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Birth weight and the risk of childhood hearing impairment

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Abstract

Background: Low birth weight neonates are confronted with some problems after birth, they should be followed up and evaluated at different ages of life.

The aim of this study was to determine the impact of birth weight on the risk of sensorineural hearing impairment on children.

Method: This cross sectional and retrospective study determined the prevalence of hearing problems in low birth weight and normal birth weight school age children. The sample was consisted of 2400 children who referred to special educational organization for hearing screening before entrance to school in Mashhad - Iran between June 2005 and June 2006. Hearing problems were checked in all groups. Case definition was based on the mean sensorineural hearing loss of more than 35 decibel (dB) hearing level (HL) and in the better-hearing ear averaged over the pure-tone hearing thresholds at 500, 1000, 2000 and 4000 Htz. The results were then compared the low birth weight and normal birth weight children.

Result: This study showed that prevalence of hearing problems was 1.4%. The prevalence of hearing impairment in low birth weight (LBW) was 2.1% and 1.3% in normal birth weight (NBW). There wasn't significant difference in hearing impairment between two groups (p=0.255).

Conclussion:In this study there was no significant difference between low birth weight and normal birth weight children in hearing impairment although other studies indicated that the risks of hearing impairment increase with the LBW and low gestational age neonates. More investigation is needed for detecting the subtle hearing problems in children.

Keyword
Hearing impairment, low birth weight, normal birth weight, school age children

Introduction

The prevalence of neonatal hearing loss is approximately 1 to 3 per 1000 live birth and increases to 1% - 5% in babies at neonatal intensive care units [1,2] . The incidence of hearing impairment in babies who are born at low gestational age is 1% - 11%, depending on the population and used definitions [2]. Base on studies infants who are born preterm or with very low birth weight (VLBW) are at increased risk of hearing impairment in early childhood [3-5].

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Although VLBW alone may not have a severe impact on hearing, it is commonly associated with other multiple risk factors that can damage hearing in a synergistic method. Therefore, the risk of hearing loss is substantially higher in LBW children than the general newborn population [6]. It is important to diagnose hearing impairment as early as possible before language acquisition [2]. Pruszewicz et al [7] have done the audiological evaluation of LBW children for investigating any possible relation between very low birth weight and the associated risk factors and the subsequent hearing loss. In this study the greatest risk of the acquired profound hearing loss and deafness in low birth weight children was connected with the general physical status of the neonates and the treatment programme in the neonatal intensive care unit.

World Health Organization have recommended hearing impairment in neonates should be diagnosed early because of the influences on speech, cognition, society and psychological development later [8].

Although studies indicated that VLBW and extremely low birth weight (ELBW) infants are greatly at risk of all kind of disability but in LBW children, we found no related document or research. Therefore this study focuses on this group. School age is critical period for every child and in LBW children some problems emerge at this age. Also studies have reported that subtle form of auditory deficit will occur at a greater rate in preterm children with 8 years of age [9]. the LBW children are neither evaluated routinely after birth, nor for subtle problems in school. In this study we determined the effect of birth weight on hearing impairment in school age children.

Methods

This cross-sectional study has determined the prevalence of hearing problems in children who were delivered with low birth weight and compared them with normal birth weight children.

The target population consisted of all children that referred to special educational organization for screening before entering the school in Mashhad- Iran. 2400 school age children were included in the study between June 2005 and June 2006. According to the prevalence of defectiveness between children, sample size was estimated to be 2400 with 95% confidence interval and d= 0.02%. Cluster sample method was used for gathering data, thus from 25 available centers of special educational organization, 10 centers were randomly selected and in each center 240 samples were selected for the study. Weight, length and occipito-frontal head circumference were documented at birth and in 6-7 years old. Birth characteristics were taken from vaccination chart prepared for all babies in delivery room which included growth pattern at birth. Anthropometrical parameters were checked for each child at the time of entrance to school. Occipito-frontal head circumference and length measured by ruler and weight was by digital balance.

For auditory screening, at first they were checked in the local center if they had problem in 35 db at 4 frequent 500, 1000, 2000 and 4000 HTZ, then they were referred to special educational center for more audiometric assessing.

Data was analyzed by SPSS version 11.5, and categorical variables by using the chi-square and Fishers exact and quantitative variables by independent sample t-test. Confounding variables controlled by using logistic regression. The cut- off level for significance was chosen at p 0.05.

Results

Result for screening of hearing showed that prevalence of hearing problem in all samples was 1.4%, and the prevalence in LBW was 2.1% and 1.3% in NBW.

Eighty one children of 2400 samples were excluded because their birth weights were not available. In 2319 samples 8.3% were LBW

Variable	Group ≥ 2500	<2500gr
Birth weight (gr) Mean± SD	3294.8±461	1999.75±353.21
Birth height(cm) Mean± SD	50.61±2.33	47.32±3.01
Birth head circumference(cm) Mean± SD	34.58±1.68	32.24±2.8
Sex (male) N (%)	1127(53)	94(48.7)
Economic status (low) N (%)	1058(50.4)	125(65.1)
Family hearing loss N (%)	87(4.1)	13(6.7)

Table 1. descriptive characteristics of two groups.

and in this group, 85.5 % had 1500-2500g birth weight, 13.5%, 1000-1499g and 1% below 1000g birth weight. 6.8% of samples had been admitted in hospital during neonatal period, 13.8% of LBW and 5.4% of NBW, hence there was significant difference between them (p=0.001). The most common reasons for admission of LBW were respiratory disorder, growth disorder and seizure but Icter in NBW .

