

POST- DOCTORAL FELLOWSHIP IN AUDIOVESTIBULAR DISEASES

Duration of the Course: One year

BROAD OBJECTIVE

This post doctoral fellowship program will be the first of its kind in India and is aimed at delivering the broadest spectrum of clinical training in audiovestibular specialty to deal effectively with hearing and balance problems in adult and pediatric age groups. The purpose of the training program is to provide a holistic approach to clinical care and research in audiovestibular conditions.

SPECIFIC OBJECTIVES:

Will be at capacity building of the trainee's skills in

- A. Clinical science
- B. Research
- C. Teaching

A. CLINICAL SKILLS

To make the trainee competent:

1. To diagnose a wide range of complex audiovestibular conditions affecting children and adults in India.
2. To use available options for treatment and choose the most appropriate among them that is applicable to conditions prevailing in India.
3. To sensitize the trainee towards the need for improvement in health-care delivery in the field of audiovestibular conditions in India with reference to preventive, diagnostic, curative and rehabilitative services.

A. RESEARCH SKILLS

The trainee would be expected to

Actively be involved in on-going research activities of the training department and to complete a prospective research project .

Publish the work in a peer-reviewed journal.

Present a paper at the annual conference of the Association of Neuro-otology and Equilibriometric society of India.

Through participation in an existing Research Methodology course, the candidate is expected to gain insight into the methodology of clinical research including the design and planning, analysis of data, simple statistical methods and finally the nuances of logical presentation of the data in a scientific communication.

A. TEACHING SKILLS

The trainee would be expected to gain teaching experience through resident and medical student programs, conferences and staff contact.

BRIEF SYLLABUS

The trainee will have exposure to a wide range of audiovestibular disorders in adults and children that are encountered in clinical practice. A large volume of experience will involve the management of hearing loss secondary to middle ear and inner ear disorders. The trainee will gain experience in surgeries done for correction of hearing impairment like tympanoplasty, mastoidectomy, ossicular reconstruction, and cochlear implants as well as surgeries for vertigo like repair of perilymph fistulae, endolymphatic sac surgeries and labyrinthectomy.

The trainee will attend regular audiovestibular clinic which occurs twice a week. Patients will be worked up, examined, investigated and treated (medically and surgically where appropriate) under supervision.

In addition to providing dedicated medical and surgical experience in management of audiovestibular conditions, the trainee will have exposure to a variety of **specialized clinic experiences** such as pediatric ENT and Hearing Aid clinics, there would be an educational tie-up with the departments of Neurology, cardiology, endocrine, rheumatology, developmental pediatrics, psychiatry and medical genetics.

DETAILED SYLLABUS

Module 1.1

Topic 1 - Physical Acoustics

At the end of the module the candidate will be able to explain

- The various characteristics of sound and how it impacts on the function of hearing.
- How sound waves interact with physical objects
- Formation and impact of standing waves
- How sound waves propagate, and how the propagation alters when sound is transmitted between different media.
- Explain the principles of room acoustics (*insulation, echo, reverberation, and requirements for audiometric test rooms*).

Topic 2 - Signals.

The focus of this topic is the measurement of sound in octaves and decibels. By the end of the topic, students will be expected to be able to explain:

- Basic concepts about common waveform types including sine, square, white noise, pink noise, band-limited noise, frequency and amplitude modulated signals, gated, compressed, threshold and clipped signals
- Explain the various characteristics of sound their measurement and their properties.

Topic 3 - Signal Processing and Systems.

This topic focuses on acoustic resonators and on signal enhancement methods. At the end of the topic students will be able to explain:

- The nature of signals and noise, and their quantitative description

- The use of synchronous signal averaging for signal enhancement. Filtering and band limiting, type of filters, their quantitative description and the advantage of filtering for signal enhancement
- The identification and description of noise contamination within signals

Topic 4 - Calibration and Instrumentation.

The focus of this topic is on calibration and instrumentation. At the end of the topic students will be expected to explain

- The purpose of calibration
- Principles of acoustic calibration
- Specific calibration techniques appropriate to response measuring equipment and clinical audiological instruments.
- Performance of sound field measurement, weightings etc.

Topic 5 - Signal Processing and Enhancement for Physiological Signals.

