

# Cochlear Implantation In Abnormal Cochlea by Transcanal Technique: Our Experience

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## Background

About 20% of children with congenital sensorineural hearing loss (SNHL) are estimated to have inner ear abnormalities. In cases of acquired hearing loss an anatomically normal cochlea can undergo fibrosis and subsequent ossification which can arise due to various causes. Through this study we would like to report our surgical experience of cochlear implantation in inner ear anomalies and cochlear fibrosis and ossification via the transcanal approach

## **Aim**

To describe the clinical profile, operative findings, surgical technique, type of implant and complications encountered in implantation of abnormal cochlea by the transcanal technique in a tertiary care centre and also discuss the advantages of transcanal technique in abnormal cochlea.

## **Materials and Methods**

This is a retrospective study done amongst 275 patients who underwent cochlear implantation by transcanal technique between January 2015 to December 2022.
 Based on pre-operative imaging with high-resolution computed tomography and magnetic resonance imaging the cochleavestibular malformations in this study were classified according to Sennaroglu classification and the Cochlear ossification was graded from I to IV.

#### Results

- Amongst the 275 patients who underwent cochlear implantation during the study period there were 32 patients with abnormal cochlea. This included 14 patients (5.09%) with congenital malformations, 7 patients (2.54%) with cochlear fibrosis and 11 patients (4%) with cochlear ossification.
- The commonest cochlear malformation was Incomplete Partition 2 (IP-II) which was present in 7 patients (50%)
  out of which 4 was associated with enlarged vestibular aqueduct

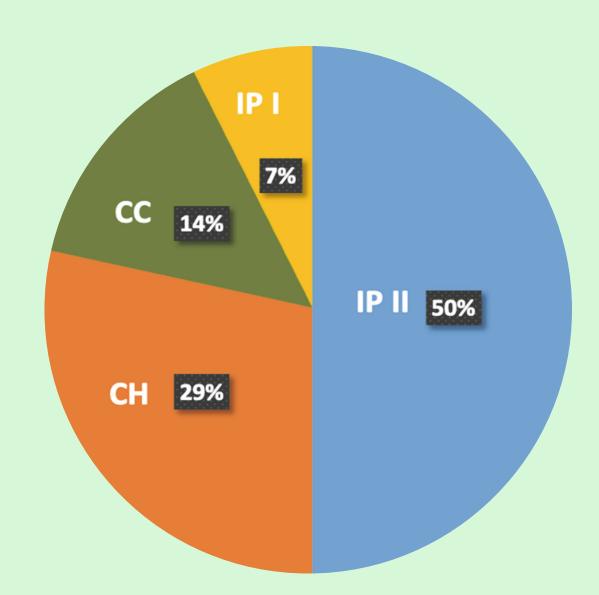


Figure 1 showing the distribution of various cochlear malformations (n=14). IP – Incomplete partition, CH – Cochlear Hypoplasia, CC – Common cavity

