Health Utility and Quality of Life Analysis in Children with Bilateral Cochlear Implantation

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Introduction

Cochlear implantation has been the standard of care for children with severe to profound sensorineural hearing impairment (SNHI) for the past 20 years. While bilateral cochlear implants (CIs) are known to improve sound localization and speech perception in noise compared to unilateral CI, their impact on health utility and quality of life (QoL) has been less explored.

This study aims to evaluate the effect of bilateral CIs on health utility and QoL in children with severe to profound SNHI.

Methods and Materials

From August 2021 to June 2022, 154 children with severe to profound SNHI and 67 children with normal hearing, all under 18 years, were enrolled. Subjects were grouped according to their assistive devices (Figure 1): (a) HA_HA (bilateral hearing aids, n=66), (b) CI_HA (unilateral CI, n=53), (c) CI_CI (bilateral CIs, n=35), and (d) NH (normal hearing, n=67). Questionnaires including EuroQoL Five Dimensions Questionnaire (EQ-5D), Mandarin Children with Cochlear Implants: Parental Perspectives (MPP), and the Mandarin version of Functioning after Pediatric Cochlear Implantation Instrument (FAPCI) were assessed.

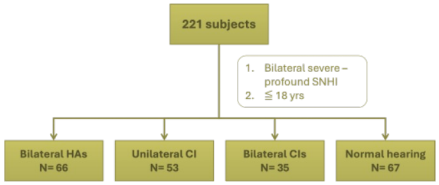

Figure 1. Subjects grouping.

Results

Health utility value was higher in both the CI_CI group (0.96±0.08) and the NH group (0.93±0.17) than in the HA_HA group (0.86±0.22) and the CI_HA group (0.88±0.21) (Figure 2). Within the CI_CI group, no significant difference was found between simultaneous and sequential implantation (0.94±0.62 vs. 0.96±0.08). The CI_CI group (179.2±10.1) outperformed the CI_HA group (172.5±21) in MPP, with a significant difference in the "general functioning" domain (p=0.05) (Figure 3). On the FAPCI, the CI_CI group (87.2±29.6) scored higher than the HA_HA (61.3±33.7) and CI_HA (76.9±32.2) groups and was comparable to the NH group (99.3±22) (Figure 3). Of note, simultaneous implantation resulted in a higher score than sequential implantation (98.8±16.3 vs. 83.9±32.2).

Discussion

In our previous validated version of the Chinese SSQ, bilateral CI users achieved higher scores than unilateral CI users. In the current study, however, no significant QoL improvements with bilateral CI were detected by the EQ-5D or the overall MPP score. Nevertheless, children with bilateral CI, but not those with HAs or unilateral CI, achieved FAPCI scores comparable to normal-hearing peers. This highlights the limited sensitivity of generic instruments and the variability across disease-specific measures.

The MPP, a parent-reported multidimensional tool, assesses both children's functioning and parents' emotional states. Parents rated positively across all domains, with particular satisfaction in social relationships (4.4±0.7), general functioning (4.2±0.6), and reduced concerns about implantation (4.2±0.7) (Figure 4). When analyzed separately, the benefits of bilateral CI were more evident in the children domains, especially general functioning, reflecting either improved performance or parents' more positive perceptions. Notably, the decision domain correlated with general functioning and differed between bilateral and unilateral CI, suggesting that confidence in implantation may shape parental ratings of outcomes. This underscores the importance of counseling to support parents and sustain positive parent-child interactions.

For younger children (<7 years), the FAPCI revealed that only bilateral CI restored functional communication to levels comparable with normal-hearing peers, whereas unilateral CI and bilateral HAs scored lower. Together, these findings indicate that disease-specific instruments, particularly MPP and FAPCI, better capture the functional and psychosocial benefits of bilateral CI than generic QoL tools.

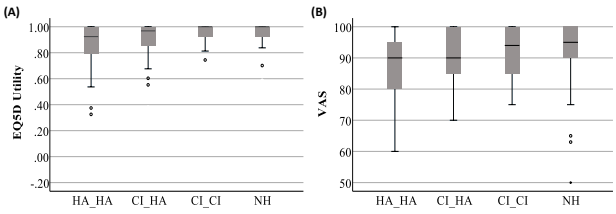

Figure 2. Health utility analysis with EQ-5D (A) and VAS (B).

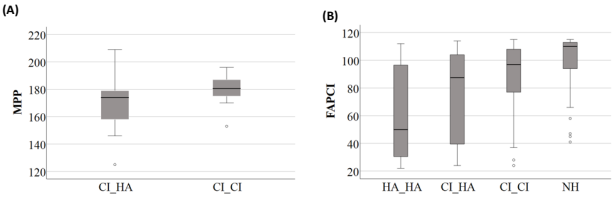

Figure 3. Comparison of the auditory and speech performance evaluated by MPP (A) and FAPCI (B).

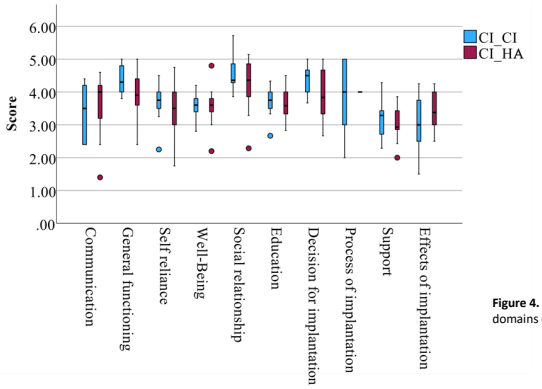

Figure 4. Comparison across the domains of the MPP.

Conclusions

Children with bilateral CI showed superior functional outcomes, comparable to normal-hearing peers. Disease-specific instruments evaluating different domains of quality of life provide more details than generic measures. Parental confidence and support play a crucial role in maximizing cochlear implant outcomes, integrating parental counseling into cochlear implant programs may enhance the child's developmental trajectory.

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