

Prevalence of Disorders in 5-6 year-old children with a history of preterm birth

BABANATAJREYHANE¹, POURDAD PARISA², POURRAMZAN ZAHRA³, POURABDOLLAHABDOLLAH⁴

¹Instructor of Nursing and midwifery school, Babol University of Medical Sciences, Babol, I.R.Iran

²Non-Communicable Pediatric Disease Research Center, Health Research Institute, Nursing and midwifery faculty, Babol University of Medical Sciences, Babol, I.R.Iran

³Pediatrician, Pediatrics Department, Mazandaran University of Medical Sciences, Mazandaran, I.R.Iran

⁴Optometry Wards Rouhani Hospital, Babol University of Medical Sciences, Babol, I.R. Iran

Correspondence to: Pourdad Parisa(MSc)

ABSTRACT

Background: Despite the improvement of the medication and nursing care the number of preterm births is still increasing and the risk of mortality in this population is also growing. The mortality and morbidity rates among premature infants are higher than the term infants and their healthcare is more expensive. Furthermore, the likelihood of postpartum problems increases as the gestational age of the infant decreases.

Method: 91 children living in Babol were studied at the ages of 5 and 6 years in 2017. Evaluation of children who referred to health centers, ophthalmology and audiology clinics, information was obtained through observation of medical records, children's files in these centers, as well as interviews with parents.

Results: Of the 91 children included in this study, 43 were female (47.25%) and 48 were male (52.75%). Besides, 43 (47.25%) and 48 (52.75%) children were 6 years old and 5 years old, respectively. Based on the information of the children with a preterm birth history, visual impairment was observed in 24 cases (51.06%), which had the highest rate. Of the 91 children studied, 47 children (51.65%) were suffering from disorders and complications. Of these 47 children, 11 children had been treated, 22 were under surveillance, and the rest were either untreated or uninformed.

Conclusion: Considering the incidence of these disorders in the studied children, it is recommended to follow up on premature infants and children with a history of admitted in the NICU. Besides, training is recommended for their parents for continued follow-up and periodic examinations.

Keywords: preterm birth, premature infant, children, developmental problems, follow-up

INTRODUCTION

Despite the improvement of the medication and nursing care the number of preterm births is still increasing and the risk of mortality in this population is also growing. The mortality and morbidity rates among premature infants are higher than the term infants and their healthcare is more expensive. Birth weight less than 2500grams is a major characteristic of the neonatal and infancy complications and its considerably leads to childhood disabilities. Furthermore, the likelihood of postpartum problems increases as the gestational age of the infant decreases. Various studies suggest that children with a history of preterm birth suffer from short-term and long-term disabilities and physical, psychological, and social problems two or three times more than other children^{1,2,3}.

Most premature infants are admitted in Neonatal Intensive Care Units (NICUs) due to many common complications such as respiratory distress or increased blood bilirubin levels, which occur in almost all premature infants. The other conditions such as anomalies comorbid with preterm birth make hospitalization in the NICUs necessary. Most infants admitted in the NICUs take special nutritional programs in proportion to their development level or condition⁴.

Premature infants may be severely ill, and it is extremely difficult for their parents, physicians, and nurses to decide on their treatment. The immune system of premature infants is unable to confront to the common diseases such as respiratory infections due to their inadequate growth and prematurity. The visual problems

are common among in this population due to the underdevelopment of the retina vessels, while hearing problems are common due to the underdevelopment of the hearing system in the uterus or because of hospital treatments in wards. Severe stimuli such as light, sound, or painful therapeutic measures in the ward can hinder the development of the neonate's brain. Besides, premature infants will suffer from developmental delay and learning disabilities due to brain damages⁵.

Today, with the increase in the studies on the developments and interventions in the growth of children, it is necessary to design and modify the NICUs to provide satisfactory care and support to the neonates and their families at birth (5-7). In addition to the preterm birth and low birth weight of the infants, the NICU environment can also increase stress in parents of the neonates admitted in NICUs. The neonatal intensive care units are often crowded due to the extensive care provided by the constantly moving personnel and the noises made by the monitors. All of these factors impair the relationship between parents and their infants. The neonates' parents are prone to depression due to the high levels of stress and anxiety. Research results also suggest that maternal depression during this period affects the mother-child interactions 1 to 1.5 years after birth, leading to the future maladjustment of the children⁶.