This topic will focus on the basic principles and mechanism of generation, properties of otoacoustic emissions and its application in clinical setting.

Topic 6 - The Auditory Periphery - A Systems Approach.

To understand this topic, students will need to be adequately familiar with the anatomical details of the peripheral auditory system, which will be reviewed within this section. Following this topic, students should be able to:

- Describe the transformations in signals that occur throughout the peripheral auditory system.
- Trace the signal in its transmission and analysis through the middle ear, through the cochlear travelling wave system and finally to the intracellular potential of the inner hair cells and the activity of the auditory nerve.
- Describe the filtering mechanism of the cochlea, its parameters, its origin, its value and the changes, which occur during cochlear disorder.
- The transduction mechanism by the hair cells in the inner ear.
- The response of the auditory nerve (physiological, pathological)
- The filter-bank analogy.

Topic 7 - Basic Psychoacoustic Phenomena.

Following this topic, students will be expected to be able to explain the nature, basic principles and measurement of the following psychoacoustic phenomena:

- Equal loudness
- Binaural hearing: Localization of sound
- Masking release
- Loudness / Pitch / Timbre
- Frequency selectivity (*the filter – bank analogy*)
- Temporal analogy

Module 1.2

Module 1.2 – Statistics

The aim of this module is to teach the student the basic methods for collecting, summarizing, presenting and analyzing data. This knowledge must be integrated into the research project and will also enable the student to judge the importance and value of findings that were published in professional journals.

Module 2: Anatomy and Physiology

Objectives of module

The aim of this module is to provide an understanding of the auditory and vestibular systems proceeding from the gross anatomy of the ear to the more detailed structure of the cochlea and vestibular organs. It will be aimed at providing an overview of the structural and functional relationships of the various components of both auditory and vestibular systems in the transmission and processing of external stimuli passing from the peripheral sensory cells to the cortex. The module will also be aimed at providing an outline of the normal embryological development of the auditory and vestibular systems and how genetic defects may affect these processes. Consideration will also be given to the way in which ototraumatic agents (*drugs, noise, disease*) result in damage to both systems, and may lead to repair and regenerative mechanisms.

Topic 1. Cell and molecular biology

Topic 2. Gross anatomy and embryology of the ear

Topic 3. Structural and functional relationships in the cochlea and vestibular system

Topic 4. The auditory pathway - efferent and afferent pathways.

Topic 5. Effects of oto-trauma on the inner ear and the central auditory pathway

Topic 6. Physiology of the auditory system

Topic 7. Embryology and molecular aspects of the development of the inner ear at the cellular level

Topic 8. Effects of loss of sensory input in development

Genetic failures in development of the auditory system and the effects of sensory loss on the auditory pathway at different stages of development.

Relevance of this knowledge in terms of cochlear implants in sensorineural deaf children.

Topic 9. Repair and regeneration in the inner ear

Topic 10. Physiology of the vestibular system

Module 3: Audio-Vestibular Diagnostics

Objectives of Module: To get hands on experience in carrying out the diagnostic procedures with knowledge of basis for doing these tests and interpretation of tests

Topic 1: Pure-tone audiometry:

Principles behind the test, procedure including masking, interpretation in clinical setting

Topic 2: Middle ear impedance audiometry

Principles behind the test, procedure, interpretation in clinical setting

Topic 3: Clinical tests and examinations

Topic 4: Otoacoustic emissions

Background and introduction

Advanced OAEs – use, artifacts, hearing screening and diagnostic applications

Topic 5: Electrophysiology

ABR, ASSR, EcochG,

Topics 6 & 7: Test of balance function – vestibulometry

Overview of vestibular disorders

Labyrinthine disorders: Meniere's, *BPPV*, common central vestibular disorders

Techniques of eye-movement recording: *AC* and *DC*, video oculography, coil and infra-red, basic principles

Electronystagmography: Gaze, saccades, *OKN*, *VOR*, *VORS*, impulse rotation - assessment of vestibular function using *ENG* test battery

Scientific basis of caloric testing: Technique (*creating a thermal gradient in the canal*), *COWS*, *CP*, *DP*, Jongkees formula, combined patterns, other parameters, effect of fixation removal on *SCV* and duration in different pathologies, fixation index, advantages and disadvantages of the caloric test

Scientific basis of rotation tests: Impulse and sinusoidal; passive and active rotation tests.

