ORIGINAL ARTICLE

Follow-up of premature children with high risk for growth and development delay: a multiprofessional assessment

Acompanhamento de crianças prematuras com alto risco para alterações do crescimento e desenvolvimento: uma abordagem multiprofissional

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ABSTRACT

Objective: To describe the activities of a multiprofessional outpatient clinic performed by neonatologist, physiatrist, physical therapist, occupational therapist, speech therapist, audiologist and psychologist, who evaluated the development of premature newborns. **Methods:** Twenty children born at a tertiary-care hospital (São Paulo, Brazil), between April 2006 and April 2007, with birth weight below 1250 g or less than 32 weeks of gestation, were evaluated. The multiprofessional evaluation included assessment of development using the Bayley III scale, at the corrected age of 3, 6, 9, 12, 18 and 24 months. **Results:** The mean gestation age at birth was 28.8 weeks; mean birth weight was 1055 g. The mean maternal age was 35 years and the mean length of stay of neonates was 46.3 days. Fifteen percent of children presented impaired sensory motor skills, 20% had hearing abnormalities and 10% motor alterations. Bayley III showed alterations in the communication area in 10% of subjects and in the motor area in 10% of individuals. The parents were oriented to stimulate the child or a specific intervention was suggested. The major development delay was observed between 6 and 18 months of age and the development was improved at 24 months of age. **Conclusions:** Most children evaluated had improved growth and development at 24 corrected-age months. Further studies with a larger sample are recommended, as well as the possibility to follow this population group up till the primary school.

Keywords: Child development; Gestational age; Hearing loss; Continuity of patient care; Ambulatory care; Muscle tonus

RESUMO

Objetivo: Descrever a atividade do ambulatório multiprofissional formado por neonatologista e fisiatra, fisioterapeuta, terapeuta ocupacional, fonoaudiólogas e psicóloga que realizaram avaliações aos 3, 6, 9, 12, 18 e 24 meses de idade corrigida. **Métodos:** Foram realizadas avaliações multiprofissionais pela equipe, incluindo avaliação pela escala de desenvolvimento Bayley III. A amostra foi constituída por 20 crianças nascidas em hospital de nível terciário em São Paulo, Brasil, com peso inferior a 1250 g ou idade gestacional abaixo de 32 semanas no período de Abril de 2006 a Abril de 2007. **Resultados:** A idade gestacional média ao nascimento foi de 28.8 semanas, peso médio 1055 g, tempo de internação médio de 46,3 dias, e idade materna média de 35 anos. Observou-se que 15% das crianças apresentaram alterações sensório-motoras, 20% alterações no desenvolvimento auditivo e 10% alterações motoras. Pela aplicação da Bayley III, observou-se 10% dos casos com alteração na área de comunicação e 10% com alteração na área motora. Os pais foram orientados a estimularem a criança ou foi sugerida intervenção específica. Observou-se que entre 6 e 18 meses de idade corrigida houve maior ocorrência de atrasos do desenvolvimento, que se adequou aos 24 meses. **Conclusões:** A maioria das crianças avaliadas alcançou crescimento e desenvolvimento adequado aos 24 meses de idade corrigida. Recomendam-se estudos futuros com amostra ampliada, assim como a possibilidade de um acompanhamento dessa população até o período de alfabetização.

Descritores: Desenvolvimento infantil; Idade gestacional; Perda auditiva; Continuidade da assistência ao paciente; Cuidados ambulatoriais; Tônus muscular

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INTRODUCTION

The advances in care delivered to very low birth weight or small gestational age newborns (NB) led to a higher survival rate of such children. At birth, due to their physical and immunological frailty, these children have different maturity levels, according to the gestational age. In the postnatal period, the newborn may present different intercurrent clinical events, be submitted to many invasive procedures during hospital stay, or have disorders that may leave permanent sequelae that will impact on the child global development.

Some studies demonstrated that human development is based on the management of domains divided in sensorial and motor aspects, capacity to acquire speech, social and emotional development, as well as cognition. Such domains are interdependent, each influencing and being influence by the others. Therefore, the first year of life is a period during which special attention should be paid to the neurological and perceptual-motor development of the premature baby[1].

