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ASSESSMENT OF ROUND WINDOW ACCESSIBILITY / VISIBILITY DURING COCHLEAR IMPLANTATION

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Abstract

Hearing loss is the commonest birth defect as international statistics show that 6/1000 live births have congenital sensorineural hearing loss. This prospective cohort study was conducted on a total number of 40 patients with severe to profound sensorineural hearing loss planned for cochlear implantation surgery. Result: No statistical correlation between visibility and accessibility (P value=0.314)). From ENT department, Al-Azhar University for Girls (Cairo) and Tanta University.

1. INTRODUCTION

Hearing loss is the commonest birth defect as international statistics show that 6/1000 live births have congenital sensorineural hearing loss. In Egypt, the magnitude of the problem is increasing markedly as studies done at Ain Shams University found that the prevalence of hearing loss is about 5-10% of the population [1].

However, the huge advances in CI gave these patients a great hope to regain normal communication with their environment. Many patients who received CIs at a young age have developed speech perception skills that allowed them to develop fluent spoken language at a rate resembling that of children with normal hearing [2].

Optimal insertion of the electrode array into the cochlea is crucially important for better hearing and speech recognition outcomes.4 Round window identification during cochlear implantation is essential for accurate electrode insertion into the scala tympani of the cochlea [3].

Many studies have tried to assess the visibility/ accessibility of the RW by using different techniques. Some authors used the preoperative radiological measurements to predict difficult cases of round window during surgery; however, some of these preoperative measurements can be inaccurate when compared with the intraoperative findings of the RW visibility/accessibility due to anatomical variants among different cases [4].

Other studies tried to classify the RW visibility during CI surgery as the Saint Thomas Hospital classification; however, there was a wide range of variation of the categories in that classification [5].

2. PATIENTS AND METHODS

This prospective cohort study was conducted on a total number of 40 patients with bilateral profound SNHL and severe to profound sensorineural hearing loss planned for cochlear implantation surgery.

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This study was carried out and started from the beginning of January 2020 till December 2021 in a tertiary otology university center at the department of ORL-HNS at Al-Azhar University Faculty of Medicine for girls (Cairo) and department of ORL-HNS Tanta University.

This study committed to the following ethical considerations as it was approved by the ethical committee in January 2020.

Exclusion criteria are severed cochleo-vestibular malformation, anatomical variation (Cochlear nerve aplasia and Mickel's anomaly), revision cases and active ear infection.

All the cases were operated upon with the routine Trans mastoid PT approach.

- Intraoperative RWN visualization was graded after complete removal of the bony niche and was graded according to ST. Classification.
- The intracochlear entry was done via RW approach without marginal cochleostomy (extended RW approach). RW approach was the main approach in our surgery unless in cases in which the RW accessibility was compromised by anatomical situations (e.g., RW membrane position, FN location, or other anatomical situations). Therefore, R.W approach was done in every case in our series through drilling of the niche of the RW to extend or widen the RW.
- Then, the electrode was inserted slowly through the RW.

3. RESULTS

The age of all cases ranged between 3-5 years with a mean of 3.67 ± 1.03 years, 21 (52.50%) of the studied patients were males, 19 (47.50%) were females. 7 (17.50%) patients had right side implant; 33 (82.50%) patients had left side implant (Table 1)

Table 1: Demographic data of the studied patients (n=40)

Age (years)	**Mean ± SD**	3.67 ± 1.03
	Range	3 - 5
Sex	**Male**	21 (52.50%)
	Female	19 (47.50%)

(17.5%) had RWM type 2a, 15 patients (37.5%) had RWM type 2b, 10 patients (25%) patient had RWM type 3. (Fig. 1).

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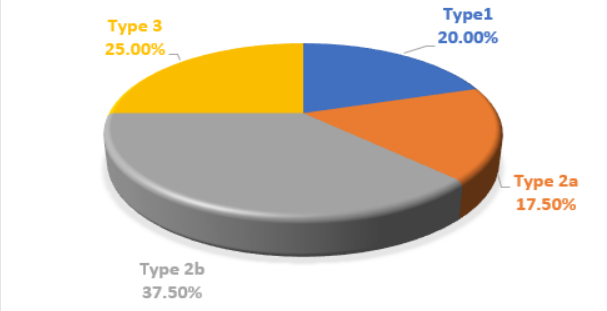
Fig 1: Round window visibility of the studied patients



After identification of the RWM, the pathway of electrode insertion through the PT approach into the scala tympani of the cochlea was considered as a criterion for assessment of the accessibility to the RW. 33 patients included in this study (82.5%) showed easy accessibility for R.W. 7 cases of the patients included in this study (17.5%) showed difficult R.W accessibility (required extra ordinary steps to achieve R.W exposure). (Fig. 2). No statistical correlation between visibility and accessibility (P value=0.314) (Fig.3).

