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Speech-Language & Audiology Canada
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SAC Position Paper on

Unilateral Hearing Loss in Children

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A position paper represents the direction CASLPA has taken on a particular topic or provides guidelines for particular areas of practice. These positions are time-bound, representing the thinking at a particular point in time.

Position

It is the position of Speech-Language & Audiology Canada (SAC) that unilateral hearing loss (UHL) in childhood has important consequences for development in areas such as auditory communication, academic and social functioning. Newborn hearing screening and early hearing loss detection is an essential step to ensure that children with UHL are identified and can access appropriate and timely intervention. This includes caregiver support and coaching, consideration of hearing technology options, monitoring and direct therapy services when required. These services should be provided within the context of an Early Hearing Detection and Intervention (EHDI) program.

Background

Definitions: Unilateral hearing loss (UHL) refers to any degree or type of hearing loss in one ear with normal hearing sensitivity in the other ear. Typically, normal hearing sensitivity in children is defined as thresholds better than or equal to 15 dB HL. Profound unilateral sensorineural hearing loss has frequently been described using the term single-sided deafness both clinically and in the literature. In this document, the audiologic term profound unilateral sensorineural hearing loss is used rather than single-sided deafness. Unilateral permanent conductive hearing loss (e.g., due to atresia) and auditory neuropathy spectrum disorder are also considered within the broad category of UHL within this document.

Prevalence: UHL estimates vary depending on the population sampled, definitions and methods utilized to determine hearing thresholds. Estimates from newborn hearing screening programs suggest approximately one in 1000 infants will have UHL (Lieu, 2018). These numbers increase with age due to late onset and acquired hearing loss with estimates ranging from 3 to 14% in the 3- to 19-year-old age range (Lieu, 2018; Shargorodsky, Curhan, Curhan, & Eavey, 2010). Data from population-level newborn hearing screening cohorts in Canada indicate that one in five to one in seven children who are identified with permanent hearing loss have UHL (Bagatto et al., 2016; Fitzpatrick, Al-Essa, Whittingham, & Fitzpatrick, 2017). Research reveals that 30-40% of children with UHL show deterioration in hearing over time and 10-20% eventually develop bilateral hearing loss (Fitzpatrick et al., 2017).

Developmental Outcomes: UHL results in a loss of binaural function which negatively impacts sound localization and speech perception abilities in noise. Sound localization is the ability to determine the location of sound sources in the environment and is important for both communication and safety. Listening in noise requires the ability to segregate or separate important sounds, like speech, from other less important sounds or background noise (Steckler & Gallun, 2012). Both of these skills involve spatial listening that is, comparing acoustic information perceived at one ear to that at the other. This requires the use of interaural cues (i.e., the difference between arrival time and between the level of the signal at the two different ears). Children with UHL have impaired spatial listening abilities (Gordon, Henkin, & Krai, 2015). There is some evidence that with UHL the auditory system reorganizes itself to strengthen input from the ear with normal hearing and weaken pathways from the impaired ear. Consequently, the child has a reduced ability to utilize spatial sound cues. These skills are very important in children as they enhance incidental learning and decrease fatigue and cognitive load (Litovsky & Gordon, 2016).

Recent studies have examined the impact of increased listening effort on learning and behaviour in children with normal hearing sensitivity and those with hearing loss (McGarrigle, Gustafson, Hornsby, & Bess, 2019). While all children are challenged by unfavourable acoustic conditions, the effects are more pronounced for children with hearing loss, including UHL. Without efficient binaural processing skills, early auditory behaviour, preverbal vocalizations, speech-language development and academic outcomes may be impacted in children with UHL.

Children with UHL are also at risk for difficulties related to vestibular function. A high prevalence of vestibular impairment has been documented in children with sensorineural hearing loss (Cushing, Gordon, Rutka, James, & Papsin, 2013). Precise prevalence data related to vestibular difficulties for children with UHL is limited, but is believed to be higher than in individuals with normal hearing sensitivity. It is estimated that vestibular impairment is present in approximately 50% of children with profound unilateral sensorineural hearing loss (Cushing et al., 2008). It has also been reported that children with profound unilateral sensorineural hearing loss experienced less severe balance deficits than those with profound bilateral sensorineural hearing loss, but more severe than their normal-hearing peers (Wolter et al, 2016). Balance function should be considered as this may be affected in children with UHL due to the lack of symmetrical hearing. There may also be a combined effect of hearing loss and vestibular function such that some consequences of UHL may actually be related to the vestibular impairment. All children with hearing loss, including those with UHL, should have their vestibular and balance function assessed. Vestibulotherapy for children with UHL and vestibular impairment should be considered (Sokolov et al., 2019).

