Amniotic fluid creatinine as Index of foetal weight

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In assessing foetal maturity during pregnancy, a precise knowledge of gestational age and foetal weight is essential but often unavailable. A poor menstrual history, for instance, interferes with accurate calculation of gestational age. Similarly, palpating the gravid uterus to determine the weight of the foetus is often unreliable particularly in the presence of hydramnios or obesity. It is not surprising, therefore that the gravest consequence of timely. termination of pregnancy through mistaken foetal maturity is delivery of a premature baby that may not survive extrauterine life.

Pitkin et al[6], however, have found that the concentration of amniotic fluid creatinine increases with the duration of pregnancy, and that at 37 or more weeks' gestation the liquor creatinine level exceeds 2 mgm/100ml. Since then, the value of monitoring gestational age by liquor creatinine determination has been confirmed by several workers[1,3,4,8,9]. Much less, however, is known about the reliability of liquor creatinine as an index of foetal weight. The present study therefore attempts to determine whether a correlation between liquor creatinine concentration and foetal weight exists in normal pregnancy, and if so, whether it is influenced by abnormal pregnancy states.

METHODS AND MATERIAL

Five to ten ml. samples of amniotic fluid were obtained from 268 pregnant women admitted to the Obstetric Unit of the University Hospital, Kuala Lumpur 1972. Amongst these were 195 patients with normal pregnancy, 63 with preeclamptic toxaemia (blood pressure of 140/90 mmHg or more with oedema or proteinuria or both, after the 24th week gestation), 5 with diabetes mellitus and 5 with twin pregnancy.

A total of 273 amniotic fluid specimens were collected either at elective caesarean section or at the time of induction of labour or soon after the onset of spontaneous labour via a Drew-Symthe Catheter. A few specimens were obtained by transabdominal amniocentesis within 3 days of delivery. Liquor creatinine was measured by an Autoanalyser system using a modified Jaffe picric acid method. Known standards were run with each batch of estimations.

RESULTS

Normal pregnancy

Figure I shows a scattergram of liquor creatinine levels plotted against birth weights of 195 infants whose mothers had uncomplicated pregnancies. It is observed that the creatinine concentration tends to rise with increasing foetal weights. The correlation is statistically significant $p < 0.005$. White[8] and Wyatt[9] have claimed that a creatinine level of 1.5 mgm/100ml reliably reflects foetal weights of 2.5 kg or more. Applying this criterion we found that the maturity by weight (i.e. 2.5 kg or more) of 163 of

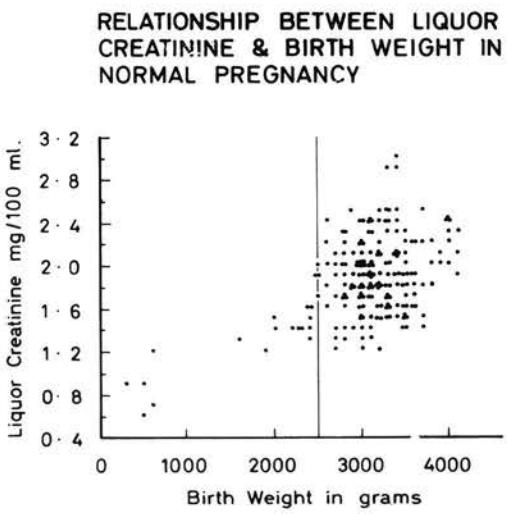


Figure 1

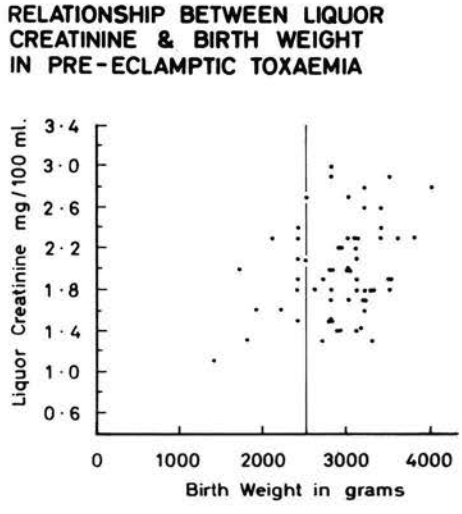


Figure 2

182 babies (89.6%) was indicated correctly and the maturity of 19 babies (10.4%) was indicated wrongly. Of these 19 infants, 4 (weighing 2000-2400gm) had creatinine levels of 1.5mgm/100ml or above. Fifteen infants (weighing 2700-3700 gm) had creatinine concentration less than 1.5mgm/100ml.

