Early Hearing Detection in Cyprus: Communication Skill Outcomes

Chryssoula Thodi[1], Marios Vogazianos[2], Paris Vogazianos[2]

[1]: European University Cyprus; [2]: Center for Preventive Pediatrics, Cyprus

Abstract

Universal Newborn Hearing Screening (UNHS) has been implemented in Cyprus since 2005, evaluating over 95% of the newborn population. Age of identification is around the 4th week, and age of hearing confirmation is before the second month. The Cyprus UNHS refers 5‰ of the screened infants for diagnostic evaluation; all referred infants receive diagnostic services, and 4.6‰ are diagnosed with some degree of hearing loss. Communication skill development outcomes were measured in children diagnosed with hearing loss from the UNHS. Receptive and expressive language, as well as cognitive measures were compared between groups of children with normal hearing, unilateral, and bilateral hearing loss, based on degree of hearing loss and amplification option. Results indicated that some language outcomes were related to severity of hearing loss and intervention. There were groups of children with language skills commensurate to normal hearing peers; there were also children whose performance was lower than that of children with normal hearing. These outcomes were related to aspects of Early Intervention, indicating areas for improvement.

Introduction

Permanent childhood hearing impairment can have a devastating impact on communication skills, educational attainment, and quality of life, with a high cost to society. Babies learn to speak and communicate orally mainly through audition. Hence, the earlier we can identify and support children with a hearing loss, the better chances they have to develop spoken language and oral communication skills and improve their mental, social, and educational potential. Children who are identified with hearing loss early and receive proper intervention and support have the potential to develop language abilities that compare to those of normal hearing peers (Fitzpatrick et al., 2011; Fulcher et al., 2012; 2014; Sininger, Grimes, Christensen, 2010).

Universal Newborn Hearing Screening (UNHS) has been implemented in Cyprus since 2005, evaluating over 95% of the newborn population. Age of identification is around the 4th week, and age of hearing confirmation is before the second month. Amplification is fitted between 4 and 6 months, and cochlear implantation takes place before the first birthday. The reported work followed children referred for hearing assessment by the Cyprus UNHS to assess language outcomes and efficacy of intervention.

Methods

Participants

Families of children who had been referred by the UNHS were invited to participate in the follow-up study. Forty nine families responded to the call. Thirty two (32) children were ages 4-8 years, 11 with normal hearing, 11 with binaural hearing loss, and 10 with unilateral hearing loss. Seventeen children (17) were 3-4 years old, with similar distribution in hearing status. Children with bilateral hearing loss used hearing aids (HA)

or cochlear implants (CI), whereas children with unilateral hearing loss did not use amplification.

Materials

Children older than 4 years were given the Raven Matrices test (Raven, Raven, Court, 1998), and were invited to complete the Word Finding Test (WF), (Vogindroukas, Protopapas, Sideris, 2009), and to respond to the Action Picture (AP) Test, (Vogindroukas, Protopapas, Stavrakaki, 2011). The WF test assesses expressive vocabulary, whereas the AP test assesses children's' pragmatic skills and morphosyntax. Children younger than 4 years were assessed with an adaptation to the Cypriot Language of the McArthur Bates Communication Development Inventory (Hamilton, Plunkett, Schafer, 2000). A compound language development index was calculated for all children, based on age-related percentile scores, in order to compare performance across age, hearing, and intervention groups.

Results

Percentile correct performance was calculated for the language tests used based on published norms. A compound language development index was calculated for all children, based on these age-related percentile scores. Analysis of Variance comparing language performance between the hearing/intervention groups showed no difference ($p>0.05$) in overall language measures between children with normal hearing, bilateral hearing loss (HA), or bilateral deafness (CI), and children with unilateral hearing loss. Figure 1 shows the language indices for children with normal hearing and unilateral hearing loss, and children with bilateral hearing loss.