Scientific basis of static and dynamic posturography.

Topic 8: Paediatric Testing

Behavioral tests in children.

Objective assessment of auditory function in children

Principles of hearing screening in children (*PW*)

Assessment of tinnitus, Tinnitus matching and masking

Topic 10: Diagnostic testing strategy

Application of tests as part of a diagnostic testing strategy

Relationship between test results

Dealing with conflicting and supportive data

Writing patient reports

Patient confidentiality

Health and safety issues

Case Histories - adult rehabilitation, neuro-otology and paediatrics

Module 4

Clinical Sciences Allied to Audiological Medicine

Basic Programme

Objectives of Module:

The range of disciplines allied to Audiological Medicine included in this module should provide the students with the foundation to understand the pathological, immunological and genetic mechanisms underpinning medical conditions presenting with vestibular, and/or auditory

dysfunction. There will be postings of 2 weeks in the following department's rheumatology, neurology, Cardio electrophysiology with the opportunity to observe and interact with specialists in these fields

In addition the basic principles of radiological investigation and imaging techniques will be covered. The speech component given will provide a basis of knowledge of speech and language disorders and provide an understanding of the effect of deafness on the development of speech.

The module is divided into two sections as follows:

Module 4.1

This will comprise Pathology, Speech and Language, Genetics and Radiology.

Topic 1: Pathology

Aspects of general pathology

Pathology of the conditions of the external, middle and inner ear

Tumors of the external and middle ear

Pathology of choleostoma and epithelial migration

Pathology of noise-induced hearing loss, ototoxicity

Pathology of the vestibular system

Neuropathology

Topic 2: Speech and Language

Neuro-mechanism of speech

Development of normal speech, language and communication

Assessment of speech, language and communication

Communication options for profoundly deaf children

Role of speech and language therapy for deaf children

Development speech and language disorders

Role of speech and language therapy for children with other communication disorders.

Topic 3: Genetics

Basic models of inheritance

Non-syndromic genetic hearing loss

Syndromes including hearing loss

Clinical approach to genetic hearing loss, including family history and pitfalls

Genetic counseling

Topic 4: Radiology

Imaging equipment and techniques to visualize the structures of the middle and inner ear
Radiological demonstration of normal and abnormal anatomy of the middle and inner ear
Demonstration and extent of disease processes and, if possible, indication of the nature of the lesion

Module 4.2

This will comprise Immunology, Ophthalmology, Psychiatry, Clinical Governance and Evidence-Based Medicine.

Topic 1: Immunology

Innate immunity

Acquired immunity (*humoral and cellular*)

Hypersensitivity Types I - IV including mucosal immune function, middle ear immunity, effects of nasal disease on middle ear, and audio-vestibular manifestations of auto-immune disease

Topic 2: Ophthalmology

Value of ophthalmology in hearing and balance disorders

Topic 3: Psychiatry

Psychological aspects of tinnitus

Psychological disorders in hearing-impaired children and adolescents; psychiatric disorders in hearing – impaired adults

Psychiatric disorders and vestibular function
Behavioural therapy in vestibular disorders

Topic 4: Clinical governance and evidence-based medicine

Understanding of evidence-based medicine

Methodology of critical appraisal of scientific/research papers
Planning, conducting and writing up research projects

Oral presentation of scientific/research data

Module 5: Vestibular Medicine and surgery

Objectives of Module:

This will cover all aspects of balance including epidemiology; overview of causes of balance problems in children and adults; diagnostic strategies; interpretation of tests; management of dizzy patient, and surgical intervention in specific disorders where appropriate and rehabilitation. Trainees will attend the audiovestibular clinics being held twice a week and will manage under guidance of the teaching staff

The vestibular system and balance in man, including the vestibulo-ocular reflex and the vestibulo-spinal reflexes, smooth pursuit, saccades and optokinetic nystagmus together with strategies used for balance with an understanding of the normal development of balance in childhood, ageing of the vestibular system and balance mechanisms, in terms of both anatomical and physiological changes.

Pathophysiology of deranged balance and vestibular function, abnormal eye movements.

Physiological basis and techniques of vestibular function tests, with specific reference to

(a) the caloric test, (b) the rotational test, (c) posturography, (d) vestibular myogenic responses, (e) vestibular perceptual tasks, and (f) otolith tests.

