.01
	2. 32-34	4	2.26 ± 0.41	1 & 3	6.52	.001
	3. 35-37	8	2.52 ± 2.27	1 & 4	9.06	.001
	4. 37-40	42	2.86 ± 0.52	1 & 5	10.75	.001
	5. 41-42	14	2.97 ± 0.15	—	—	—
Toxaemia	1. 32	—	—	—	—	—
	2. 32-34	3	2.10 ± 0.24	2 & 3	1.02	.05
	3. 35-37	3	2.6 ± 0.67	3 & 4	0.73	.05
	4. 37-40	12	2.96 ± 0.5	2 & 4	3.75	.01
	5. 41-42	1	3.0	—	—	—

Discussion

The physical appearance of amniotic fluid changes from clear in early weeks (32 weeks and less) of pregnancy and becomes opalescent in 37-40 weeks. Similar findings have been observed by other workers (Woyton, 1963; Hussain and Sinclair, 1971).

The composition of amniotic fluid is in a dynamic stage throughout pregnancy. The increase in creatinine levels indicate addition of foetal urine to the amniotic cavity (Pitkin *et al*, 1968). The amniotic fluid in the third trimester is largely due to a substantial increase in the number of functioning glomeruli (Potter and Thierstein, 1943). This explains the increasing trend of creatinine levels in pregnancy.

In normal pregnancy, the amniotic fluid creatinine value was found to be below 0.81 mg% in pregnancy less than 32 weeks while it gradually increased from 1.4 mg% at 32-34 weeks to 1.72 mg% at 37-40 weeks and 1.92 mg% at 41-42 weeks. The rise is statistically significant. Similar rising trends have been observed by other workers (Parmley and Miller, 1969; Roopnarinesingh, 1970 and Donnai *et al*, 1971). The average levels varied from 1.5 mg% to 1.72 mg% at term in these series. The accuracy varied from 85% to 94.5% in the present series.

A similar more pronounced gradual increase was seen in cases of toxaemia of pregnancy. The values were 1.72 mg% at 32-34 weeks; 2.05 mg% at 37-40 weeks. Similar findings have been expressed by Roopnarinesingh (1973). In contrast, Pennock, (1972) has found no significant difference in the two groups.

The amniotic fluid creatinine/serum creatinine ratio was found to be a more sensitive index. The ratio increased two times at 37-40 weeks interval and approximately two and a half times at 41-42 weeks gestation from the 32 week ratio in normal cases. This had also been observed by Roopnarinesingh (1973). However, Harrison (1973) found no relation between serum and amniotic fluid creatinine concentration.

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