It is by means of the acquisitions of the fine and gross motor development that the child acquires the skills required for motor performance throughout the years, such as walking and running, the perception of body and space, the ability to play, dexterity, as well as the motor coordination necessary for the development of writing and other daily activities[2].

Transient neurological abnormalities including posture, fine and gross motor skills, coordination and balance, reflexes, and, above all, tone disturbances (hypertonia or hypotonia), are detected in 40 to 80% of cases, but may disappear before the second year of life[3].

Early detection of such abnormalities allows efficient indication of early intervention, with the objective of providing stimuli to create nervous connections. In this manner, the commands for the stimulated areas become more numerous, and the synapses more stable, which is clinically expressed by the progressive acquisition of normal or almost normal movements and postures[4].

Developmental abnormalities, including hearing abnormalities and problems in the feeding function[5-6] are often seen in those children. It is well known that for every one thousand births, three newborns will have hearing loss, and in neonates at risk, the incidence is 30:1000[7]. In regard to the oral sensory motor system, 50% of neonates who suffer peri- or postnatal problems will have some degree of oral motor and/or feeding problem[8].

Besides hearing disorders, episodes of uncoordination between suction, breathing and swallowing are frequent, as well as the presence of other functional problems, including food refusal, selecting food by type or texture, refusal of solid food, abnormalities in the oral motor patterns and/or dysphagia[6,9]. Behavioral problems such as food aversion are often seen[10], and are most often associated with gastroesophageal reflux disease.

Considering the possible developmental and growth abnormalities, the present study aimed to detect early changes, with the objective of providing continuous care to high-risk neonates after hospital discharge, as well as to suggest interventional actions to minimize the impact of the abnormalities on the lives of these children.

METHODS

This is a descriptive and retrospective study using secondary data. The sample is a cohort of 20 children born at the Hospital Israelita Albert Einstein (HIAE), São Paulo, Brazil, between April 1st, 2006 and April 30th, 2007. The inclusion criteria were children born at the HIAE with birth weight lower than or equal to 1250 g or gestational age less than 32 weeks, with the parents and the pediatrician's consent. Children born at other hospitals, who presented birth weight greater than 1250 g or were diagnosed with multiple malformations were excluded from the study.

The study was approved by the Research Ethics Committee of Hospital Israelita Albert Einstein, process number 633/07.

The children were evaluated at 3, 6, 9, 12, 18 and 24 months of corrected age. A multiprofessional outpatient clinic was established comprising a neonatologist, a physiatrist, a physiotherapist, an occupational therapist, speech therapists, and a psychologist. The assessment was divided into three stages. On the speech therapy assessment, sound emission and reception were checked, as well as the sensory–motor-oral system at rest and in function, besides the feeding aspect. All children underwent transient evoked otoacoustic emissions (ILO288) before hospital discharge and were referred to auditory brainstem response. In the follow-up evaluations for hearing development, the pediatric audiometer (PA5 Interacoustics) was used, being observed the localization for different frequencies and intensities. In regard to the feeding function, motility and posture of the phonoarticulatory organs at rest were evaluated, in addition to the function of chewing and swallowing with different food consistencies and cutlery. The evaluation considered as reference the child's age group and the food regularly consumed and recommended by the pediatrician.

In the assessment by the physiatrist, physiotherapist and by the occupational therapist, the objective was to evaluate muscle tone, attitudes, posture and motor acquisitions pertinent to age.

A protocol based on theoretical reference of the main periods for the acquisition of developmental landmarks was used. Cervical, as well as trunk control, rolling over, sitting, crawling, lateral march, standing and walking alone are considered as main landmarks of gross motor development. To evaluate fine motor development, the different grasping types, visual performance, independence on daily activities and the many aspects of playing were considered. The physiatric evaluation consisted of a brief neurologic exam, focused on abnormalities of muscle tone and persistence or loss of primitive reflexes, as well as the assessment of osteomuscular abnormalities. The theoretical neurodevelopmentalist referential was used to support this process[11]. The Babson Growth Curve was adopted for the first year of life, and the curve of the National Center for Health Statistics (NCHS) for the second year in the growth assessment by the neonatologist. The psychological evaluation with parents and caregivers focused on the child's routine and the difficulties faced daily (colic, sleeping or feeding problems, relationship disturbances and others). The evaluation using the Bayley Scale of Infant Development III (BSID III) was scheduled as from the fourth month of life[12].