Since premature infants suffer from prematurity-related developmental and physical disorders later in life, the early identification of the development problems in children is substantially important as regards the rehabilitative interventions. The physiological speed of

brain maturation in the early years of life is considerably high, while the therapeutic and rehabilitative interventions are more effective than the subsequent years. This approach creates an opportunity for closely monitoring the developmental progress of infants in the early years of life and providing training and interventions if necessary. Developmental problems in premature infants are more common than the other infants. Hence, the developmental assessment of infants and children has to be performed at different ages. In the present study, we evaluated the prevalence of developmental problems and physical disorders in 5-6 year-old children with a history of prematurity.

METHOD

In a descriptive study, 151 premature infants with a birth weight of less than 2000 grams and a gestational age of less than 34 weeks, who were admitted from March 21, 2011 to November 21, 2012 in the neonatal intensive care units of Shafizadeh Children Hospital of Amirkola and Ayatullah Ruhani Hospital of Babol and 91 children living in Babol were studied at the ages of 5 and 6 years in 2017. The samples were selected using the convenience sampling technique. Of the 151 premature infants born during this period, 60 children were excluded from the study due to the following reasons: 49 children (81.66%) due to migration and residence in the adjacent cities, 7 children (11.67%) due to a change of address and phone number, 3 children (5%) due to death, and 1 child (1.67%) due to non-participation in the study. The study children aged 5-6 years and had a history of hospitalization in NICUs at birth.

Retinopathy of Prematurity (ROP) screening during infancy was carried out in accordance with the eye examination protocol by a retina ophthalmologist 4 to 6 weeks after birth. The stage and zone of ROP was determined for each premature infant based on the international classification of ROP, and the infants in need of treatment were treated with Avastin. The studied children included premature infants with or without ROP.

Assessment of incidence was performed by a pediatrician and clinical nurse specialist by taking a history and reviewing the child's medical records and by conducting an eye examination by an optometrist. Measurable visual problems in the studied children included visual acuity, refractive errors, strabismus, and amblyopia. Height and weight of children with scales (RAFAI, C01900, Iran) by a pediatrician was measured. The most important evolutionary areas included: visual, auditory, motor, and linguistic development. Frequency of developmental problems and physical disorders were collected by obtaining information through observation of medical records, control of children's files in clinics, as well as interviews with parents.

The descriptive statistics methods were used to study frequency and frequency percentage of the disorders. Information was provided to parents about all probabilities and percentages of developmental problems and physical disorders. Oral informed consent for data acquisition was provided by the parents. The parents of the child were informed and trained in this study.

RESULTS

Of the 91 children studied, 43 were female (47.25%) and 48 were male (52.75%). Besides, 43 children were 6 years old (47.25%) and 48 children were 5 years old (52.75%). The information collected on children with a history of preterm birth revealed that conditions such as visual problems, weight loss, speech or language disorders, hypothyroidism, hearing loss, seizures, hydrocephalus (brain shunt), hepatosplenomegaly, umbilical hernia, asthma/allergy, cholecystectomy, hemiplegia (right-sided), ptosis, ruptured appendicitis and nephrolithiasis had been reported. The frequency and frequency percent of the disorders are listed in Table 1.

Table 1: Frequency and frequency percent of the disorders

Disorders	Frequency	Frequency (%)
Visual problems	24	51.06
Weight loss	4	8.51
Speech disorders	3	6.38
Hypothyroidism	3	6.38
Hearing loss	2	4.25
Seizures	2	4.25
Hydrocephalus (brain shunt)	1	2.13
Hepatosplenomegaly	1	2.13
Umbilical hernia	1	2.13
Asthma and allergy	1	2.13
Cholecystectomy	1	2.13
Hemiplegia	1	2.13
Ptosis	1	2.13
ruptured appendicitis	1	2.13
nephrolithiasis	1	2.13
Sum	47	100

Of the 91 children, 47 (51.65%) were diagnosed with disorders and complications. Of these children, 11 were treated, 22 were under surveillance, and the rest were untreated or uninformed.

In children studied, the respiratory distress syndrome (RDS) 69 cases, transient tachypnea of the newborn (TTN) 9 cases, intrauterine growth restriction (IUGR) 7 cases, and sepsis 6 cases had the highest frequencies of final neonatal diagnosis in the order mentioned.

Of the children that diagnosed with and admitted for sepsis as neonates 2 cases had weight loss, 1 case had hydrocephalus (brain shunt), and 1 case had visual problems. As for children who had been diagnosed with and admitted for RDS as neonates, visual problems (21 cases) had the highest frequency. Besides, 2 cases were diagnosed with hypothyroidism and 1 child had seizures.