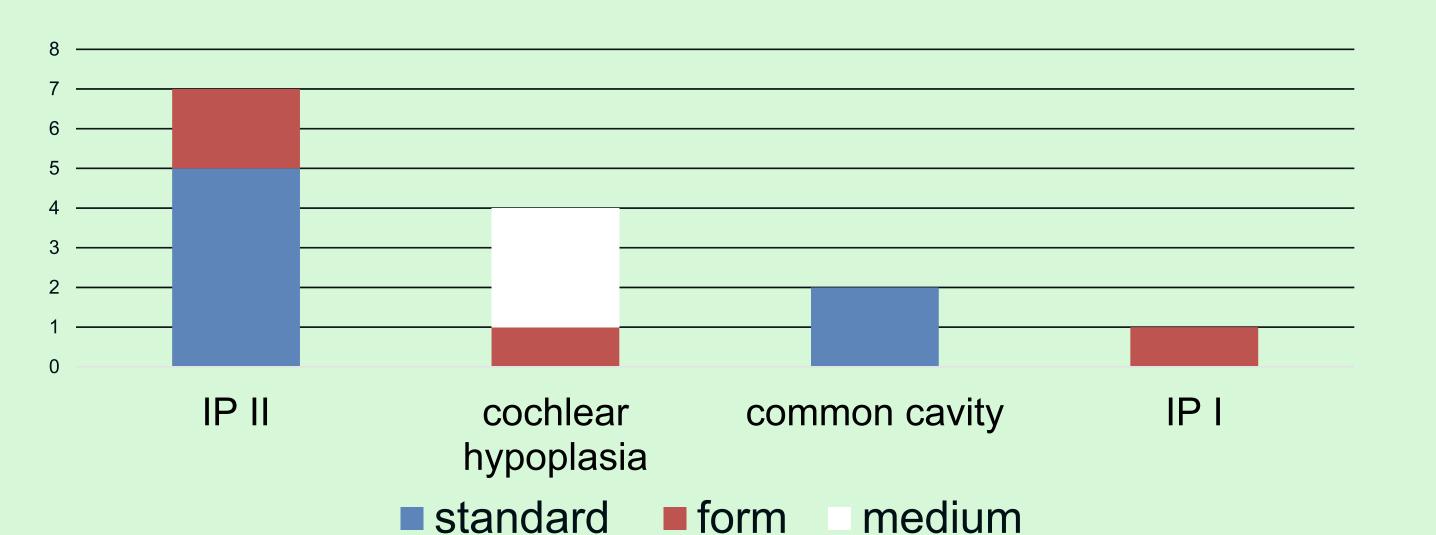


Figure 2 showing the type of electrode used in each malformation

- Out of the 7 patients with cochlear fibrosis, 4 patients had fibrosis only in the basal turn.
- Out of the 11 patients with cochlear ossification 6 patients (54.54%) had a grade 1 ossification, 1 patient had a grade 2 ossification and 4 patients had a grade 3 ossification. 1 patient required re-exploration for correct placement of electrode.

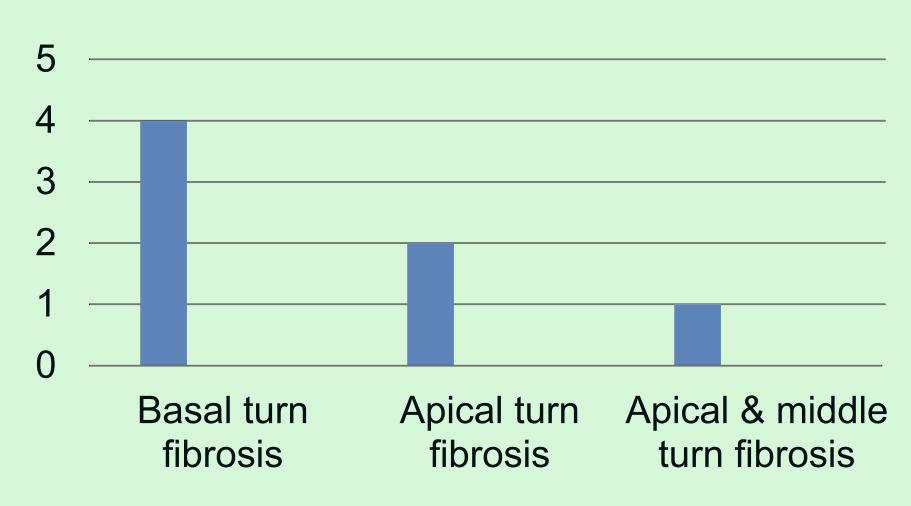


Figure 3 showing the area involved by fibrosis

Grade of ossification	No: Cases	Surgical technique	Type of implant
Grade 1	6 (54.5%)	Scala tympani insertion -4	3 Standard , 1 Medium
		Scala Vestibuli insertion -2	1 Standard , 1 Medium
Grade 2	1 (9.1%)	Scala vestibuli insertion	1 Medium
Grade 3	4 (36.4%)	Basal turn drill out	3 Medium, 1 Compressed

Table showing the severity of ossification, surgical technique & type of implant used

## Discussion



Figure 4 A) Intraoperative image showing the tunnel being drilled in the posterior canal wall using Trifon perforator B) Intraoperative image showing the cochleostomy (yellow arrow) site in a case of IP II C) Intraoperative image showing a standard implant inserted through the tunnel into the cochlea.

