ASSESSMENT OF FOETAL MATURITY BY AMNIOTIC FLUID EXAMINATION

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Introduction

When elective induction of labour is indicated, accurate assessment of the degree of foetal maturity forms the major problem in the successful management of certain obstetric conditions like toxaemia, diabetes, Rh isoimmunization, suspected postmaturity, H/O unexplained intrauterine deaths at term during previous pregnancies, etc. This is more so if menstrual history and/or clinical examination are inadequate to provide the reliable answer.

Recently, amniotic fluid study has opened a simple way from which additional information can be obtained regarding the intrauterine status of the foetus.

In this work an attempt has been made to study relative merits of amniotic fluid examination for assessing foetal maturity in normal pregnancy.

Technique of Amniotic Fluid Collection (Amniocentesis):

In the present study, all samples of amniotic fluid were obtained (with sterile precautions) by abdominal amniocentesis. This procedure was done under local anaesthesia using 18 gauge lumbar puncture needle. All patients had been sedated by injecting pethidine 50 mgs with largactil 25 mgs half an hour before the procedure. In majority of the patients amniocentesis was successful at the first attempt. It was found, that with a cephalic presentation, the most favourable site for amniotic puncture was a space immediately posterior to the foetal neck. Ten ml of the fluid were enough for the diagnostic purposes.

Most of the investigators think that transabdominal amniocentesis, for diagnostic purposes, is a safe procedure. However, it carries the risk of certain complications. 1. Placental injuries leading to formation of haematoma, development of haemo-amnion and intra-amniotic infection. 2. Leaking of foetal blood cells into the maternal circulation. 3. Injuries to the foetal part by penetration of the needle. 4. Premature onset of labour.

However, incidence of individual complication has not been mentioned in the available literature and the absence of any emphasis on these complications suggest its wide margin of safety.

In the present study, none of the patients who underwent amniocentesis developed any of the above mentioned complications or any other complication.

Material

Fifty-two samples of amniotic fluid from 51 patients, who attended Sassoon

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General Hospitals, Poona, during 1970-71 were studied. Patients fulfilling following criteria, were only selected for study:

1. Patients with absolutely regular menstrual cycles.
2. L.M.P. accurately known.
3. Accurately known date of earliest confirmation of present pregnancy with size of the uterus, expressed in weeks at the time of confirmation.
4. Accurately known date of quickening.

Patients with complicated pregnancies were excluded from the study.

1. Duration of gestation varying between	34-36 wks. 9+1*
2. Duration of gestation varying between	38-41 wks. 37+1*
3. Duration of gestation varying between	41-44 wks. 4
Total	51

Methods

Each sample of liquor was studied for—

1. Creatinine concentration—estimated by Folin Wu adaptation by Jaffe's alkaline picrate reaction.[7, 8, 12]
2. Percentage of polygonal faintly orange stained cells, using 0.1% solution of Nile blue sulphate. The technique of staining was exactly followed as described by Ivo Brosens and H. Gordon and others. Five hundred cells were studied from each sample.

Excepting those patients who were not near term (10 patients) all patients delivered within one week after the amniocentesis and hence the degree of neonatal maturity could be immediately assessed on the following criteria as described by Usher *et al* (1966) and others.

(a) Birth weight near 2500 gms. or over.

(b) Well developed breast nodules and nipples.

(c) Neonatal reflexes—i. Moro reflex, ii. grasp reflex, iii. sucking reflex.

Observations

Data from full term patients (38) who delivered fully matured infants gave following observations—

(a) Mean duration of gestation—39.5 weeks.

(b) Mean creatinine concentration of liquor—2.62 mgs% with standard deviation (S.D.) of 0.035, giving variation from 2.55 to 2.7 mgs%.

(Variation = Mean ± 2 S.D.)

(c) Mean percentage of orange stained cells—24.5% with S.D. of 26.6%, thus giving variation from 0 to 77.8%

(d) Mean birth weight of infants—2.8 kgs. with S.D. of 0.1824, giving variation from 2.5 to 3.1 kgs.

