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Universal Neonatal Hearing Screening Program in Poland – 10-year summary

Program Powszechnych Przesiewowych Badań Słuchu u Noworodków w Polsce – podsumowanie dekady

Authors' Contribution:
A – Study Design
B – Data Collection
C – Statistical Analysis
D – Data Interpretation
E – Manuscript Preparation
F – Literature Search
G – Funds Collection

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ABSTRACT:

Introduction: The analysis was aimed to summarize the outcomes of Polish Universal Neonatal Hearing Screening Program (PUNHSP).

Materials and methods: The analysis comprised the population of children registered in the PUNHSP database between 2003 and 2013. The evaluated parameters included: the program coverage (percentage of children covered by the Program in relation to the number of births), results of screening tests at different levels of the Program and hearing loss incidence.

Results: The average screened population was 96,0% with respect to total number of live births in Poland. Children requiring further evaluation represent annual average 8.5% of the study population. Among them, on average 55.8% were consulted in audiological centers. Hearing loss incidence was estimated to be 0,3%. The highest hearing loss incidence was detected in children which failed the OAE test with concomitant risk factors. 58.2% of children were fitted with hearing aids, 34.0% were referred for surgical treatment, and 7.8% for further rehabilitation.

Conclusions: The results of the program evaluation confirmed its good efficiency. The coverage and hearing tests results are comparable to those from other countries conducting similar national hearing screening programs.

KEYWORDS: hearing loss, newborn hearing screening, risk factors

STRESZCZENIE:

Wstęp: Celem pracy jest podsumowanie i analiza wyników Programu Powszechnych Przesiewowych Badań Słuchu u Noworodków w Polsce (PPPBSuN).

Materiały i metody: Analizą objęto dzieci zarejestrowane w bazie Programu w latach 2003-2013. W podsumowaniu wyników uwzględniano powszechność Programu, tj. odsetek dzieci objętych Programem w stosunku do liczby urodzeń. Przeanalizowano wyniki badań przesiewowych na poszczególnych poziomach Programu oraz liczbę zgłoszeń dzieci do kolejnych jego etapów.

Wyniki: W Programie rocznie jest badanych średnio 96 proc. populacji dzieci żywo urodzonych w Polsce. Dzieci wymagające dalszej diagnostyki stanowią rocznie średnio 8,5 proc. badanej populacji. Na kolejny etap Programu zgłasza się rocznie średnio 55,8 proc. dzieci, wymagających dalszej diagnostyki. W populacji objętej analizą jakiekolwiek zaburzenie słuchu stwierdzono u 0,3 proc. dzieci, z czego największy odsetek niedosłuchów wystąpił w grupie z nieprawidłowym wynikiem badania przesiewowego oraz współistniejącymi czynnikami ryzyka. Po szczegółowej diagnostyce do zaopatrzenia protetycznego w aparaty słuchowe skierowano 58,2 proc. dzieci, do leczenia operacyjnego 34 proc., a do dalszej rehabilitacji 7,8 proc.

Wnioski: Wyniki analizy PPPBSuN pokazują, że Polska plasuje się w światowej czołówce krajów prowadzących podobne programy screeningowe. Odsetek dzieci, u których identyfikowany jest niedosłuch, pokrywa się ze statystykami wykrywania niedosłuchu w innych populacjach noworodków na świecie.

SŁOWA KLUCZOWE: niedosłuch, badania przesiewowe słuchu u noworodków, czynniki ryzyka

INTRODUCTION

The Polish Universal Neonatal Hearing Screening Program (PUNHSP) has been implemented in Poland for over 11 years [1]. Its leading organising entity is The Great Orchestra of Christmas Charity Foundation, and it is coordinated by the program medical coordinator in all its material aspects. Since 2003 the hearing screening is conducted in the whole country and covers all newborns in Poland. This was possible due to the Ministry of Health regulations [7], financial support of the National Health Fund, and cooperation of neonatologists, ENT specialists, audiologists, nurses, midwives and parents.

