Nowadays the only worldwide accepted disability that is able to be cured is deafness. Quite for a long time all mankind has had the dream to have the miracle power to heal the disable. The high progress in technology of computerized hearing aid devices introduced us the prosthesis that cures deafness which allowing the deaf to be able to communicate and connect to the world. This is "the cochlear implant" (CI).

Hearing impairment seems to be a progressively more important health problem after the common infectious diseases problem are less. The rehabilitation via the hearing aid devices could help, but still have the limitation in severe hearing impairment (more than 70 dB.) especially in sensorineural hearing loss (SNHL). The rehabilitation is even more difficult in a prelinguistic young child.

■ First: Volta (1800), who heard the boiling sound from electric rods through his external ear. Djoumo and Eyries (1957) used direct electrical stimulation of the electrodes at the auditory nerves during large cholesteatoma removal operation which can produce speech sound. House, Simmons, Michelson introduced the single channel cochlear implants in real patients in 1961 and wearable sound processor in 1972. Clark (1978) introduced multi-channel electrode cochlear implants which were wearable in 1982.

■ The cochlear implant is an electronic device which is surgically implanted in the inner ear of the profoundly or completely deaf. It provides the hearing-impaired person a sensation of hearing. The major function replaces the function of the damaged cochlear in the ear (Hair cells). The cochlear implant composes of 2 parts: external and internal components.

External components include a microphone, speech processor and radiofrequency transducer or primary headpiece coil. These parts can be seen and there are many designs among each company. Generally the speech processor has a nano-chip (or micro-chip) which can support the new strategic programs or technologies in the future. Therefore patients do not need to wait for the latest series of implants and able to update the more modern technique.
channel electrode inside the cochlear duct to directly stimulate the auditory nerve. Cochlear implants do not restore normal hearing, but allow recipients to function at a level similar to less hearing-impaired patients who are successful hearing aid users.

During 1980 to 2000 cochlear implantations slowly progressed in numbers, but in the last 10 years, this operation has rapidly become popular. Major companies provide devices in thousands from that time and increasing every year to nearly 20 thousand in 2008. According to the United States Food and Drug Administration (USFDA), there were more than 112,000 people worldwide who had received cochlear implants at the end of 2006 and more than 150,000 people at the present time.

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**Sources**

There are 3 major companies providing cochlear implants approved by the USFDA at the present time and all of them are available in Thailand. The first company is Cochlear Corporation (Australia) which produces implants with 22 channels. Products from this company have been approved since 1985. Advanced Bionics Corporation (ABC USA) produces implants with 16 channels approved by the USFDA since 1997. The latest approved implants in 2001 are made by Medical Electronics (Med-El Austria). Their electrodes contain 12 channels. Another available product in Thailand is Neurelec (France) producing implants with 20 channels.

**Development of cochlear implantation in Thailand**

- Now cochlear implantation is not new in Thailand. From the first single channel cochlear implantation in 1986 and multi-channel cochlear implantation in 1994, there were only about 70 people operated in Thailand in the year 2005. However, more than 300 patients were implanted at the end of 2008.

- The first training course was on the Nucleus product of Australia since the year 1997.

- The second training course was conducted by Med-El products of Austria in the years 1999 and 2001.

- In 2005 the Bangkok Otologic Center held the training course for the Advance Bionics Corporation of USA.

Cochlear implantation has the same principles as the other rehabilitations especially the multidisciplinary team includes preoperational screening and preparation of all concerned; the most important part is the family. Actually cochlear implantation is just the beginning of the communication rehabilitation process and the operation is only the minor part of the whole process. Regular follow up in the audiologic clinic for mapping and rehabilitation is the major part for the best results. Therefore the teams for cochlear implantation services are not only surgeons, but also audiologists, speech therapists, teachers.

Operative technique for cochlear implantation generally is not complicated among Ear Nose Throat (ENT) surgeons who are interested in the otological field. Every ENT doctor who is interested in this field can frequently try on temporal bone resection. Generally the numbers of audiologists and speech therapists in Thailand are less proportional with Thai population. Thailand has only 1 official program for audiologists and speech therapists training. The bachelor degree program has just started in 2004. This means a small number of audiologists and speech therapists in Thailand. This situation is one of the factors restricting implantation to rise in a limited area of Thailand.

The other major concern about cochlear implantation is its cost. In Thailand, these services including device and operation cost the patients about 1 million baht meanwhile the Gross Domestic Product per capita of Thailand in the year 2000 was about 80,000 baht and increased to 120,000 baht in year 2006. Therefore the rate of implantations has increased very slowly until the special project of the Ministry of Public Health of Thailand in 2006 provided free 80 cochlear implantations for severely impaired hearing children below 5
years old for dedication to celebration of the King’s birthdays. Another reason for the increasing rate in implantations in Thailand is the reimbursement in 2007 for government officers.

