Letter to the Editor

Evaluating the Potential Correlation Between the Degree of Hearing Loss, Pretreatment Compromised Threshold, and Irreversibly Dead Cochlear Regions: Insights for Future Studies

Paola Di Mauro[1], **Giannicola Iannella[2]**, **Salvatore Ferlito[1]**, **Luigi Maiolino[1]**, **Antonino Maniaci[1,3]**

[1]Department of Medical and Surgical Sciences and Advanced Technologies "GF Ingrassia" ENT Section, University of Catania, Catania, Italy
[2]Department of Organi di Senso, University Sapienza, Rome, Italy
[3]Department of Biomedical and Biotechnological Sciences (BIOMETEC), University of Catania, Catania, Italy

ORCID iDs of the authors: D.M.P. 0000-0001-7914-6325, I.G. 0000-0003-1781-2809, F.S. 0000-0001-7136-9698, M.L. 0000-0002-5295-7221, A.M. 0000-0002-1251-0185.

Dear Editor,

We read with great interest the paper by Attia Askar et al titled "Discriminant Analysis of the Prognostic Factors for Hearing Outcomes in Patients with Idiopathic Sudden Sensorineural Hearing Loss."[1] The authors conducted a discriminant multivariate analysis to investigate the predictive variables influencing audiological outcomes in patients with idiopathic sudden sensorineural hearing loss (ISSNHL) treated with intratympanic steroid (ITS) injections.

Profound hearing loss, presence of peripheral vertigo, diabetes, and a treatment delay of more than 30 days were identified as negative prognostic factors for hearing recovery. However, variables such as gender, age, and tinnitus did not influence the prognosis.

We commend the authors for this paper. However, we would like to highlight some important considerations.

First, in the "Results" section, the univariate analysis showed that parameters such as diabetes, vertigo, onset of treatment, pre-hearing loss pure tone average (pre-HL PTA) type, grade, and PTA average were significant. Variables such as vertigo, diabetes, and onset of treatment are user-friendly because they are based on their "presence/absence."[2,3] On the other hand, to use the variables PTA average, pre-HL PTA type, and grade in clinical practice,[3-5] it would have been helpful to specifically indicate the success rates for each variable relative to each type of variable.

We currently only have significant data indicating that profound hearing loss yields the worst outcomes in terms of hearing recovery. The authors did not evaluate the proposed variables in the patients included in the study. However, they demonstrated a significant correlation as discriminant prognostic factors for hearing outcomes after ISSNHL.

For instance, in the study by Aldè M. et al, the variables were explained and the means of pre/post hearing threshold were analyzed, emphasizing that there were no significant differences found with early hyperbaric oxygen therapy in ISSNHL compared to baseline ($P = .90$).[2]

Moreover, in the study by Včeva A. et al, the patients were stratified into groups on the basis of their hearing threshold before and after treatment according to modified Siegel's criteria.[3] Moreover, the authors reported at follow-up a significantly lower hearing threshold at multifrequency subanalysis ($P < .001$).

Considering the best audiological improvement was achieved at 1000 Hz (median change of 32 dB), it would have been constructive to include in future studies the risk stratification through, for example, a subanalysis of "post-HL grade" or "post-HL threshold," specifying each hearing loss degree/threshold to increase the predictability of functional recovery.

In this regard, the threshold equalizing noise test (TEN test)[6,7] could represent a useful and accessible tool to evaluate dead regions in the cochlea and improve indications for ITS injection treatment.

Lastly, considering the 81% spontaneous recovery rate shown in the studies by Kitajiri et al[8] and Bayoumy et al,[9] it could be intriguing to evaluate the potential association between the severity of ISSNHL, the pretreatment compromised threshold, and the presence of irreversibly dead cochlear regions.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept – A.M., P.M.; Design – G.I., L.M.; Supervision – S.F., L.M.; Resources – A.M., P.M.; Materials – P.M., A.M.; Data Collection and/or Processing – L.M., S.F.; Analysis and/or Interpretation – A.M., P.M.; Literature Search – A.M., P.M.; Critical Review – S.F., A.M.

Declaration of Interests: The authors have no conflict of interest to declare.

