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Editorial Open Access

Non-Tumoral Auditory Brainstem Implantation: The Current Status and Future Directions

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Editorial

The Auditory Brainstem Implant (ABI) is indicated in individuals who suffer from bilateral profound hearing loss associated with congenital or acquired abnormalities of the cochlea and/or auditory nerve. These individuals cannot receive a cochlear implant due to the inability of electrical stimulation through intra-cochlear electrodes. The congenital anomalies include dyplastic or aplastic cochleas and/aplastic or hypoplastic auditory nerves, while the acquired anomalies include neurofibromatosis type 2 (bilateral acoustic schwannomas), cochlear otosclerosis and post-meningitic cochlear ossification.

ABIs have been traditionally practiced in NF2 individuals throughout the world over the last 40 years. These implants need to be placed in the brainstem simultaneously at the time of acoustic neuroma removal. Some of these are also placed as sleeper implants to be activated at a later stage. Bilateral ABIs in tumoral cases have also been performed safely and have shown reasonable success provided the brainstem is not too distorted by the tumors. With such a success over many years among tumoral cases (adults), the focus has today shifted to non-tumoral cases (children) over the last two decades. Today ABI surgery is acknowledged as the treatment of choice for retro-cochlear deafness.

Even though useful auditory information is provided via the ABI, it is established that the results with this device does not match the expected results achieved with cochlear implantation. The reason being the lack of tonotopicity within the cochlear nucleus as noted within the cochlear turns, which leads to frequency specific delivery of auditory information to the brain. Also, due to anatomical variations in the brainstem, electrode placement and stimulation pattern variations, ABI programming is more challenging than CI. These children also need prolonged habilitation with meticulous follow up over many years, as their audition, speech and language skills slowly develop with the device [1,2]. The overall results are satisfactory for environmental auditory awareness and baseline speech intelligibility. ABI helps to understand auditory cues and aids in developing prosody and intonation. Thereby ABI children are able to develop satisfactory communication skills over long term implant use [1-4].

Research in the field of ABI is a 'hot-topic' in international podiums today. Work is currently being done to study PET-CT/functional MRI of the cerebellar flocculus and pons with its surgical findings during implant placement. This in future will help in identifying the 'sweet-spot' in the brainstem to perfectly position the ABI [5-7]. Three dimensional volumetric analysis of the cochlear nucleus is also being investigated to understand the 'onion-peel' like tonotopicity within it - a phenomenon as yet not being tapped by the current ABI devices which have surface electrodes. An attempt at auditory midbrain implantation has been tried by Lenarz and colleagues in Germany, since the inferior colliculus is more tonotopically organized than the brainstem [8]. The future remains exciting with prospects of an auditory cortical implant to directly stimulate the Auditory Brain - that would herald the evolution of the ultimate auditory implant with perfect neuro-bionic integration!

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