AMNIOTIC FLUID GLUCOSE IN NORMAL AND HIGH RISK PREGNANCIES AND ITS RELATION TO NEONATAL OUTCOME

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SUMMARY

The mean amniotic fluid glucose level at 37-40 weeks of gestation was 11.2 ± 6.2 mg/100 ml. There was significant downward linear trends of amniotic fluid glucose levels with advancing gestation. Thus estimation of glucose in the amniotic fluid can serve as a fairly good parameter for assessment of foetal maturity.

There was significant decrease in the amniotic fluid glucose levels in pregnancies with presumed placental insufficiency. In pregnancies associated with diabetes mellitus there was significant increase in amniotic fluid glucose level. Increased incidence of depressed and low birth weight infants were observed with decreased amniotic fluid glucose level.

Introduction

Normal foetal growth and differentiation demand a continous and syndromous supply of nutrients. A constant infusion of glucose providing energy for cellular metabolism is of primary importance. Towards the end of gestation, the normal foetus accumulates large reserves of carbohydrate in its liver and skeletal muscles and these help to tide over the transitional period between birth and the establishment of efficient suckling. Since the foetus plays an important role in the dynamics and origin of liquor amnii, amniotic fluid glucose could reflect foetal glucose reserves.

The present study was undertaken to find out, the amniotic fluid glucose variations in different periods of gestation, in high-risk pregnancies and to find out the relation if any of amniotic fluid glucose level to neonatal outcome.

Material and Methods

One hundred and fifty cases, admitted in Obstetrical wards of Kamla Nehru Memorial and Swaroop Rani Hospital, Allahabad during the year 1983 were evaluated thoroughly. Glucose content

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was determined in amniotic fluid obtained between 16th to 43rd weeks of gestation. Samples of amniotic fluid in term pregnancies were directly collected from bag of water or at the time of caesarean section while before 20 weeks samples were obtained from women seeking termination either by transabdominal amniocentesis or at the time of hysterotomy. Samples of amniotic fluid were collected in fluoride vial. Estimation of glucose was done by the method of Asatoor and King as described by Varley (1964) in "Practical clinical Biochemistry". This method is specific and sensitive method for glucose. No other reducing carbohydrate or non carbohydrate interfers with this method. It is thus a measure of the true glucose content of the amniotic fluid.

The cases studied were divided in two groups as shown in Table 1.

Results

Sixty-five cases of normal pregnancy at different period of gestation were studied with a view to find out the amniotic fluid glucose variations at different age, parity and gestation.

Age—The amniotic fluid glucose, maximum value (17.2 ± 5.23 mg/100 ml) being at thirty six to forty year age group, however did not show any correlation with the age.

Parity—The highest mean amniotic fluid level (16.6 ± 5.6 mg/100 ml) was recorded in fourth and fifth para group. These values however did not show any correlation with parity.

Gestation—The highest mean amniotic fluid glucose value was observed at 16 to 20 weeks of gestation (32.52 ± 9.6 mg/100 ml) while the lowest mean value was recorded (8.80 ± 3.2 mg/100 ml) at 39 to 40 weeks of gestation (Table II).

The amniotic fluid glucose levels showed a significant downward linear trend with advancing gestation (Graph 1).

TABLE I

Distribution of Cases in Normal and High Pregnancies

Groups	No. of cases	Percentage
. Normal pregnancy		
— Term (37-40 weeks)	42	28
— Preterm (28-36 weeks)	12	8
— Intruption of pregnancy (16-20 weeks)	11	7.30
. High risk pregnancy		
— Post maturity (41-43 weeks)	20	13.3
— Pre-eclampsia	26	17.3
— Intrauterine growth retardation	8	5.3
— Severe anaemia	20	13.3
— Intrauterine death	6	4
— Diabetes mellitus	5	3.3

(i) Normal pregnancy.

(ii) High-risk pregnancy

In pregnancies in which amniotic fluid was measured 72 hours or less before the onset of induction of labour, the value of amniotc fluid glucose was correlated with the Apgar score and birth weight (100 cases).

