A LONGITUDINAL FOLLOW UP OF DEVELOPMENT OF PRETERM INFANTS

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ABSTRACT

A prospective study was undertaken to determine the development of preterm (PT) babies (gestation less than 37 weeks). One hundred and seventy two preterm babies and 36 control babies were followed up for a period of 18-24 months. Psychomotor development was assessed using the Bayley Scales of Infant Development at 3, 6, 9, 12, 18, 24 months, using the corrected or post conceptional age. Preterm babies, as a group, caught up with normal babies between 18-24 months, both on the motor and mental scale. Higher the birth weight, better was the mean motor development quotient at 18 months. Uncomplicated preterm babies showed higher mean development quotients at 18 months than preterm babies with additional complications and they also caught up earlier (12-18 months) than the latter group who caught up between 18-24 months. Similarly, PT appropriate for gestational age (AGA) babies showed, earlier 'catch up' than PT small for gestational age (SGA) babies. The incidence of cerebral palsy was low (4%).

Key words: *Development, Preterm, Bayley Scales of infant development, Cerebral palsy.*

The survival of preterm infants has increased considerably with better perinatal care over the last two decades. With the improved survival of preterm (PT) infants, there is concern being voiced over the quality of life of the survivors(1). Hence the motor and mental development of these preterm babies needs to be closely monitored. For the parents and the physicians caring for these preterm babies it is of vital importance to know if they are going to be normal. If they show delay in development at what age they may be expected to catch up with their peers. Stewart *et al.*(2) reviewed all world literature for outcome of low birth weight babies. They concluded that there has been an increase in the population of healthy survivors with a relatively low permanent handicap rate of 6 to 8% for LBW babies.

This study was undertaken to determine the development of preterm babies discharged from a neonatal special care unit (NSCU). The main aim was to compare the psychomotor development of preterm babies with that of full term controls and to determine the approximate age at which they may be expected to "catch up". Uncomplicated PT babies who had no additional risk factors other than prematurity and low birth weight were compared with controls. Additional medical complications specially neurological insults are known to cause developmental delay(3). Uncomplicated preterms were compared with preterm babies who had one or more associ-

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ated medical complications in the neonatal period. In the Western countries, most of the PT babies are appropriate for gestational age (AGA), while in developing countries many of the babies may be small for gestational age (SGA). The development of PTAGA babies and PTSGA babies was compared with that of controls.

Material and Methods

A study was undertaken at the K.E.M. Hospital, Pune for a period of three years. All preterm babies discharged from NSCU within a 24 month period were asked to come for follow up. They were followed up for a period of 18-24 months.

All babies admitted to the NSCU were examined and a gestational age was assessed(4) by a senior resident in neonatology. Any baby with a gestation less than 37 weeks was labelled as preterm. Birth weight was also recorded and the baby was classified as AGA or SGA(5). All medical problems encountered during the hospital stay were recorded. Babies who had congenital anomalies were excluded from the study. At the time of discharge all preterm babies were given a special High Risk Card and were asked to attend the High Risk Clinic regularly.

The importance of close follow up was explained to the parents and grandparents. The paternal grandmother was specially called because the mother-in-law plays an important role in child care in India. The baby was followed up in a special high risk clinic run by a team of neonatologists, psychologists, occupational therapist and a social worker. A detailed physical examination and anthropometric measurements were done and routine advice regarding feeding and immunization was given. Psychomotor assessment was done by two psychologists, one acting as the tester and the other as an observer, in a sound proof room with a one way mirror. The assessment was done using the Bayley Scales of Infant Development (BSID). Indian norms(6) were used and babies were tested at 3, 6, 9, 12, 18 and 24 months. Post conceptional or corrected age was used while giving appointments.

Full term babies with a normal antenatal, natal and postnatal course and a birth weight above 2500 were identified as controls and went through the same protocol. A mental development quotient (MeQ) and a motor development quotient (MoQ) were determined. A quotient above 85 was considered as normal, between 70-85 as delayed and below 70 as grossly delayed.

