AMNIOTIC FLUID ALPHA—FETOPROTEIN IN NORMAL PREGNANCY

By

M. Dayal, M. Singh and R. Baveja

SUMMARY

Alpha-Fetoprotein was determined by radial immunodiffusion in 24 amniotic fluid samples. A maximum level of 15.8 mg/100 ml was obtained at 14 weeks of gestation. During the second trimester the level of AFP was from 6.6 mg/100 ml to 12.5 mg/100 ml and in the third trimester it was 2.2 mg/100 ml to 6.6 mg/100 ml while AFP was absent at 42 weeks of pregnancy. A highly significant correlation between advancing gestation and the decreasing AFP level was noted in second trimester (r = —0.902) but this correlation was insignificant in the third trimester (r = —0.28). There was no statistically significant correlation (= —0.28) between infant birth weight and the AFP level.

Introduction

A glycoprotein specific for the fetus was first demonstrated in foetal calf serum, which was named as "Fetuin" by Pederson (1944), Bergstrand and Czar (1956) reported a "new protein fraction" of molecular weight 70,000 in the electrophoresis of plasma protein migrating between albumin and alpha-globulin fraction in a foetus. Gitlin arbitrarily labelled it "Alpha-Fetoprotein" (Gitlin and Boesman (1966). A.F.P. is synthesized by foetal liver (Gitlin and Boesman, 1967) and yolk sac (Gitlin, 1971). According to Gitlin and Boesman (1966) AFP first appears in the amniotic fluid at 6 weeks and the relative concentration of foetal AFP is maximum at 14 weeks (6.6 mg/ml).

Ruoslahti and Seppala (1971) postulated that AFP represents a foetal element in the amniotic fluid. It is believed that even though the amniotic fluid is in intimate contact with the foetus the protein turnover is comparatively slow. AFP reaches the amniotic fluid via the foetal urine and the levels follow closely the pattern of foetal serum levels.

Unlike most foetal monitors which are restricted to a small portion of gestation, measurement of AFP is clinically useful in all the three trimesters of pregnancy.

The present report is on amniotic fluid AFP levels in all the three trimesters of pregnancy and their relation to the gestational age and infant's birth weight.

Material and Methods

The material for the present study was collected from 24 uncomplicated pregnancies at different period of gestation. Period of gestation was calculated from the date of last menstrual period.

From: Department of Obstetrics and Gynaecology, M.L.N. Medical College, Allahabad.

Accepted for publication on 23-3-88.

Amniotic fluid was collected by all glass syringe and 18 gauze needle under aseptic precautions at the time of hysterotomy, by transabdominal amniocentesis, in labour directly from the bag of waters and at the time of caesarean section done for contracted pelvis and malpresentation.

Clear amniotic fluid was selected for the analysis and meconium or blood stained ones were rejected. The samples thus collected were centrifuged at 1800 r.p.m. for 5 minutes and the supernatant fluid was removed in a sterile container and was stored in deep freeze until analysed.

Concentration of AFP was detected by radial immuno-diffusion using Behringwerke' M-Fartigen Alpha-Fetoprotein 'immunodiffusion plates and standard serum (22 mg/100 ml) for the standardization of the test.

Observations

Age distribution of the patients varied from 20 to 35 years, 66.6% cases were in the age-group of 21 to 30 years, and 94.7% were of parity 0 to 5.

Period of gestation and Alpha-Fetoprotein Concentration

The AFP level decreased with the advancing gestation. There was a highly significant correlation between pregnancy weeks and the decreasing AFP levels during the second trimester ($r = -0.902$). In the third trimester this correlation was not statistically significant ($r = -028$).

The cases studied were from 10 weeks of gestation to 42 weeks of gestation (Tabe I). Between 10 to 18 weeks the level of AFP varied from 12.5 to 15.8 mg/100 ml. Maximum level of 15.8 mg/100 ml was found at 14 weeks of gestation. In the second trimester the level of AFP was from 6.6 mg to 12.5 mg/100 ml and in the third trimester it was 2.2 mg to 6.6 mg/100 ml. In one case of 42 weeks it was absent.

TABLE I
Duration of Gestation and Levels of AFP

Sl. No.	Duration of gestation (weeks)	No. of cases	Value of AFP (mg/100 ml)
1	10 to 12	1	12.5
2	13 to 15	1	15.8
3	16 to 18	1	12.5
4	20 to 24	3	8-12.5
5	25 to 28	2	6.6-8
6	30 to 33	2	3.2-5.5
7	34 to 37	5	3.2-6.6
8	38 to 40	8	2.2-6.6
9	42	1	0

Relationship of Infant birth weight and Alpha-Fetoprotein

The correlation between infant birth weight and the AFP level was not statistically significant ($r = -0.28$). Maximum level of AFP was 8 mg/100 ml. at 28 weeks of gestation with minimum birth weight 1800 gms. The minimum recorded AFP value was 2.2 mg/100 ml at 38 weeks of gestation with birth weight of 3750 gms. AFP was absent in 1 at 42 weeks of gestation with a birth weight of 3000 gms (Fig. 1).