TABLE II
Amniotic Fluid Glucose Levels at Different Periods of Gestation

Periods of gestation in weeks	No. of cases	Glucose (mg%) Mean ± SD
16-20	10	32.53 ± 9.6
28-32	9	20.04 ± 3.61
33-34	3	18.12 ± 5.08
35-36	4	16.91 ± 2.60
37-38	25	12.02 ± 6.12
39-40	14	8.80 ± 3.2

Group II

High-Risk Pregnancy

The mean amniotic fluid glucose level in various cases of high-risk pregnancy and its comparison with normal was shown in Table III (Graph 2).

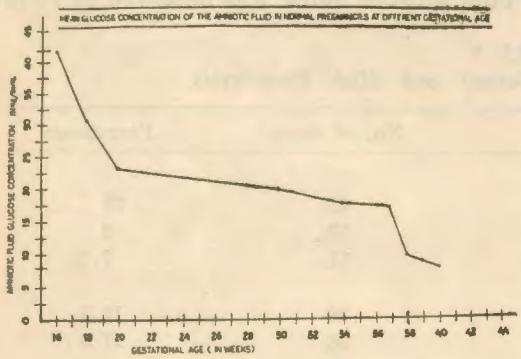

Fig. 1.

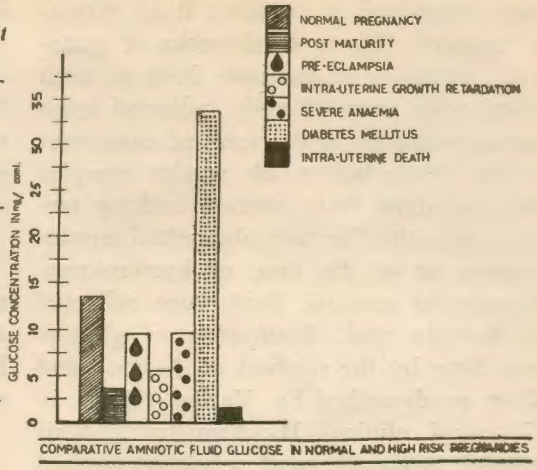

Fig. 2

There was significant decrease in mean amniotic fluid glucose level in pregnancies with presumed placental insufficiency i.e. postmaturity, pre-eclampsia, intrauterine growth retardation and severe anaemia when compared with the controls.

In cases of intrauterine death, the amniotic fluid glucose values were significantly lower ($t = 6.6$, $p < .01$).

In diabetic pregnancies significantly higher mean value of amniotic fluid glucose (33.68 ± 6.15 mg/100 ml) was observed when compared with the control ($t = 7.89$, $p < .01$).

TABLE III
Comparative Amniotic Fluid Glucose (37-40 *Weeks*)

Groups	No. of cases	Mean ± SD (mg/100 ml)	't'	'p'
Normal pregnancy (control)	42	13.3 ± 6.2		
Post maturity	20	3.69 ± 3.02	23.60	<.001
Pre-eclampsia	26	9.2 ± 1.36	4.01	<.05
Intrauterine growth retardation	8	5.6 ± 3.74	3.89	<.05
Severe anaemia	20	9.6 ± 2.2	2.96	<.05
Intrauterine death	6	1.51 ± 1.16	6.6	<.01
Diabetes mellitus	5	33.68 ± 6.15	7.89	<.01

TABLE IV

Correlation of Amniotic Fluid Glucose Values With the Apgar Score of the Newborn (Cases of Diabetes Mellitus were Excluded)

Amniotic fluid	Total No. of cases	No. of cases Apgar score <7		Apgar score between 8-10	
. Negative	6	5	(83.3%)	1	(16.7%)
. 1-8 mg/100 ml	44	28	(63.6%)	16	(36.4%)
. >8 mg/100 ml	50	4	(8%)	46	(92%)

As shown in Table IV, 100 cases were studied with a view to observe whether there was any correlation between amniotic fluid glucose level and the apgar score of the foetus. With negative amniotic fluid glucose, out of 6 cases, in only 1 case (16.7%) the apgar score was in between 8-10 while in rest of 5 cases (83.3%) the apgar score was less than 7, with amniotic fluid glucose levels between 1-8 mg/100 ml, in 63.6% of cases the apgar score was below 7, while where amniotic fluid glucose values were above 8 mg/100 ml only 4 babies out of 50 (8%) had apgar score below 7. Thus with the amniotic fluid glucose 8 mg/100 ml, the apgar score of the foetus was almost always good.

