زراعة الحلزون في 225 عملية

جمال قسومة*

الملخص

هدف البحث: هو تقييم النتائج السمعية والكلامية لعمليات زرع الحلزون في سورية على مدى 4 سنوات ونصف.

طرائق البحث: أجريت دراسة استباقية حيث تم تقييم المرضى بشكل دوري من قبلي ومن قبل مدربة النطق ومختص السمعيات ومختص البرمجة، ومن خلال استجواب الأهل عن مدى أداء الطفل في المنزل. جُمِعَت المعلومات وصُنِّفَتْ حسب التصنيفات العالمية لتمييز الكلام سمعياً والذي هو ثماني درجات بدأت من "عدم الإلمام نهائياً بالأصوات المحيطة وانتهت ب"استعمال الهاتف مع شخص معروف للمريض" ثم أخذ الوسطي منها. وقورن مع نتائج مركز عالٍ معروف. ثم درست إمكانية فهم كلام المريض من قبل الآخرين وهو ست درجات من "كلام غير مفهوم" إلى "كلام مفهوم لمعظم الناس" وأخذ الوسطي منها وقورن مع مركز عالمي معروف.

النتائج: تم أُخِذَ الوسطي من حيث تمييز الكلام سمعيا وفهم الكلام وقورن مع مركز مقاطعة يورك في بريطانيا، وهو من المراكز العريقة في مجال زراعة الحلزون وقد تأسس المركز في أوائل التسعينات.

الاستنتاجات: بعد المقارنة تبيّن أن نتائجنا متقاربة جداً مع مركز يورك حتى أن نتائجنا أفضل بقليل تم استقصاء الموضوع لمعرفة السبب فوجدت أننا نعطي 5 جلسات أسبوعياً، وهم يعطون نحو 3 جلسات أسبوعياً؛ مما يجعلنا نتأكد في النهاية من دور التأهيل المكثف.

الكلمات المفتاحية: زراعة الحلزون – فهم الكلام– وضوح الكلام

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Cochlear Implants; Results of 225 Cases

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Abstract

Objective: to evaluate the results of cochlear implant operations in Syria, during around 4 and half years, in both auditory and verbal communication.

Methods: A prospective study: The patients were routinely evaluated by the audiologists, speech pathologists and myself and also through interviewing the patient's family about the child's performance at home. The data was then gathered, analyzed and categorized according to international standardization of auditory recognition, which is divided into separate categories, which range from "inability to recognize environmental sounds" to "effective use of the telephone with a known person". These results were then averaged and compared to the Yorkshire Cochlear Implant Center, U.K. Then the patients' speech intelligibility after CI operations was evaluated. The results were then gathered and organized according to the international standardization of speech intelligibility which ranges from "unintelligible speech" to "speech that can be understood by most people". These results were then averaged and compared to those of the YCIC.

Results: The results were averaged and compared to these of the Yorkshire Cochlear Implant Center, U.K., which is a well renowned center in its division and which was established in the early 90s.

Conclusion: After comparing both our results and those of the YCIC, it appears that our results are very similar if not better than those of the YCIC. After researching the reason for these results, it was discovered that the YCIC give only 3 speech and hearing sessions a week, whereas, we give around 5, which confirms the essential role of intensive rehabilitation.

Key Word : Cochlear implantation speech discremenation and Intelligibility

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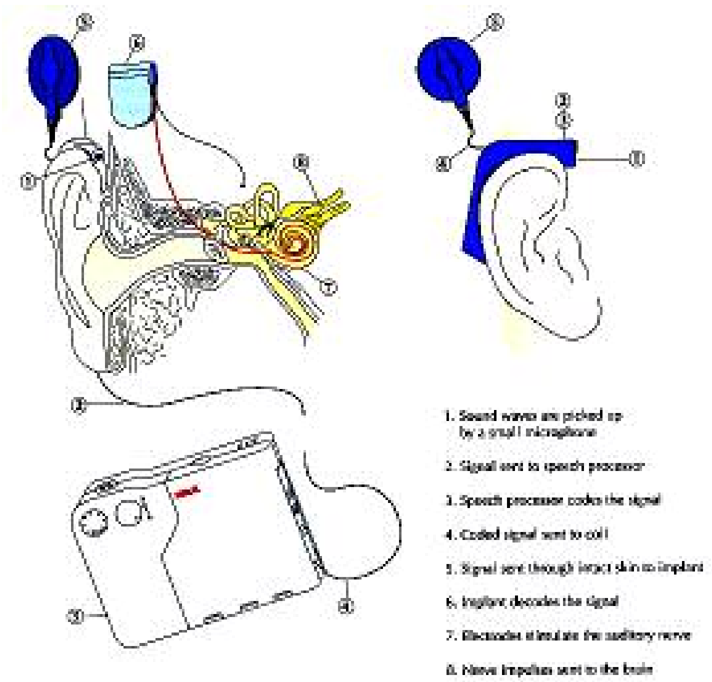


Introduction

Sensorineural hearing loss typically results from lost or dysfunctional cochlear hair cells and a resultant lack of the synaptic activity that normally occurs between hair cells and auditory nerve afferents. Despite this inactivity, viable nerve fibres remain in the auditory nerve, and these nerve fibres remain excitable. Because much of the central auditory pathway remains viable in deafness, and processing capability are retained, cochlear implants are capable of restoring physiological meaningful activity in that pathway.