Main PUNHSP objectives include early detection of hearing loss, precise diagnosis and audiologic intervention [2]. The Programme also covers an analysis of concomitant risk factors (RF) predisposing to hearing loss. The Polish Universal Neonatal Hearing Screening Program is implemented in 508 centres, divided into three levels described as reference levels. The first, basic level includes neonatology, newborn, and obstetrics centres, at which otoacoustic emission (OAE) tests are performed. OAE tests aim is to select children suspected of hearing loss requiring further verification. Furthermore, hearing loss risk factors are identified and registered in every single newborn. [10]. Children with an incorrect screening test result, and/ or with concomitant hearing loss risk factors, as well as children without screening test (OAE test was not performed for whatever reason) are referred to the second reference level of the program. The second level consists of ENT departments, and audiology centres responsible for comprehensive diagnostics to confirm or exclude hearing impairment. The third reference level comprises centres responsible for audiologic interventions. These include hearing aids fitting, surgical interventions and rehabilitation of children diagnosed with hearing loss. According to the program guidelines, children suspected with hearing loss should be diagnosed at the age of 3 months and no later than by 6th month of their life receive proper treatment - dependent on type and severity of hearing loss(e.g. hearing aids, cochlear implants)[3].

The aim of the study is to summarize and discuss the most important results of the Polish Universal Neonatal Hearing Screening Program since its initiation.

MATERIALS AND METHOD

The summary covers a group of 4,345,326 children registered in the database of the Polish Universal Neonatal Hearing Screening Program from January 2003 to December 2013. On the day of the analysis, there were 415 canters registered on 1st level, 70 centres on 2nd level and 23 centres on 3rd level. The analyzed parameters included: 1) the program coverage (the number of children registered in the PUNHSP central database (CDB) and data from the Central Statistical Office (GUS), 2) results of the screening tests at the PUNHSP 1st reference level and 3) incidence of hearing loss risk factors recorded during the screening test on the first level, 4) referral rate to the second level of the program, 5) hearing loss incidence in children on the second level, 6) age of the diagnosis.

Statistical analysis was performed with MS Excel 2010 and Statistica 10.0 applications.

RESULTS

Results - Level 1

1) Program coverage

When compared with data from Central Statistical Office, the percentage of children screened under the program throughout the studied period corresponds to 96% of the total number of live births. The minimum value was 94.3% and it was noted in 2009, and the maximum rate was 97.1% in 2003.

2) results of screening tests

Of children registered at the first level of the program, incidence of recorded results were as follows: pass result on otoacoustic emission tests without concomitant risk factors of hearing loss was recorded in 91.1% of newborns, a "pass" result on otoacoustic emission tests with at least one risk factor was recorded in 3.4% of children, a "refer" result on otoacoustic emission test without risk factors was found in 2.9% of newborns, and a "refer" result on otoacoustic emission test accompanied by hearing loss risk factors was found in 0.5% of newborn children. Otoacoustic emission tests were not conducted in 2.1% of children.

