Print ISSN: 2321-6379
Online ISSN: 2321-595X
DOI: 10.17354/ijss/2016/463

Original Article

Comparison of Surgical Outcome in Children with Cochlear Implant Placed using Different Approach

Rakesh Kumar[1], Sarita Bharke[2]

[1]Associate Professor, Department of ENT, RKDF Medical College Hospital and Research Center, Bhopal, Madhya Pradesh, India, [2]Senior Resident, Department of Ophthalmology, L. N. Medical College, Bhopal, Madhya Pradesh, India

Abstract

Background: To demonstrate whether there are differences in the outcome of children with cochlear implantation (CI) using the techniques between mastoidectomy with posterior-tympanotomy approach (MPTA) and veria, suprameatal approach (SMA).

Materials and Methods: A study was undertaken of congenitally deaf 43 children (28 boys and 15 girls), who underwent CI before the age of 7 years at a tertiary hospital affiliated to Barkatullah University in Bhopal from 2013 to 2015, were included in this study. All children were profoundly deaf, and radiological assessment was undertaken using magnetic resonance imaging. Children with severe mental retardation, cardiac problem or with cochlear malformations were excluded from the study.

Results: All 43 children had a completely patent cochlea. 30 patients underwent cochleostomy and 13 patients had round window insertion. Full insertion was accomplished in 43 children. In 12 children ALPS implant with 22 channel electrode used and in rest of 31 children's NUCLEUS 22 channeled electrode is used one child developed flap necrosis and two had infected stitches both were treated accordingly and both recovered fully. During follow-up rest, all children did not encounter problems. All children's still wears the cochlear implant showing substantial progress in auditory perception skills. No children experienced device migration or dislodgment of the electrode array.

Conclusion: A surgical outcome of CI in all patients with good early results of tuning and rehabilitation with no significant difference between MPTA techniques and SMA technique.

Key words: Cochlear implant, Mastoidectomy, Supra meatal approach

INTRODUCTION

Congenital sensorineural hearing loss is a significant childhood condition with an incidence in the order of 2/1000 live births. There is significant socioeconomic impact in untreated hearing loss with respect to both school and future employment opportunities.[1]

The rate of hearing loss in children has been estimated as 2-3/1000. This includes those cases of genetic hearing loss that present later in childhood or hearing the loss of an acquired etiology.

Access this article online

www.ijss-sn.com

Month of Submission : 06-2016
Month of Peer Review : 07-2016
Month of Acceptance : 08-2016
Month of Publishing : 08-2016

The advent of neonatal hearing screening has significantly increased early detection of significant childhood hearing loss and resulted in earlier intervention with respect to both hearing amplification and cochlear implantation (CI). Normal hearing is a pre-requisite for adequate speech and language development, and therefore, identification and management of hearing loss is critical to ensure an optimal outcome in this regard.[2]

CI has provided a major advance in the treatment of children with severe to profound bilateral sensorineural hearing loss. It continues to provide the only real electro/electro-acoustic hearing rehabilitation when hearing aids are no longer useful. Early identification, intervention, and rehabilitation often result in children with significant hearing loss achieving educational and occupational level commensurate with their normal hearing peers. This results in a significant social dividend with respect to education and employment as well as reducing the impact of a hearing disability.[3]

Corresponding Author: Dr. Rakesh Kumar, S-556 Nehru Nagar, Bhadbhada Dam Road, Bhopal - 462 003, Madhya Pradesh, India. Phone: +91-7869642886. E-mail: drakes_raj@yahoo.co.in

The conventional technique for CI is the mastoidectomy with posterior-tympanotomy approach (MPTA). Posterior-tympanotomy was first described by Jansen in 1957 as a means of approaching the middle ear. This approach was subsequently embraced by the cochlear implant surgeons as the accepted route of access to the round window and promontory. MPTA for cochlear implant surgery was first introduced by house in 1961. Although it may be relatively easily performed, there have been reports in the literature describing temporary injury to both the facial and chorda tympani nerve. Only a few alternatives to this classical approach have been described in the literature.[4]

In 2000, Kiratzidis described a technique using a tunnel drilled in the mastoid area without mastoidectomy to approach the middle ear.[5] The endomeatal approach was given in one of the studies but infection and electrode extrusion through the skin of the external auditory canal led to the abandonment of this approach.[6] Collins *et al.* described an approach via the middle fossa, and Singh used the canal wall down technique in the cases of congenital anomalies.[7]