RESULTS

During the period of the study, 37 children were born at the HIAE with birth weight equal to or smaller than 1250 g. Six children died, two as fetuses and four as newborns. One neonate was transferred to another hospital. Three had severe problems during hospital stay, which required multiple treatment and visits to specialists after hospital discharge, making it impossible for the parents to attend one more evaluation.

The population accrued on this study included children with mean gestational age at birth equal to 28.8 weeks, mean birth weight of 1055 g, mean length of stay of 46.3 days, mean maternal age of 35 years. Chart 1 depicts the results of some perinatal and neonatal variables of this population.

Table 1 depicts the growth data in the first two years of life.

Fifteen children had weight and growth abnormalities at discharge and more than 50% of the sample had reached normal ranges in the subsequent evaluations. Of the whole sample, four children had important intrauterine growth restriction.

Table 2 shows the percentage of children who presented with developmental abnormalities during the multiprofessional evaluations.

Chart 1. Distribution of some perinatal and neonatal variables of the studied sample, 2007

NB	Maternal age	ART	IUGR	Apgar 1st minute	Apgar 5th minute	Sex	GA	Weight	Neonatal morbidity	HLS
1	36	Yes	Yes	3	6	M	33	980	HMD, Sepsis, ICH I, PAD, ROP I, GER, hypospadia	48
2	36	Yes	No	8	9	M	33	1140	HMD*, Sepsis, ICH I, PAD, ROP I, GER, hypospadia	48
3	44	Yes	Yes	8	9	F	27	760	ROP I, GER, AP	85
4	44	Yes	Yes	7	9	F	27	1000	ROP I, GER, AP	85
5	35	Yes	Yes	8	9	F	26	810	HMD*, Sepsis, AP**, PAD, ROP I, GER	85
6	36	Yes	No	8	9	F	31	1730	HMD*, Sepsis, AP**, ICH I, PAD, GER	42
7	33	No	Yes	8	10	F	27	860	HMD*, Sepsis, AP**, PAD, ROP II, ICH I, GER	71
8	32	No	Yes	7	9	M	28	890	AP, PAD, ROP I, GER	54
9	35	No	No	6	8	F	29	1310	AP, PAD, ROP I e GER	58
10	35	No	No	8	9	F	29	1145	AP, PAD, ROP I e GER	61
11	35	No	No	9	9	F	29	1210	AP, PAD, ROP I e GER	59
12	35	Yes	No	8	9	M	27	1130	HMD*, Sepsis, AP**, PAD, ROP I, GER	54
13	35	Yes	No	5	9	F	27	1040	AP**, PAD, ROP I, ICH I, GER	65
14	40	No	Yes	5	9	F	29	670	Sepsis, AP**, ROP I, GER, NEC, SBS	118
15	31	Yes	No	8	9	M	30	1175	HMD*, Sepsis, AP**, PAD, ROP I, GER, hypospadia (surgical correction)	52
16	31	Yes	No	8	9	M	30	1270	HMD*, Sepsis, AP**, PAD, ROP I, GER,hypospadia(surgical correction)	37
17	40	Yes	No	3	7	M	28	1140	HMD*, Sepsis, AP**, PAD (surgical correction), ROP II, ICH II, GER, NEC, SBS	79
18	37	Yes	Yes	6	9	F	26	970	HMD*, Sepsis, AP**, PAD, ROP I, GER	63
19	31	No	No	8	9	F	29	1080	HMD*, Sepsis, AP**, PAD, ROP I, GER, Tetralogy of Fallot	51
20	32	No	Yes	8	9	F	29	790	MDH*, Sepsis, AP**, PAD, ROP I, ICH I, GER	55

Source: Serviço de Arquivo Médico (SAME), HIAE, 2007.
*Surfactant treatment; **Red blood cell transfusion.
NB: newborn; M: male; F: female; ART: assisted reproductive technologies; IUGR: intrauterine growth restriction; GA: gestational age (weeks); HMD: hyaline membrane disease; ICH: intracranial hemorrhage; PAD: patent arterial duct; GER: gastroesophageal reflux; ROP: REtinopathy of prematurity; AP: anemia of prematurity; NEC: necrotizing enterocolitis; SBS: short bowel syndrome; HLS: hospital length of stay (days).
Note: all NB were born by cesarean section.