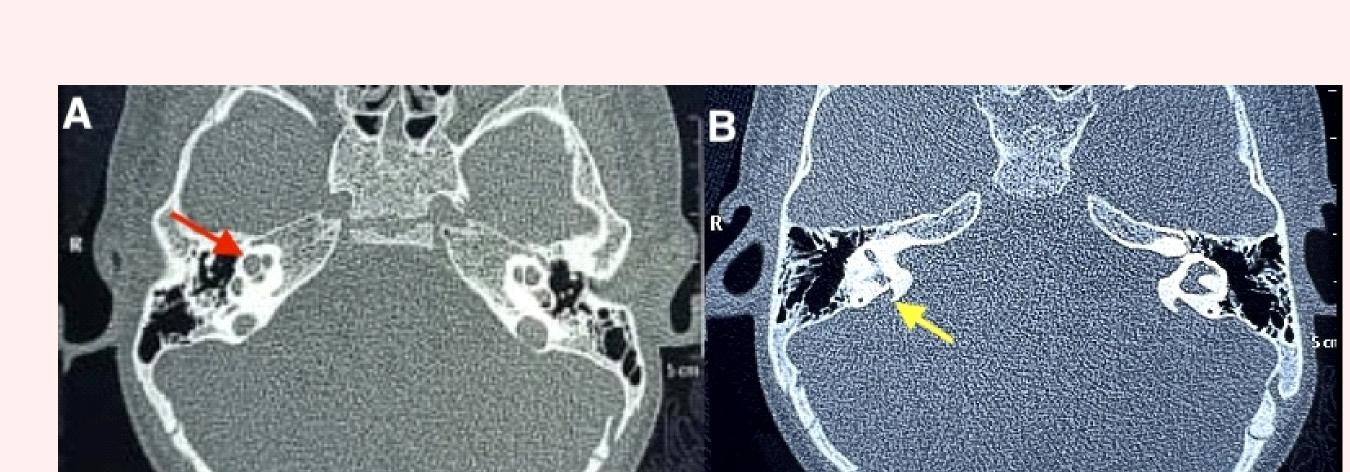


Figure 5 showing HRCT temporal bone images of a child with Mondini's deformity who was successfully implanted. A) shows the cochlea with incomplete partition II anomaly (red arrow). B) shows the associated enlarged vestibular aqueduct (yellow arrow)

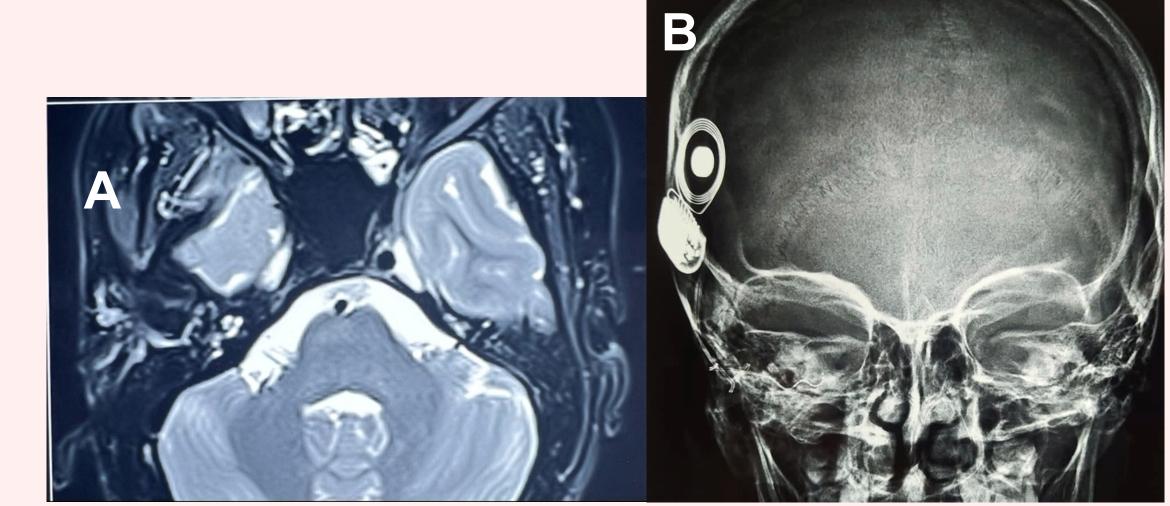


Figure 6 A) showing the MRI images of a post-meningitic patient with fibrosis of the right proximal basal turn who was successfully implanted. B) Postoperative Xray skull in transorbital view showing compressed electrode in situ in a case of cochlear fibrosis involving middle and apical turns.

## Advantages of transcanal technique in cochlear malformations as compared to posterior tympanotomy are :

- 1) It provides a panoramic view of the mesotympanum.
- 2) It helps in early identification of round window niche. [1]
- 3) This technique is beneficial in hypoplastic cochlea in which the promontory may not have the usual protuberance.[2]
- 4) The transcanal approach provides a wide access for packing in CSF gushers.
- 5) In cases of cochlear ossification where a drill out is required, it is easy to follow the curve of the basal turn.

## Conclusion

Cochlear malformations are no longer a contraindication for cochlear implant with proper evaluation and team work. Transcanal approach provides good access for the implantation of abnormal cochlea

## Refrences

- . Weber BP, Dillo W, Dietrich B, Maneke I, Bertram B, Lenarz T (1998) Pediatric cochlear implantation in cochlear malformations. American Journal of Otology 19: 747–753.
- 2. Sennaroğlu L, Bajin MD. Classification and Current Management of Inner Ear Malformations. Balkan Med J. 2017 Sep 29;34(5):397-411.