

Vestibular (Balance) Disorders in Children with Hearing Loss



What Does the Vestibular System Do?

The vestibular system is responsible for tracking motion and orientation of the head. This information, along with input from our eyes and sense of touch, is sent to the brain to interpret the position of the body. When all areas function together normally, the human body has good balance. A vestibular organ is located on each side of the head sharing fluid with the cochlea (organ of hearing). If hearing is affected, then the vestibular system can also be affected on one or both sides.

Incidence and Causes of Balance Issues

Research shows an incidence of 20 – 70 % of children with sensorineural hearing loss also have balance issues. Prevalence increases with severity of hearing loss. Children with profound degree of hearing loss are more likely to have balance issues than a child with mild degree of hearing loss.

The following are known causes of vestibular dysfunction in the pediatric population with hearing loss:

- Otitis media (common ear infection)
- Large vestibular aqueduct syndrome
- Idiopathic congenital hearing loss
- Common syndromes associated with hearing loss: Usher, Waardenburg, Pendred, and Alport
- Cytomegalovirus (CMV)
- Hearing loss caused by meningitis
- Abnormal anatomy of the vestibular organ
- Acquired post-surgery (cochlear implantation)

Symptoms of Vestibular Dysfunction

Symptoms can be congenital (born with) or acquired. Clumsiness and frequent falling are common. Vertigo (spinning sensation that can last seconds to days) may be experienced. Young children unable to verbally express “spinning” may cling to parents, have difficulty sleeping, or have no desire to stand. Rhythmic eye movements (nystagmus) may be observed when these symptoms occur.

Developmental delays in head control, unsupported sitting, standing, walking, and hopping may also indicate issues with the vestibular system. Delayed fine and gross motor development and vision problems can be associated with abnormal balance. Children may also have difficulties with reading.

Decline in balance skills can be observed in children with progressive hearing loss. Concern for changes in balance should be discussed with the managing physician, to coordinate any indicated referrals to other healthcare specialists.

Vestibular Function Testing

Available tests to assess balance in the pediatric population may vary depending on the patient’s age and physical ability. The vestibular evaluation may include assessment of visual acuity, detailed questionnaires about the patient’s vestibular development, or specific tests using goggles and placing the patient in different positions. The managing physician will determine which tests are required based on the child’s symptoms and medical history.

Management and Treatment

Vestibular habilitation or rehabilitation therapy can help correct the dysfunction or help the patient develop compensation techniques to minimize symptoms. This type of therapy is usually provided by a physical or occupational therapist. Therapy is typically initiated at 3-4 years of age. This age range is an important time for developing balance skills. Failure to start therapy may delay development/improvement of vestibular skills. To manage vestibular function, monitoring of ongoing vestibular development or deterioration of balance skills is strongly advised.

Resources:

Vestibular Disorder Association:

<http://vertigo.org>

American Balance Institute:

http://dizzy.com/education_foundation.htm

Cincinnati Children's Hospital:

<https://www.cincinnatichildrens.org/service/a/audiology/programs-services/additional>

References:

Akdogan, O., Selcuk, A., Ozcan, I., & Dere, H. (2008). Vestibular nerve functions in children with auditory neuropathy. *International Journal Of Pediatric Otorhinolaryngology*, 72(3), 415-419. <http://dx.doi.org/10.1016/j.ijporl.2007.11.004>

Christy, J. & Rine, R. *Part II: Pediatric Vestibular Disorders- Assessment for children. Vestibular Disorders Association*. Retrieved 12 January 2017, from <http://Vestibular.org>

Cushing, S., Gordon, K., Rutka, J., James, A., & Papsin, B. (2013). Vestibular End-Organ Dysfunction in Children With Sensorineural Hearing Loss and Cochlear Implants. *Otology & Neurotology*, 34(3), 422-428. <http://dx.doi.org/10.1097/mao.0b013e31827b4ba0>

