INTRODUCTION

• Functional mapping is often necessary across different clinical settings. In particular, language lateralization is a critical step, among other scenarios, in surgical planning.
• Currently, multiple approaches are available to lateralize language, each with different advantages and disadvantages, including intracranial mapping, functional MRI, MEG, and Wada testing.
• High-Density EEG is a non-invasive, relatively inexpensive approach that provides comprehensive coverage of cortical activity with excellent temporal resolution.
• Here, we studied whether HD-EEG source reconstruction of brain activity recorded during a language task could help lateralize language relative to the same task performed during functional MRI acquisition.

METHODS

• A total of 30 patients with varying degrees of aphasia following left middle cerebral artery (MCA) stroke after at least 6 months were included and completed the following task:

DATA ANALYSIS

• Functional MRI was analyzed by means of T maps comparing BOLD signals between the concrete nouns vs. abstract images
• HD-EEG was acquired with 64 channels and the preprocessing data involved the following steps. ESI was conducted by Epilog (www.epilog.care):
  1. Filtering with a Zero Phase Shift Butterworth bandpass filter 0.5Hz to 30Hz with order 5
  2. Visual selection of bad channels based on standard deviation
  3. Interpolation of bad channels
  4. Average referencing
  5. Independent Component Analysis to remove eye blink artefacts
• The generation of ERPs involved the following steps:
  1. Overlap marker names (“concrete” and “abstract”) at time of presentation
  2. Segment epochs from -500 to 2000ms of the markers
  3. Remove bad trials based on peak-to-peak amplitude
  4. Baseline correction from -500 to 0ms

RESULTS

• We found several cases in which HD-EEG showed a more clear left-sided lateralization than fMRI, likely driven by EEG’s superior temporal resolution, allowing analyses to be restricted to a more fine-grained temporal window relevant to language processing compared to the BOLD signal:

DISCUSSION

• Our findings reveal that task-based HD-EEG may be a useful tool in lateralizing language, presenting several advantages over other approaches, including its relative ease of implementation and relative low cost.
• These preliminary results must be tested across a wide array of controls and other clinical populations in order to ascertain their generalizability.
• Further studies should also directly compare with other approaches and determine the potential differences of different configurations (e.g. are 265 electrodes superior to 64 electrodes?)