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Minimal incision cochlear implantation: is it the future

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ABSTRACT

Background: The objective of the study was to compare the incision size, operative time and complications in minimal incision cochlear implantation (MICI) and standard incision cochlear implantation (SICI).
Methods: Patients who underwent cochlear implant surgery from August 2015 to August 2017. Patients in the MICI group underwent surgery with 2 cm post aural incision whereas patients in SICI group underwent surgery with inverted J incision.
Results: A total of eight patients who underwent cochlear implantation during study period were divided into SICI and MICI group of four patients each. The mean size of incision in SICI group was 7.62cm (SD 0.47) and in MICI group was 2 cm. The mean operative time in SICI group was 211.25 minutes (SD 8.53) and in MICI group was 247.5 minutes (SD 11.9). One patient (25%) in SICI group had flap necrosis whereas MICI group had none.
Conclusions: The MICI can be performed with a small incision of 2 cm. It causes less trauma to the flap with very less incidence of flap necrosis. Technique can be mastered by surgeon with less experience in Cochlear Implant surgery. Other complications are comparable to SICI though operating time is more initially. This is a small study which indicates that Minimal Incision cochlear Implantation is less traumatic and has a more favourable cosmetic outcome with benefits comparable to that of standard technique.

Keywords: Minimal incision cochlear implantation, Standard incision cochlear implantation

INTRODUCTION

Cochlear implantation is the biggest innovation in the field of otology in recent times. This technological advancement has changed the lives of many deaf children and adults worldwide. About 5.3% of world population is suffering from disabling hearing loss. In India the incidence of the significant hearing loss is about 6.3%. Every fourth child in 1000 suffers from severe to profound hearing loss. About 100,000 babies are born with severe auditory impairment in India.[1] The only treatment available to these children is cochlear implant surgery. Worldwide many cochlear implant surgeons are moving away from standard incision cochlear implantation (SICI) to minimal incision cochlear implantation (MICI) as it reduces the impact of surgery on the patient without any preoperative shaving of the hairs and improves cosmesis, while maintaining the low morbidity of conventional wider access approaches with earlier switch on of the device.[2,3]

The objective of present study is to compare the incision size, surgical time, intraoperative complications and post operative wound dehisence in minimal incision cochlear implantation group and standard incision cochlear implantation group.

METHODS

The present study was conducted at Dr Rajender Prasad Government Medical College, Kangra (Tanda), Himachal Pradesh, India. The study included eight children who

underwent cochlear implant surgery from August 2015 to August 2017.

Inclusion criteria

Inclusion criteria were parents giving informed consent to participate in study; patient having bilateral congenital sensorineural hearing loss >90 dB; no contraindication to undergo cochlear implant surgery

Exclusion criteria

Exclusion criteria were parents not giving consent; patient having acoustic nerve lesions; patients having middle ear infection.

Of the eight patients four were operated as MICI and four were treated with SICI. The patients in two groups were compared for the following points.

- Length of incision
- Duration of surgery
- Intra operative complications
- Post operative wound dehiscence

Surgical technique

Minimal incision cochlear implantation

All the MICI procedures were performed by the senior author. The senior author's present technique of MICI involves 2 cm incision. The incision is marked 1 cm posterior to post auricular sulcus. Superior end of incision is marked at a point corresponding to the root of helix (Figure 1).

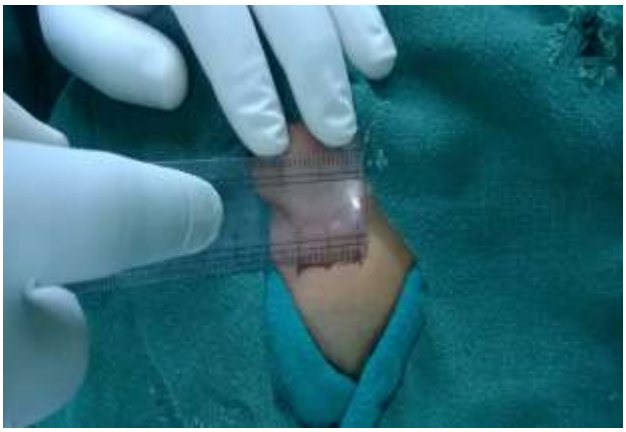

Figure 1: Postauricular incision in MICI.

The Incision is deepened and temporalis fascia graft is harvested. Anteriorly based C shaped flap is elevated up to periostium and is retracted anteriorly towards pinna (Figure 2). The surgeon elevates subperiosteal flap for the device fixation as the assistant retracts the skin.

Figure 2: Anteriorly based C shaped flap elevated and retracted.

Figure 3: Well drilled for the receiver stimulator.

Figure 4: The device is fixed into the well.

Figure 5: Final closure in minimal incision cochlear implantation.

