



Functional Mapping with Depth Electrodes in Epilepsy Surgery: Usefulness and Limitations

Jorge Alvaro Gonzalez-Martinez MD, PhD; Gwyneth L. Hughes MD; Tsulee Chen MD; Ryan Brennan MD; Sumeet Vadera; Juan Bulacio; William E. Bingaman MD

Introduction

Invasive monitoring using stereotactic implantation of depth electrodes (a.k.a. stereo-electroencephalography, or SEEG) is a promising method of invasive monitoring for refractory epilepsy. Although designed for mapping the epileptogenic zone (EZ) only, precise functional mapping can be also obtained, influencing the surgical strategy.

Methods

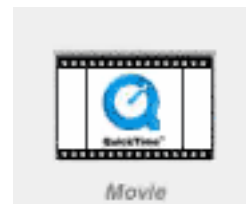
From March 2009 to February 2010, 80 consecutive patients who underwent SEEG implantation and subsequently functional mapping were prospectively analyzed. Goals for the SEEG electrode implantation included (1) mapping the EZ and (2) delineation of cortical functions. Indications for SEEG included discordant pre-implantation data, presumed proximity of the EZ to eloquent areas, possibility of multifocal or bi-hemispheric epilepsy and failed previous subdural evaluation. Functional mapping was performed using similar protocol used for subdural grid mapping. Demographics, type of seizures, success in mapping eloquent areas, complications and functional outcome were analyzed.

Results

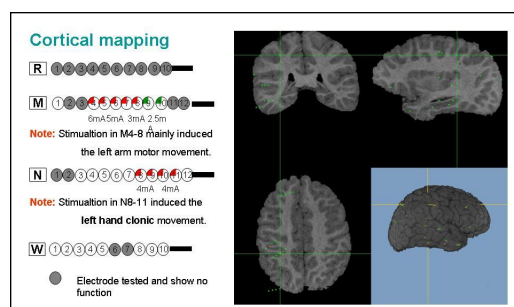
The mean age was 30 years. The mean follow-up was 12 months. Mean duration of the epilepsy syndrome was 19 years. The average number of implanted electrodes/patient was 14. The SEEG methodology was able to provide a precise and surgical useful functional mapping data in most of the targeted areas. Motor (negative and positive functions, primary and supplementary motor function), sensory (primary and secondary functions) and vision functions were precisely mapped in cortical and subcortical areas and incorporated into the surgical strategy. Speech areas were only found in two patients in a minimal number of contacts (2). Speech mapping in specific cases were complemented by intra-operative speech mapping during the time of resection. No complications occurred due to the stimulation.

Conclusions

Mapping for motor, sensory and vision functions using depth electrodes is a important and useful portion of the SEEG evaluation. It is precise and highly relevant, allowing a safe resection, with a predictable functional outcome. Language mapping is difficult to obtain, and a complementary technique is mostly necessary.



Preoperative planning.



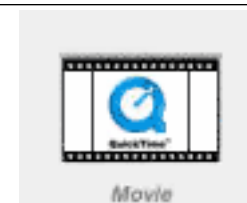
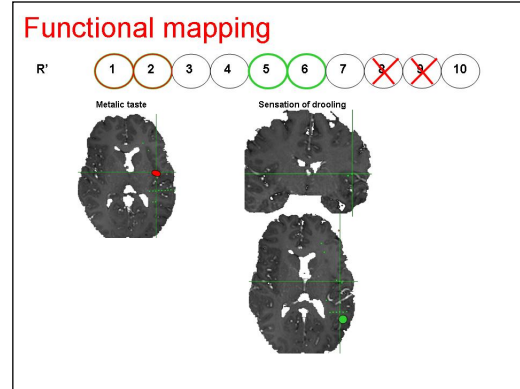
Learning Objectives

To understand the indications of Invasive Monitoring in Epilepsy Surgery.

To understand the advantages and limitations of functional mapping using depth electrodes

References

Cossu M, Cardinale F, Castana L, Citterio A, Francione S, Tassi L, et al. Stereoelectroencephalography in the presurgical evaluation of focal epilepsy: A retrospective analysis of 215 procedures. *Neurosurgery* 2005; 57: 706-18.



Postoperative imaging.