Pre-eclampsia

Figure 2 is a scattergram comparing the individual creatinine values with the birth weights of 63 infants whose mothers had pre eclampsia during pregnancy. No statistical significant correlation between foetal weight and liquor creatinine concentration in pre-eclampsia can be discerned. However, the mean concentration of liquor creatinine for corresponding foetal weights is found to be generally higher in pre-eclampsia than in normal pregnancy, Table I. Roopnarinesingh[7] et al have also noted that the levels of liquor creatinine in pre-eclampsia are significantly higher than normal values at corresponding periods of gestation. They suggest that the increase in liquor creatinine concentration in pre-eclampsia is related to a diminution in the rate of transfer of creatinine across the placenta to the mother. Furthermore they cite that in pre-eclamptic toxaemia the clearance of paraaminohippurate from amniotic fluid is reduced (Edelberg)[5] and that the transmission of sodium and amino-acids is also diminished (Cox)[2].

TABLE 1

Birth Weight (gram)	Amniotic Flud Creatinine mg/ 100ml.			
	Normal Pregnancy		Pre-eclampsia	
	Mean	I.S.D.	Mean	I.S.D.
1500	1.35	0.13	1.50	0.12
2000	1.45	0.11	1.79	0.32
2500	1.85	0.32	1.94	0.26
3000	1.93	0.36	2.04	0.40
3500	1.90	0.30	2.39	0.61
4000-5000	2.22	0.19	2.80	

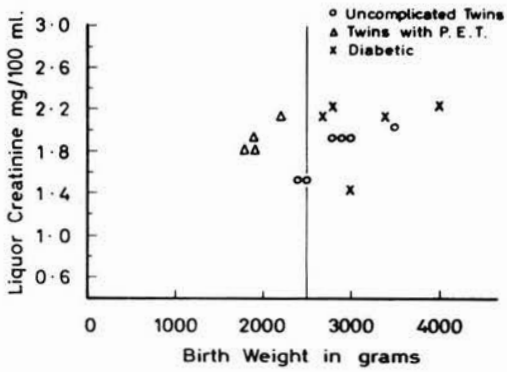
Diabetic pregnancy

5 patients had diabetes mellitus, Figure 3. The predicted maturity by weight (i.e. 2½ kg or more) from liquor creatinine determination was correct for 4 of the patients. The number was too small for statistical evaluation.

Twin pregnancy

Of the 5 patients with twin pregnancy, 2 developed pre-eclamptic toxaemia, Figure 3. In these 2 cases all 4 babies (weighing 1800 to 2250 gm) had creatinine levels of 1.5mgm/100ml or above: i.e. their maturity was indicated wrongly. On the contrary, the maturity by weight of all 6 babies from the 3 normal twin pregnancies was correctly predicted.

RELATIONSHIP BETWEEN LIQUOR CREATININE & BIRTH WEIGHT IN ABNORMAL PREGNANCY



DISCUSSION

It is widely accepted that the concentration of liquor creatinine increases with gestational age. At 37 or more weeks' gestation the liquor creatinine level has been found to be 2mgm/100ml or more. With this yardstick, Pitkin and Zwirek[6] have correctly predicted foetal maturity in 94% of their cases. Not surprisingly then, we also have observed the level of liquor creatinine to rise with the foetal weight. However, our range of normal creatinine values is too broad to be of use for precise antenatal prediction of foetal weight. Even so, a liquor creatinine level of 1.5 mgm/100ml has been found to be a reliable guide for foetal weights of 2.5kg or more in our series. In other words, a liquor creatinine reading of 1.5 mgm/100ml may be regarded as a fair indication that the foetus has reached a stage of gestation compatible with early maturity.

In pre eclamptic toxaemia our results have failed to show any correlation between creatinine levels and foetal weights. Quite possibly in our study, the inclusion of patients with varying severity of toxaemia as well as patients on thiazide therapy could have influenced such as outcome. At the present time we feel that liquor creatinine estimation for predicting individual foetal weight during pregnancy is of limited value especially when toxaemia has supervened.

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