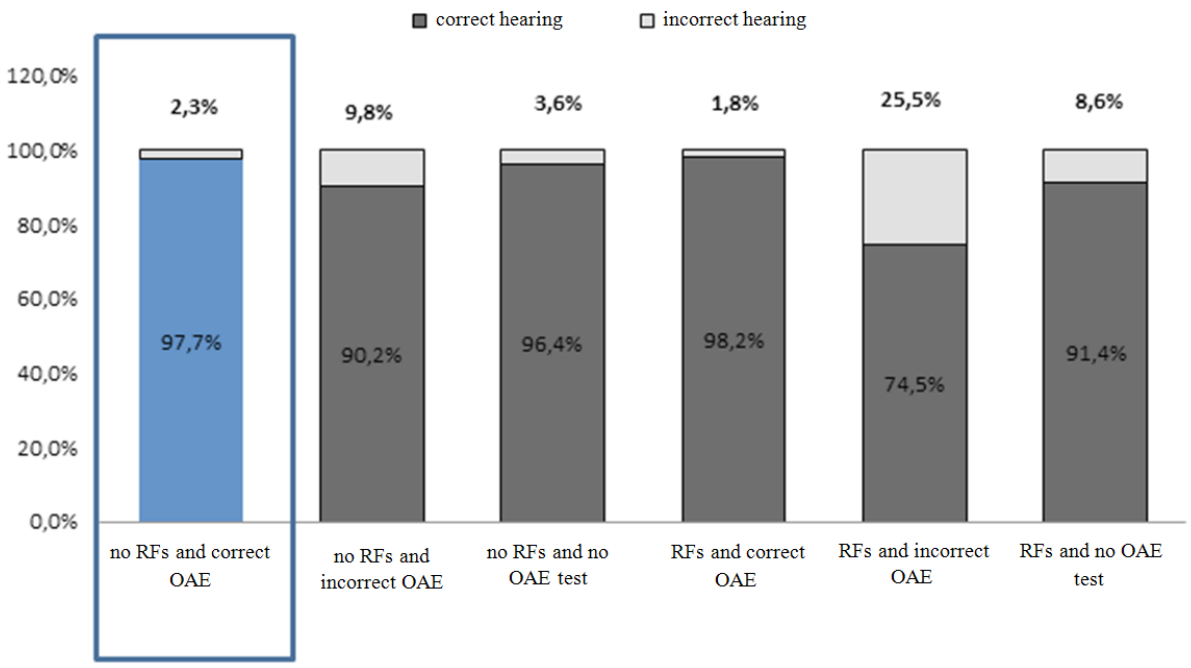

Fig. 1 Children with audiology diagnostics completed at the 2nd level, classified in accordance with the OAE test result and risk factors at the 1st level.

All newborns that did not meet pass criteria on the first level ("refer" results in at least one ear, at least one risk factor present, without hearing screening)were referred to ENT, audiology centres (Program 2nd level). On average, each year this group represents 32,613 children ± 1,689 SD, corresponding to 8.5% of the population of newborn children in Poland. The percentage of referred children was the lowest in 2006, at 8% (n = 29 777), and the highest in 2003, at 10% (n = 34 912).

Results - Level 2

According to the program database, the population of 18,203 children ± 1777 SD requiring audiological diagnostics is consulted on the 2nd level centres annually. This corresponds to 55.8% of all children referred from the 1st level of the program. A final diagnosis, both for confirmation or exclusion of hearing loss, is made in 90% of children consulted at the 2nd level. Surprisingly, the analysis of the results shows that each year 5,304± 1,381 SD of children with "pass" resut of otoacoustic emission tests and without any hearing loss risk factor recorded during screening reported additionally at the second level.

Since the initiation of the Program, 228,880 infants (47.5% of the population referred for a diagnosis to the 2nd level) were diagnosed at the 2nd level. In this group, normal hearing was diagnosed in 95% (n=217,432), but the remaining 5% (n = 11,448) of infants were diagnosed with hearing impairment .

An age median for children coming for the first visit at the PUNHSP 2nd level is 79 days, and a median for diagnosis completion is 85 days.

In the studied population, a hearing loss incidence analysis demonstrated a bilateral and unilateral sensorineural hearing loss greater than 20 dB in 46.4% and in 13.5% of all diagnosed hearing loss cases, respectively. Conductive hearing loss corresponds to 16.4% and 10.5% of bilateral and unilateral hearing loss cases, respectively. In 3.8% and 9.4% of children, a mixed unilateral and bilateral hearing loss was confirmed, respectively.