Cortical mastoidectomy is completed. Posterior tympanotomy is done and round window is identified and cochleostomy is done at antero- inferior end of round window. Cochleostomy and post tympanotomy area is packed with cotton ball. Surgeon shifts to the other side of patient and a well is drilled for the receiver stimulator pedestal with assistant retracting the skin (Figure 3). The device is fixed into the well and the cochlear electrode array is inserted and the cochleostomy packed with small pieces of temporalis fascia (Figure 4). The periosteum is then closed as completely as possible. Incision is closed with Vicry 3-0 subcuticular suture (Figure 5). Intra-operative neural response telemetry and postoperative radiographs are used to confirm appropriate electrode placement if necessary. Post operative intravenous antibiotic were given to avoid infection.

Standard incision cochlear implantation

The SICI Technique involved about 8cm inverted J incision. All the surgeries were performed by the senior author. A posteriorly based flap was raised. Cortical mastoidectomy was performed. Posterior tympanotomy was done, round window was identified and cochleostomy was done at standard antero- inferior end of round window. Well drilled and device fixed and electrode array inserted. The wound was closed in layers (Figure 6).

Figure 6: Final closure standard incision cochlear implantation.

Statistical analysis

Statistical analysis was performed using the SPSS (version 16) software. The results are expressed as mean (±SD). The study data were compared using paired t-test. A $p<0.05$ was considered significant.

RESULTS

Between August 2015 to August 2017 four patients underwent MICI (50%) and four underwent SICI (50%). The mean age of children undergoing cochlear implant in SICI group was 2 yrs (SD 0.81) whereas mean age in MICI group was 2.37 yrs (SD 1.10). In SICI group two male and two female children underwent cochlear implant whereas in MICI group all the four children who underwent cochlear implant were females. Five children were implanted with nurotron device and three were implanted with advanced bionics implant (Table 1).

Table 1: Study demographics.

Variable	SICI	MICI
Mean age at implantation yrs (SD)	2 (0.81)	2.37 (1.10)
Sex		
Male	2	0
Female	2	4
Total implants No	4	4
Nurotron	2	3
Advanced bionics	2	1

The mean incision length in MICI was 2 cm and the mean length of incision in SICI group was 7.62 cm (SD 0.47). The MICI group had longer operative time with mean of 247.5 minutes (SD 11.9). The SICI group had mean operative time of 211.25 minutes (SD 8.53).

Table 2: Comparison between SICI and MICI groups.

Variable	SICI	MICI
Mean length of incision cm (SD)	7.62 cm (0.47)	2 cm
Mean operative time minutes (SD)	211.25 (8.53)	247.5 min (11.9)
Complications	Nil	Nil
Incidence of flap necrosis (%)	1 (25)	Nil

In both the groups no operative complication was encountered. Postoperatively the SICI group had one case of flap necrosis (25%) which required re exploration with resuturing (Figure 7). The MICI group had no incidence of flap necrosis (Table 2).

Figure 7: Flap necrosis with device visible in SICI group.

DISCUSSION

The standard incision cochlear implantation (SICI) is associated with incidence of flap necrosis in about 4.5% to17%.[3] The longer incisions used in the SICI approach requires shaving of hairs from wide area of scalp which can be source of anxiety among potential candidates or parents of prospective candidates.[4] The standard approach is associated with wide dissection and bulky flaps which leads to tissue devascularisation, postoperative oedema, venous stasis and increased risk of infection and tissue necrosis. Minimal access approaches have been developed to deal with these issues.

The minimal access approaches can only have wide acceptability if their complication rate is comparable or preferably lower than that of standard approaches. Hoffman and Cohen in a large series of 5000 implants from a single manufacturer reported 9.8% overall complication rate with SICI approach. Flap-related complications were on the order of 4.5%.[5]

Many studies have demonstrated the safety of minimal access approaches. Stratigouleas et al in their study of 176 patients reported 12.5% complication rate with MICI.[6] This study reaffirms that MICI is safe alternative to standard approach techniques. Though in our study fortunately we did not encounter any complication but this could be attributed to less number of patients in study.

Pragera et al in their study found comparable complication rate in minimal access and standard approaches. They conducted their study on 122 patients and concluded that minimal access cochlear implantation require shorter operative times when compared to the standard access cochlear implantation.[7] In our study the MICI group had longer operative time. This could be due to less experience of the surgeon in MICI.

One of the major complications after cochlear implantation are flap related problems, such as cutaneous ulceration with device extrusion, which occurs in up to 8.5% of CI patients.[8] None of our patient in the MICI group had flap necrosis whereas in the SICI group one patient (25%) had flap necrosis and required resuturing.

CONCLUSION

This study clearly emphasises that minimal incision cochlear implantation is a safe and better technique for cochlear implant surgery. MICI can be done with a 2 cm incision causing less trauma to the flap. The technique can be mastered by surgeon with less experience in cochlear implantation. The complication rate of MICI is comparable to SICI though initially it requires more operative time. The incidence of flap necrosis is very less in MICI. This small study indicates that minimal incision cochlear implantation may be the future of cochlear implant surgery.

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