Knowledge of a diagnostic approach for the evaluation of dizziness and falls in both the adult and pediatric population.

Management of the clinical presentation, methods of diagnosis, and outline management of specific vestibular disorders including surgical interventions

Module 6: Clinical Auditory Medicine and Surgery - Children and Adults Objectives of Module:

To provide the student with knowledge of medical conditions affecting hearing in children and adults. The importance and methods of hearing screening and assessment of the hearing of a child of different chronological and developmental age will be taught.

Effects of deafness on speech and language development, its psychological consequences and the methods of management of deafness.

Epidemiology of hearing impairment and tinnitus in the adult population
The normal physiological ageing process versus pathology

Ageing of the auditory system in terms of anatomical/histological and physiological changes.

Relevant pathology, clinical presentation, methods of diagnosis and management of specific auditory disorders.

Conditions of the external and middle ear - acquired and congenital: Conditions of the inner ear

Central auditory disorders

Metabolic/renal/vascular/neurological/immunological disorders presenting with hearing impairment.

Clinical Assessment of hearing impairment: Surgical management of hearing loss:

Adult Auditory Rehabilitation

Methods of assessment of disability/handicap models of rehabilitation
The components of an auditory rehabilitation programme

Management strategies of tinnitus, assessment of its effect on patients, treatment of identifiable pathology, reassurance, retraining programme.

Surgical and medical management of tinnitus.

Auditory Medicine in Children

Epidemiology of sensorineural hearing loss, otitis media with effusion, tinnitus in childhood.

Development of the normal/abnormal/handicapped child and of auditory behaviour/attention.

Handicapping hearing loss in a child and effect of conductive or sensorineural loss on development of speech and language

Identification of hearing impairment

Screening

Historical perspective and evolution of screening for hearing impairment
Principles of screening and its advantages and disadvantages

Setting up a screening programme

Quality standards and outcome measures
Types of screening programmes:

Surveillance

Raising and maintaining parental and professional awareness
Importance of parental concern

Audiological Assessment

Evaluation of audiological responses in children with neuro-developmental problems
Effect of neuro-developmental problems on auditory behaviour

Audiological responses in children with visual impairment
Compounding effect of dual sensory impairment

Difference between screening and diagnostic tests
Distraction, co-operative and performance tests.
Behavioral Tests:

- o Behavioral observation audiometry
- o Visual reinforcement audiometry.
- o Pure tone/warble tone in sound/closed field
- o Speech discrimination tests
- o Test for central auditory

dysfunction Objective Tests:

- o Tympanometry
- o Acoustic reflexes
- o Auditory brainstem responses
- o Electrocochleography
- o Middle and late latency responses
- o Otoacoustic emissions
- o Protocols for sedation

Knowledge of diagnostic strategy for evaluation of a child presenting with hearing impairment or speech delay.

Medical conditions in children presenting with hearing impairment

Relevant pathology and clinical presentation of specific auditory disorders - acquired/congenital.

Conditions of the external, middle and inner ear, such as :

Meatal atresia

Otitis media

Glue ear

Cleft palate

Disruption of ossicular Chain

Ototoxicity

Noise-induced hearing loss

Rhesus incompatibility

Hereditary loss

Non-organic hearing loss

Unilateral deafness

Tinnitus in children

Bacterial and viral conditions causing sensorineural hearing loss
Metabolic and endocrine causes of sensorineural hearing loss
Syndromic, non-syndromic causes of sensorineural, conductive or progressive hearing loss.

Central auditory disorders.

- Relations between speech and language disorders and behaviour disturbance/autism.
- Psychiatric aspects of working with the deaf child and his/her family

Aetiological investigation protocols

- Importance of investigations at different ages
- Management of children with hearing problems
- Recognition of the linguistic, psychological and social effects of the various types and degrees of hearing loss.
- The multidisciplinary approach to the hearing impaired child and family, to the choice of communication methods, to children with complex problems, to promotion of active family/ carrier involvement.
- Roles of others (audiological scientist, medical technical officer, child psychologist (educational, clinical) deaf community worker, social worker, speech and language therapist, teacher of the deaf, educational audiologist, clinical geneticist, ENT surgeon, ophthalmologist, pediatrician, plastic surgeon, psychiatrist.
- Selection of hearing aids according to its physical and electroacoustic characteristics (i.e. body worn, behind the ear, in the ear), ear moulds, hooks, tubing, battery technology, adaptations for young infants and special needs children, output limiting, gain-frequency response.
- Appropriate choice of hearing aid systems - bone-anchored hearing aids, vibro-tactile aids, and frequency transposition aids, programmable aids, cochlear implant.