An all out effort was made to ensure good follow up. The social worker made an appointment for the next visit and wrote it on a card. A reminder was sent one week before the scheduled visit. If an appointment was missed, a home visit was made by the social worker to determine the cause for defaulting. Transportation charges were paid if the parents were poor.

The data was fed to a computer and analysis was done using software programmes based on dbase III plus and SPSS. Statistical analysis was done using usual tests of significance like χ^2 of F test. χ^2 values of >3.84 were taken as significant, a $p < 0.05$ was considered as significant.

Results

All babies with a gestational age less than 37 weeks, discharged from the NSCU from 1st October, 1987 to 30th September, 1989 were enrolled in this study and asked to come for regular follow up. Two hundred and sixty four preterm babies

were discharged during this 2 year period. Many of these babies who lived in other cities could not come for regular BSID testings and 65 have not reached 18 months as yet. So, only those babies who had at least two BSID testings in the first 12 months of life and at least one testing subsequently, are analyzed in this study. One hundred and seventy two babies fulfilled these criteria and the study is restricted to these babies. Out of the 172 preterm babies, 77 (45%) were AGA and 95 (55%) were SGA babies. *Table I* shows the distribution of these babies according to birth weight and gestational age.

It is a prerequisite for BSID testing, that the baby should be in optimum health and alert, during the testing. Many a times testing had to be abandoned because the baby was irritable, sleepy and uncooperative. Hence, the number of babies assessed at each testing shows so much variation. Out of the 172 babies, 110 were tested at 18 months and 81 babies who had reached 24 months during the study period could be tested. *Tables IIa/IIb* show the mean mental and motor quotients of the babies at 3, 6, 9, 12, 18 and 24 months. These were compared with the quotients of 36 control babies. Twenty nine control babies were tested at 24 months. The difference in their quotients was statistically significant till the age of 18 months. At 24 months, there was no statistically significant difference in the performance of the preterm and the control babies, both on the mental and motor scale.

The mental and motor quotients of these babies were analyzed further according to their birth weight categories. It was found that higher the birth weight, better was the motor performance, at 18 months, as seen in the *Fig.*

Babies who had an absolutely uneventful course in the NSCU and did not have any apparent problems other than prematurity and low birth weight were called as "uncomplicated" preterms. Babies with additional risk factors like respiratory distress syndrome, hyperbilirubinemia, septicemia, *etc.* were labelled as "complicated preterms". Sixty three babies were uncomplicated preterms and 109 (63.3%) were termed as complicated preterms. The

TABLE I—*Birth Weight and Gestational Age of Preterms and Controls*

Birth weight (g)	n	%	Gestation (weeks)	n	%
≤1000	3	1.7	<28	1	0.6
1001-1500	72	42.0	29-30	4	2.3
1501-2000	86	50.0	31-32	23	13.3
>2000	11	6.3	33-34	69	40.1
			35-36	75	43.7
Total	172			172	
Controls					
>2500	36		FT (40 weeks)	36	

AGA = 77 (45%); SGA = 95 (55%).

TABLE II(a)—*Comparison of Mental Quotients of Preterms and Controls at Various Ages*

Age (mo)	3	6	9	12	18	24
Preterms						
Mean	86	84	83	88	89	86
SD	4.2	12.2	15.9	13.8	20.7	17.4
n	137	147	132	135	110	81
Controls						
Mean	90	91	95	96	99	93
SD	13.7	6.0	10.4	8.1	11.5	5.2
n	36	36	36	29	36	29
χ^2	NS	*	**	**	*	NS
F	NS	**	**	**	NS	NS

TABLE II(b)—*Comparison of Motor Quotients of Preterm and Controls at Various Ages*

Age (mo)	3	6	9	12	18	24
Preterms						
Mean	78	84	86	82	87	87
SD	24.5	13.7	15.0	14.8	25.7	22.6
n	137	147	132	135	110	81
Controls						
Mean	89	92	95	96	103	96
SD	18.8	8.9	7.15	6.3	17.4	16.7
n	36	36	36	36	29	29
χ^2	NS	**	**	**	*	NS
F	*	**	**	**	*	NS