Table 1. Distribution of children with growth abnormalities in the first two years of life, per 10th and 3rd percentiles of the Babson (1-12 months) and NCHS (12-24 months) curves, 2009

Assessments	Weight (g)	Height (cm)	Head circumference (cm)
Child at discharge	n = 15 mean = 2180 n = 10* n = 5**	n = 15 mean = 47.8 n = 10* n = 5**	n = 1 HC = 34.2 n = 1**
1st assessment (3 months)	n = 7 mean = 3970 n = 3* n = 4**	n = 7 mean = 55.2 n = 13* n = 4**	n = 1 HC = 35.8 n = 1**
2nd assessment (6 months)	n = 7 mean = 5135 n = 3* n = 4**	n = 7 mean = 60.1 n = 3* n = 4**	n = 1 HC = 40.1 n = 1**
3rd assessment (9 months)	n = 7 mean = 7110 n = 3* n = 4**	n = 7 mean = 65.4 n = 3* n = 4**	n = 1 HC = 42.4 n = 1**
4th assessment (12 months)	n = 7 mean = 8105 n = 3* n = 4**	n = 7 mean = 69.8 n = 3* n = 4**	n = 1 HC = 44.9 n = 1*
5th assessment (18 months)	n = 4 mean = 9830 n = 3* n = 4**	n = 4 mean = 72.7 n = 4**	n = 1 HC = 46.1 n = 1*
6th assessment (24 months)	n = 4 mean = 10720 n = 1* n = 3**	n = 4 mean = 75.3 n = 4**	n = 1 HC = 47.9 n = 1*

Source: Medical records, Clinic of Pediatric Specialties – HIAE – 2009.
*Change in growth curve below P_{10}, **Below P_3.

Among the oral sensory motor system and/or feeding abnormalities, a subdivision could be observed among some aspects, such as sensory motor abnormalities, food refusal, selectivity for food textures and difficulties to accept solid food. The percentage of abnormalities observed in the sample, in each of the aspects mentioned above, is found in table 3.

About hearing assessment, in the first two appointments, abnormalities in auditory development related to attention and lateral sound detection were observed.

In the third evaluation, the highest percentage of hearing development abnormality was observed, 40% (n = 8) of the total assessed. The delay in hearing development was related to sound location above and below the child's visual field. It was noted that 50% (n = 4) of the children with abnormalities in that evaluation had normal auditory pattern in the following visit.

At the end of the evaluations, it was noted that, among the children with delayed hearing development, 75% (n = 3) had sustained delay since the third assessment, and 25% (n = 1) presented delay in the second and in this last assessment, most of the cases having transient abnormalities.

Regarding neuromotor development, during the follow-up period, the abnormalities found were transient in 55% (n = 11). At the end of the 24-month period, only 18% (n = 2) had motor impairment.

Tone abnormalities were seen in 30% (n = 6) – in that, 15% (n = 3) were hypotonia and 15% (n = 3) were hypertonia.

In the evaluation of gross motor development, 5% (n = 1) had delayed cervical control; 15% (n = 3) did not support themselves on the upper limbs in the prone

Table 2. Percentage of global development abnormalities per assessment (n = 20)

Assessments	Altered sensory-motor-oral and/or feeding n (%)	Delay in auditory development n (%)	Altered acquisition of motor skills n (%)
1st assessment (3 months)	6 (30)	1 (5)	1 (5)
2nd assessment (6 months)	5 (25)	2 (10)	7 (35)
3rd assessment (9 months)	4 (20)	8 (40)	6 (30)
4th assessment (12 months)	5 (25)	5 (25)	3 (15)
5th assessment (18 months)	5 (25)	4 (20)	3 (15)
6th assessment (24 months)	3 (15)	4 (20)	2 (10)

