

**A COMPARATIVE STUDY OF ANTHROPOMETRIC, MORPHOLOGIC,
NEUROLOGIC AND COMBINED MORPHOLOGIC AND NEUROLOGIC
CRITERIA FOR THE ASSESSMENT OF GESTATIONAL AGE OF THE
NEWBORN INFANTS**

by

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Introduction

The need for determination of gestational age (G.A.) in recent years has become important. This is not academic, but has practical application of differentiating 2 groups of newborns having low birth weight-preterm (born before 37 weeks of gestation) and small for gestation age (S.G.A.) babies. These 2 groups are separate clinical groups having different complications and line of management. Investigatory methods for assessment of G.A. which require special equipment are (e.g., enzyme assays, nerve conduction velocity etc.) are impractical for our country as these are available only at few advanced centres due to their prohibitive cost. History of first day of last menstrual period (L.M.P.) is accurate but not reliable constantly in all sections of society. The physical characteristics defined by Usher (1966) are not reliable below 36 weeks of gestation. The Farr's criteria (Farr *et al*, 1966) has been found to be fairly accurate by Anand *et al* (1976).

The neurological behaviour also show consistent reliability (Dargassies, 1965; Shingwekar *et al*, 1973; Singh *et al*, 1975). Dobowitz *et al* (1970) showed that positive correlation is present in certain morphological and neurological characteristics with gestation age.

The present study was aimed at evaluating these clinical criteria and to analyse their consistency statistically.

Material and Methods

The present study was conducted at the State Zenana Hospital, Jaipur. The sample consisted of 500 new of mothers who knew their L.M.P. accurately and with certainty and had no obstetric complications and the babies having no such disease or malformation known to alter anthropometric measurements, morphologic features or neurologic behaviour.

Antenatal history was checked in each case and record made of significant diseases, irradiation and drugs etc. in mothers. All obstetric data including complications of pregnancy were recorded. Details of delivery were noted. Apgar scoring was done at 1, 5 and 10 minutes after delivery. A thorough examination was carried out in all newborns. Gestation age assessment was made after 48

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hours in optimal conditions described for neurological examination (Beintemma, 1968). The following were included:

Anthropometry: All the measurements were carried out as per Indian Council of Medical Research specifications (1957). The following measurements were carried out—weight, crown to heel length, crown to rump length, circumference of head chest and cephalothoracic difference.

Morphologic Features: The following were evaluated—skin edema, skin texture, skin opacity, skin color, lanugo, plantar creases, nipple formation, breast size, ear form, ear firmness and genitalia. These items have been graded according to Dubowitz *et al* (1970) and Farr *et al* (1966).

Neurological Behaviour: This included posture, squate window, ankle dorsiflexion, arms recoil, popliteal angle, heel to ear maneuver, head lag, scarf sign and

ventral suspension. These were graded as per Dubowitz *et al* (1970). Total maximum score was 35.

The maximum score for combined morphological and neurological criteria was 70. Gestation was then calculated as described by Dubowitz *et al* (1970).

Observations

There were 232 primiparae, 102 second parae and 262 multiparae. Upto 20 years there were 150 mothers, between 21-30 years 322 and above 30 years 28 mothers. Out of 500, 116 mothers belonged to upper middle and rich socioeconomic class and rest to middle class which also included 10 mothers from poor families. All mothers were literate.

Table I shows results of anthropometry. All parameters showed increase in mean values with increase in G.A. except for

TABLE I
Anthropometry at different gestational ages

G.A. (weeks)	Mean \pm Standard Deviation					
	Weight (gms)	C.H. length (cms)	C.R. length (cms)	Head circum. (cms)	Chest circum. (cms)	C-T diff. (cms)
28	1250 \pm 212	42.5 \pm 3.5	27.2 \pm 4.0	25.5 \pm 4.1	20.5 \pm 5.2	5.5 \pm 0.4
29	1370 \pm 410	44.5 \pm 3.2	28.1 \pm 4.1	26.2 \pm 4.3	21.5 \pm 5.0	4.7 \pm 0.3
30	1500 \pm 430	46.2 \pm 3.3	29.1 \pm 4.3	28.0 \pm 4.2	23.5 \pm 5.3	4.6 \pm 0.4
31	1640 \pm 450	47.0 \pm 3.5	29.4 \pm 3.9	29.1 \pm 4.5	23.8 \pm 5.6	5.3 \pm 0.4
32	1700 \pm 440	47.5 \pm 4.3	30.0 \pm 3.5	30.0 \pm 3.3	24.6 \pm 5.4	5.4 \pm 0.5
33	1900 \pm 430	48.0 \pm 3.8	30.2 \pm 3.5	30.6 \pm 3.5	25.5 \pm 6.4	5.1 \pm 0.4
34	2150 \pm 380	48.4 \pm 4.4	30.2 \pm 3.3	31.6 \pm 3.5	27.0 \pm 6.6	3.6 \pm 0.4
35	2380 \pm 390	49.2 \pm 4.2	30.8 \pm 3.2	32.2 \pm 3.2	29.0 \pm 5.8	3.2 \pm 0.3
36	2550 \pm 570	50.0 \pm 3.9	31.2 \pm 3.5	33.2 \pm 3.8	30.6 \pm 4.7	2.6 \pm 0.2
37	2630 \pm 750	50.6 \pm 3.8	31.2 \pm 3.4	33.5 \pm 4.4	31.0 \pm 4.7	2.5 \pm 0.2
38	2865 \pm 820	51.0 \pm 3.8	31.4 \pm 2.1	33.8 \pm 4.5	31.5 \pm 4.5	2.3 \pm 0.2
39	3320 \pm 470	51.0 \pm 4.6	32.2 \pm 2.9	34.2 \pm 4.3	32.2 \pm 4.7	2.0 \pm 0.1
40	3410 \pm 430	52.0 \pm 4.6	32.8 \pm 2.5	34.6 \pm 5.0	32.2 \pm 4.6	1.4 \pm 0.1
41	3500 \pm 430	52.2 \pm 4.4	33.2 \pm 2.6	34.8 \pm 4.5	33.6 \pm 4.5	1.2 \pm 0.1
'r' =	+ 0.9911	+ 0.9758	+ 0.9735	LL96'0 +	+ 0.9901	- 0.9389