Selection of FM/infra red systems

- Verification of function (*behavioral and electroacoustic methods*)
- Counseling / monitoring of hearing aid users and their families

Cochlear implant:

- Protocols of selection Assessment Surgery
- Post-operative management and rehabilitation
- Access to health and social services for children and adolescents with hearing impairment.

Schedule of Postings

Parent audiovestibular medicine	7 months
General ENT	1 months
Pediatric ENT	2 weeks
Neurology	2 weeks
Radiology	2 weeks
Psychiatry	2 weeks
Developmental Pediatrics	2 weeks
Research posting	1 1/2 months

Community posting : Trainee will spend 3 hours a week of the last 6 months of the trainee period in one of the primary and secondary care hospitals where she/he will be dealing with only patients with giddiness and hearing problems.

RECOMMENDED TEXT BOOKS

Katz J Burkard R, MedwetskyL[2001] 5th edition Handbook of clinical audiology
Lippincott Williams&Wilkins Publishers

Yost WA (200) Fundamentals of Hearing 4th edition Accademic PressBaloh RW,
Honrubia Veds(2001) Clinical Neurophysiology of Vestibular system 3rd edition
Philadelphia: Davis. Contempory Neurology Series

Neurology of eye movements 3rd edition R John Leigh and David S Zee published
by Oxford University Press

Otoacoustic emissions Clinical applications Martin S Robinette and Theadore J
Glatke published by Thieme

Dillon H (2001) Hearing Aids Thieme

Attention Deficit and Hyperactivity in Children and adults Pasquale J Accardo
published by Marcel Dekker. INC

Text book of Pediatric Otorhinolaryngology (2 volumes) Editors: Charles D. Bluestone,
Sylvan E. Stool, Cuneyt M. Alper, Ellis M. Arjmand, Margaretha L. Casselbrant,
Joseph E. Dohar, Robert F. Yellon Saunders Publication, Philadelphia, 2003

Cochlear implants, principles and practices: John K. Niparko Editors: Danette K,
Joyce AM, Brandy M, Published by Lippincott Williams and Wilkins 2000

Cummings Otorhinolaryngology, Head and neck surgery 4th edition volume 3 Editor:
Charles W Cummings, Published by Elsevier Mosby

Recommended Journals

International Journal of audiological Medicine

International Journal of Audiology

Otology and Otoneurology

International Journal of Pediatric Otolaryngology

Cochlear Implants International

Otolaryngol Head and Neck Surgery

Journal of Otology and Laryngology

References

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- I. Royal College of Physicians. Hearing and balance disorders: achieving excellence in diagnosis and management. Report of a working party. London: RCP, 2008.

iiBMJ 1997; 314: S2-7075 (Published 18 January 1997); Wendy Albuquerque and Doris-Eva Bamiou Career Focus, BMJ, 4th January 2002;

iii. Baltussen Rob,¹ Abraham Vinod J, ² Priya Monica,² Achamma Balraj,² Anand Job,² Gift Norman,³ and Abraham Joseph³ Costs and health effects of screening and delivery of hearing aids in Tamil Nadu, India: an observational study. BMC Public Health 2009: 9:135

iv. Bess F H, Dodd-Murphy J, Parker R. Children with minimal sensorineural hearing loss-Prevalence, Educational Performance & Functional Status Ear and Hearing, 1998. 19,Pp. 339-354.

v. Nikam S. (Ed.): Hearing Impairment, in Kundu, C.L. (Ed.) Disability Status India 2003, New Delhi, Pp.81 - 196.

vi. Prevalence and Etiology of Vertigo in Adult Rural Population Raman Abrol, Vikas I, Nehru Y, Venketramana. Indian Journal of Otorhynolaryngology and Head and Neck Surgery Vol 53 No 1, January – March 2001