Fig 2: Difficult R.W accessibility

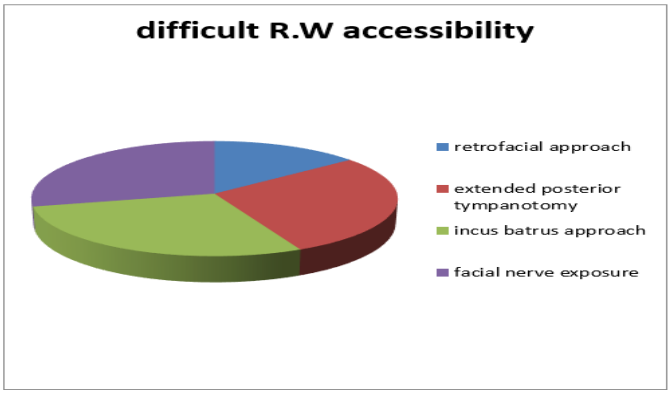
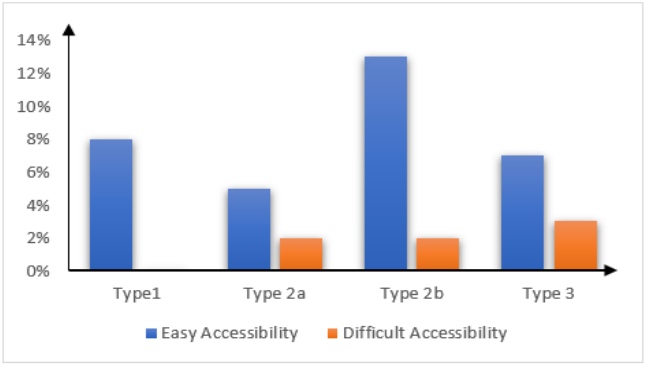


Fig 3: Relationship between R.W visibility and accessibility in the studied patients.



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4. DISSCUSION

There is a wide normal anatomical variation in the degree of visibility of RWM during surgery which may be difficult and might hamper the accessibility of RWM, STH made a famous classification for the degree of the RWM visibility to four groups: type I defined as the exposure of 100% of the membrane, type II where subtotal exposure and is sub-classified into type IIa, more than 50% but less than 100% of the membrane and type IIb, less than 50% but more than 0%. In type III, the membrane cannot be visualized at all even after best surgical effort. RW insertion was feasible in type I and IIa, while cochleostomy (a separate opening into the cochlea and not an extension of the RW) was mandatory for type II b and III [6].

This was a prospective cohort study that was conducted on a total number of 40 patients with severe to profound sensorineural hearing loss planned for cochlear implantation. According to the current study, the visibility of the RWM were as following 8 patients (20%) had RWM type I, 7 patients (17.5%) had RWM type IIa, 15 patients (37.5%) had RWM type IIb, 10 patients (25%) patient had RWM type III, 4 patients with type III had completely invisible RW

Furthermore, after identification of the RWM, the pathway of electrode insertion through the PT approach into the scala tympani of the cochlea was considered as a criterion for assessment of the accessibility to the RW. Our results revealed that 33 patients included in this study (82.5%) showed easy accessibility for R.W compared to 7 patients (17.5%) had difficult accessibility. Moreover, the present study demonstrated that RW accessibility was no significantly related to visibility.

The results of Richard et al demonstrated that insertion of the electrode through the cochleostomy approach is associated with extensive fibrous tissue formation around the electrode with neo-ossification inside the scala tympani of the cochlea, also cochleostomy was associated with greater damage to the cochlea. On the other hand the round window insertion was associated with minimal trauma to the cochlea and significantly less amount of fibrosis and this may explain that the round window insertion results in better stimulation to the cochlear nerve endings in the modiolus and better outcomes regarding speech perception, language acquisition and speech production [7].

In order to visualize the round window through standard approach, we turned to use four of the alternative techniques for round window visualization during CI surgery these includes the following: retrofacial approach was done in one case with congenital abnormal FN canal position (anterolateral FN canal). Incus buttress approach was done in cases with hypopnumatized mastoid associated with anterior position of sigmoid sinus causing difficulty to do standard posterior tympanotomy. Wide posterior tympanotomy and sacrificing the choeda tympani was done in cases with posterior rotated RW. FN exposure was done to widen the narrow posterior tympanotomy in cases with posterior rotated RW [8].

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5. CONCLUSION

Cochlear implantation is a successful treatment option for many children with severe-to-profound hearing loss. Accessibility to RWM differ among patients. RW visibility was insignificantly different between easy and difficult accessibility.

References

1) Korver AM, Smith RJ, Van Camp G, Schleiss MR, Bitner-Glindzicz MA, Lustig LR, Usami SI, Boudewyns AN. Congenital hearing loss. Nat Rev Dis Primers. 2017;3:16094.

2) Schorr EA, Roth FP, Fox NA. Quality of life for children with cochlear implants: perceived benefits and problems and the perception of single words and emotional sounds. J Speech Lang Hear Res. 2009;52:141-52.

3) Briggs RJ, Tykocinski M, Stidham K, Roberson JB. Cochleostomy site: implications for electrode placement and hearing preservation. Acta Otolaryngol. 2005;125:870-6.

4) Majumder PP. People of India: Biological diversity and affinities. Evolutionary Anthropology: Issues, News, and Reviews: Issues, News, and Reviews. 1998;6:100-10.

5) Havenith S, Lammers MJ, Tange RA, Trabalzini F, della Volpe A, van der Heijden GJ, Grolman W. Hearing preservation surgery: cochleostomy or round window approach? A systematic review. Otol Neurotol. 2013;34:667-74.

6) Lo J. Trauma and Residual Hearing Loss After Cochlear Implantation Surgery: University of Melbourne Australia; 2019.

7) Richard C, Fayad JN, Doherty J, Linthicum FH. Round window versus cochleostomy technique in cochlear implantation: histologic findings. Otology & neurotology : official publication of the American Otological Society, American Neurotology Society [and] European Academy of Otology and Neurotology. 2012;33:1181-7.

8) Rizk H, O'Connell B, Stevens S, Meyer T. Retrofacial approach to access the round window for cochlear implantation of malformed ears. Otol Neurotol. 2015;36:e79-83.