Systematic Review of Cochleostomy versus Round window Insertion of Electrodes in Cochlear Implant patients

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By
Omar Mustafa Yusuf Yassin
M.B., B.CH.
Faculty of Medicine AinShams University

Under Supervision of
Prof.Dr / Amr Gouda Shafik
Professor of Otorhinolaryngology
Faculty of Medicine-Ain Shams University

Prof.Dr /Mohamed Amir Hassan
Professor of Otorhinolaryngology
Faculty of Medicine-Ain Shams University

Dr/Mohamed Shehata Taha
Assistant Consultant of Otorhinolaryngology
Ain Shams University Hospitals

Faculty of Medicine
Ain Shams University
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بسم الله الرحمن الرحيم

(قَالُوا سُبْحَانَكَ لاَ عِلْمَ لَنَا إِلاَّ مَا عَلَّمْتَنَا إِنَّكَ أَنْتَ العَلِيمُ الحَكِيمُ)

صدق الله العظيم

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List of Abbreviations

CF .... Characteristic frequency

CNC .... Consonant-vowel-consonant

CUNY....... City University of New York

EAS.......... Electro acoustic stimulation

FDA .... Food and drug administration

FEM......... Fixed effect method

Fig............. Figure

HINT .... Hearing in noise test

HP .... Hearing preservation

IHC .... Inner hair cell

LOC .... Lateral olivocochlear

LSO.......... Lateral superior olive

MLNT...... Multisyllabic lexial neighbourhood test

MOC .... Medial olivocochlear

MPTA...... Mastoidectomy with posterior tympanotomy approach

MSO......... Medial superior olive

NYU .... New York University

OCB .... Olivocochlear bundle

OHC......... Outer hair cell

OR........... Odds ratio

R/S .... Reciever stimulator

RD............ Risk difference

REM .... Random effect method

RR........... Risk ratio

SE............. Standard error

TEM......... Transition electron microscopy

INTRODUCTION

A cochlear implant is an electronic device designed to improve or enable hearing for people with hearing impairment disabilities. Unlike typical hearing aids, which are worn externally, cochlear implants constitute an external device and an internal implant. Also, hearing aids simply amplify sounds to enhance sound perception, whereas cochlear implants bypass the outer and middle ear to electrically stimulate acoustic nerves within the auditory system **(Moctezuma A et al., 2011).**

From what once seemed impossible and outrageous, after decades of research and development, modern cochlear implants had advanced to enable the comprehension of sound and speech for those with hearing disabilities. They allow the possibility of communication, development of language skills, and media enjoyment such as music and television. The discovery that electrical current could convey meaningful sound to the brain was an unthinkable breakthrough **(Moctezuma A et al., 2011).**

The expanding indication criteria for cochlear implantation because of the improved postoperative hearing results lead to a worldwide increase in patients with residual hearing who are fitted with a cochlear implant. In the last decade, several research groups have explored various methods of implanting different electrode arrays in the cochlea to preserve the residual hearing and combine acoustic and electric speech processing. The different electrode arrays (hybrid), specifically developed for this purpose, vary in several aspects, shorter length, more flexible, and thinner. Although much attention has been given to minimize trauma by optimizing the electrode design, a minimal traumatic opening of the cochlea and insertion of the electrode is essential for hearing preservation **(Havenith et al., 2013).**

Historical Overview:

Table (1) shows a brief summary of the cochlear implant development through the years. An overview of the history provides an understanding of the slow progression and breakthrough.

Year	Event
1800	Allesandro Volta used electrical current to stimulate his inner ear.
1950	Lundberg performed the first direct stimulation of auditory nerve.
1956	Jack Urban and Dr. William House designed a workable/wearable implant.
1972	Dr. William House builds the first wearable signal processor.
1977	Adam Kissiah proposed the fundamental design of cochlear implant (US patent 4063048) Implantable Electronic Hearing Aid, December 13.
1978	Dr. Graeme Clark and Dr. Brian Pyman operate the

	first multi-channel cochlear implant.
1980	US Food and Drug Administration (FDA) began regulation of cochlear implants.
1984	The first approved commercial device by the FDA for adults implant: House/3M.
1985	Cochlear Corp. Nucleus® 1 system approved by USFDA.
1989	Medical Electronics Corporation (MED-EL) founded by Ingeborg and Erwin Hochmair.
1990	FDA approved implant for children above 2 years old.
1996	Advanced Bionics Corporation (AB) implant approved by USFDA.
2000	FDA approved implant for children above 12 months of age.

AIM OF THE WORK

Systematic review of the literature in trial to answer the question whether cochleostomy or round window approach is better as regard electrode insertion depth and post operative residual hearing.