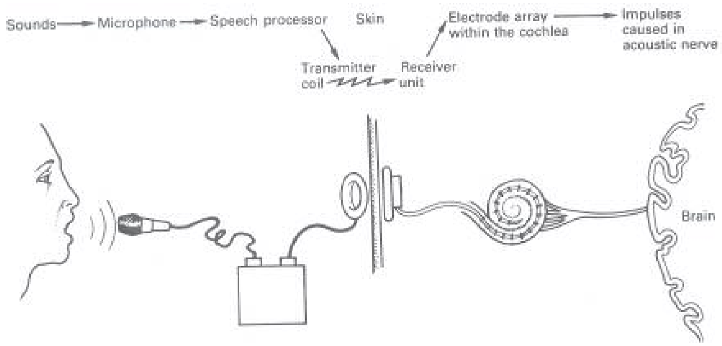
Cochlear implants consist of implantable circuity and information processing systems that enable deaf individuals to access environmental and voiced sounds. Cochlear implants generate auditory percepts using distinctly different strategies from those employed by other forms of auditory rehabilitation. Rather than introducing a processed acoustic signal, implant receive, process, and transmit acoustic information via electric stimulation. Electrode contacts implanted within the cochlea serve to bypass non-functional cochlear transducers and directly depolarise auditory nerve fibres.

The evolution of cochlear implants can be considered monumental for several reasons. The implant represents the most successful attempt to date to interface a prosthetic device with the human nervous system. More relevant to the physician, however, is the availability of a reliable intervention for individuals with advanced levels of sensorineural impairment who derive little practical benefit from conventional hearing aid amplification a patient population that went virtually unaddressed prior to the 1970s. For many of those patients, cochlear implants have become the therapy of choice. As of early 2001 almost 40,000 individuals have received a cochlear implant.

Advances in microcircuitry for signal processing have markedly impacted processing technology for cochlear implants. The speed and accuracy with which the acoustic signal can be electrically coded have fostered the development of devices that more effectively convey information about speech signal.

Cochlear implantation is not, however, without risks. There is potential morbidity inherent in the surgical procedure, placement of prosthesis, and direct electrical stimulation. Success requires a strong commitment to rehabilitation. In some candidates there is a risk of no capacity, or more likely, limited capacity to comprehend the complex information contained in the speech signal. Thus patient and family understanding and expectations of the process of implantation are likely to heavily influence the perceived level of satisfaction with a cochlear implant. With clinical experience, however, has come recognition of the factors that help to reduce morbidity and predict the approximate level of gain in communication. For properly selected candidates, the benefits of cochlear implantation now clearly outweigh the associated risks.

Profound deafness in an adult can have disastrous consequences; in children it can be catastrophic whether congenital in origin or acquired the latter most commonly due to meningitis. In acquired deafness speech and language development may be arrested, reversed or even lost; in cases of congenital profound sensorineural hearing loss a child may fail to develop any spoken language and will be denied access to the world of the hearing even with the most powerful conventional hearing aids. It is in these patients that cochlear implantation may be considered.



History Of Cochlear Implant

The biological application of electricity has driven the development of a wide range of medical treatment, both past and present.

Typically applied to disorders involving the nervous system and to heart and skeletal muscle. Electrical stimulation provides well-accepted treatment strategies for disorders such as endogenous depression, paralysis of voluntary muscles and cardiac arrythmias. Interest in biologic application of electricity is centuries old. However, interest has often exceeded the level of understanding the mechanism of action, and historical descriptions often express a mix of fear and mustique.

In the late 1700s, Luigi Galvani noticed that two different metals (Zinc and Copper) when placed in an acid bath, were capable of producing electrical current. His subsequent experiments of applying this electricity on the frog leg caused the muscle to contract. The notion that electrical current generated by combinig nonorganic materials could generate biological activity was soon applied to the ear.Electrical stimulation of the auditory pathway as an alternative to deafness similarly extends to the late 18^{th} century.

