However, even 9 years after GTR recurrences could be observed. The strongest predictor of recurrence was the extent of resection. Compared to GTR, STR increases the risk of recurrence by 10 times and NTR by 3 times.
Conclusion: In case of incomplete VS resection recurrences occur more early and more frequently. Therefore shorter MRI follow-up intervals may be appropriate.In all subgroups, however, there are also recurrences over the long term. Based on our data, a follow-up of at least 10 years should be performed.

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AUDITORY BRAINSTEM IMPLANTATION GRADING SCALE: AN ORIGINAL VALIDATED GRADING SCALE FOR CLINICAL PRACTICE

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Introduction: Auditory brainstem implantation (ABI) technology provides prosthetic electric stimulation of the cochlear nucleus in the brainstem to restore hearing sensations, but many aspects of the outcomes of ABI still remain unknown. In this study, we would like to develop a predictive model to estimate the hearing outcomes following ABI surgery.
Methods: Retrospective review of prospectively maintained database from 2008-2018 was conducted at one of the world's largest centers for ABI. Various statistical models including, multivariable logistic regression (MLR) and artificial neural network (ANN) were used to classify and predict the outcomes following ABI surgery. The grading scale was defined as A, B, C and D with each corresponding to open set speech, increased discrimination with lip reading, awareness and worst respectively. Grade A and B belong to good outcomes, and Grade C and D corresponding to poor outcomes.
Results: 1,177 electrodes were stimulated intraoperatively among 85 patients [females, n=48 (56.6%)]. The mean follow-up of ABI was 29.6 months (range, 18-33.4 months). MLR analysis revealed that patients with age $\leq$ 20 years and good preoperative hearing had 1.13- [Odds ratio (OR) : 1.13, 95% Confidence Interval (CI): 1.14-3.96, p=0.03] and 4.22- (OR: 4.22, 95%CI: 1.58-35.4, p=0.04) folds significantly higher likelihood of good outcome. Patients with age >60 years and those with prior surgery had 67% (OR: 0.33, 95%CI: 0.04-0.87, p=0.04) and 57% (OR: 0.43, 95%CI: 0.12-0.96, p=0.02) more likelihood of poor outcome following ABI respectively. ANN showed 85.7% and 81.3% predictive accuracy of the model in the training and validation dataset. Furthermore, the area under the curve (AUC) revealed that Grade A had 0.95, Grade B had 0.95, Grade C had 0.90, and Grade D had 0.86.
Conclusion: The factors leading to improved performance are not completely clear, these new results show that excellent hearing outcome is possible with ABI.

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ARTIFICIAL NEURAL NETWORK ANALYSIS OF EVOKED AUDITORY BRAINSTEM RESPONSES FOR PREDICTION OF ACTIVE AUDITORY BRAINSTEM IMPLANT (ABI) ELECTRODES IN PATIENTS WITH NEUROFIBROMATOSIS TYPE II

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Background: Auditory brainstem implantation (ABI) is used to provide auditory sensations through electric stimulation of the cochlear nucleus. The exact position of the 3 by 7 electrode array with respect to the cochlear nucleus is not known, due to complex tumor removal, procedures during surgery, potential distortions to the anatomy, and possible post-op movements. In this study we would like to develop a predictive model to estimate the active electrode in the post-operative period, to maximize the outcome.
Methods: A retrospective study of a prospectively maintained database of ABI users with evoked brainstem responses was carried out at an academic institution. Multi-class classification was conducted using the multilayer perceptron (MLP) feed forward neural network model (FF-NN) to classify and predict the post-operative active electrodes.
Results: 1,177 electrodes were stimulated intraoperatively among 85 patients [females, n=48 (56.6%)]. ABI was implanted to the right and left side in 44 patients (51.7%) and 43 patients (48.3%) respectively. The mean follow-up of ABI was 29.6 months (range, 18-33.4 months). Notably, the heat map showed that electrodes at the center and the medial end (E9-16) of the array showed higher likelihoods of being active, irrespective of right or left side. The network was trained for 500 epochs with a learning rate of 0.3 and achieved a mean classification of about 92.3%. The open accessible software for predicting the monopolar electrode stimulation postoperatively based on bipolar intraoperative stimulation can be found here at: file:///Users/nidafatima/Desktop/Plot%25201%20copy.html
Conclusion: An ideal MLP FF-NN structure was achieved and hence may result in understanding more precisely about the ABI stimulation and bringing consistency among the neurosurgeons and audiologists worldwide.

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VOLUMETRIC GROWTH TRENDS OF RESIDUAL VESTIBULAR SCHWANNOMAS: A SYSTEMATIC REVIEW AND META-ANALYSIS

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Background: Gross total resection remains the gold-standard approach for most vestibular schwannomas (VS). In some cases, incomplete resection (IR) becomes a desired alternative to preserve the facial nerve function and the patient's quality of life. While earlier studies described incompletely resected VSs as dormant, more recent studies reported a higher growth rate following IR. Therefore, examining the volumetric residual VS growth rates could have implications on the follow-up protocols. Moreover, prognostic factors predicting preoperative VS growth have been previously investigated. However, these factors have not been investigated following IR. Our review aims to examine the volumetric growth rate of residual VS following IR and examine variables associated with regrowth.
Methods: The review was conducted in accordance with the PRISMA statement and registered a priori with PROSPERO (CRD42021268113). Six databases were searched from 2010 to 2021. Full-text articles analysing volumetric growth rates in at least 10 patients who had residual VS after IR were assessed. We conducted a meta-analysis using a random-effects model.
Results: 14 studies totalling 849 patients were included in the analysis. The mean planimetric growth rate was 1.57mm/year (range 0.16–3.81 mm/year). The mean volumetric growth rate was 281.725 mm^3/year (range 17.9–530.0 mm^3/year). Age, sex, pre-operative tumour size/volume, histopathology, MIB-1 index, and Intracanalicular location were not associated with re-growth. Residual tumour size/volume was statistically significant to residual growth (OR = 0.65, 95% CI 0.47–0.90, *p*-value = 0.01). Radiological re-growth occurred in an average of 26.6% cases (range 0–54.5%).
Conclusion: Only the residual tumour volume/size was associated with residual VS growth. Therefore, postoperative surveillance for at least 5 years remains of utmost importance to monitor disease progression and provide timely interventions. Our study shows that future work should be aimed at molecular and histological characteristics of residual VSs to aid prognostic understanding of residual growth.

4.3 Pituitary Tumors
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AUTOMATED VOLUMETRIC ASSESSMENT OF PITUITARY ADENOMA

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Background: Assessment of pituitary adenoma volume and extent of resection (EOR) through manual segmentation is time-consuming and likely suffers from poor interrater agreement, especially postoperatively. Automated tumor segmentation and volumetry by use of deep learning techniques may provide more objective and quick volumetry.
Methods: We developed an automated volumetry pipeline for pituitary adenoma. Preoperative and three-month postoperative T1-weighted, contrast-enhanced magnetic resonance imaging with manual segmentations were used for model training. After adequate preprocessing, an ensemble of convolutional neural networks was trained and validated for preoperative and postoperative automated segmentation of tumor tissue. Augmentation and transfer learning techniques were applied in an attempt to improve postoperative performance. Generalization was evaluated on a separate holdout set.