Discussion

In normal pregnancy A.F.P. levels were estimated from 10th to 42nd week of gestation. Maximum concentration of 15.8 mg/100 ml was obtained at 14 weeks of gestation. This is in accordance with

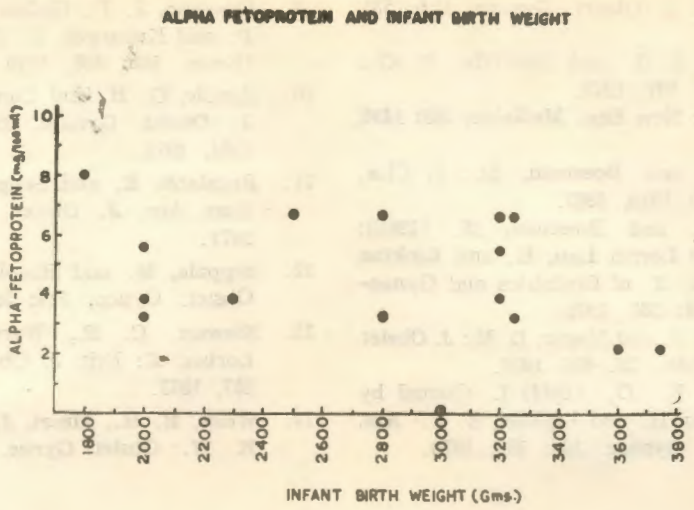

Fig. 1

the observations of Gitlin and Boesman (1966) and Seppala and Ruoslahti (1972).

With advancing pregnancy the range of A.F.P. decreased (Table I). Statistically, high significant negative correlation ($r = -0.902$) was between advancing gestation and decreasing A.F.P. level in second trimester of pregnancy. In the third trimester however this relation was not significant ($r = -0.28$).

Queenan *et al* (1970) found great range of variation in early pregnancy but they also observed definite decrease in level from 24 weeks to term Seppala and Ruoslahti (1972) observed statistically highly significant correlation ($r = -0.695$: $P < 0.001$) between increasing gestational age and decreasing A.F.P. values. Stewart *et al* (1975) and Welss *et al* (1976) also determined a negative correlation between the AFP concentration and gestational age. Various other workers have also supported this view (Brock and Sutcliffe, 1972; Allan *et al* 1973; Randle and Cumberbatch, 1973; and Nevin *et al* 1974).

Kelkar and Magar (1976) recorded absence of A.F.P. in 57 out of 62 samples from third trimester, the positives were from abnormal foetuses, whereas we found presence of A.F.P. constantly in all upto 40 weeks of gestation except at 42 weeks.

This relationship of amniotic fluid AFP and increasing gestational period has been suggested to be of great value in prediction of foetal age.

The relationship of infant birth weight and AFP levels is shown in Fig. 1. In the present study no statistically significant correlation could be demonstrated between A.F.P. levels and birth weight ($r = -0.28$). Seppala and Ruoslahti (1972) also correlated the level of A.F.P. with infant birth weight but they did not find any statistical significance ($r = -0.2$).

References

1. Allan, L. D., Ferguson-Smith, M. A., Donald, I., Sweet, E. M. and Gibson, A. A. M.: Lancet, 2: 522, 1973.
2. Bergstrand, C. G. and Czar, B. (1956): Quoted by Lorrin Lau, H. and Linkins,

S. E.: Am. J. Obstet. Gynaec. 124s 533, 1976.
3. Brock, D. J. H. and Sutcliffe, R. G.: Lancet, 2: 197, 1972.
4. Gitlin, D.: New Eng. Medicine, 285: 1436, 1971.
5. Gitlin, D. and Boesman, M.: J. Clin. Invest, 46: 1010, 1967.
6. Gitlin, D. and Boesman, M. (1966): Quoted by Lorrin Lau, H. and Linkins, S. E.: Am. J. of Obstetrics and Gynaecology, 124: 535, 1975.
7. Kelkar, S. S. and Magar, D. M.: J. Obstet. Gynec. India. 26: 494, 1976.
8. Pederson, K. O. (1944) L Quoted by Lorrin Lau, H. and Linkins, S. E.: Am. J. Obstet. Gynaec. 124: 533, 1976.
9. Queenan, J. T., Gadow, E. C., Bachner, P. and Kubarych, S. F.: Am. J. Obstet. Gynec. 108: 406, 1970.
10. Randle, G. H. and Cumberbatch, K. N.: J. Obstet. Gynaec. Brit. C'wealth. 80: 1054, 1973.
11. Ruoslahti, E. and Seppala, M.: Quoted from Am. J. Obstet Gyne. 124: 533, 1471.
12. Seppala, M. and Ruoslahti, E.: Am. J. Obstet. Gynec. 114: 595, 1972.
13. Stewart, C. R., Ward, A. M. and Lorber, J.: Brit. J. Obstet. Gynaec. 82: 257, 1975.
14. Weiss, R. R., Macri, J. N. and Elligers, K. W.: Obstet. Gynec. 47: 697, 1976.