Among the children that had been diagnosed with and admitted for TTN as neonates, 1 case had weight loss and 1 case had ruptured appendicitis. Of the children who had been diagnosed with and admitted for IUGR as neonates, 2 cases had visual problems, 1 case had hypothyroidism, 1 case had hemiplegia (right-sided), 1 case had seizures, and 1 case had hearing loss. In children evaluated at the time of birth, 62 children showed different degrees of ROP while 29 children did not have ROP. Visual problems in the children are reported in Table 2 along with the frequency distributions.

Table 2: Frequency distribution and visual problems

Disorder	No ROP(%)	Yes ROP(%)
Hyperopia	1(100)	8(34.78)
Myopia	0	2(8.70)
Astigmatism	0	4(17.40)
Strabismus	0	6(26.08)
Amblyopia	0	3(13.04)
Sum	1(100)	23(100)

Based on Table (2), visual problems had the highest frequency among the 62 children with a history of ROP. Refractive errors included 8 cases of hyperopia, 2 cases of myopia, and 4 cases of astigmatism. Of the 28 children with no history of ROP, no one developed amblyopia and strabismus.

In the study, children with weight loss included 3 boys and 1 girl. 3 children were 6 years old and 1 child was 5 years old. Only three children were monitored by nutritionists. The gender distribution, average weight, and height of the children with weight loss are listed in Table (3).

Table3: The gender distribution, average weight, and height

Gender	Weight(kg)	Height(cm)
Girl (6 year old)	17	110
Boy (6 year old)	17	115
Boy (6 year old)	16	118
Boy (5 year old)	15	97

Speech disorders in the children studied included: Delay in speech initiation age 1 case and spelling difficulty (incorrect pronunciation of words) 2 cases. Children with speech disorders included 2 girls and 1 boy. 2 children were 5 years old and 1 child was 6 years old. A 5-year-old girl had speech delay and two other children (5-year-old girl and 6-year-old boy) had difficulty pronouncing. All three children are under the supervision of a speech therapist.

DISCUSSION

In this study, the developmental problems in 91 premature infants were studied at the ages of 5-6 years old. Given the special problems among the premature infants, many studies have been conducted with regard to the developmental problems in these infants. The most important Iranian study on the developmental problems is a review study that reviewed the foreign studies, hence the need for the present study⁹.

Our study revealed that 51.06% of the children had visual problems. Among these children, hyperopia showed the highest frequency. The frequency of visual problems in children with a history of ROP was higher than children with no history of ROP. Besides, hyperopia was observed in 8 children (34.78%) and strabismus was observed in 6 children (26.08%) with a history of ROP. Retinopathy of prematurity is one of the major causes of blindness and visual impairment around the world. Refractive errors including myopia, astigmatism, and anisometropia are also common among premature infants with and without ROP¹⁰. Preterm birth, low birth weight (LBW), and severe retinopathy of prematurity are considered the risk factors for the development of strabismus and refractive errors.

Among the children with satisfactory structural and visual results for both eyes, the prevalence of strabismus was 26% in the 6-year-old children¹¹.

In a cohort study by Helgert et al. (EXPRESS), all of the extremely premature infants were examined for the visual outcomes at the age of 6 years and the effects of prematurity and ROP were evaluated. Among the extremely premature infants aged 5-6 years, 37.9% had visual problems. In the control group, 6.2% of the children suffered visual problems.

As reported in the previous studies, prematurity, stress, and congenital diseases may impair the natural development of the eyes. Therefore, it is necessary to assess premature infants during the school and pre-school years to confirm the long-term outcomes of refractive errors^{10,11,12}.

According to our study, 6.38% of these children suffer from speech or language disorders. As compared to the other studies on speech delay or language development disorder among children aged 3-5 years, who had extremely preterm births, this rate is 32-48% and 30-35% for children with gestational ages less than 30 weeks and 31-34 weeks, respectively. Riedy et al., conducted a study on 198 seven-year-old children with gestational ages less than 30 weeks or birth weights less than 1250 grams as well as 70 same-aged children with preterm births to assess their language skills using the standard language tests. Their results indicated that premature and LBW (low birth weight) children underperformed the control group in the following five areas: phonetics, semantics, grammar, conversation, and linguistics¹³.

