Poster Presentation

Predictive Biomarkers for Responsive Neurostimulation in Drug-Resistant Epilepsy: A Systematic Review

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Abstract

Introduction: Responsive neurostimulation (RNS) is a promising treatment for drug-resistant epilepsy, but patient response variability necessitates reliable predictive biomarkers. This systematic review synthesizes evidence on potential biomarkers for RNS efficacy, addressing a critical knowledge gap in epilepsy management. *Materials and Methods:* We systematically searched PubMed, Scopus, and Cochrane Library databases from inception to August 2024 using a comprehensive search strategy combining terms related to "responsive neurostimulation", "epilepsy", and "biomarkers". Studies evaluating predictors of RNS outcomes in drug-resistant epilepsy were included. Exclusion criteria encompassed non-English publications, case reports, and studies lacking outcome data. To minimize bias, study selection and data extraction were conducted in separate phases. The Joanna Briggs Institute critical appraisal tools were used for quality assessment. The primary outcome was the identification of biomarkers associated with RNS efficacy. *Results:* Eight studies (1 randomized controlled trial, 7 cohort studies) met inclusion criteria, involving 3,695 patients. Neuroimaging biomarkers, particularly structural connectivity patterns on diffusion-weighted imaging, were consistently associated with seizure reduction. Electrophysiological markers, including high-gamma band synchronizability and specific interictal discharge patterns, showed potential in forecasting RNS response. Magnetoencephalography-derived functional connectivity measures demonstrated high predictive accuracy in one study. Clinical factors such as unifocal seizure onset, prior stereoelectroencephalography, and shorter epilepsy duration were frequently associated with improved outcomes. Quality assessment revealed moderate to high methodological rigor across studies, with robust outcome measures and adequate follow-up periods. *Conclusion:* Emerging neuroimaging, electrophysiological, and clinical biomarkers show promise in predicting RNS efficacy for drug-resistant epilepsy. Integration of these biomarkers may optimize patient selection and improve clinical outcomes. Future research should focus on prospective validation and development of integrated prediction models to enhance clinical applicability.

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