The maximum mean amniotic fluid value (13.3 ± 7.34 mg/100 ml) was found with birth weight between 3-3.5 kg, while minimum mean value (9.2 ± 4.32 mg/100 ml) was found with birth weight less than 2 kg (Table V).

TABLE V

Relationship of Birth Weight With the Amniotic Fluid Glucose Levels

Birth weight (kg)	No. of cases	Amniotic fluid glucose values (mg/100 ml) Mean ± S.D.
2.0	12	9.2 ± 4.32
2.0-2.5	54	9.86 ± 3.26
2-5-3.0	25	10.5 ± 6.40
3.0-3.5	7	13.3 ± 7.34
3.5-4.0	2	11.4 ± 1.60

Discussion

It was observed that with increasing gestation, the amniotic fluid glucose values steadily decline throughout gestation. The decrease in human amniotic fluid is well documented by Makepeace (1931), Schreiner (1963), Bai *et al* (1969), Drazancic (1974), Dhar (1980).

Comparatively lower values of amniotic fluid glucose were observed in various high-risk pregnancies like post maturity, pre-eclampsia, intrauterine growth retardation and severe anaemia. These conditions are associated with state of chronic foetal distress. Our finding is consistent with the finding of Drazancic (1974) and Dhar (1980).

The finding of increase amniotic fluid glucose in diabetes was in agreement with the observation of Pedersen (1954), Archimaut (1974), Drazancic (1974), Wood and Sherline (1975) Dhar (1980).

The amniotic fluid glucose levels were considerably decreased in intrauterine death. This decrease may be because of considerable decrease in the carbohydrate reserves of the foetal liver in cases of intrauterine death.

Amniotic Fuid Glucose Levels with the Relation to Neonatal outcome

A higher incidence of depressed infant (apgar score < 7) was observed in pregnancies with lowered amniotic fluid glucose concentration. It was observed

that with amniotic fluid > 8 mg/100 ml, the apgar score was almost always good. It was also observed that increasing birth weight was associated with increase in amniotic fluid glucose level.

Pedersen (1954) suggested that amniotic fluid glucose may predict perinatal asphyxia. Schreiner (1963) reported that amniotic fluid glucose may predict altered foetal growth, and increased frequency of perinatal asphyxia. Wood and Sharline (1963) observed that when amniotic sugar was 10 mg% or less, there was often evidence of foetal distress or delay in onset of regular respiration but when the sugar was more than 10 mg% the foetal condition was almost always good. Drazancic (1974) reported a significantly higher incidence ($P < 0.01$) of depressed infants (Apgar score < 7) and infant with acidosis in pregnancies with lowered amniotic fluid glucose concentration. In pregnancies with decreased oestriol excretion a significantly lower mean value ($P < 0.1$) was evident.

References

1. Archimaut, G., Ross, N., Exebio, J. and Inandy, E.: XII Congreso Argentino de Obstetrica Ginecologia. 3: 749, 1970.
2. Bai, K. S., Rohatgi, P. and Sur, B. K.: J. Obstet. Gynec. India. 19: 162, 1969.
3. Dhar, R., Eduljee, S. Y., Bhatt, I. J.: J. Obstet. Gynec. India. 30: 794, 1980.
4. Drazancic, A. and Kuvacic, I.: Am. J. Obstet. Gynec. 24: 40, 1974.
5. Makepeace, A. W., Fremont-Smith, F., Dailey, M. E. and Carroll, M. P.: Surg. Gynec. Obstet. 53: 635, 1931.
6. Pedersen, J.: Acta. Endocrinol. 15: 342, 1949.
7. Schreiner, W. E. and Gubler, A.: Zentralbl Gynekol. 85: 304, 1963.
8. Wood, G. P. and Sherline, D. M.: Am. J. Obstet. Gynec. 192: 151, 1975.