

Cord blood Alphafoetoprotein Levels in Gestational Age Assessment

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Summary

Ibrahim M, Yakubu AM and Emonbolu JO. Cord Blood Alphafoetoprotein Levels in Gestational Age Assessment. *Nigerian Journal of Paediatrics* 1994; 21:8. Alphafoetoprotein (AFP) was determined in the sera of 113 normal infants of gestational age ranging from 27 to 43 weeks, using double antibody radio-immunoassay technique. Gestational age was determined, using the Dubowitz criteria. The mean AFP values, though within the range of normal values, were higher at all gestational ages than those reported for other races. The AFP values were not influenced significantly by the sex or birthweight of the infant. There was a significant degree of negative correlation between AFP and gestational age, $r = -0.77$ ($P = 0.001$). The 95 percent confidence limit for estimating gestational age from a single reading of AFP was ± 4.2 weeks.

Introduction

ASSESSMENT of gestational age in the newborn infant has been previously carried out by several workers, using anthropometry,¹ physical characteristics, including the stage of neurological development^{2,7} and a combination of physical and neurological features.⁸ The above studies concerned caucasian infants and here in Nigeria, some workers⁹⁻¹¹ have confirmed that using the

Dubowitz criteria,⁸ assessment of gestational age of African infants is valid.

Further interest in the determination of gestational age was later shifted to the use of biochemical tests, but these tests were not considered to be precise.¹² However, following the demonstration of alphafoetoprotein (AFP) in human foetal serum,¹³ several workers¹⁴⁻¹⁶ confirmed that this substance was a good parameter for the assessment of gestational age. As assessment of gestational age of our infants, using AFP values has not, to our knowledge, been studied previously, the aim of the present study was to determine cord blood levels of AFP and correlate these values with the gestational age of our newborn infants.

Subjects and Methods

The study involved healthy infants of gestational age, between 28 and 43 weeks, delivered at Ahmadu Bello University Teaching Hospital

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(ABUTH), Zaria. All the babies underwent clinical examination and the gestational age was determined, using the Dubowitz criteria.⁸ All sick babies, or those with Apgar scores less than seven points, congenital deformities, birth injuries, prolonged labour, or those with stained, or foul-smelling liquor and twins were excluded from the study. Babies born to mothers with toxæmia, diabetes, chronic heart disease, hypertension and chronic liver disease, were also excluded.

Cord blood was obtained at the time of delivery as soon as the umbilical cord was severed and clamped; 10ml of blood from mother's side of the cord, was obtained into a 10ml plastic tube. Each specimen was kept at room temperature for one to two hours and then centrifuged at 3000 rpm. The serum was separated and kept frozen at -20°C until analysed. Alphafoetoprotein was determined by radio-immunoassay, using the NE 1612 gamma counter and pharmacia AFP-RIA kit, obtained from pharmacia diagnostics AB, Uppsala Sweden. The standards were calibrated against WHO reference standard preparation 72/225. A dilution of one in 100 was used for all the samples, which were analysed in one batch.

Each determination for both standard and unknown was performed in duplicate. The detection limit of the AFP-RIA kit is 9IU/L. The kit has no measurable cross-reactivity with human serum albumin. Data deduction was achieved with both a manual calculator and BBC desk top microcomputer, running a statgraphic programme, comprising several statistical analysis, routines, including standard parametric and non-parametric tests, analysis of variance, multilinear regression and Pearson's correlation. The results were age-grouped at two-weekly intervals. The mean and range for each age group was calculated. Linear regression analysis was also performed. The coefficient of correlation, the standard error of the coefficient and the P value were calculated. The gestational age of each baby was corrected to 40

weeks for the purpose of calculating the 95 percent confidence limits.

Results

There were 113 infants (62 males and 51 females; ratio = 1.2:1) of gestational age ranging from 27 weeks to 43 weeks. Seventy-five (66.4 percent) of the 113 infants were in the gestational age group 38-41 weeks (Table). Thirty-six (31.8 percent) babies were preterm (gestational age less than 37 weeks), while two babies were born post-term.

TABLE

Mean Levels and Ranges of Alphafoetoprotein (AFP) at various Gestational Ages.