The MPTA technique has proven to be efficient for the vast majority of cases, however, one major drawback of this technique is the possibility that the chorda tympani may be sacrificed and/or that the facial nerve may be injured. In the early days of CI, incidences of injury to the chorda tympani and facial nerve of 1.7-2.0% were not uncommon. Although there has been a decline in the incidence of injury to the chorda tympani and facial nerve in recent years, it still occurs on rare occasions.[8,9]

Several surgical techniques have been described in literature as alternatives to overcome the risk of facial nerve injury. Alternative techniques for CI includes:[10,11]

1. The endomeatal approach
2. The middle fossa approach
3. The mastoid tunnel technique
4. The pericanal electrode insertion technique
5. The suprameatal technique.

Along with the reduced risk of facial injury, all these alternative techniques have in common that mastoidectomy is avoided. The supra meatal technique introduced by Kronenberg *et al.* in 1999 seems to be gaining popularity among ear surgeons.[12] It involves exposing the middle ear through the external auditory canal and inserting electrodes into the cochlea through a suprameatal tunnel bypassing the mastoid cavity. This technique is suitable for both children and adults. In addition, extrusion of the electrode through the skin of the external auditory canal is avoided using the suprameatal tunnel.

The suprameatal approach was developed as an alternative technique to the classical approach and it is based on retro-auricular tympanotomy approach as access to the middle ear and cochleostomy site. The electrode is introduced into the middle ear via a suprameatal route thus avoiding mastoidectomy.[13-15]

MATERIALS AND METHODS

A study was undertaken of congenitally deaf 43 children (28 boy and 15 girls), who underwent CI before the age of 7 years at a tertiary hospital affiliated to Barkatullah University, Bhopal from 2013 to 2015, were included in this study. All children were profoundly deaf, and radiological assessment was undertaken using magnetic resonance imaging. Children with severe mental retardation, cardiac problem or with cochlear malformations were excluded. 17 patients were operated via supra meatal approach (SMA) approach and 26 patients via post-tympanotomy approach. All children were assessed before surgery and 3, 6, 9 and 12 months after surgery. Pre-implant evaluation consisted of pure tone audiometry and tests of speech recognition, both with hearing aid and without hearing aid.

Post-implant evaluation included the same tests with CI off and on, carried out with free field stimulation in a sound proof room. Threshold evaluation was conducted using category of auditory perception, free field stimulation, and in the analyses of speech perception; we considered the speech intelligibility rating and listening skills development rating. In this study, we considered the speech detection threshold (SDT) and speech recognition threshold (SRT). SDT corresponds to the value of sound intensity at which the verbal message is not understood but perceived as generic sound, therefore with a percentage of intelligibility of 0%. The SRT indicates the level of intensity at which the patient correctly repeats 50% of the words.

The surgical outcome looked at the presence of any medical or surgical complication related to the implant surgery or to the age of these patients.

Surgical Techniques

The MPTA technique for CI was performed as described by Clark *et al.* in 1979. It includes mastoidectomy with posterior-tympanotomy and facial reassess approach.

The SMA Technique Involve

The middle ear cavity is entered via an endaural tympanotomy after performing a retroauricular incision. A suprameatal tunnel is drilled superoposterior to the suprameatal spina

toward the posterior part of the aditus-ad-antrum at 1 O'clock position for the left ear and 11 O'clock for the right ear. A bony sub periosteal well is created posteriorly in temporal bone to accommodate the receiver-stimulator and loop of electrode. The electrode is inserted into the cochleostomy, which is drilled anteroinferior to the oval window and give access to scala tympani.

RESULTS

All 43 children had a completely patent cochlea. 30 patients underwent cochleostomy and 13 patients had round window insertion. Full insertion was accomplished in 43 children. In 12 children, ALPS implant with 22 channel electrode used and in rest of 31 children's NUCLEUS 22 channeled electrode is used one child developed flap necrosis and two had infected stitches both were treated accordingly and both recovered fully. During follow-up rest, all children did not encounter problems. All children's still wears the cochlear implant showing substantial progress in auditory perception skills. No children experienced device migration or dislodgment of the electrode array.