Children with UHL are at risk for difficulties in auditory, communication and cognitive development (Anne, Lieu, & Cohen, 2017; Lieu, 2018; Purcell, Shinn, Davis, & Sie, 2016). Although some children with UHL develop speech and language according to age-appropriate norms, a recent systematic review concluded that overall, these children experience delays in language abilities compared to their peers with normal hearing (Anne et al., 2017). Studies within this systematic review also suggested that children with more severe hearing loss had weaker speech and language skills. Research on early-identified children with UHL also showed that they are at risk for lower vocabulary and language levels compared to their hearing peers (Fitzpatrick et al., 2019; Kishon-Rabin, Kuint, Hildesheimer, & Ari-Even Roth, 2015). The presence of fluctuating conductive hearing loss in one or both ears may also compound the impact of permanent UHL in infants and young children (Graydon, Rance, Dowell, & Van Dun, 2017).

Historically, concerns have emerged about the academic functioning of children with UHL and recent studies tend to support these findings (Porter, Bess, & Tharpe, 2016). Difficulties have been reported in a range of areas including educational, social and behavioural domains (Porter et al., 2016). Other research has shown that children with UHL required individualized educational plans at three times the rate of their siblings without hearing loss (Lieu, 2013). It is unclear whether these educational difficulties stem from weaker language abilities such as lower vocabulary levels, difficulties localizing sound and optimally accessing information in a busy classroom or possibly some combination of these or other factors (Lieu, Karzon, Ead, & Tye-Murray, 2013).

The growing body of research has led to a consensus that UHL of any degree in childhood presents as a risk factor for difficulties in at least some developmental areas. Consequently, UHL in children is increasingly recognized as a public health and educational issue requiring attention from audiology and rehabilitation professionals.

Rationale

In the context of EHDI, children with UHL are now identified in infancy and early childhood. However, UHL specifically may not be part of the target disorders for EHDI programs in all jurisdictions. This is largely due to the limited research about the benefit of intervention. For many clinicians there is uncertainty around the need for and the most appropriate intervention for children with UHL. Consequently, treatment approaches range from watchful waiting to the use of hearing technology such as hearing aids or cochlear implants as well as speech and language intervention. The consequences of UHL are not well understood, especially when hearing loss is identified in infancy. Given the increasing number of children identified with UHL at a younger age and the lack of clear evidence regarding intervention, it is important for audiologists, speech-language pathologists and other professionals interacting with these children and their families to stay current with emerging research.

The provision of information to families regarding the potential impacts of UHL, including speech, language, academic, and social issues, is an important component of the care process. Families need an understanding of how auditory deprivation and binaural advantages can impact their child's development.

Recommendations

When a child is diagnosed with a UHL, it can be a very confusing and overwhelming time for families. Families are faced with an inordinate amount of information about their child's hearing loss, technology and other intervention options. Caregivers have expressed concerns regarding the time needed for audiology and medical appointments, their child's communication development and the impacts on educational achievements. Research shows that professional attitudes, communication and manner are important contributors to caregivers' perceptions and can greatly impact their decision-making process (Fitzpatrick et al., 2016).

Evidence-based counseling is a key component during the diagnosis, intervention and ongoing audiologic care of a child with UHL (Munoz, Price, Nelson, & Twohig, 2019) and family-centred support improves communication between families and the audiologist (Bagatto et al., 2019). Shared decision-making is an important element of family-centred care where the audiologist supports the family in making a decision that is consistent with their values and considers their expectations. In light of continued clinical uncertainty about technology and intervention options for children with UHL, caregivers need to receive adequate information from the audiologist and other care providers to make an informed choice. Using support tools such as visual aids and decision aids may help caregivers in their decision making (Porter, Creed, Hood, & Ching, 2018).

