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The value of intraoperative facial motor evoked potential for facial outcomes in CP angle tumor surgery: A systematic review and meta-analysis

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ADMINISTRATIVE INFORMATION

Support - No.

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Conflicts of interest - None declared.

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Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 15 December 2023 and was last updated on 15 December 2023.

INTRODUCTION

Review question / Objective To investigate the diagnostic value of facial motor evoked potentials (FMEP) for facial outcomes in CP angle tumor surgery.

Rationale Facial monitoring has become an indispensable practice in modern CPA tumor surgery due to its critical role in preserving facial nerve function. Current facial monitoring techniques include free-running electromyography (EMG), triggered EMG with direct electrical stimulation (DES), and facial motor evoked potentials (FMEP). Compared to EMG techniques, FMEP was less studied and may be underestimated due to diverse criteria and monitoring methods. Our aim is to explore the value of intraoperative FMEP for facial outcomes in CPA tumor surgery to provide an evidence-based consensus standard for future clinical practice and prospective studies.

Condition being studied The contextual framework of the PICO (patients, intervention/ index tests, comparison/reference tests, outcome) for the meta-analysis was delineated as follows: P: brain tumor patient who underwent CP angle (or skull base) tumor surgery; I: IONM with facial MEP; C: clinical facial function; and O: diagnostic accuracy.

METHODS

Search strategy Two authors (SY, P and CR, L) conducted independent electronic searches in the PubMed, Em-base, Cochrane CENTRAL, Web of Science, and ClinicalTrials.gov databases using the following keywords (Facial motor evoked potential OR Corticobulbar tract motor evoked potential OR facial MEP OR Corticobulbar MEP OR CoMEP) AND (Cerebellopontine angle tumor OR CP angle tumor OR Skull base surgery). The search encompassed records from the database's inception (i.e., the earli-est entry) up until the database search date (June 26, 2023).

Participant or population Brain tumor patient who underwent CP angle (or skull base) tumor surgery.

Intervention IONM with facial MEP.

Comparator Clinical facial nerve function.

Study designs to be included Observational studies.

Eligibility criteria The following inclusion criteria were used: (1) studies enrolling CP angle or middle to posterior skull base tumor patients who underwent surgery (without age or surgical method limitations), (2) studies investigating the intraoperative neurophysiology with facial MEP, (3) studies with available data for pre- and post-operative facial nerve function assessment, and (4) studies with obtainable facial MEP cut off criteria to get the number of true positive, true negative, false positive, false negative for contingency table.

Information sources Two authors (SY, P and CR, L) made independent electronic searches in the PubMed, Embase, Cochrane CENTRAL, Web of Science and ClinicalTrials.gov with keyword of (Facial motor evoked potential OR Corticobulbar tract motor evoked potential OR facial MEP OR Corticobulbar MEP OR CoMEP) AND (Cerebellopontine angle tumor OR CP angle tumor OR Skull base surgery) through the earliest record to June 26, 2023.

Main outcome(s) In this meta-analysis, we investigated the value of intraoperative facial MEP for facial outcomes in CP angle tumor surgery. The overall accuracy of facial MEP was significantly better than chance. The statistical significance was maintained within the meta-regression model with timing, alert criteria, and type of outcome assessments as covariates with interaction analyses. We found that studies employing different types of alerts and outcome assessments should not be amalgamated when summarizing sensitivity, although there was no difference in specificity.

Additional outcome(s) Moreover, we identified a positive correlation between logit sensitivity and specificity which il-lustrated in SROC plot.

Data management Two independent authors (SY, P and HL, W) extracted data from the evaluated studies, including demographic data, study design parameters with duration of follow-up, details of the intraoperative neuromonitoring protocol and techniques, intra-operative warning criteria with accuracy cut off criteria, and the clinical outcomes. To avoid misinterpretation, the evaluators paid special attention to the facial MEP threshold and criteria used in each study for diagnostic test accuracy calculation. In situations where data were unavailable within the published articles, we contacted the corresponding authors to obtain the original data.

Quality assessment / Risk of bias analysis To investigate the methodological quality of the evaluated studies, we used the QUADAS-2 (Quality Assessment of Diagnostic Accuracy Studies, version 2), which consists of four main domains for evaluating study quality: patient selection, index test, reference standard, and flow and timing. Each domain is assessed in terms of risk of bias, and the first 3 domains are also assessed in terms of concerns regarding applicability.

Strategy of data synthesis Logistic regression models used both fixed and bivariate random-effects meta-analysis. Sensitivity, specificity, and likelihood ratios were our main measures of fMEP test accuracy. Forest plots were constructed with 95% confidence intervals (Cis) for sensitivity and specificity for each study and their predicted averages across studies. Estimated points and curves were plotted on a summary receiver operating characteristic curve (sROC) graph. Nine-five percent confidence and prediction ellipses were used to graphically represent heterogeneity within and between studies, respectively.
Variation between studies from different thresholds was investigated by inclusion of a correlation parameter. In models without covariates the I2 statistic of Zhou and Dendurkui accounted for between study variability in sensitivity and specificity. Logistic regression models were implemented with the command metadta in Stata (Nyaga 2022, 2023). A two-tailed p value of less than 0.05 was considered statistically significant.

Subgroup analysis Heterogeneity was also investigated by subgroup analyses of amplitude or threshold alert criteria, and outcome assessments in the immediate post-operative for follow-up periods. Threshold method and time of outcome assessments were also included as covariates in multivariate regression model to investigate their contribution to between-study heterogeneity and their interaction. For comparisons between immediate and follow-up outcomes, the predictor was modified for repeated measurements.

Sensitivity analysis To confirm the robustness of this meta-analysis, sensitivity analyses were performed using the one-study removal method to determine whether there was a statistically

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significant change in the summary estimates of test accuracy after removing a particular trial from the analysis.

Language restriction No language limit.

Country(ies) involved Taiwan, USA.

Keywords Facial motor evoked potential(FMEP), Corticobulbar tract motor evoked potential(Corticobulbar MEP or CoMEP), Cerebellopontine angle tumor(CPA tumor), Skull base surgery.

Contributions of each author
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