Cushing, S., Papsin, B., Rutka, J., James, A., & Gordon, K. (2008). Evidence of Vestibular and Balance Dysfunction in Children With Profound Sensorineural Hearing Loss Using Cochlear Implants. *The Laryngoscope*, 118(10), 1814-1823. <http://dx.doi.org/10.1097/mlg.0b013e31817fadfa>

Fernandes, R., Hariprasad, S., & Kumar, V. (2015). Physical therapy management for balance deficits in children with hearing impairments: A systematic review. *Journal Of Paediatrics And Child Health*, 51(8), 753-758. <http://dx.doi.org/10.1111/jpc.12867>

Gioacchini, F., Alicandri-Ciufelli, M., Kaleci, S., Magliulo, G., & Re, M. (2014). Prevalence and diagnosis of vestibular disorders in children: A review. *International Journal Of Pediatric Otorhinolaryngology*, 78(5), 718-724. <http://dx.doi.org/10.1016/j.ijporl.2014.02.009>

Jerome, A., Kannan, L., Lakhani, H., & Palekar, T. (2013). Prevalence of Vestibular Dysfunction in Hearing Impaired Children. *International Journal Of Pharmaceutical Science And Health Care*, 2(3).

Karltorp, E., Löfkvist, U., Lewensohn-Fuchs, I., Lindström, K., Eriksson Westblad, M., & Teär Fahnehjelm, K. et al. (2014). Impaired balance and neurodevelopmental disabilities among children with congenital cytomegalovirus infection. *Acta Paediatrica*, 103(11), 1165-1173. <http://dx.doi.org/10.1111/apa.12745>

Maes, L., De Kegel, A., Van Waelvelde, H., & Dhooge, I. (2013). Rotatory and Collic Vestibular Evoked

Myogenic Potential Testing in Normal-Hearing and Hearing-Impaired Children. *Ear And Hearing*, 35(2), e21-e32. <http://dx.doi.org/10.1097/aud.0b013e3182a6ca91>

Maes, L., De Kegel, A., Van Waelvelde, H., & Dhooge, I. (2014). Association Between Vestibular Function and Motor Performance in Hearing-impaired Children. *Otology & Neurotology*, 35(10), e343-e347. <http://dx.doi.org/10.1097/mao.0000000000000597>

Masuda, T. & Kaga, K. (2014). Relationship between acquisition of motor function and vestibular function in children with bilateral severe hearing loss. *Acta Oto-Laryngologica*, 134(7), 672-678. <http://dx.doi.org/10.3109/00016489.2014.890290>

Nash, R., Veness, J., Wyatt, M., Raglan, E., & Rajput, K. (2014). Vestibular function in children with auditory neuropathy spectrum disorder. *International Journal Of Pediatric Otorhinolaryngology*, 78(8), 1269-1273. <http://dx.doi.org/10.1016/j.ijporl.2014.05.008>

Rine, R. & Christy, J. *Part I: Pediatric Vestibular Disorders- Vestibular impairments in children. Vestibular Disorders Association*. Retrieved 12 January 2017, from <Http://vestibular.org>

Rine, R. & Christy, J. *Part III: Pediatric Vestibular Disorders- Effective intervention or treatment. Vestibular Disorders Association*. Retrieved 12 January 2017, from <http://Vestibular.org>

Seco, C., Oonk, A., Domínguez-Ruiz, M., Draaisma, J., Gandía, M., & Oostrik, J. et al. (2014). Progressive hearing loss and vestibular dysfunction caused by a homozygous nonsense mutation in CLIC5. *European Journal Of Human Genetics*, 23(2), 189-194. <http://dx.doi.org/10.1038/ejhg.2014.83>

Thierry, B., Blanchard, M., Leboulanger, N., Parodi, M., Wiener-Vacher, S., Garabedian, E., & Loundon, N. (2015). Cochlear implantation and vestibular function in children. *International Journal Of Pediatric Otorhinolaryngology*, 79, 101-104.



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