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Enabling the Deaf to Hear

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Cochlea is a spiral shaped cavity, filled with fluid found in inner layer of the ear.[1] It is vital in hearing process and auditory transduction, converting auditory received signals to neural impulses. People with hearing loss or impairment due to inner ear damage, even not able to hear properly with hearing aides, are fit cases for cochlear implant (CI). It is a device implemented to be used as sound processor, fitted behind the ear, receiving sound from outside. The sound signals are sent to the receiver, placed under the skin, to the electrodes in the cochlea. The received signals trigger cochlear nerve, sending the signals to the brain, hence sound is heard.

The first cochlear implant was performed in 1957. D Journos & Eryies in Paris, establishing that the hearing could be achieved, made a single channel implant.[1]

Later on, in 1961 William House (Otologist), John Doyle(neurosurgeon) and James Doyle (Phaysicist) started work on implantation of single channel device. Till 1970 the House work was continued, producing 3 M single channel device was manufactured.[1]

In 1985 worlds 1st commercial multichannel C.I Nucleus 22 was approved by FDA.[1]

In 1990, the CI was approved by FDA for the children age above 2 years, this limit was reduced to 18 months in 1998 and 12 months in 2000.[2]

Practically speaking there are three forces for the development in any field;
1. Skilled human resources,
2. Technological progress, and
3. Psychological understanding of early language development.

Now to establish hearing in a deaf child we have;
I. Conventional hearing aids,
II. Bone conduction hearing aids,
III. Middle ear implant in specific indications.

20th century medical innovation, life changing and most dramatic is the cochlear implant.

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Cochlear Implant provides access to sound that enable development of speech, language and literacy which make them to attend main stream education.[3]

Implantable hearing aids include;
1. Electric hearing i-e; cochlear Implant,
2. Acoustic hearing i-e; different bone conduction hearing aid.

Cochlear implant is the choice of implant in majority of children with profound sensor neural hearing loss. The implantable prosthesis electrically stimulates spiral ganglion cells of the cochlear nerve, when hair cell of the cochlea doesn't function effectively.

Component of the Cochlear Implant

A. External processor

The patient wears it. It communicates with internal receiver by induction and activate the internal unit by transmitting power to it. It has single or dual microphone and a speech processor. It has coding strategy to convert sound into electrical stimulation. There is a magnet which holds the processor to the internal magnet and a transmitter to send signal by induction across the skin.

B. Internal component having 4 parts
1. A magnet,
2. A receiving inducting coil placed together to locate the outer transmitting coil by ma gn et ti ng attraction,
3. A processor,
4. An electrode.

Also there is a return electrode incorporated in the housing of the processor. Number of active stimulating position on the intra cochlear electrodes varies from 12 to 22 according to the design of the implant.[1]

Cost and funding

Total cost of the CI package is 9500 US dollars at present in Pakistan, Pakistan Bait- Ul-Maal (PBM) provides total funding to their panel hospitals.

CI has revolutionized auditory rehabilitation in pre-lingual children. 1st CI was performed in Pakistan dated 16th August 2000 at Lahore till date total 4604 CI done in Pakistan. In Khyber Pakhtunkhwa total 154 CI done. Out of the total KP patients 100 CI done in Saidu teaching hospital. Saidu teaching hospital is only public sector hospital in the whole KP providing this facility in collaboration with PBM.

1st Otologist assess the patient hearing by doing audiological tests and physical examination done if found to be having bilateral profound hearing loss radiological assessment done for the inner ear and brain, followed by psychological assessment of the parents is achieved. Patient gets registration at PBM. Presently children below 5 years is the target group, unilateral C.I implant.

Procedure

Anesthesia: General Anesthesia.
Position: Supine and face opposite to the surgeon.
Incision: Post auricular.

Approach: Trans mastoid (cortical mastoidectomy) posterior tympanotomy between facial nerve and chordatympani. Cochlea is identified, round window in the middle ear via posterior tympanotomy. CI Electrode Insertion: via round window and chochleostomy. Sealing of the chochleostomy with fat or fascia. Placement of the device over the temporal bone. Closing of the wound in layers. NRT and ART on the table for the electrode proper functioning and positioning in the cochlea. Switch on of the device after 4 to 6 weeks. Mapping after each 40 days and speech therapy twice weekly for 2 years mandatory and onward if needed.[4]

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