

AMNIOTIC FLUID CREATININE IN NORMAL AND ABNORMAL PREGNANCIES

by

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Introduction

Amniotic fluid is derived from multiple maternal and foetal sources. The biochemical changes reflect the protein balance occurring during normal and toxae-mias of pregnancy. The two closely related compounds in the process of protein metabolism are creatine and creatinine. The latter is present in amniotic fluid and is found to depend upon the duration of pregnancy.

Pitkin and Zwirek in 1967 observed highly significant correlation between a pregnancy of 37 weeks or more gestation and amniotic fluid creatinine concentration of 2 mg% or more which was indicative of foetal maturity in normal pregnancy.

There was a significant correlation between birth weight and creatinine concentration of liquor amnii but the mean values were greater in the pre-eclamptic group.

Liquor creatinine was found to exceed maternal blood creatinine at each period

of gestation and both the values were higher in toxae-mias than in normal cases.

Moore and Ward (1971) reported that amniotic fluid creatinine level was a reliable index of gestational age when foetal growth was normal but unreliable when it was retarded.

In normal pregnancy higher levels in liquor were regarded as a sign of approaching the end of placental function.

Amniotic fluid creatinine helps to distinguish between premature and dysma-ture infants and in estimating foetal maturity.

The present work has been undertaken in view to study the importance of creatinine levels in liquor, maternal and cord blood in normal pregnancies, toxae-mias and other associated obstetric and medical complications of pregnancy. An attempt has been made to study the statistical significance of the creatinine levels in the above cases and its relation with duration of gestation, birth weight and appar scoring.

Material and Methods

The study consists of 140 cases including toxae-mias of pregnancy and pregnancies with associated obstetric complications.

After taking a detailed history, clinical examination and necessary investigations

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were carried out. The cases were divided into 5 groups.

Group I: Normal Pregnancy (80 cases).

Group II: Mild pre-eclamptic toxæmia (20 cases) B.P. below 140/90 mm with or without oedema/albuminuria.

Group III: Moderate/severe pre-eclamptic toxæmia (15 cases) B.P. ranging between 140/90 to 200/130 mm Hg. with oedema and albuminuria.

Group IV: Eclampsia (15 cases).

Group V: Pregnancy with associated obstetric complication (10 cases) with or without any systemic diseases.

With aseptic precautions the amniotic fluid was collected from the above cases in a sterile bottle by amniotomy during labour or caesarean section. At the same time maternal blood by venepuncture and cord blood from the placental end of the cut cord was collected in sterile bottles.

After delivery the birth weight of the newborn was taken and the apgar score was recorded.

Estimation of creatinine concentration in amniotic fluid, maternal serum, and cord blood was done by Folín-Wu adaptation Jaffe reaction.

TABLE I

Mean Amniotic Fluid Creatinine mg% at Various Periods of Gestation in Normal and Abnormal Pregnancy

Gestation (weeks)	Normal	Mild P.E.T.	Mod. to severe P.E.T.	Eclampsia	Asso. Obst. complications
26	—	—	1.70	—	—
28	—	—	1.89	1.89	—
30	0.82	2.00	—	1.44	—
32	0.95	—	1.89	2.14	1.29
34	1.22	2.03	2.13	—	1.91
35	1.83	2.10	—	—	—
36	2.03	2.50	2.46	2.52	2.13
37	2.20	2.57	2.41	2.42	—
38	2.12	2.78	2.86	—	2.40
40	1.94	2.99	2.66	3.56	1.59

TABLE II

Mean Amniotic Fluid Creatinine mg% Against Birth Weights in Normal and Abnormal Pregnancy

Birth Weights (Grams)	Normal	Mild P.E.T.	Mod. to severe P.E.T.	Eclampsia	Asso. Obst. Complications
1200—1400	0.55	—	1.80	—	0.67
1401—1800	0.84	2.00	1.86	1.87	0.88
1801—2200	1.34	2.43	2.69	2.20	1.14
2201—2600	1.43	2.44	2.28	2.57	1.98
2601—3000	2.19	2.57	2.35	2.53	2.31
3001—3400	2.38	2.69	2.86	—	2.39
3401 and above	2.42	2.79	3.66	3.56	—

TABLE III

Mean Creatinine Concentration (mgm%) in Amniotic Fluid, Maternal Blood and cord Blood Along With Mean Birth Weights and Apgar Score in Normal and Abnormal Pregnancies

Groups of Cases	A.F.C.	M.B.C.	C.B.C.	Birth Weight (grams)	Apgar Score
Normal	2.00	0.71	0.66	2627.00	7.78
Mild P.E.T.	2.53	0.83	0.80	2622.95	7.80
Mod. to severe P.E.T.	2.33	0.83	0.78	2296.00	5.46
Eclampsia	2.37	0.86	0.83	2314.26	5.66
Asso. Obst. Complications	1.71	0.68	0.68	2363.00	6.18

TABLE IV

Ratio Between Mean Liquor and Mean Maternal Blood Creatinine in Normal and Toxaemias of Pregnancy

Group of Cases	No. of Cases	Mean A.F.C. (mgm%)	Mean M.B.C. (mgm%)	Ratio
Normal Pregnancy	80	2.00	0.71	1:2.81
Toxaemia of pregnancy	50	2.41	0.85	1:2.83

Observations and Results

The observations and statistical analysis of present study are given in the Tables 1, 2, 3 and 4.