* = $p < 0.05$; ** = $p < 0.01$; NS = > 0.05

risk factors in these 109 babies are shown in *Table III*. Some babies had more than one risk factor. The mean mental and motor quotients of these two groups at 18 months are shown in *Table IV*. While the uncomplicated preterm babies are showing quotients in the nineties, the group with additional risk factors shows borderline

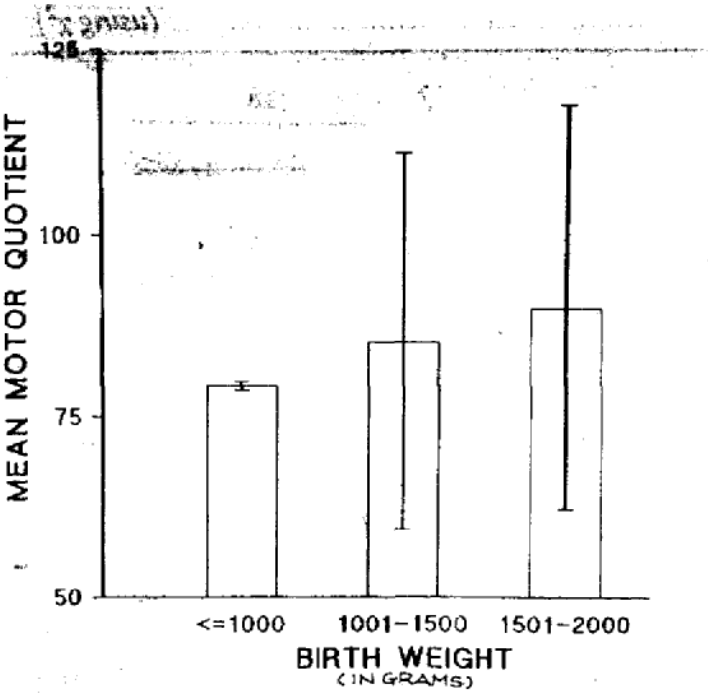

Fig. Motor development at 18 months by birth weight Mean ± S.D.
The height of the bar shows the mean motor quotient with the vertical lines representing + one standard deviation.

TABLE III— *Preterms with Additional Medical Complications*

Risk factor	n	%
Birth asphyxia	17	15.6
Hyperbilirubinemia	28	25.7
Sepsis	80	73.3
IVH	10	9.1
Respiratory distress	24	22.0
Convulsions	9	8.2
Apnea	24	22.0

Preterms with additional medical complications (n = 109) (63.3%)

normal quotients at 18 months. When the uncomplicated PT babies were compared with controls, they showed a statistically significant difference in their performance at 9 and 12 months on the mental scale and 3, 9 and 12 months on the motor scale. This

TABLE IV— *Development at 18 Months by Risk Factors*

Group	Mean mental quotient	Mean motor quotient
Uncomplicated Preterms (n = 37)	95 (± 15.7)	92 (± 18.0)
Preterms with other risk (n = 73)	87 (± 22.6)	85 (± 28.5)
Controls (n = 36)	99 (± 11.5)	103 (± 17.4)

difference disappeared at 18 months as shown in *Table Va*. Hence as a group, they caught up between 12-18 months corrected age. Preterms with other risk factors caught up between 18 and 24 months. (*Table Vb*).

The performance of PTAGA babies was compared with that of controls. Similarly, the performance of PTSGA babies was compared with controls as shown in *Tables VIa & b*. The difference in the performance of PTAGA babies and controls disappears at 18 months. When PTSGA babies were compared with controls the difference in their performance disappears at 24 months.

Out of the 172 babies who were included in this study, 11 (6.4%) babies had a gross delay in development. Seven babies had frank cerebral palsy, 5 of these had spastic quadriplegia, 1 had hemiplegia and 1 had spastic diplegia. Three babies with cerebral palsy had associated mental retardation. The incidence of cerebral palsy in this study was 4%. Four babies (2.3%) had severe mental retardation with delay in their motor performance.