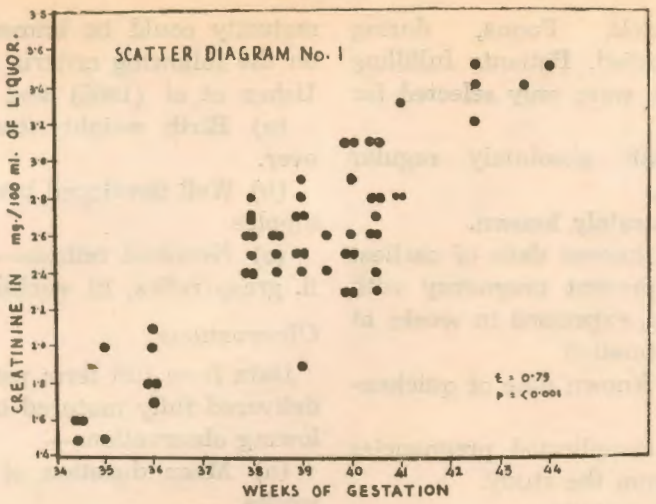
Duration of gestation and creatinine concentration of liquor show a positive correlation ($r = 0.79$) which is statistically highly significant ($P<0.001$). Scatter diagram 1 shows almost linear correlation between the two (Fig. 1).

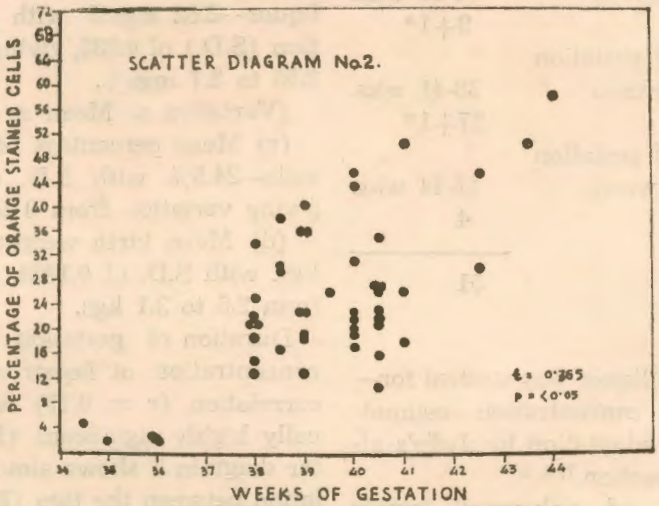
Duration of gestation and percentage of orange stained cells have a positive correlation ($r = 0.365$) which is again statistically significant at 5% level. ($P<0.05$). Scatter diagram (Fig. 2) also shows the same.

Birth weights of infants (Fig. 3) and creatinine concentration of liquor show a highly significant correlation statistically ($r = 0.91$; $P<0.001$). Scatter diagram (Fig. 4) is illustrative.

Birth weight of infants and percentage of orange stained cells show poor corre-

(* In one case amniocentesis was done once before and once after 36 weeks of pregnancy).





lation ($r = 0.155$, $P<0.1$). Scatter diagram (Fig. 5) is suggestive.

Comparing two parameters (i.e. concentration of creatinine in liquor and percentage of orange stained cells in liquor (Fig. 6) it is evident that—

I. Creatinine concentration of liquor has coefficient of variation—1.33%.

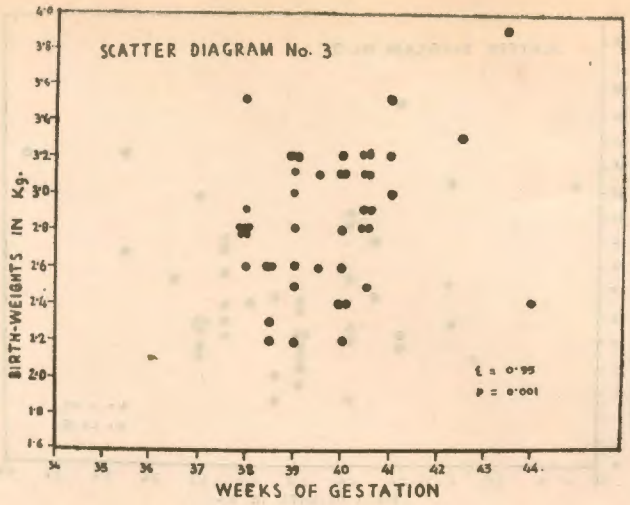
II. Percentage of orange stained cells has coefficient of variation—108.8%.

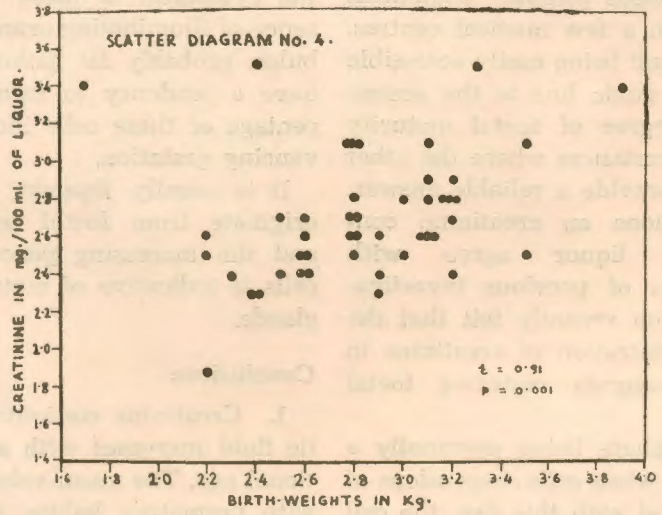
Thus creatinine concentration of liquor is a highly reliable criterion of foetal maturity than the percentage of orange stained cells in the liquor amnii.