In children with a pass results of OAE tests at the 1st level and concomitant risk factors (RF), hearing loss was diagnosed in 1.8% of cases. In children with "refer" results of OAE tests without RF, hearing loss was diagnosed in 9.8% of cases, and in children with: "refer" results of OAE tests and concomitant RFs, hearing loss was found in 25% of cases. In children without hearing screening at first level and without risk factors, hearing loss was found in 3.6% of cases, and in children without hearing screening but with RFs present, hearing loss was found in 8.6% of cases. In a group of children with a pass OAE test result at the 1st level and without risk factors (RF), i.e., in a group of children theoretically not referred for further audiological diagnosis, hearing loss was found in 2.3% of cases (Figure 1) (Pearson's chi-square, p = 0,0000).

Results - Level 3

Data from the third reference level covering 23 centres indicate that of children diagnosed with hearing loss 58.2% are referred for fitting of hearing aids, 34% are referred for surgical treatment, and 7.8% require appropriate rehabilitation.

CONCLUSIONS

The analysis presents data for over 4.3 million of children covered by the Polish Universal Neonatal Hearing Screening Program. The absolute number of children covered by hearing screening is high as such, but only by comparing it with statistical data for live births in Poland (GUS), a universal nature of this Program can be demonstrated. The recorded number of registrations at the 1st level of the program, being 96%, qualifies Poland as one of 19 countries in Europe and only a few in the world, in which the hearing screening covers more than 95% of neonatal population [8]. Of 11,448 of children diagnosed with hearing loss, as many as 46.4% of cases are children with bilateral sensorineural hearing loss. The Polish results do not differ from those in the global literature, where the hearing loss rate is estimated to be at the level from 1–2 cases per 1000 births for the hearing threshold of >=40 dB for a better hearing ear to 2–3 cases per 1000 births for the hearing threshold of >=25 dB for a better hearing ear. When a hearing loss threshold of >=70 dB for a better hearing ear is assumed, this frequency is 4–10 per 10,000 children [4, 5, 6, 9].

There is a statistically significant difference in the hearing loss incidence in children in a group based on a risk factor presence, and in a group based on OAE test results at the PUNHSP 1st level. It should be noted that hearing loss in children from the highest risk group, i.e., with "refer" result of OAE test at the first level accompanied by RFs, was diagnosed in as many as 25.5% of children, while in children with "refer" result of OAE test and without RFs it was found in 9.8% of studied cases. A similar percentage of children with hearing loss was found in the group without OAE screening test at the first level, but with RFs recorded. In that case, hearing loss was diagnosed in 8.6% of children.

When comparing the hearing loss rate in group in children with "pass" result of the OAE test and without RFs versus those with RFs, it can be seen that hearing loss is more frequent in the group without (2.3%) than with (1.8%) RFs (Fig. 1). According to the Program assumptions, in theory children with a "pass" results of OAE tests and without risk factors should complete their participation in the program at the 1st level. However, the results analysis shows that on average 5,304 ± 1,381 SD of such children report at the PUNHSP 2nd reference level every year. They represent 1.4% of children with a pass result of OAE test t without RFs recorded at the PUNHSP 1st level.

In children with "refer" result of OAE tests , without OAE test, or with risk factors recorded, the referral rate at the 2nd level corresponds to 55.8%. It is not possible to analyse the number of reported cases solely on a basis of information recorded in the program database. However, it should be noted that not all ENT and audiology clinics in Poland participate in the program Therefore, it can be assumed that some children are diagnosed at centres outside the program,

The Polish Universal Neonatal Hearing Screening Program is continuously adapted to new requirements and strives to improve availability of the 2nd and the 3rd level centres, and to obtain continuously improved results. The above analysis is an introduction to a series of publications summing up the results of this largest health promoting program in Poland.

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standardów postępowania medycznego przy udzielaniu świadczeń zdrowotnych z zakresu opieki okołoporodowej sprawowanej nad kobietą w okresie fizjologicznej ciąży, fizjologicznego porodu, połogu oraz opieki nad noworodkiem).

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