Alessandro Volta (1800) is credited with the personal observation that electrical current applied to metal rods of approximately 50 volts created

a booming sensation within the head, followed by a sound similar to that of boiling thick soup.
Subsequently, several crude applications of electrical stimulations to the ear for a range of indications were described through the 18th and 19th century in Paris (L`Academie des sciences), Amesterdam (Dermann), London (Cavalo and Blezard), and Berlin.
In the 1930s and 1940s, verbal reports circulated in Europe that battery-supplied electrical current could stimulate the auditory nerve to evoke auditory sensations.
Djourno and Eyries (1957) provided the first detailed description of effects of directly stimulating the auditory nerve in deafness.
After a formal proposal to stimulate the auditory nerve directly with a monopolar electrode in 1953, they placed a wire on the auditory nerve of a patient undergoing surgery for facial nerve paralysis that had resulted from previous cholesteatoma surgery.
Prior opening of the cochlea provided access to the auditory nerve. The implantation procedure did not require surgical invasion of the ear. When current was applied to the auditory nerve, the patient described high-frequency sounds reminiscent of a “roulette wheel of the casino”. With a signal generator that provided up to 1,000 Hz pulses, the patient eventually developed limited recognition of common words and improved reading capabilities.
Based on a sense of optimism generated by the French case report, attempts at stimulating the auditory nerve for clinical benefit began in the United States. Doyle et al (1964) and House (1976) described stimulation of the auditory nerve via a scala tympani electrode in 1961. Their approach was to stimulate pattern of electrical activity within the auditory system that they had observed in direct nerve recordings obtained during exposure of the auditory and vestibular nerve during Meniere`s disease.
Two patients underwent a series of extracochlear and intracochlear stimulus trials between January to March 1961. Both subjects reported a greater sensation of loudness as stimulating voltage was increased and higher pitch with increments in stimulus rate. Neither patient tolerated the implanted hardware. Reduced responsiveness over several weeks suggested implant rejection, and both patients were explanted. Nonetheless, these reports of hearing sensation that were “pleasant and useful” lent impetus to further development of cochlear implant systems.

In 1964, Simmons placed an electrode through the promontory directly into the modular segment of the auditory nerve. The subject demonstrated that, in addition to being able to discern the length of signal duration, some degree of tonality could be achieved.
House (1976) and Michelson (1971) refined clinical applications of electrical stimulation of the auditory nerve through scala tympani implantation of electrodes driven by implantable receiver-stimlutors. These devices were evidence of the growing capabilities for microcircuit fabrication that stemmed from computer development.
In 1972, a speech processor was developed to interface with the House 3M single electrode implant. This device was the first to be commercially marketed and more than 1000 were implanted from 1972 into the mid-1980s. In 1980, age criteria for use of this device were lowered from 18 to 2 years. By the mid-1980s, several hundred children had been implanted with the House 3M single-channel intra cochlear device.
The first multiple-channel devices were introduced in 1984. They supplanted single-channel devices based on enhanced spectral perception and enhanced speech recognition capabilities, as reported in large adults trials (Gantz et al 1988; Cohen et al, 1993).
In the 1990s, clinical and basic science investigation produced changes in implant technology and in clinical approaches to cochlear implantation. Electrode and speech processor designs have evolved to produce encoding strategies that are associated with successively higher performance levels.
In parallel with device development and observation of safety and durability has come an emphasis on earlier implantation of children.
There is now recognition of the required services for children to optimise implant performance and the structure of the interaction needed among the implanted child, family member, school staff, and implant team professionals. The benefits of cochlear implants placed in early life appear to be far more predictable.
There is now substantially greater potential for open-set speech understanding in children and adults. Moreover, technology advances of the past decade have refined speech encoding strategies have expanded implant candidacy that have altered speech encoding strategies have expanded implant

Syrian experience with CI

225 cases were performed from 5/5/2002-25/1/2007, we studied the results and came up with the following statistics:

Referral:

Most of the referrals were self-referrals and came in too late. Most were not using hearing aids and if they were, the onset was at a very late age.

Assess:

The assessment was carried out through: clinical examination, hearing tests (with and without hearing aids), CT scans and MRIs if necessary, blood tests and vaccinations.

History

Causes of Deafness:

We analyzed the cause of deafness and it came up as the following:

Hereditary (87)

Acquired (48); Meningitis (17)
Ototoxicity (9)
Jaundice (7)
Post natal hypoxia (9)
Head injury (1)
Premature (3)
German measles (1)
Meneire's disease (1)

Syndromes (2); Usher's syndrome (1)
Waadenburg syndrome (1)

Cochlear hypoplasia (9); Mondini (5)
Common cavity (4)

Unknown (79)

Surgery:

215 of the surgeries were performed in the right ear.10 were performed in the left ear for the following reasons: CT scan was better in the left ear (5)
Perforation in the right ear (2)
Sclerosis (meningitis) in the right ear (2)
Right ear was dead ear and patient>20y (1)

Sex:

123 male, 102 female.