In the present study, 6.38% of the children suffered congenital hypothyroidism, which seems to be less than the incidence rate reported by Prabhakara Rao et al. Of the 272 children and the 328 adolescents studied, the prevalence of dysthyroidism (hypothyroidism) was 9.9% and 10.4%, respectively¹⁴. In the study by Aminzadeh, screening was carried out for congenital hypothyroidism in 86567 infants, and 194 cases (100 men; F/M = 0.94; total incidence 1:446) were confirmed¹⁵.

In the present study, there was 1 case (2.13%) of hemiplegia (right-sided). Based on the medical records and documents of this child at the time of birth, the gestational age was 34 weeks and the birth weight was 1000 grams. This child was diagnosed with and admitted for IUGR in an NICU. No resuscitation was performed at the time of admission. For the treatment of hyperbilirubinemia, he had a blood exchange 1 time. As cerebral palsy is now the most common type of developmental problems in premature infants, it is associated with long-term disability. Different degrees and types of cerebral palsy are currently the most common developmental problems among premature infants with long-term disabilities. The estimated prevalence of clinical cerebral palsy among the children at the school-age is 3 to 4 out of every 1000 patients in the United States¹⁶.

Another report revealed that the prevalence of cerebral palsy is 2 out of every 1000 live births in the United States¹⁷. However, the prevalence of cerebral palsy caused by prenatal infections and kernicterus has decreased drastically but preterm birth has increased its prevalence.

In this study, there were 2 cases of hearing loss (4.25%). Of these two children, one had right hemiplegic paralysis and the other had been resuscitated once in infancy (first resuscitation steps) and had delayed speech onset. Other studies revealed that LBW infants are prone to hearing loss or deafness, and 2-3% of LBW infants suffer from these disorders¹⁸. Moreover, premature infants are prone to the risk of severe hearing loss 20 times more than full term infants^{19,20}. The presence of infants in NICUs increases the risk of sensorineural hearing loss (SNHL) and conductive hearing loss. Therefore, it is recommended that all these infants undergo hearing screening prior to discharge²¹.

Developmental and physical disorders in children are important. We only talked about some of these problems and their prevalence. We studied the highest frequency and percentage of problems and reviewed articles related to these problems.

CONCLUSION

Given the incidence of these disorders and problems in the children studied, it is necessary to follow-up premature infants and children with a history of admitted in NICUs and to provide training to parents to continue the follow-up and carryout periodic examinations. Since the incidence rate of these disorders among the term children in the previous studies was lower than the preterm children^{22,23,24}, a similar study with a control group is recommended for comparing the relationship between these disorders and preterm birth.