The neonatal characteristics such as weight, height and head circumference at birth, family and childhood characteristics were all compared in two groups (Table 1). As shown in the table 1 there was significant difference between two groups in economic status, birth weight, birth height and head circumference (p<0.0001), but there was not significant difference in sex and family hearing loss (p= 0.705 and p=0.24 respectively).

Hearing problem in LBW group was 2.1% and in NBW group was 1.3%. Chi- square test didn't show significant difference between two groups (p=0.255).

Regarding to the kind of hearing loss, in all children, 0.22% had unilateral hearing loss, 0.22% had bilateral hearing loss, 0.13% had hearing loss in low frequency and 0.26% needed hearing aid and 0.57% had temporary problems such as irrigation requirement and otitis media, had subjective sign without objective signs and inflammation (Table2).

Unilateral and bilateral hearing loss were more prevalent in the LBW group than NBW group. Chi-square test showed significant difference between the two groups in unilateral and bilateral hearing loss (p<0.01and p<0.05 respectively), but the LBW children did not need hearing aid as much as the NBW. Also hearing loss of low frequency was more in NBW than LBW group (Table2).

The influence of confounding variables on birth weight was controlled by logistic regres-

Variable	Group NBW (n=2080)	LBW (n=193)	Total	p-value
Unilateral hearing loss N (%)	3(0.14)	2(0.84)	5(0.22)	P<0.01
Bilateral hearing loss N (%)	4(0.19)	1(0.42)	5(0.22)	P<0.05
Hearing loss in low frequency N (%)	3(0.14)	0%	3(0.13)	P<0.001
Need to hearing aid N (%)	5(0.24)	1(0.42)	6(0.26)	P=0.069
Others* N (%)	12(0.57)	1(0.42)	13(0.57)	P=0.12
Total N (%)	27(1.3)	5(2.1)	32(1.4)	P=0.225

* Temporary problem such as the need for irrigation, inflammation, otitis media and subjective sign without objective sign.

Table 2. Kind of hearing loss in two groups.

sion. None of confounding variables had significant role on hearing problems.

Discussion

Prevalence of hearing impairment in all samples was 1.4%, LBW 2.1% and in NBW 1.3% with no statistically significant difference between two groups.

Roth study on 206 children with gestational age<33 week at birth showed the prevalence of hearing loss was 9% [10]. Gross found 1% hearing loss in 149 children who were born <28 gestational age [12].

Erickson showed 7% hearing loss and Hack reported 1% hearing loss in young people who was born premature [12,13].

Engdahl and colleagues investigated the impact of birth weight on the risk of sensorineural hearing loss in children. His results showed that neonates with birth weight less than 1500gr as compared with NBW children gave an adjusted odds ratio for sensorineural hearing loss 6.3 and concurrent defects. Their result showed that the risk of hearing loss decreased with increasing birth weight [14]. Most of our population had birth weight of 1500-2500gr, and according to Engdahl study the risk of hearing loss decreased with increasing birth weight and in low birth weight children the risk was the same as NBW. In our study there was no significant difference in hearing impairment between the LBW and NBW group. The prevalence of hearing impairment in our study was lower than Roth and Erikson study and higher than Gross and Hack study. In these studies infants were preterm or very low gestational age but our samples were low birth weight with range of 1500-2500gr.

Van Naarden determined the prevalence, relative risk and attribute fractions for congenital bilateral sensorineural hearing impairment in relation to lower birth weight. The prevalence was 12.7/10000 among 1500-2499gr children [15]. In our study prevalence of hearing impairment in the LBW children was 2.1% versus 1.27% of Van Naarden study. Hence the prevalence of hearing impairment in our study was more than Van Naarden study.

Weisglas-Kuperus (1993) determined the prevalence of hearing loss for 3-4 years old of VLBW children. Mild hearing loss was found in 26%, moderate hearing loss in 13% and severe hearing loss in 3% of the children, but none of the children was deaf [16].

Veen et al (1993) determined hearing loss in very preterm and very low birth weight infants at the age of 5 years old. His result showed that hearing loss was conductive/unspecific in 13.8% and sensorineural in 1.5% children. The prevalence of sensorineural hearing loss in very low birth weight and extremely low birth weight infants was similar [17].

Darlow et al determined the survival and sensorineural outcome at 7-8 years old in very low birth weight infants born in newzealand in 1986. His result showed that deafness requiring aid was 1.3% in all samples [18]. But in our study deafness requiring aid was 0.26% and less than Darlow study. This is due to the fact that this study was focused on LBW children but Darlow studied children with VLBW. Jason Wang (2008) determined prevalence of hearing problems in children with very low birth weight. Their result showed that among children with very low birth weight with non conductive hearing loss, 20% received hearing rehabilitation by 6 months of age [19].

Studies indicated that two third of LBW infants in developing countries are intrauterine growth retardation (IUGR) or small for gestational age (SGA). The most common definition of IUGR is a fetal weight that is below the 10th percentile for gestational age as determined through an ultrasound [20].

In our study more than half of our LBW group had birth weight more than 2000gr and might have been IUGR, but we had no access to their gestational age that can influence in the result. Also hearing impairment in children was checked by audiometery and special detection

test such as ABR was not used, thus further investigation is called for detection of subtle problems at this group.

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