DISCUSSION

In the hospital where the study was performed 43 patients were operated by Dr. Hans, Dr. Kirtane, and Dr. Haital have operated all cases, and authors have assisted them all cases as the first assistant. Dr. Hans has operated all cases via VERIA Technique while Dr. Kirtane Sir and Dr. Haital have operated via post-tympanotomy technique.[15-17]

Intraoperative

Neural response telemetry (NRT) was done by other surgical assistants. Intraoperative insertion and functional status of electrode channels are verified by NRT.

All the children were followed for 9 months post-operatively to watch for any surgical complication or difference in results, but all children were found to be normal and having the same surgical outcome.

Post-operative X-ray

Post-operative X-ray is carried out to verify the position of the electrode and to rule out any dislocation/displacement.

Complication

One patient male had flap necrosis (MPTA technique) and two patients had initial stitch infection.

Prognosis

All patients recovered fully.

CONCLUSION

This study shows the same surgical outcome of CI in all patients with good early results of tuning and rehabilitation with no significant difference between MPTA techniques and SMA technique. All 43 children's have their implant in position and working perfectly. No patient had any complaint of displacement of the implant of malfunctioning of any electrodes. No difference is seen in surgical outcome in any children underwent surgery via both techniques.

REFERENCES

1. Postelmans JT, Grolman W, Tange RA, Stokroos RJ. Comparison of two approaches to the surgical management of cochlear implantation. Laryngoscope 2009;119:1571-8.
2. Postelmans JT, Cleffken B, Stokroos RJ. Post-operative complications of cochlear implantation in adults and children: Five years' experience in Maastricht. J Laryngol Otol 2007;121:318-23.
3. Rama-López J, Cervera-Paz FJ, Manrique M. Cochlear implantation of patients with far-advanced otosclerosis. Otol Neurotol 2006;27:153-8.
4. Proops DW, Stoddart RL, Donaldson I. Medical, surgical and audiological complications of the first 100 adult cochlear implant patients in Birmingham. J Laryngol Otol Suppl 1999;24:14-7.
5. Kiratzidis T. "Veria operation": Cochlear implantation without a mastoidectomy and a posterior tympanotomy. A new surgical technique. Adv Otorhinolaryngol 2000;57:127-30.
6. Hoffman RA, Cohen NL. Complications of cochlear implant surgery. Ann Otol Rhinol Laryngol Suppl 1995;166:420-2.
7. Collins MM, Hawthorne MH, el-Hmd K. Cochlear implantation in a district general hospital: Problems and complications in the first five years. J Laryngol Otol 1997;111:325-32.
8. Fayad JN, Wanna GB, Micheletto JN, Parisier SC. Facial nerve paralysis following cochlear implant surgery. Laryngoscope 2003;113:1344-6.
9. Hehar SS, Nikolopoulos TP, Gibbin KP, O'Donoghue GM. Surgery and functional outcomes in deaf children receiving cochlear implants before age 2 years. Arch Otolaryngol Head Neck Surg 2002;128:11-4.
10. House WF. Cochlear implants. Ann Otol Rhinol Laryngol 1976;85 suppl 27:1-93.
11. Häusler R. Cochlear implantation without mastoidectomy: The pericanal electrode insertion technique. Acta Otolaryngol 2002;122:715-9.
12. Kronenberg J, Migirov L, Dagan T. Suprameatal approach: New surgical approach for cochlear implantation. J Laryngol Otol 2001;115:283-5.
13. Yin S, Chen Z, Wu Y, Wang L, Zhang J, Zhou W, *et al.* Suprameatal approach for cochlear implantation in 45 Chinese children. Int J Pediatr Otorhinolaryngol 2008;72:397-403.
14. Migirov L, Yakirevitch A, Kronenberg J. Surgical and medical complications following cochlear implantation; comparison of two surgical approaches. ORL. J Otorhinolaryngol Relat spec 2006;68;213-9.
15. Lehnhardt E. Intracochlear placement of cochlear implant electrodes in soft surgery technique HNO 1993;41;356-9.
16. Available from: http://www.drjmhans.com/services.php. [Last accessed on 2016 Apr 25].
17. Available from: http://www.drkirtane.com/surgeries-performed/. [Last accessed on 2016 Apr 30].

How to cite this article: Kumar R, Bharke S. Comparison of Surgical Outcome in Children with Cochlear Implant Placed using Different Approach. Int J Sci Stud 2016;4(5):222-224

Source of Support: Nil, **Conflict of Interest:** None declared.