Table 3. Percentage of specific speech abnormalities of the oral sensory motor system and/or feeding, described per assessment (n = 20)

Speech abnormalities	Percentage of delays	Altered sensory-motor-oral (%)	Refusal to eat (%)	Accepting solid foods (%)	Consistency selectivity (%)
1st assessment	30	15	15	N/A	N/A
2nd assessment	25	15	10	N/A	N/A
3rd assessment	20	10	10	N/A	N/A
4th assessment	25	10	10	5	0
5th assessment	25	5	1	10	0
6th assessment	15	5	10	0	10

N/A: not assessed.

Table 4. Results obtained by the BSDI III

Assessments	Number of children assessed	Children with delay	Cognitive area n (%)	Communication area n (%)	Motor area n (%)	Children presenting delay in more than one area n (%)
1st assessment (4 months)	20	8	4 (50)	4 (50)	6 (75)	5 (62)
2nd assessment (9 months)	19	7	0	4 (57)	6 (85)	2 (28)
3rd assessment (14 months)	17	7	0	3 (43)	4 (57)	0
4th assessment (18 months)	10	2	0	1 (10)	1 (10)	0

position, and 25% (n = 5) did not acquire the expected rolling ability at 3 months of age; 45% (n = 9) did not sit at 6 months; 20% (n = 4) did not crawl, and 35% (n = 7) did not perform dynamic postural changes expected for 9 months of age. In the other evaluations, the children had the expected acquisitions for the corrected age.

As to fine motricity, 5% (n = 1) had the palmar grasp reflex present beyond the expected period; 40% (n = 8) had delay in grasp development, and 15% (n = 3) did not grasp with finger dissociation, specially the index finger, which is expected for 9 months; 20% (n = 4) had tactile hypersensitivity. And it stands out that 50% (n = 10) had a poor object exploration while playing in different follow-up periods.

Table 4 shows the BSDI III results.

In this assessment, there were fewer delays as compared to the previous ones. Another aspect observed was the remission of delay in the cognitive area after the second evaluation. In the last two evaluations, the children demonstrated delay in only one of the areas and there was important improvement in global development.

DISCUSSION

Monitoring child growth is a primary healthcare action. The process of growth during the first years of life, due to its intensity, is highly vulnerable to multiple factors that may impair it, therefore dedicated control is necessary and fundamental[13]. Among the three anthropometric parameters assessed, head circumference demonstrated better growth profile, with early catch-up, reaching normal ranges within the first year. Peterson et al. demonstrated that adequate growth of the head circumference in the first years is associated with better developmental prognosis[14].

In relation to sensory–motor-oral and feeding development, some aspects concerning abnormalities of posture and tongue motility at rest and during function were observed, as well as those related to food refusal. Posture abnormalities may be related to prematurity[8] and are often consequences of endotracheal intubation or prolonged feeding tube. Food refusal and aversion are predominantly associated with severe gastroesophageal reflux[6,10] and may persist until the introduction of thicker or solid foods, when the symptoms usually improve, what is in tune with the data obtained. The children with food refusal had the diagnosis of gastroesophageal reflux, the symptoms having disappeared in the sixth evaluation, concomitantly to the insertion of complete solid food on the children's diet. After the fourth evaluation, besides the abnormalities observed until then, selectivity for solid consistency was also diagnosed, compatible to premature babies close to the first year of life[6]. The literature characterizes selectivity abnormalities for solid consistency in low birth weight children, associated with a delay in the introduction of this consistency, typical in families of premature babies who present difficulties in broadening the variety and consistency of the food offered[9].

Concerning auditory development at three months of corrected age, some children had a delay in regard to sound response. Azevedo[15] demonstrated that premature children may present sound response latter when compared to full-term children. For this reason, we could also observe that, at six months, in the second evaluation, a small number of children assessed presented a delay in lateral sound location. When a delay in the pattern of sound response occurs, the probability of a delay in lateral location is high, since it is necessary to first develop the response pattern and then localize.

At nine months, a higher prevalence of delay in the auditory development was found, which is compatible with the findings of the evaluation of motor development and of the BSDI III. Since it is a period during which the child needs motility to localize sound, movement restrictions may delay the beginning of such abilities.

