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Cochlear Implant Decision-Making for Children with Residual Hearing

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Eunjung Na, PhD candidate
Elizabeth Fitzpatrick, PhD
Karine Toupin April, PhD
Janet Olds, PhD

Introduction

Candidacy criteria for pediatric cochlear implantation have changed and expanded over the years to include children with greater degrees of residual hearing. More recently, the criteria have expanded to also include children older than age five with single-sided deafness and asymmetric hearing loss.[1] An increasing number of studies of children with residual hearing who received cochlear implants (CI) have reported improvements in many areas including speech, language and auditory functioning.[2–4] Positive clinical outcomes, new device technology, and new surgical techniques have contributed to this increase in implanting children with more residual hearing.

According to a recent survey in the U.S.,[5] 63 of 81 (78%) surgeons performed CI surgery for off-label (better than severe-profound hearing loss) or non-traditional

indications in children and adult populations. Of these surgeons, 21 (27%) reported that it would be useful to have FDA approval of CI candidacy for people who have greater degrees of residual hearing. Evidence-based guidelines from an Australian research group recommend that implantation be considered for children with unaided pure-tone average (PTA) hearing levels in the range of 65–80 dB HL.[6] Similarly, a recent systematic review published in 2018 reported that CIs are recommended for children with PTA thresholds in the range of 70–-90 dB HL.[7]

Despite these trends, some clinicians may still be uncomfortable recommending CI for these children due to variability in audiometric candidacy criteria in clinical practice.[2,7,8] This variation in determining CI candidacy for children with residual hearing may result in healthcare inequity in terms of access to optimal hearing technology.[5] It is generally agreed that during the CI assessment process, families and practitioners need to consider individual environmental factors and characteristics rather than just adhering to audiometric criteria.[8,9]Assessments of the child's auditory functioning usually involves the use of auditory behaviour questionnaires, closed-set, and open-set word and sentence tests that are selected clinically depending on the child's age and linguistic function. However, Wilson et al. reported that when children show usable residual hearing,[10] it is a challenge for practitioners to confidently determine whether they will derive greater benefit from CIs compared to hearing aids.[10] The lack of specific candidacy criteria and guidelines regarding residual hearing can complicate the decision-making process.[11]

Decision-making about CI for these children is also difficult for parents because they experience more uncertainty when their children show auditory benefits and are developing language through HAs.[2,12,13] There is very limited information about CI decision-making to assist parents and practitioners related to this population of children.[14] Therefore, we conducted a comprehensive study at the Children's Hospital of Eastern Ontario (CHEO) and the University of Ottawa to examine the characteristics and outcomes of children with residual hearing and to better understand the decision-making experiences of families and practitioners.

Objectives and Methods

Our study involved three inquiries: (1) we explored the clinical characteristics and outcomes of children with residual hearing through a retrospective medical chart review, (2) summarized the evidence about the benefits and risks of CI compared to HAs in children with residual hearing through a systematic review, and (3) explored the decision-making process and needs for children with residual hearing from the perspective of parents and practitioners by using qualitative research methods.

Preliminary Findings

Chart Review

In our retrospective study, we found that a total of 100 of 389 (25.7%) children who received CI from 1992 to 2018 at CHEO had residual hearing. Children with residual hearing took longer to receive CIs compared to children with bilateral profound hearing loss (median time of 29.6 months [interquartile range-IQR: 11.8, 61.4] vs. 16.7 months [IQR: 7.8, 46.8]), suggesting that decision making may take longer due to uncertainty. Auditory behaviour and speech perception data were available for 83 (83.0%) of the children and demonstrated that they received important benefits following CI. Approximately 70% of these children achieved open-set word perception scores of 80% or more post-CI.

Systematic Review

Our systematic review included eight studies on children with residual hearing who received CI, conducted from 2003 to 2019. These studies indicated that children with CI showed significantly better speech perception scores than those with HAs based on evidence from four weak to moderate quality studies. Two weak quality studies also suggested some improvement in speech intelligibility (results not statistically significant). Two aspects of social-emotional functioning (hyperactivity/inattention and pro-social behaviour) showed significant benefit from a CI in one weak quality study. Four studies provided data on risks following CI including loss of residual hearing and discontinued or limited use of CI in children with residual hearing.

Qualitative Findings

Our interviews with practitioners and parents revealed that CI decision-making for children with residual hearing remains challenging. However, practitioners reported that confidence in determining candidacy and supporting parents has increased largely due to their experiences with positive outcomes for these children. Practitioners identified the need for more evidence-based information to assist them in guiding parents. Most parents indicated that they are satisfied with the CI decision-making for their children; however, they emphasized the importance of receiving more information tailored to their child's specific needs and learning context.

Summary

To our knowledge, this is the first study that examined decision-making for children with residual hearing in the Canadian context. Our study contributes new information about the characteristics of children receiving CI, the potential benefits and risks for children with residual hearing and decision-making needs from the perspectives of families and health practitioners. The proportion of children with residual hearing who receive CI is increasing across Canada and worldwide. Our research is a useful first step in providing evidence to assist the CI decision-making process for this specific population. Additional studies involving collaborative research in audiology and decision-making science can help support decision-making for the families of children with residual hearing.

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