

## BILATERAL COCHLEAR IMPLANTATION- SRMC EXPERIENCE

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### INTRODUCTION:

A cochlear implant (CI) is a surgically implanted electronic device to restore hearing in persons with profound hearing loss that cannot be improved with hearing aids. The cochlear implant is often referred to as a bionic ear. Unlike hearing aids, the cochlear implant does not amplify sound, but works by directly stimulating any functioning auditory nerve fibres inside the cochlea with an electric field. The implant relays the incoming signal through the implanted electrodes in the cochlea. The speech processor processes the sound and converts it to electrical signals.<sup>(1)</sup>

### History of Cochlear Implantation

Hearing stimulation by electric current was discovered in 1790 by Volta and the direct stimulation of acoustic nerve by an electrode by Djourno and Ryries in 1957<sup>(2)</sup>

In 1961 Dr William House (an otologist), John Doyle (a neurosurgeon) and James Doyle (an electrical engineer) commenced work on a single channel device in Los Angeles. In 1972 the House 3M single-electrode implant was the first to be commercially marketed. The device, manufactured by 3M, was ultimately implanted in some thousand or so recipients and paved the way for future clinical development of multichannel CIs. The House/3M unit was the first approved by the FDA (Food and Drug Administration of the USA) for implantation in adults in 1984<sup>2</sup>. Parallel to the developments in California, in the seventies there were two other groups, working on the development of the Cochlear Implant in Vienna, Austria and Melbourne, Australia.<sup>(3)</sup>

In 1978, the first successful cochlear implant was carried out by Prof Greame Clark in Australia on an adult patient. He was the first recipient who could hear sounds clearly and understand speech and could speak. In December 1984, the Australian cochlear implant was approved by the United States Food and Drug Administration to be implanted into adults in the United States. In 1990 the FDA lowered the approved age for implantation to 2 years, then 18 months in 1998, and finally 12 months in 2002, although off label use has occurred in babies as young as 6 months in the United States and 4 months internationally<sup>(4)</sup>.

Till recently cochlear implantation was done in one ear only as it was considered adequate for improving communication and development of language. Of late, the

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benefits of bilateral stimulation and binaural hearing have been realized. Hearing in two ears allows people to localize sounds and to hear better in noisy environment. Nearly 3000 people worldwide are bilateral cochlear implant users, including 1600 children. As of 2006, the world's youngest recipient of a bilateral implant was just over 5 months old (163 days) in Germany (2004). In India less than 30 cases have been done so far.

The benefits of bilateral cochlear implantation are based on known deficits experienced by both unilateral cochlear implant users as well as individuals with unilateral profound hearing loss (single sided deafness- SSD). Binaural hearing enables optimal performance of the auditory system. The binaural advantage results in improved speech understanding in quiet and in noise, as well as sound localization ability.

Cochlear Implantation Programme of SRU (CLIPS) was inaugurated in late 2004 and the first implantation was done in Jan 2006. So far 18 patients have benefited from this treatment and many children are attending normal schools. On December 2<sup>nd</sup>, 2009 another milestone was reached by the Department of ENT, Head and Neck surgery as the first bilateral cochlear implant surgery performed in a University hospital in Chennai.

### First bilateral cochlear implantation at SRMC – our experience

Our patient was a 4 ½ yr old boy, son of an engineer, who was diagnosed to have bilateral profound hearing loss from childhood (fig 1). He was using hearing aids in both ears for the last three and half years with no hearing benefit. He was evaluated in detail with a series of audiological tests Speech evaluation and behavioral observational audiometry in the Department of SLHS. All the tests confirmed the diagnosis of bilateral profound hearing loss. Radiological evaluation with CT scan and MRI studies of the temporal bone revealed anteriorly rotated cochlea in left. After detailed



**Figure 1:** Picture of patient on 1<sup>st</sup> post op day



Fig.2

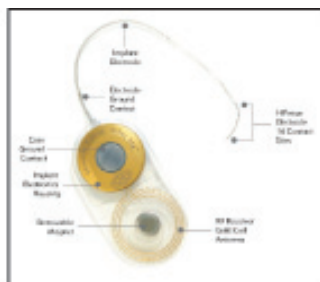


Fig. 3

Fig. 2 & 3: Cochlear Implant used in this patient

counseling of the parents on several occasions he was selected to undergo cochlear implantation in both ears (fig 2 & 3).

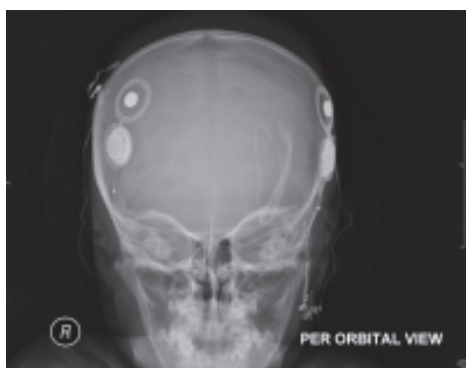


Fig 4: Post op x- ray skull showing both electrodes array in cochleae

The surgery was carried out successfully and the performance of the implant was assessed in the operation theatre and found satisfactory (fig 4). At present, the patient is doing well. Switch on of the implant was carried out on Jan 5<sup>th</sup> and he heard sound for the first time in his life. He is on a regular follow up. An intensive rehabilitation program has been started, which will spread over a period of 18 months as it is an important and integral part of the cochlear implantation strategy to restore hearing. The mapping and habilitation program will be under the supervision of Prof. Roopa Nagarajan, Head of the Dept of Speech and Audiology, SRU.

**CONCLUSION:**

Through the 1990's, clinical and basic science studies have resulted in progress in implant technology electronics in speech processor and in surgical approaches in implantation and audioverbal therapy. Over the years, risks have been minimized and more people have accepted cochlear implants. Some of the successful implantees have become fashion models (Miss America 2002), classical singers, musicians, doctors and scientists. Cochlear implantation is the only bionic device till date; that can supplement a special sense (hearing). It is now an established treatment strategy for the profoundly hearing handicapped patients. Recent research is focused on miniaturization, totally implantable cochlear implants and on hybrid implants. India is the country with the highest potential candidates for cochlear implantation after China (An estimated 1.5 million patients are potential implantees and we expect to bring a ray of hope into the lives of those million deaf children in our country, at affordable costs). An indigenous cochlear implant is being developed by DRDO and is likely to be evaluated in several centers including SRMC. It is hoped that this technology will be made affordable to the millions of patients.

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