C.H. = crown to heel; C.R. = crown to rump; circum. = circumference; C-T diff. = cephalothoracic difference.

cephalothoracic difference. Correlation coefficient (r) for weight, crown to heel length, crown to rump length and head and chest circumferences were +0.9911, +0.9758, +0.9677, +0.9735 and +0.9901 respectively and for cephalothoracic difference — 0.9389.

Table II shows average scores of morphological features, neurological beha-

criteria similar pattern was observed as the scores were the result of addition of the previous two.

Comments

Birth weights in the present study was higher than those reported by Ghosh *et al* (1971) and Balkrishna and Puri (1973)

TABLE II

Results of Morphological, Neurological and Combined Morphological and Neurological Scoring at Different G.A.

G.A. (weeks)	Number of cases	Average morphological score	Average neurological score	Average combined score
28	10	6	6	12
29	7	6	7	13
30	12	10	9	19
31	9	12	11	23
32	27	13	13	26
33	23	15	15	30
34	32	17	17	34
35	38	20	18	38
36	79	21	21	42
37	106	23	23	46
38	78	24	24	48
39	39	27	26	53
40	27	30	29	59
41	13	30	30	60
Correlation coefficient (r) =		+0.9960*	+0.9951*	+0.9976*
Regression equation (Y) =		25.2382	25.2119	59.1627
		+0.5105 X	+0.5221 X	+5.39 X

* Significant.

viour and combined morphological and neurological criteria in relation of G.A. Thus, it was seen that the mean morphological score at 28-29 weeks was only 6 and at 40-41 weeks 30 and further that in these later weeks scores of 31-35 were also seen in few cases. In neurological assessment in earlier weeks (28-36) average score varied between 6 and 21 and after 36 weeks between 23 and 30 with increasing number of cases recording scores between 31-35. In the combined

at 28, 29, 30 and 31 weeks of gestation. Cases in the present series were less in number than in their study. Further, their study was consecutive and ours was selective. As in the present study all mothers were literate and most belonged to middle and upper strata of society. About 90 per cent had regular antenatal check up qualitatively and quantitatively and none had any medical or obstetric complications. Therefore, those cases where intrauterine growth retardation occurs on account of

lack of care were relatively few. Hence, our values were higher than studies cited *vide supra* and were comparable to studies from developed countries (Usher *et al*, 1966). The measurable parameters were however, comparable to Indian studies. Cephalothoracic difference decreased with advancing G.A. and was more than 3.0 cm. in preterm infants as compared to term infants. Similar observations were made by Balkrishna and Puri (1973).

The average scores of morphological features increased with advancing G.A. (Table II) and recorded $r = 0.9960$ which was significant. Other workers have also reported such an increase (Anand *et al*, 1976; Shingwekar *et al*, 1973; Singh *et al*, 1975 and Dubowitz *et al* 1970). A curvilinear pattern has been reported by Shingwekar *et al* (1973). But this study included cases upto 44 weeks. It has been shown that after 41 weeks scores have no more direct relationship with G.A. The regression equation was $Y = 25.2382 + 0.5105 X$ where 'Y' is G.A. in weeks and 'X' is total morphologic score.

Neurological criteria also showed similar results. The 'r' was $+ 0.9951$ and regression equation was $Y = 25.2119 + 0.5221 X$, where 'Y' was G.A. in weeks and 'X' was total neurological score. Other workers have also observed similar findings (Dubowitz *et al*, 1970; Shingwekar *et al*, 1973; Singh *et al*, 1975). Statistically morphological characteristics were more consistent than neurological ones which was contrary to findings of other workers (Dubowitz *et al*, 1970; Shingwekar *et al*, 1973 and Singh *et al*, 1975). This perhaps, resulted from difference in interpretation of neurological behaviour and selective nature of this study. The combined criteria was more consistent than all other with 'r' of $+ 0.9976$ and regres-

sion coefficient of $Y = 59.1627 + 5.39 X$, where 'Y' was G.A. in weeks and 'X' was total combined scores. However, each criteria was significantly correlated.

In the present study, each method has been found to be significantly correlated. The combined criteria seems to yield best results. But then this will be cumbersome and time consuming. One single assessment takes about 30 minutes. Thus, a search for a simple and easy method should be continued.

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