Figure 1. Language development, hearing level, and intervention type

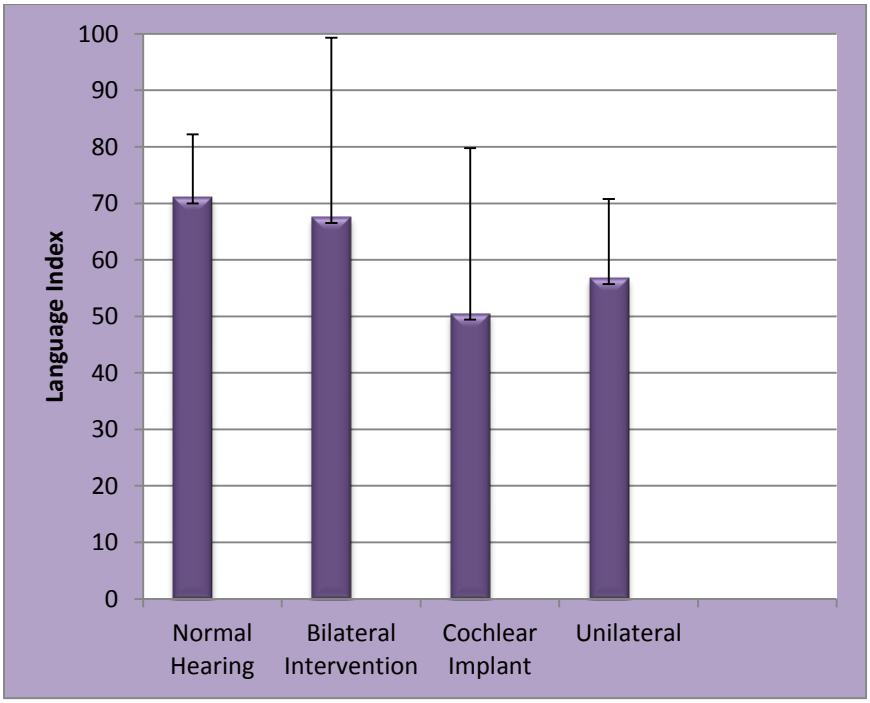

Table 1 presents descriptive statistics for children's performance on specific language tests according to hearing status (WF: Word Finding; AP: Action Pictures; CDI: Communication Development Inventory).

Table 1. Language means and standard deviations according to hearing level

			WF	AP	CDI
Normal H		**Average**	**64.7**	**50.0**	**86.7**
		SD	**31.4**	**23.7**	**7.1**
Unilateral HL		**Average**	**59.5**	**62.7**	**63.6**
		SD	**34.4**	**19.1**	**26.8**
Bilateral HL		**Average**	**50.8**	**61.2**	**61.4**
		SD	**34.2**	**20.4**	**21.0**

Analysis of Variance Comparison of performance on the Word Finding and Action Pictures language tests between children with normal hearing, unilateral hearing loss, and bilateral hearing loss showed that there were no differences between the children with HA and children with normal hearing ($p>0.05$). Children with CI scored lower on the Word Finding test than children with HA ($p=0.02$), and children with normal hearing ($p=0.002$). On the Action Pictures test there were no differences between the groups, resulting in overall similar performance shown on the compound language index.

Discussion

Newborn hearing screening programs have been validated by outcome studies that consistently show that timely identification and appropriate intervention can reverse the catastrophic effects of hearing loss on the development of spoken language (Fitzpatrick et al., 2011; Fulcher et al., 2012; 2014; Sininger, Grimes, Christensen, 2010).

Children with hearing loss referred by the Cyprus UNHS (using hearing aids or cochlear implants) showed language skills commensurate to those of normal hearing peers. These results concur with Fitzpatrick et al. (2012), who reported that children with moderately severe or severe hearing loss can develop language skills commensurate to those of children with normal hearing. However, in contrast to the Fitzpatrick, (2012) study we found that overall children with CI performed similarly on the language measures. The children using CI in this study were identified early, and implanted close to the first year of age. The difference of at least a year in the implantation age may account for the higher performance noted among children participating in the present investigation.

Children with CI performed lower than normal hearing peers or children with HA on the Word Finding test. Schwartz et al. (2013) reported that children with CIs have poorer selective attention and control, which might provide an explanation for the lower lexical access efficiency exhibited in this study.

This first follow-up of children referred by the Cyprus UNHS affirms the value of newborn hearing screening by documenting that early identified children with bilateral hearing loss and deafness who use hearing aids and cochlear implants develop language at levels comparable overall to those of normal hearing peers. Further analysis of factors affecting lexical access and development of language with cochlear implants may facilitate services and support to children with CI.

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