BIAP Recommendation 07/9:

Indications for Cochlear Implantation in Children with Single-Sided Deafness

General foreword

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Introduction

For children with congenital or early acquired profound single-sided deafness (SSD) and limited usable hearing unilaterally (LUHU) (1), cochlear implantation (CI) is an option aimed at improving auditory perception, localization and speech development. Below is an overview of the indications, benefits and rehabilitation considerations.

Recommendation

Indications

Cochlear implantation is indicated for children with SSD if:

1. There is a mandatory commitment by parents and family to enter a program (surgery, rehabilitation, consistent device use, supporting the long-term rehabilitation process), which requires a significant time investment.
2. There is profound hearing loss in one ear with normal or near-normal hearing in the other ear.
3. Inner ear imaging does not show contra-indications or an increased risk by surgery.
4. Critical periods for auditory development (especially ages 1−3) are prioritised, as early intervention during this period may lead to better auditory and linguistic outcomes. Brain neuroplasticity is optimal under the age of 2 years so is an ideal period for cochlear implantation. (2, 3, 4).

The major goal is to develop binaural hearing that allows sound sources localisation and a better understanding in noisy environments.

The goal is also that the **central auditory processes development** will be improved. (5).

Benefits of Cochlear Implantation in SSD Children

CI can provide several advantages for children with congenital SSD:

1. **Reduction in listening fatigue** for children (similar to that in those with bilateral hearing loss).
2. **Enhancement of Sound Localisation**. By providing auditory input to the deaf ear, CI can help children develop the ability to locate sounds in their environment. This is crucial for safety and navigating complex auditory environments.
3. **Improvement in Speech Perception in Noise**. With CI, children with SSD may experience improved speech understanding in noisy environments, as the implant helps balance auditory input from both sides.
4. **Support of Speech and Language Development**. Studies suggest that early cochlear implantation in children with SSD can support more typical development of speech, language and auditory skills, as the brain receives bilateral auditory input during critical periods.
5. **Prevention of Auditory Deprivation risks**. Early intervention in SSD may prevent the deprived ear from further neural decline, which could reduce potential limitations in binaural processing and auditory pathway development over time.

Rehabilitation Considerations

The success of cochlear implantation in children with SSD depends significantly on post-implant rehabilitation. This includes:

1. **Auditory Training and Therapy**, which focuses on auditory training to help the child recognise and differentiate sounds from the CI, improve speech perception, and gradually build confidence in using auditory cues from both ears. Training often starts with simple sounds and gradually incorporates complex sounds and speech in various listening environments.
2. **Wireless connection systems**, which are a very good tool to stimulate exclusively the implanted ear (6).
3. **Mandatory regular wearing of the sound processor** (when awake), even if the immediate benefit is not evident. Data-logging will be useful.
4. **Bimodal Stimulation Integration.** Children with SSD need to learn how to integrate sound from the implant with their normal hearing ear. Therapy often includes exercises that encourage binaural hearing, such as localising sounds and practicing speech perception in both quiet and noisy settings.
5. **Family Involvement and Support.** Since children with SSD might initially find it challenging to adapt to the new auditory input, consistent encouragement and support from family are essential. Families are often guided on how to incorporate listening exercises at home and in daily activities.
6. **Monitoring and Adjustments.** Regular assessments with audiologists and speech-language therapists are crucial to monitor the child's progress and make necessary adjustments to the CI device settings. This may involve fine-tuning the implant for optimal auditory balance with the natural ear.
7. **Peer Interaction and Social Listening Practice.** Social interactions are valuable for children with SSD who are adapting to CI. Group auditory exercises, play-based

listening and interaction in noisy settings (such as classrooms) help reinforce the use of binaural auditory cues and speech perception skills in real-world settings.

Outcomes and Considerations

Early implantation in SSD has shown promising results in supporting typical auditory and language development, but outcomes vary with factors such as the age at implantation, rehabilitation engagement and neural plasticity. While cochlear implantation does not restore typical hearing, it provides a significant functional benefit by helping balance auditory input, which can be pivotal for language development, social engagement and overall quality of life.

Cochlear implantation should be carefully weighed against potential risks and benefits especially in case of inner ear malformation(s) or other general medico-surgical considerations.

Complete vestibular assessment is mandatory. (7)

Regular monitoring of the contralateral ear is essential.

In summary, cochlear implants for children with congenital SSD, along with thorough rehabilitation, can play a crucial role in developing binaural auditory skills, which are essential for language, social interactions and day-to-day auditory processing.

References

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This recommendation was created and approved in a multidisciplinary cooperation between professionals of all audiophonologic disciplines, which are medicine, audiology, pedagogy, speech therapy, psychology and hearing instrument audiology.

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