

Evaluation by Stereoelectroencephalography (SEEG) of the Insular Region in Drug-Resistant Focal Epilepsies: Diagnostic Experience and Technique in the First Reported Cohort in Argentina

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Abstract

Introduction: The insula, due to its deep location, complex anatomy, and clinical interpretation, represents a challenge in the study of drug-resistant epilepsies.

Method: Seventeen patients implanted between 2018 and 2025 with suspected insular involvement were included. Micromar® frames (2020–2023) and Leksell® frames (2023–2025) were used. Trajectories, number of contacts, ictal onset zone, thermocoagulations, and complications were analyzed. In addition, dissections were performed on six human hemispheres (Klingler technique) to validate safe trajectories.

Results: During the study period, 218 electrodes were implanted, of which 56 (25.7%) targeted the insula, with 128 contacts in insular cortex. Accumulated experience enabled a transition from orthogonal trajectories (32 trajectories, covering opercular and insular regions, average of 2 insular contacts) to planning with both orthogonal and oblique trajectories (26 trajectories, exclusively insular coverage, average of 7 contacts).

Discussion: Insular SEEG exploration has been increasingly reported worldwide, yet data from Latin America remain scarce. Our series, the largest in Argentina, confirms the feasibility and safety of insular implantation in drug-resistant focal epilepsy. Indications were based on semiology suggestive of insular onset or early propagation, and SEEG confirmed an insular ictal onset zone in one-third of cases. Technical refinement from orthogonal to oblique trajectories allowed denser sampling (up to 7 contacts/electrode) while avoiding vascular injury, with only one hematoma unrelated to insular electrodes. No procedure-related morbidity was observed. These findings reinforce the role of systematic insular exploration in SEEG protocols, given the limitations of non-invasive studies and the potential for therapeutic thermocoagulation when the insula is the primary ictal onset zone.

Conclusions: Insular SEEG implantation is safe and feasible. Progressive technical optimization allowed denser coverage without increased morbidity. The possibility of identifying primary ictal activity and treating it through thermocoagulation supports its systematic inclusion in SEEG studies, despite its challenging anatomy.

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