Hearing Technology*:* The provision of a hearing aid is recommended for children with UHL if the degree of hearing loss on the affected side permits the child to receive appropriate speech audibility from either an air or bone conduction hearing aid (McCreery, Bentler, & Roush, 2013; Moodie, Scollie, Bagatto, & Keene, 2017). Typically, mild to severe degrees of hearing loss receive appropriate audibility through a hearing aid, depending on the frequencies affected. A remote microphone system is also recommended, especially for classroom settings. For children with profound unilateral sensorineural hearing loss, contralateral routing of sound (CROS) devices may be considered if the child can orient their head to avoid noise sources. This applies to both air and bone conduction devices that contralaterally route sound. Consistent with any hearing aid fitting, appropriate gain, output, frequency bandwidth and sound quality should be considered.

Children with profound unilateral sensorineural hearing loss may also be considered candidates for a cochlear implant. The use of a cochlear implant for UHL began as a treatment for tinnitus in adults with UHL (Van de Heyning et al., 2008) and has expanded to both adults and children with profound UHL (Arndt et al., 2015). Abnormal cortical function is seen in individuals with profound unilateral sensorineural hearing loss and preliminary evidence suggests that implantation reverses this, such that normal hemispheric representation of sound in the brain is restored (Polonenko, Gordon, Cushing, et al., 2017). For children with profound UHL, research suggests that to be effective, cochlear implantation should occur as soon as possible after onset and within the first four years of deafness (Gordon & Kral, 2019). Intervention is required post-implantation to help the child with UHL learn to integrate the acoustic and electric signals.

Functional Outcomes: Hearing technology in children requires careful monitoring and evaluation of benefits. In recent years, functional outcome measures have been widely adopted to identify areas of concern and to validate the benefits of hearing devices. Several functional outcome questionnaires have been developed for these purposes and are recommended for children with UHL in a recent consensus statement (Bagatto et al., 2019). These include caregiver and child questionnaires that assess areas such as localization abilities (e.g., Speech Spatial and Qualities of Hearing Questionnaire) (Gatehouse & Noble, 2004) and listening behaviours (e.g., Early Listening Function, LittlEARS Auditory Questionnaire, Parents Evaluation of Aural/Oral Performance of Children) (Anderson, 2000; Ching & Hill, 2007; Tsiakpini et al., 2004). There are also questionnaires to be completed by teachers in order to document functioning in school, such as the Screening Instrument for Targeting Educational Risk (Anderson, 1989) and the Teachers' Evaluation of Aural/Oral Performance of Children (Ching & Hill, 2005). When choosing outcome measures, consideration of chronological as well as developmental age of the child is critical.

Given that children with UHL are at risk for further deterioration in hearing in one or both ears, it is important to continue to monitor their auditory abilities through audiologic and functional assessments.

Speech-language Intervention: As noted previously, some children with UHL will develop spoken communication along typical developmental trajectories. However, given that these children are at risk for auditory and communication development delays as compared to their hearing peers, intervention for children and their families that extends beyond hearing technology should be considered for children with UHL. While these children, especially with the benefit of early hearing loss detection and intervention, may not require the intensity of therapy typically required for children with bilateral hearing loss, their development in auditory, language, and related skills must be carefully assessed and monitored using conventional standardized speech-language measures, caregiver questionnaires, and functional outcome measures (Bagatto et al., 2018). Additional intervention and caregiver coaching should be provided if needed to facilitate auditory, linguistic and cognitive development. Furthermore, intervention and support for families can lead to increased duration/frequency of hearing technology use which can be monitored with daily use logs (Ganek, Cushing, Papsin, & Gordon, 2020). There is some evidence that intervention can be beneficial for children with UHL in improving speech recognition abilities in noise (Tavora-Vieira & Rajam, 2015; Hassepass et al., 2013), sound localization and spatial hearing (Ganek et al., 2020; Hassepass et al., 2013; Tavora-Vieira & Rajan, 2015).

Conclusions

The majority of children with UHL are identified in infancy and early childhood in regions with EHDI programs. There is evidence that UHL may affect children in multiple developmental domains. Technology and other interventions can reduce the negative consequences associated with UHL. However, best practices in intervention for these children are still relatively new and continue to develop. Audiologists must continue to apply current evidence to support families in decision-making. Ongoing research is needed to better understand the impact of UHL for different children and how to provide optimal interventions.

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