Gestational age (Weeks)	Mid-range Point (weeks)	No of Subjects	Mean AFP (IU/L)	Range (IU/L)
27-28.9	28	3	331,200	302,000 -357,300
29-30.9	30	4	306,400	291,000 -312,000
31-32.9	32	9	258,100	240,000 -275,000
33-34.9	34	8	242,400	225,000 -240,000
35-36.9	36	12	221,267	200,000 -240,000
37-38.9	38	10	189,708	148,000 -205,000
39-40.9	40	47	175,738	125,000 -225,000
41-42.0	41.5	18	149,810	115,000 -200,000
42-42	-	2	106,500	88,000 -125,000

The cord blood AFP level, determined from the sera, ranged from 88,000 IU/L to 357,300 IU/L. There were wide individual variations in AFP levels at all gestational ages. The mean AFP values at birth, irrespective of gestational age, was 201,152.2IU/L with a standard deviation of 57,328.6 IU/L. The mean and range of AFP levels at various gestational ages, are shown in the Table; a steady decline in AFP levels with increasing gestational age is evident. Female babies had higher mean AFP levels at all gestational age groups; however, there were few cases of male

babies with higher AFP levels. There was no difference ($X^2 = 0.631$; $p > 0.05$) in AFP levels between the sexes in the various gestational ages.

The coefficient of correlation (r) for AFP versus gestational age was -0.88 for females, -0.63 for males and -0.77 for all the infants. All the correlations were highly significant ($p = 0.001$).

The figure is a scatter diagram showing the correlation between the serum concentration of AFP and gestational age. The formula that was used for the regression line is $y = 50,507 - 5,93 \times 10^{-5}x$. From a given AFP level, the 95 percent confidence limit for estimating gestational age was 4.2 weeks. For the three preterm infants, the coefficient of correlation (r) for AFP and gestational age was -0.92 ($p = 0.001$). Thus, AFP correlated poorly to birth weight $r = -0.185$ ($p = 0.05$).

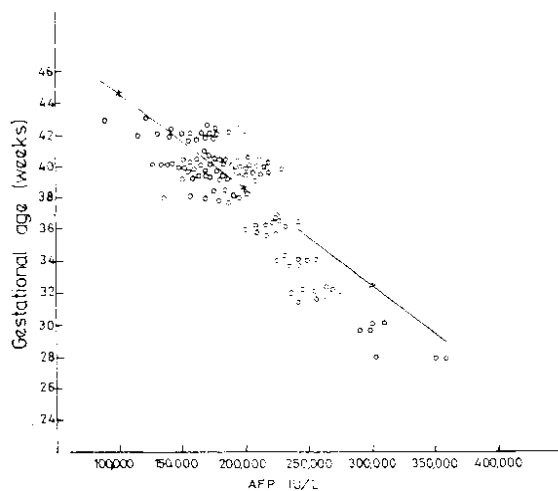


Fig: Regression Line and Scattergram for Alphafoetoprotein and gestational age.

Discussion

Since the first demonstration of AFP by paper electrophoresis,¹³ much work has been carried out in order to establish its normal value in the newborn infant, but procedural problems hampered these earlier attempts at such normal values, as workers reported differing values.¹⁷ Recent studies¹⁸ have, however, confirmed radio-immunoassay as the method of choice in determining AFP values. With a reference standard of 72/225 for AFP value, as recommended by the WHO, the accepted unit currently in use, is the international IU/L.¹⁹

In the present study, the high AFP values obtained were in agreement with those reported elsewhere;¹³⁻¹⁶ they were however, higher than those obtained for other races,^{14, 20-22} but still within the range of normal values. In our series, the AFP values were consistently higher in females than in the males, although the difference was not significant ($P > 0.5$). It is noteworthy that this finding has been reported by others,^{14, 17} but is in contrast to the significant sex difference reported elsewhere.^{23, 24}

In our series, there was a significant negative correlation ($P = 0.001$) between AFP values and gestational age, a finding that was comparable to those in other series,^{16, 25} but different from those reported by other workers.^{15, 22} It is of interest to note that a correlation coefficient as high as -0.9 has been reported for term infants.²⁴ As with any biological measurements, procedural differences, subject selection, methodology etc, may account for the discrepancies in the results obtained by different workers. The 95 percent confidence limit used in the present study for the determining of gestational age, using AFP in cord blood, was ± 4.2 weeks. The corresponding periods reported by others were ± 4.2 weeks,¹⁴ ± 16 days¹⁵ and ± 24 days. From the present findings, it is concluded that cord blood AFP level is not valuable in estimating gestational age, especially when other

cheaper and less complex methods are available.

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