Observations with pre-term liquor samples (10 patients) i.e. pregnancies varying between 34 to 36 weeks showed that—

(a) Negligible percentage of orange stained cells could be detected in these liquor samples (scatter diagram 2).

(b) Mean creatinine value—1.76 mg% with S.D. of 0.2211 giving variation from 1.32 to 2.2 mg% (Fig. 1).





With full term babies mean creatinine value—2.62 mg%. Applying 't' test, 'b' and 'c' give 't' value equal to 29.3.

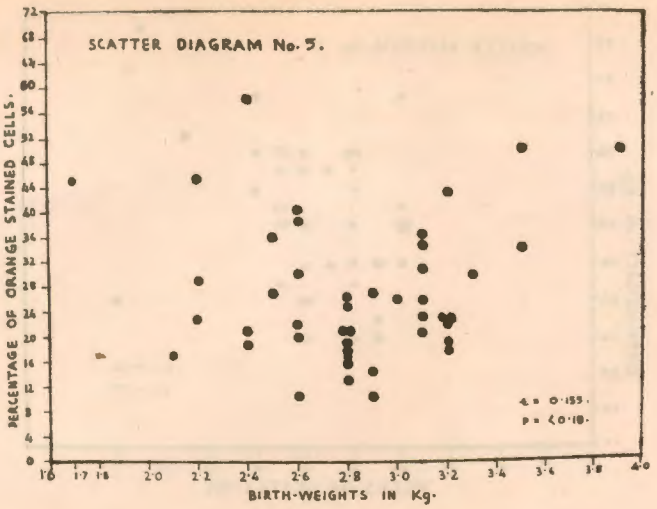
That means the observed difference in respective mean creatinine values before and after 36 weeks of gestation is statistically highly significant ($t = 29.3$).

Creatinine value and percentage of orange stained cells with postmature babies were higher than those with full term babies.

Discussion

As already mentioned menstrual history and/or clinical examination are inadequate for assessing foetal maturity. Radiological investigations may be of some help but these results are not always satisfactory. Moreover, there are possible dangers of the effects of radiation to the mother and to the foetus.

Ian Donald's method of using ultrasonic for measurement of foetal bi-pari-



etal diameter, needs complex equipment available only in a few medical centres.

The liquor amnii being easily accessible may give some guide line to the assessment of the degree of foetal maturity under the circumstances where the other criteria fail to provide a reliable answer.

Our observations on creatinine concentration in liquor agree with the observations of previous investigators. It has been recently felt that the increasing concentration of creatinine in liquor amnii suggests maturing foetal kidneys.

Nile blue sulphate being essentially a fat staining dye, when cells suspensions of liquor are stained with this dye, the cell population is divided into two types of cells. (Photomicrograph of amniotic fluid cells).

1. Cells with uniformly stained cytoplasm and centrally situated, deep blue stained, distinct nuclei. The cell margins are well defined and these cells never form clusters. They are probably the foetal dermal cells.

2. Polygonal cells with faintly orange stained cystoplasm but no nucleus. When illumination is increased or decreased, the cytoplasm of these cells show presence of illuminating orange coloured globules, probably fat globules. These cells have a tendency to form clusters. Percentage of these cells increases with advancing gestation.

It is usually thought that these cells originate from foetal sebaceous glands and the increasing percentage of these cells is indicative of maturation of these glands.

Conclusions

1. Creatinine concentration of amniotic fluid increases with advancing gestational age. The mean value (in this study) with premature babies (i.e. between 34 to 36 weeks) was 1.76 mgs per 100 ccs of liquor and that with the full term mature babies was 2.62 mgs%.

2. Percentage of orange stained cells also shows progressive rise with the advancing pregnancy. The percentage was negligible, in the present study, before 36 weeks of pregnancy and it was near 24.5% (mean value) with full term mature babies.

3. Estimation of creatinine concentration of liquor is a more reliable parame-

ter of degree of foetal maturity than the estimation of orange stained cells in liquor amnii.

4. The technique and the interpretations being safe and simple, this method could be used more widely in routine estimation of the foetal maturity whenever indicated.

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See Fig. on Art Paper I