REFERENCES

- Schmidt B, Roberts RS, Davis PG, Doyle LW, Asztalos EV, Opie G, et al. Prediction of Late Death or Disability at Age 5 Years Using a Count of 3 Neonatal Morbidities in Very Low Birth Weight Infants. *The Journal of Pediatrics*. 2015;167(5):982-6.e2.
- Spittle A, Orton J, Anderson P, Boyd R, Doyle LW. Early developmental intervention programmes post-hospital discharge to prevent motor and cognitive impairments in preterm infants. *Cochrane Database Syst Rev*. 2012;12:CD005495.
- Bennett FC, Scott DT, editors. Long-term perspective on premature infant outcome and contemporary intervention issues. *Seminars in Perinatology*; 1997: Elsevier.
- Martin RJ, Fanaroff AA, Walsh MC. *Fanaroff and Martin's Neonatal-Perinatal Medicine E-Book: Diseases of the Fetus and Infant*: Elsevier Health Sciences; 2010.
- Bolisetty S, Dhawan A, Abdel-Latif M, Bajuk B, Stack J, Oei J-L, et al. Intraventricular hemorrhage and neurodevelopmental outcomes in extreme preterm infants. *Pediatrics*. 2014;133(1):55-62.
- Nakanishi H, Suenaga H, Uchiyama A, Kono Y, Kusuda S. Trends in the neurodevelopmental outcomes among preterm infants from 2003–2012: a retrospective cohort study in Japan. *Journal of Perinatology*. 2018;38(7):917-28.
- Fledelius HC, Bangsgaard R, Slidsborg C, laCour M. Refraction and visual acuity in a national Danish cohort of 4-year-old children of extremely preterm delivery. *Acta ophthalmologica*. 2015;93(4):330-8.
- Bastani F, Ali Abadi T, Haghani H. The effectiveness of participatory care program in neonatal intensive care unit on state anxiety of mothers of preterm newborns. *Journal Of Babol University Of Medical Sciences*. 2012;14(3):59-65.
- Soleimani Farin, Zaheri Farzaneh, Abdi Fatemeh. *Developmental Outcome Of Low Birth-Weight And Preterm Newborns: A Review Of Current Evidence*, Tehran University Medical Journal (TUMJ) DECEMBER 2013 , Volume 71 , Number 9; Page(s) 551-561.
- Hsieh C-j, Liu J-w, Huang J-s, Lin K-c. Refractive outcome of premature infants with or without retinopathy of prematurity at 2 years of age: A prospective controlled cohort study. *The Kaohsiung journal of medical sciences*. 2012;28(4):204-11.
- VanderVeen DK, Bremer DL, Fellows RR, Hardy RJ, Neely DE, Palmer EA, et al. Prevalence and course of strabismus through age 6 years in participants of the Early Treatment for Retinopathy of Prematurity randomized trial. *Journal of American Association for Pediatric Ophthalmology and Strabismus*. 2011;15(6):536-40.
- Robaei D, Kifley A, Gole GA, Mitchell P. The impact of modest prematurity on visual function at age 6 years: findings from a population-based study. *Archives of Ophthalmology*. 2006;124(6):871-7.
- Reidy N, Morgan A, Thompson DK, Inder TE, Doyle LW, Anderson PJ. Impaired language abilities and white matter abnormalities in children born very preterm and/or very low birth weight. *The Journal of pediatrics*. 2013;162(4):719-24.
- Subrahmanyam K, Prasad D. Prevalence of subclinical hypothyroidism in children and adolescents of northern Andhra Pradesh population and its association with hyperlipidemia. *International Journal of Research in Medical Sciences*. 2017;5(12):1.
- Aminzadeh M. Higher prevalence of permanent congenital hypothyroidism in the Southwest of Iran mostly caused by dys-hormonogenesis: a five-year follow-up study. *Archives of endocrinology and metabolism*. 2018;62(6):602-8.
- Yeargin-Allsopp M, Van Naarden Braun K, Doernberg NS, Benedict RE, Kirby RS, Durkin MS. Prevalence of cerebral palsy in 8-year-old children in three areas of the United States in 2002: a multisite collaboration. *Pediatrics*. 2008;121(3):547-54.
- Bax MC, Flodmark O, Tydeman C. Definition and classification of cerebral palsy. From syndrome toward disease. *Developmental medicine and child neurology Supplement*. 2007;109:39-41.
- Arzani A, Kermanshahi S, Zahedpasha Y, SalehMohamadzadeh E. The role of pre-discharge mothers' education on follow-up examination of visual, hearing and brain problems in Preterm neonates. *Hormozgan Medical Journal*. 2009;13(2):115-22.
- Zamani A, Karimi A, Naseri M, Amiri E, Milani M, Sazgar AA, et al. Prevalence of hearing loss among high risk newborns admitted in hospitals affiliated to Tehran University of Medical Sciences. *Tehran University Medical Journal TUMS Publications*. 2010;68(1):64-70.
- Daneshmandan N, Borghei P, Yazdany N, Soleimani F, Vameghi R. Oral communication development in severe to profound hearing impaired children after receiving aural habilitation. *Acta Medica Iranica*. 2009;363-7.
- Valkama AM, Laitakari KT, Tolonen EU, Väyrynen MR, Vainionpää LK, Koivisto ME. Prediction of permanent hearing loss in high-risk preterm infants at term age. *European journal of pediatrics*. 2000;159(6):459-64.
- Hellgren K, Tornqvist K, Jakobsson PG, Lundgren P, Carlsson B, Kallen K, et al. Ophthalmologic outcome of extremely preterm infants at 6.5 years of age: Extremely preterm infants in Sweden study (EXPRESS)2016. 555-62 p.
- Holmström G, Kallen K, Hellström A, G Jakobsson P, Serenius F, Stjernqvist K, et al. Ophthalmologic Outcome at 30 Months' Corrected Age of a Prospective Swedish Cohort of Children Born Before 27 Weeks of Gestation The Extremely Preterm Infants in Sweden Study2013.
- Woythaler M, McCormick MC, Mao W-Y, Smith VC. Late preterm infants and neurodevelopmental outcomes at kindergarten. *Pediatrics*. 2015;136(3):424-31.