At 24 months, a small number still had a delay in hearing development, related to sound location as well as concerning verbal stimuli. Those children must be followed, since they may have abnormalities of central auditory processing, which may, in the future, make the alphabetization process more difficult[16-17].

The main abnormalities found during the follow-up period, in relation to the sensory motor aspects, demonstrated a delay in posture acquisition, as well as cervical control, rolling over, sitting, crawling, standing, and performing dynamic postural changes.

Concerning fine motricity, persistence of the palmar grasp reflex, delay in the development of the different types of grasping, poor object exploration

while playing, as well as aspects related to deficit of sensorial integration, mainly tactile hypersensitivity, were observed.

Abnormalities of muscle tone, posture, and acquisition of fine and gross motor abilities were mainly transient, except in a small percentage of the children, who had sustained sensory motor abnormalities until the end of the follow-up.

The peak incidence of the abnormalities occurred between six and nine months of corrected age, accounting for the period of greater demand of the acquisitions of anti-gravitational postures, i.e., sitting, and performing postural changes expected for that period[11].

The high incidence of delay in acquisition of sitting and of dynamic postural change had direct impact on poor environmental exploration and on playing, probably due to a smaller spatial movement capacity.

According to the literature, to efficiently reach and grab objects, an adequate axial control is necessary. Tonic abnormalities associated with a poor trunk balance reflect into a deficit in playing development and in improving grasping to more efficient ways[18]. Parents and caregivers of the children who presented with abnormalities in the evaluations were oriented to perform activities or punctual exercises and environmental changes to favor development.

In cases with persistent abnormalities in the subsequent evaluations, physical therapy and occupational therapy were indicated.

By means of the application of the BSDI III, it was noted that the cognitive abnormalities seen in the first evaluation disappeared; nevertheless, the alterations in the communication area and in the motor area remained in the other evaluations. During the first assessment, the mothers expressed concern with their child growth and often during the period of reorganizing the house, which may have influenced the presence of the abnormalities, since they also expressed being overprotective with the children, as well as a decrease in the stimuli adequate to the age group. Garel et al.[19] verified that mothers expressed anxiety feelings and depression symptoms two months after the neonate's hospital discharge, and had problems in emotionally reorganizing themselves, being still very concerned with the child growth.

Persistence of the motor abnormalities might be related to more demand of anti-gravitational postural acquisitions, as previously mentioned, whilst the abnormalities in the area of communication may be related to the possible alterations in auditory processing that this population presents[17]. It was also observed that most children with delay had impairment in more than one assessed area.

During the children's development, decreased percentage of specific and global abnormalities was seen. This fact may be related to the counseling or suggestions of specific intervention provided by the team, as well as more parental attention in regard to the global development of the child and due to nervous system maturation. Koldewijn et al.[20] observed, in their follow-up study of very low-weight premature babies, that the participation of these children in an intervention program was correlated to a better performance in the motor cognitive scale and in behavior when evaluated by means of BSDI II at six months of corrected age. There were fewer children assessed by BSDI III in comparison to the first evaluation. The reasons were lack of time by the parents to bring the child, or normal development according to the previous multiprofessional assessment.

An extremely low-weight premature baby may present transient and/or permanent delays or impairments in his/her development, which requires adequate sensory motor experiences to give opportunity to the full development of his/her abilities.

The fact that we do a multiprofessional work may have helped in parental counseling, so that they could make stimulations accordingly and, therefore, decrease the percentage of abnormalities seen in the following evaluations.

CONCLUSIONS

In spite of the short follow-up period of the neonates with birth weight ≤ 1250 g and of the limitation to establish direct relation between causes and effects in the interventions performed, and the results obtained, the data of the present study demonstrate the "profile" of this specific population served at a reference institution for high-risk neonates.

Our findings demonstrated critical periods of developmental delay at 6, 9, and 18 months of corrected age for the speech and neuromotor aspects, which were adequate at 24 months in most cases. Growth also followed the same trend.

Future studies with larger samples are recommended, as well as the possibility of following this population up to the period they learn to read and write.

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