The mean values in normal ranged from 0.82 mg% at 30 weeks to 2.20 mg% at 37 weeks after which the mean values showed a decline. The levels were higher in cases of toxaemias but followed the same pattern as in normal (Table I).

The mean birth weights ranged from 0.55% at 1200 gms to 2.42 mg% at a birth weight of above 3400 gms. in normal cases. The liquor creatinine in toxaemias ranged from 2.00 to 2.79 mg% in mild P.E.T., 1.80 to 3.66 mg% and 1.87 to 3.56 mg% in moderate to severe P.E.T. and eclampsia respectively for same range of birth weights. In cases of associated obstetric complications the range was from 0.67 to 2.39 mg% from 1200 to 3400 gms (Table II).

Table III shows the mean creatinine

concentration in amniotic fluid, maternal and cord blood alongwith mean birth weight and apgar scoring in normal and abnormal pregnancies.

Table IV shows ratio between mean liquor and maternal blood creatinine being 1:2.81 in normal and 1:2.83 in toxaemias of pregnancy.

Discussion

Pitkin and Zwirek (1967) obtained liquor creatinine value of 2.00 mg% at 37 weeks in normal pregnancy. Similar values were obtained by (Begneaud *et al*, 1969; and Parmley and Miller, 1969). All workers agree that the liquor creatinine exceeded maternal blood creatinine, and was found to increase as pregnancy advanced.

Begneaud *et al* (1969) stated that creatinine was in equilibrium between maternal and cord blood, hence similar creatinine values were obtained in both by

Sinha (1975) and were found to be of no statistical significance.

Roopnarinesingh (1973) reported a linear rise of creatinine values in liquor and maternal blood with increasing gestation more in toxæmic than in normal pregnancies. He found no statistical significance in maternal blood creatinine values.

Khanna and Chandra (1973) recorded higher values of maternal blood creatinine after 36 weeks, while Benzie *et al* (1974) reported a mean of 0.70 mg%.

White *et al* (1969) showed correlation of liquor creatinine of 1.5 mg% and baby weight of 2500 gms obtained a value of 2.03 mgm% with babies of 2,500 gms and more.

In the present study the amniotic fluid creatinine values were found to increase with advancing gestation both in normal and abnormal pregnancies but the values were higher in toxæmias. In normal and associated obstetric and medical complications a mean value of 2.00 mg% was obtained at 36 weeks gestation when the foetus had reached a stage of maturity while in toxæmias 2.00 mg% was obtained at 30 weeks pregnancy.

The mean liquor creatinine was also found to increase with increasing foetal weight, both in normal and abnormal pregnancies. A value of 2.19 mg% was obtained at 2600 gms. and above when the foetus was mature in normal cases while in toxæmias it was obtained between 1400 to 1800 gms birth weight, when the foetus was premature.

The mean creatinine values in liquor were 2.00 mg% in normal, 2.53 mg%, 2.33 mg% and 2.37 mg% in mild P.E.T., moderate to severe P.E.T. and eclampsia respectively. In associated obstetric and medical conditions the value was 1.71 mg%. The levels in moderate to severe

P.E.T. and eclampsia were lower than mild P.E.T. possibly because of three factors. (1) 20% still birth rate in both the groups of cases. (2) 70% and 50% newborns had birth weights less than 2500 grams in moderate to severe P.E.T. and eclampsia respectively. (3) Both these groups of cases had received treatment before the liquor sample was collected.

The mean birth weights in normal and mild cases were above 2500 gms with an appgar score of above 6 indicating a mature foetus while in toxæmias especially moderate to severe P.E.T. and eclampsia, although the liquor creatinine levels were greater than 2 mgm%. The birth weights were less than 2500 grams and the appgar score was less than 6 indicating premature or small for dates foetuses.

Creatinine in liquor and maternal blood were found to be statistically significant between normal and different degrees of toxæmias. No correlation was obtained between liquor and maternal blood creatinine. The ratio between the two was 1:2.81 in normal cases and 1:2.83 in toxæmias.

Summary and Conclusion

The present study has been undertaken in 140 cases comprising of 80 cases of normal pregnancy, 50 cases of toxæmias and 10 cases of associated obstetric complications with a view to observe the creatinine concentration in amniotic fluid and its reflection in cases of toxæmia and foetal status.

The mean creatinine levels in liquor, maternal and cord blood were increased with duration of pregnancy, but the levels were higher in toxæmias.

The mean liquor levels always exceeded mean maternal and cord blood levels. The liquor levels were found to rise with

increasing birthweights in most of the cases.

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ABBREVIATIONS

- A.F.C. — Amniotic Fluid Creatinine.
- C.B.C. — Cord Blood Creatinine.
- mg% — Milligrams per cent.
- P.E.T. — Pre-eclamptic Toxaemia.