REFERENCES

1.   Askar AA, Ghonim MR, Shabana YK. Discriminant analysis of the prognostic factors for hearing outcomes in patients with idiopathic sudden sensorineural hearing loss. *J Int Adv Otol*. 2023;19(3):162-168. [CrossRef]

2.   Aldè M, Cantarella G, Piatti G, Ambrosetti U. Sudden hearing loss and early hyperbaric oxygen therapy: A preliminary study. *Undersea Hyperb Med*. 2023;50(2):145-153. [CrossRef]

3.   Včeva A, Zubčić Ž, Mihalj H, Maleš J, Mendeš T, Šestak A. Pretreatment hearing grades and hearing recovery outcomes after primary hyperbaric oxygen treatment in patients with idiopathic sudden sensorineural hearing loss. *Diving Hyperb Med*. 2022;52(3):191-196. [CrossRef]

4.   Padilha C, Garcia MV, Costa MJ. Diagnosing cochlear "dead" regions and its importance in the auditory rehabilitation process. *Braz J Otorhinolaryngol*. 2007;73(4):556-561. [CrossRef]

5.   Ferlito S, Fadda G, Lechien JR, et al. Type 1 tympanoplasty outcomes between cartilage and temporal fascia grafts: A long-term retrospective study. *J Clin Med*. 2022;11(23):7000. [CrossRef]

6.   Kara E, Aydın K, Akbulut AA, et al. Assessment of hidden hearing loss in normal hearing individuals with and without tinnitus. *J Int Adv Otol*. 2020;16(1):87-92. [CrossRef]

7.   Kitajiri S-I, Tabuchi K, Hiraumi H, Hirose T. Is corticosteroid therapy effective for sudden-onset sensorineural hearing loss at lower frequencies? *Arch Otolaryngol Head Neck Surg*. 2002;128(4):365-367. [CrossRef]

8.   Ferlito S, La Mantia I, Merlino F, et al. Long-term anatomical and hearing outcomes of canal wall down tympanoplasty for tympano-mastoid cholesteatoma: A 20-year retrospective study. *Life (Basel)*. 2022;12(11):1745. [CrossRef]

9.   Bayoumy AB, van der Veen EL, Alexander de Ru JA. Assessment of spontaneous recovery rates in patients with idiopathic sudden sensorineural hearing loss. *JAMA Otolaryngol Head Neck Surg*. 2018;144(8):655-656. [CrossRef]

Author's Response

Dear Editor,

I am writing in response to the article titled "Evaluating the Potential Correlation Between the Degree of Hearing Loss, Pretreatment Compromised Threshold, and Irreversibly Dead Cochlear Regions: Insights for Future Studies." I appreciate the opportunity to share my perspective on this matter, as I believe there are additional points that need to be considered.

Helpful specification of the success rates for each variable relative to each type of variable in the univariate analysis as parameters such as diabetes, vertigo, onset of treatment, pre-hearing loss pure tone average (pre-HL PTA) type, grade, and PTA average were significant. Variables such as vertigo, diabetes, and onset of treatment are user-friendly because they are based on their "presence/absence." On the other hand, to use the three variables—PTA average, pre-HL PTA type, and grade.[1]

Points of argument made in the article (non evaluated variables enrolled in the study patients, to increase the predictability of functional recovery need to specifying each hearing loss degree/threshold, considering the 81% spontaneous recovery rate shown in mentioned studies).

I believe that open and honest communication is crucial in any discussion, and I value Di Mauro et al's perspective. However, I would like to offer some additional insights and considerations to further our understanding of the issue at hand.

First, our aim of study to make scoring Like equation to distinguish between two groups (recovery and nonrecovery) based on a set of predictor variable. The discriminant function equation was the best choice for this purpose. Establishing one or more linear combinations of predictors in a discriminant analysis creates a new latent variable for each function. The relationship between each predictor and each function's discriminant score is defined as structure correlation coefficients. The discriminant function's linear combination's weights for each predictor mentioned as standard coefficients. The distinctive root of each function in a discriminant analysis is referred to as an eigenvalue. It is a measure of how effectively the function separates the groups, with a bigger eigenvalue indicating a more effective function.[2]

