**Predictors for tinnitus recovery following unilateral cochlear implantation**

Hans GXM Thomeer, MD, PhD1,2; Geerte GJ Ramakers, MD1,2; Gijsbert A. Van Zanten, MD, PhD1,2; Robert J Stokroos, MD, PhD; Martijn W. Heymans, PhD3; Inge Stegeman, PhD1,2

1)Department of Otorhinolaryngology, Head and Neck Surgery, University Medical Center Utrecht, P.O. Box 85500, 3508 GA Utrecht, The Netherlands

2) Brain Center Rudolf Magnus, University Medical Center Utrecht, Universiteitsweg 100  
3584 CG Utrecht, The Netherlands

3) Department of Epidemiology & Biostatistics, VU University Medical Center, Amsterdam, The Netherlands

**Objective:** To develop and internally validate a prediction model for tinnitus recovery following unilateral cochlear implantation.

**Setting:** A questionnaire concerning preoperative and postoperative tinnitus was sent to all patients with bilateral severe hearing loss who underwent unilateral cochlear implantation at the University Medical Center Utrecht between January 1st 2006 and December 31st 2015.

**Participants:** Of 137 included patients, 87 patients experienced tinnitus preoperatively. The data of these 87 patients was used to develop the prediction model.

**Main Outcome(s) and Measure(s):** The outcome of the prediction model was tinnitus recovery. Investigated predictors were age, gender, duration of deafness, preoperative hearing performance, tinnitus duration, tinnitus severity, tinnitus localization, follow-up duration, localization of cochlear implant compared to tinnitus side, surgical approach, insertion of the electrode, CI brand, and difference in hearing threshold following cochlear implantation. Multivariable backward logistic regression was performed (p<0.157). Missing data were handled using multiple imputation. The performance of the model was assessed by the calibrative and discriminative ability of the model. The prediction model was internally validated using bootstrapping techniques.

**Results:** The tinnitus recovery rate was 40%. A lower preoperative Consonant-Vowel-Consonant (CVC) score, unilateral localization of tinnitus, and larger deterioration of residual hearing at hearing threshold 250 Hertz revealed to be relevant predictors for tinnitus recovery. The Hosmer and Lemeshow test showed a good fit of the model. The area under the receiver operating characteristics curve (AUC) of the initial model was 0.722 [IQR: 0.703-0.729]. After internal validation of this prediction model, the AUC decreased to 0.696 [IQR: 0.667-0.700].

**Conclusion and Relevance:** Lower preoperative CVC score, unilateral localization of tinnitus, and larger deterioration of residual hearing at hearing threshold 250 Hertz were significant predictors for tinnitus recovery following unilateral cochlear implantation. The performance of the prediction model developed in this retrospective pilot study is promising. However, before clinical use of the model, the conduction of a larger prospective study is recommended.