Age:

The ages varied from 1.1-61y

Pre-lingual: 112; 1.1-14

Post-lingual: 13; 18-61

Family History:

We studied the family history of the patients and found that 87 had a positive family history of hearing loss, whereas, 148 did not, however, 62 of these had parents who were first cousins.

Hearing Aid Use:

138 were hearing aid users, 87 were not. However, all were required to use hearing aids for a trial period of 1-3 months before considering surgery.

During Surgery

Telemetry:

ok in all cases

Full insertion:

Full insertion was obtained in 208 of the cases. Partial insertion was obtained in 17: 8 of which 20\24 channels were inserted and 9 had 22\24 channels inserted.

Stapedial Reflexes:

Was positive in all cases except 5; 3 suffered from common cavity and 2 had Mondini.

Gusher:

Gusher was present in 10 cases for the following reasons: Mondini (5)

Normal cochlea (5)

Stopped at surgery (9)

Leak for 1 week (1)

NRT:

ok except in 2 cases

Complications:

Chorda tympani damage (20)

Subcutaneous haematoma (3)

Comparative Studies

We carried out a comparative study between our patients in Syria and the patients of the Yorkshire Cochlear Implant Center (YCIS). This was to study the auditory and speech intelligibility development of these patients over the period of 5 years.

0 No awareness of environmental sounds

1 Awareness of environmental sounds

2 Response to speech sounds (e.g. ‘go’)

3 Identification of environmental sounds

4 Discrimination of some speech sounds without lip-reading

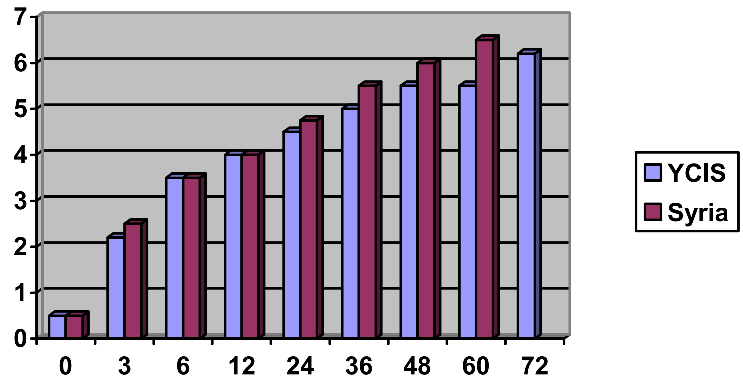
5 Understanding of common phrases without lip-reading

6 Understanding of conversation without lip-reading

7 Use of telephone with known speaker

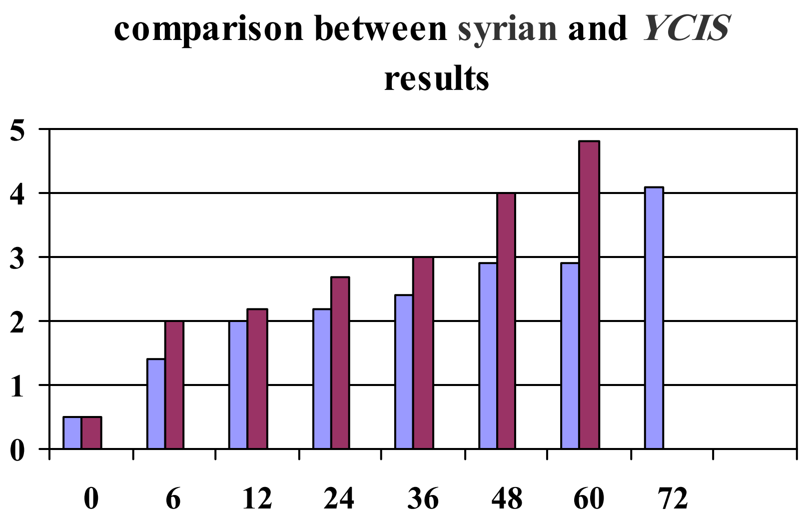
Grading of Auditory Performance:

Comparison between Average Auditory Functional Ability in Syria and YCIS



Speech Intelligibility Rating Criteria

- Category 5: Speech intelligible to everyone.
- Category 4: Speech intelligible to most listeners.
- Category 3: Speech intelligible to sensitive listeners.
- Category 2: Unintelligible speech.
- Category 1: Some useful lip-patterns
- Category 0: Pre-recognized spoken


comparison between syrian and *YCIS* results
5
4
3
2
1
0
0
6
12
24
36
48
60
72

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