MECHANICAL ENGINEERING COLLOQUIUM



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GANGWAL SCHOOL OF MEDICAL SCIENCES AND TECHNOLOGY IIT KANPUR

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CONQUERING THE BARRIERS TO PRECISION INNER EAR MEDICINE

ABSTRACT

Protected by one of the hardest bones in body, the cochlea is nearly an impenetrable structure frustrating both bacteria and clinician trying to gain access to it. As a result, a means for reliable delivery of agents into the inner ear for therapeutic purposes remains a formidable challenge. No method currently exists to provide effective and precisely dosed delivery of therapeutics to the inner ear without risking permanent damage to the patient's hearing. We believe that an elegant solution to overcome the difficulties of intracochlear delivery is to use microneedles to facilitate reliable and predictable intracochlear delivery across the RWM without anatomic or functional damage. Intracochlear drug administration has been shown to be superior to transtympanic injection and results in significantly higher and less variable drug levels. In addition, there is a much smaller concentration gradient from base to apex, as is typical of transtympanic injection, resulting in a more even distribution of material. With the availability of a reliable method of inner ear delivery, targeted delivery to hair cells, spiral ganglion neurons or other intra-cochlear structures could be accomplished for the treatment of variety of auditory and vestibular disorders such as sudden or progressive SNHL, Ménière's Disease, and tinnitus.

ABOUT THE SPEAKER

Anil K. Lalwani, MD, is the Dean of the Gangwal School of Medical Sciences and Technology at IIT Kanpur. Dr. Lalwani is considered one of the leading experts on hearing loss in children and adults. His research has focused on two key areas: identifying genes that are critical for hearing and developing and investigating gene transfer technology for the treatment of hearing disorders. More recently, his NIH funded research has focused on the development of microneedle technology for inner ear delivery leading to founding of Haystack Medical to commercialize the technology. He has authored numerous highly cited papers and books. He is the founding Field Chief Editor of the journal Frontiers in Audiology and Otology. The 4th edition of his highly successful book, Current Diagnosis & Treatment in Otolarynology - Head & Neck Surgery was published in 2020; it has been previously translated into Spanish, Turkish, and Portuguese. Dr. Lalwani has served in numerous leadership roles and has provided service to the specialty. He served as the President of American Neurotology Society (2014-2015), American Auditory Society (2017-2018), New York Otological Society (2023), Otosclerosis Study Group (2024-2025), and the Columbia University Asian Faculty Association (2024-26). In 2026, he was given the Association for Research in Otolaryngology's (ARO's) Innovator Award in Clinical Science.