TABLE V(a)—*Comparison of the Development of Uncomplicated Preterms with Controls (using χ^2)*

Age (mo)	3	6	9	12	18	24
Preterms (n =63)						
n	50	54	46	42	37	33
Controls (n =36)						
n	36	36	36	36	36	29
MeQ	NS	NS	*	**	NS	NS
MoQ	**	NS	*	**	NS	NS

TABLE V(b)—*Comparison of the Development of Complicated Preterms with Controls (using χ^2)*

Age in (mo)	3	6	9	12	18	24
Preterms (n =109)						
n	87	93	86	93	73	48
Controls (n = 36)]						
n	36	36	36	36	36	29
MeQ	NS	**	**	**	*	NS
NoQ	**	**	**	**	*	NS

* = $p < 0.05$; ** = $p < 0.01$; NS = $p > 0.05$.
MeQ = Mental Quotient; MoQ = Motor Quotient.

Discussion

It is extremely important to use corrected (postconceptional) age, while assessing the development of preterm infants. Chronological age should not be used to judge their performance(7). It is a well known fact that there is a large drop out rate in any longitudinal follow up study, and hence intensive efforts were made by us to get a good follow up.

Out of the 264 preterm babies discharged from NSCU, 65 babies had not crossed 18 months, at the time of analysis. Since our NSCU is a referral centre, many babies from far off places are admitted. These babies could not come for regular BSID testings. Appointments were missed for various reasons like intercurrent illnesses, problems like transportation due to

TABLE VI(a)—*Comparison of the Development of PT AGA with Controls*

Age (mo)	3	6	9	12	18	24
Preterms (n = 77) n	67	67	61	70	51	41
Controls (n = 36) n	36	36	36	36	36	29
MeQ	NS	NS	*	*	NS	NS
MoQ	*	NS	*	*	NS	NS

TABLE VI(b)—*Comparison of the Development of PT SGA with Controls*

Age (mo)	3	6	9	12	18	24
Preterms (n = 95) n	70	80	71	65	59	40
Controls (n = 36) n	36	36	36	36	36	29
MeQ	NS	*	*	*	*	NS
MoQ	*	*	*	*	*	NS

* = $p < 0.05$; NS = $P > 0.05$.
MeQ = Mental Quotient; MoQ = Motor Quotient.

various 'bandhs' and inability of the parents to get leave on the day of the appointment. Many a times a baby came for the testing, but the testing had to be abandoned because the baby was too cranky or sleepy or uncooperative especially for the 18 and 24 month testing. This is why the number of babies tested at different ages varies so much. In order to make sure that there was no bias introduced, the sample at 18 months and 24 months was compared with the whole sample. There was no statistically significant difference in terms of birth weight, gestational age and risk factors.

When all preterm babies as a group, were compared with normal controls, they caught up for both motor and mental development between 18-24 months. It was also seen that higher the birth weight category better was the performance of that group on the motor scale.

Development of uncomplicated preterms at 18 months was compared with preterms who had one or more additional complications during the neonatal period. The mean motor and mental quotients of the latter group were in the borderline range while as uncomplicated preterms had mean MeQ and MoQ in the nineties. The uncomplicated PT babies caught up earlier with their peers, between 12-18 months, while the group with additional risks took longer to catch up. They caught up between 18-24 months.

When the performance of PTAGA babies was compared with controls, it was found that they caught up with normals between 12-18 months. PTSGA babies took a little longer and caught up between 18-24 months, both for mental and motor development. Our findings differ from those described by Stave and Ruvalo(8).

The incidence of permanent handicap in the form of cerebral palsy was low, *i.e.*, 4%. This incidence compares well with reports from the developed world(9).

The prospects for development of the preterms who graduate from the NSCU appear bright especially if they are AGA and have no additional complications during the neonatal period.

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