Development of cochlear implantation in Siriraj

Cochlear implantation was introduced to Siriraj by Professor Suchitra Prasansuk, who coordinated with cochlear implant provider; Cochlear corporation. She recruited the patient and invited a guest professor for demonstration. The first implantation in Siriraj Hospital was conducted on 14 August 2000 by Professor Andrew Van Hasselt from Hong Kong. This adult patient had bilateral deafness from post-meningitis. This was the first up-to-date technological multichannel device implanted in Thailand.

In 2004, the demonstration of cochlear implantation was performed by Professor Hermann Jenkins from Colorado, USA which was included in the international temporal bone dissection course which was conducted twice a year by the Otological Center, Bangkok unit, WHO collaborating center at Siriraj Hospital, Faculty of Medicine, Siriraj hospital, Mahidol University. Two demonstrated cases of cochlear implantations were held on 28 July 2004. One was operated by Dr.Samut Chongvisal.

In addition, a 4-year-old boy with non-syndromic congenital hearing loss was operated on 19 January 2005 in a temporal bone course by Dr.Samut Chongvisal with Professor Jenkins as consultant in the operating theater with the Med-El device.

Furthermore, the implantable devices; Clarion HiRes 90K, of the Advance Bionics Corporation were inserted in the fifth and sixth patients on 19 August 2005. Also, Dr.Samut performed the seventh and eighth cases, who were the 3-year-old girl on 26 April 2006 and next the 45-year-old lady with post meningitis on 7 July 2006.

From 2007, the Comptroller General’s Department provides the reimbursement for the government officers leading to easier access the new technology for the deaf. The cochlear implant committee was founded in 2007 at the Siriraj Hospital gathering of ENT surgeons, and psychiatrists (pediatricians for children as well). Responsibilities of this committee are evaluation and making improvement of the patients following the recommendations of the government. The processes of the procedure for cochlear implantation are:

1. ENT doctors confirm diagnosis of the bilateral severe to profound sensorineural hearing loss (SNHL) with the behavioral and the objective test; audiogram with Auditory Brainstem Response (ABR) and/or Auditory Steady State Response (ASSR).

2. ENT doctors evaluate that a patient does not get any benefit from the hearing aids.

3. Contraindication is established to demolish the inappropriate situation for surgery.

4. CT and/or MRI for the patency of the cochlear duct and the patency of the auditory nerve are subsequently performed.

5. Psychosocial evaluation to exclude mental retardation, improper emotional response, desiring to live in the hearing world, having realistic expectations about results, and having the support from family and friends including the teachers.

6. The cochlear implant committee approves the surgery.

This might be the pioneer system model for managing the cochlear implantation academically and transparently which is applicable to the other services units.

The first approved patient from the committee was a one-year-old girl with congenital nonsyndromic hearing loss. The parents chose bilateral cochlear implants for her future potential abilities after recognizing the leaping of her language development within 6 months.

Neurelec from French company was fitted in an operation on the 16th November 2007, for the first time in Thailand. As mentioned above, this confirms the policy of variation of brands and the patient’s right to

<table>
<thead>
<tr>
<th>Brand</th>
<th>Sex</th>
<th>Age</th>
<th>Operation date</th>
<th>Paying method</th>
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choose implantations at Siriraj Hospital providing all brands of cochlear implants.

Conclusion
At the end of 2008, we have operated on 15 ears, 14 patients. There were 4 males and 11 females. Age ranged from one and a half years to 58 years. We did implantations in 5 cases on the left side, in 10 cases on the right side and 1 case bilaterally.

There are 8 postlingual and 7 prelingual patients. The causes of deaf are 3 post meningitis, 1 ototoxicity, 5 nonsyndromic congenital hearing loss, 1 Mondini malformation and 5 idiopathic cause. The duration of deafness ranged from 1 month to 47 years.

Outcome
Most of the cases were satisfied with the result of implantation from better communication skills, better speech perception and verbal language skills, language developing rate, able to learn in mainstream school and combined school and working communication including telephone use.

There is only one case that the successful developmental language has not reached the average mean comparing to other patients due to lack of practice and time. No local and serious complications nor implant extrusion and reimplantation were found or needed.

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REFERENCES

ADDENDUM

Akkrapol Mungnirand et al., the authors of the original article “Ten years Siriraj’s experience of wound infection rate at the third post-operative day or the day of discharge in acute appendicitis pediatric patients” published in Siriraj Medical Journal, Volume 61, Number 4, July-August 2009, pages 197-199, would like to add the following statement in the “ACKNOWLEDGEMENTS” : “This study has been supported by the Routine to Research Management Found, Faculty of Medicine Siriraj Hospital, Mahidol University.”