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Rationale

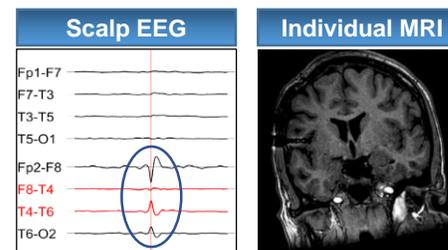
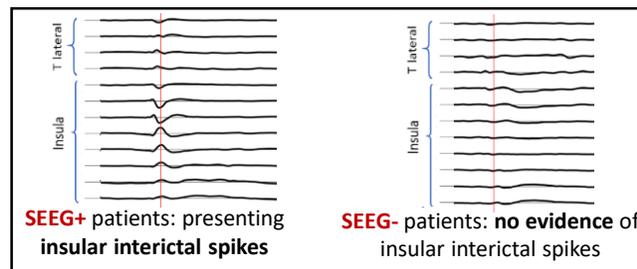
- Stereo-EEG (SEEG) is often needed to characterize involvement of the insula in the epileptogenic zone (EZ).
- Adequate definition of suspected insular epileptogenic foci is crucial to **optimize SEEG electrode placement**.
- **Electrical Source Imaging (ESI)** may offer an early and practical solution to **localize the irritative zone (IZ) to the insula**, which cannot be done by simple visual scalp EEG analysis.

Objectives

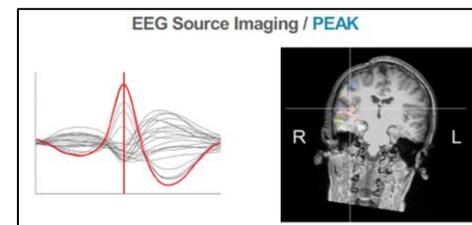
- To define the **accuracy** of low density interictal ESI in defining the insular IZ.
- Comparison of **concomitant**:
 - **interictal ESI localization** (spikes recorded with low-density EEG)
 - **SEEG interictal activity** in patients implanted in the insula
- To evaluate ESI results based on the **pattern** (dominant or propagated) insular interictal spikes.

Methods

- Patients **inclusion criteria** (Saint-Luc University Hospital) :
 - SEEG with at least one depth electrode exploring operculo-insular region(s)
 - concomitant scalp EEG with 19-25 electrodes
 - pre-operative 3T structural MRI
- **Interictal ESI**, using **Epilog PreOp®** (Epilog NV, Belgium): automated spike-clustering and subsequent sLORETA
 - **patient-specific head model**, from individual MRI.
 - results at **half-rising** and **peak** time of the spike
- **Retrospective SEEG review** (4th and 5th night after surgery, 2 consecutive hours per night) :



↓ Epilog PreOp ↓



- **ESI-insular-IZ** patients: at least one **ESI insular cluster** (i.e. localized to implanted operculo-insular sublobes)

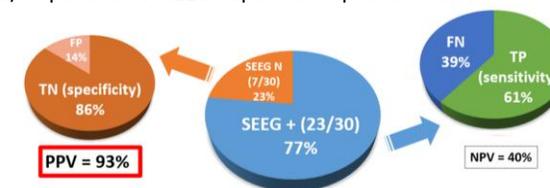
ESI/SEEG concordance analysis:

True positive (TP) = SEEG+ and ESI-insular-IZ
True negative (TN) = SEEG-, no ESI-insular-IZ

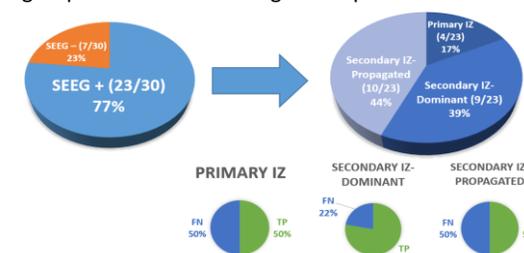
- Subgroup classification:
 - **Primary IZ**: SEEG+ and insular contacts involved in the **seizure onset zone (SOZ)**
 - **Secondary IZ-dominant**: no insular SOZ, prevalence of **spikes with insula as dominant contact**
 - **Secondary IZ-propagated**: no insular SOZ, prevalence of spikes **propagating to the insula from other contacts**

Results

- 30 patients included with verified **SEEG insular contacts**
 - Mean n of insular **contacts** = 6,2 per patient
 - Mean n of EEG **hours** analysed= 143 per patient
- 23/30 patients → **SEEG+** upon retrospective review



- Subgroup classification among SEEG+ patients:



Conclusion and perspectives

- Automated low-density ESI may localize with good accuracy the insular irritative zone, as confirmed by retrospective SEEG review
- High **specificity** and **PPV** → usefulness to confirm a suspected insular irritative focus for implantation

Next steps

- ★ Analysis of the SEEG mean recordings concomitant to the scalp EEG spikes pooled in ESI insular clusters