Achanta Lakshmipathi Oration
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AUDITORY NEURAL PROSTHESES – A WINDOW TO THE FUTURE

SUMMARY

Hearing loss is one of the commonest congenital anomalies to affect children world-over. The incidence of congenital hearing loss is more pronounced in developing countries like the Indian sub-continent, especially with the problems of consanguinity. Hearing loss is a double tragedy, as it leads to not only deafness but also language deprivation. However, hearing loss is the only truly remediable handicap, due to remarkable advances in biomedical engineering and surgical techniques. Auditory neural prostheses help to augment or restore hearing by integration of an external circuitry with the peripheral hearing apparatus and the central circuitry of the brain. A cochlear implant (CI) is a surgically implantable device that helps restore hearing in patients with severe-profound hearing loss, unresponsive to amplification by conventional hearing aids. CIs are electronic devices designed to detect mechanical sound energy and convert it into electrical signals that can be delivered to the cochlear nerve, bypassing the damaged hair cells of the cochlea. The only true prerequisite is an intact auditory nerve. The emphasis is on implantation as early as possible to maximize speech understanding and perception. Bilateral CI has significant benefits which include improved speech perception in noisy environments and improved sound localization. Presently, the indications for CI have widened and these expanded indications for implantation are related to age, additional handicaps, residual hearing, and special etiologies of deafness. Combined electric and acoustic stimulation (EAS / hybrid device) is designed for individuals with binaural low-frequency hearing and severe-to-profound high-frequency hearing loss. Auditory brainstem implantation (ABI) is a safe and effective means of hearing rehabilitation in patients with retrocochlear disorders, such as neurofibromatosis type 2 (NF2) or congenital cochlear nerve aplasia, wherein the cochlear nerve is damaged or absent on both sides and hence, a cochlear implant (CI) would be ineffective. In such patients, the brainstem implant bypasses the damaged / absent cochlear nerves and directly stimulates the cochlear nucleus in the

brainstem. The auditory midbrain implant (AMI) has been designed for stimulation of the auditory midbrain, particularly the central nucleus of inferior colliculus (ICC). It is used especially in patients with large neurofibromatosis type 2 (NF2) wherein tumor induced damage to the brainstem/cochlear nucleus often co-exists. The efficacy and safety of auditory neural prostheses is well proven. Advancements in technology will enhance the benefit provided by these prostheses.