We selected variables for our study based on clinical practices to make our study applicable to real practice. The grade of hearing loss in our study offers a general categorization of the overall hearing loss, whereas the threshold provides detailed information about an individual's hearing abilities across various frequencies at a specific dB level. This has been the preferred selection in several studies.[3-5]

Regarding spontaneous recovery in the mentioned studies,[6,7] ethical issues surrounding depriving patients diagnosed with idiopathic sudden sensorineural hearing loss (ISSNHL) of a potentially effective intratympanic steroid (ITS) or other management modalities and thus waiting for spontaneous recovery are multifaceted and require careful consideration of the principles of respecting a patient's autonomy, beneficence, nonmaleficence, justice, and the specific circumstances of the case.[8,9]

Quantifying this recovery would be especially useful if no method of steroid administration has proven to be better in individuals with ISSNHL who are not receiving treatment because the spontaneous hearing recovery rate in these patients is large. However, we have not included a placebo arm since it would be immoral to withhold routine care when using steroids, and potential study participants indicated during patient and public consultation that they would not accept being randomly assigned to "no treatment," rendering a trial with a placebo arm unfeasible. Given that it might be as high as 60%, spontaneous recovery of ISSNHL should not be disregarded.[9]

Furthermore, it is crucial to emphasize the need for suggested policies in ISSNHL treatment (threshold equalizing noise test and other accessible tools to evaluate dead regions in the cochlea). As this will help us move forward in a positive direction and improve indications for ITS injection treatment.

In conclusion, I appreciate *The Journal of International Advanced Otology* for providing open dialogue and discourse within the otorhinolaryngology community. By considering different perspectives and engaging in constructive discussions, we can collectively work toward a better future.

I thank Di Mauro et al for their attention to this matter. I look forward to subsequent discussions on this important topic in *The Journal of International Otology*.

REFERENCES

1. Askar AA, Ghonim MR, Shabana YK. Discriminant analysis of the prognostic factors for hearing outcomes in patients with idiopathic sudden sensorineural hearing loss. *J Int Adv Otol*. 2023;19(3):162-168. [CrossRef]

2. Bökeoğlu Çokluk Ö, Büyüköztürk Ş. Discriminant function analysis: concept and application. *Eğitim Araştırmaları Dergisi*, 2008:73-92.

3. Attanasio G, Russo FY, Di Porto E, et al. Prediction of hearing recovery in sudden deafness treated with intratympanic steroids. *Acta Otorhinolaryngol Ital*. 2018;38(5):453-459. [CrossRef]

4. Chang YS, Park S, Lee MK, Rah YC, Choi J. Framingham risk score is associated with hearing outcomes in patients with idiopathic sudden sensorineural hearing loss. *J Laryngol Otol*. 2020;134(5):419-423. [CrossRef]

5. Kara E, Cetik F, Tarkan O, Sürmelioğlu O. Modified intratympanic treatment for idiopathic sudden sensorineural hearing loss. *Eur Arch Otorhinolaryngol*. 2010;267(5):701-707. [CrossRef]

6. Bayoumy AB, van der Veen EL, Alexander de Ru JA. Assessment of spontaneous recovery rates in patients with idiopathic sudden sensorineural hearing loss. *JAMA Otolaryngol Head Neck Surg*. 2018;144(8):655-656. [CrossRef]

7. Kitajiri S-i, Tabuchi K, Hiraumi H, Hirose T. Is corticosteroid therapy effective for sudden-onset sensorineural hearing loss at lower frequencies? *Arch Otolaryngol Head Neck Surg*. 2002;128(4):365-367. [CrossRef]

8. Chaushu H, Ungar OJ, Abu Eta R, Handzel O, Muhanna N, Oron Y. Spontaneous recovery rate of idiopathic sudden sensorineural hearing loss: A systematic review and meta-analysis. *Clin Otolaryngol*. 2023;48(3):395-402. [CrossRef]

9. Smith ME, et al. Protocol for a multicentre randomised controlled trial of steroid administration routes for idiopathic sudden sensorineural hearing loss: the STARFISH trial. *medRxiv*, 2023. [CrossRef]

Ahmed Attia Askar

Student Hospital, Mansoura University, Mansoura, Egypt