

# Comparison of electrode placement systems for scalp video telemetry for pre-surgical evaluation in patients with medically refractory epilepsy

Michelle Blythe<sup>1</sup>, Janet Pearson<sup>2</sup>, Athi Ponnusamy<sup>3</sup> and Ros Kandler<sup>3</sup>

<sup>1</sup>Specialist Clinical Physiologist, Department for Clinical Neurophysiology, Royal Hallamshire Hospital, Sheffield  
<sup>2</sup>Epilepsy Surgery Co-ordinator, Department for Clinical Neurophysiology, Royal Hallamshire Hospital, Sheffield  
<sup>3</sup>Consultant clinical Neurophysiologist, Department for Clinical Neurophysiology, Royal Hallamshire Hospital, Sheffield

## Introduction

Video telemetry (VT) is performed during pre-surgical evaluation in patients with medically refractory epilepsy. The international 10/20 system of electrode placement describes scalp locations at designated 10% and 20% distances from specific cranial landmarks and is widely accepted as a standard and reproducible method between different centres. Subsequent advances in EEG technology, high-density electrode placement systems, including: 10/10 and 10/5, have been introduced to further increase spatial resolution of EEG recordings for comparison with neuroimaging for concordance (Jurcaki et al, 2007; Lantz et al, 2003).

At the Department of Clinical Neurophysiology at the Royal Hallamshire Hospital, Sheffield, all patients undergoing scalp VT have 23 scalp electrodes applied according to the international 10/20 placement system, with the addition of bilateral surface sphenoidal electrodes and a single channel (modified lead I) ECG recording. In March 2014, based on published literature about the 10/10 electrode placement system, 8 additional electrodes were applied to the pre-existing placement system, to provide more detailed coverage of the inferior temporal regions in both hemispheres (Figure 1).

## Aims & Objectives

- (1) To compare the yield of interictal abnormalities using the previous vs current electrode placement system
- (2) To assess any additional ictal information obtained from the current electrode placement system when compared to the previous system

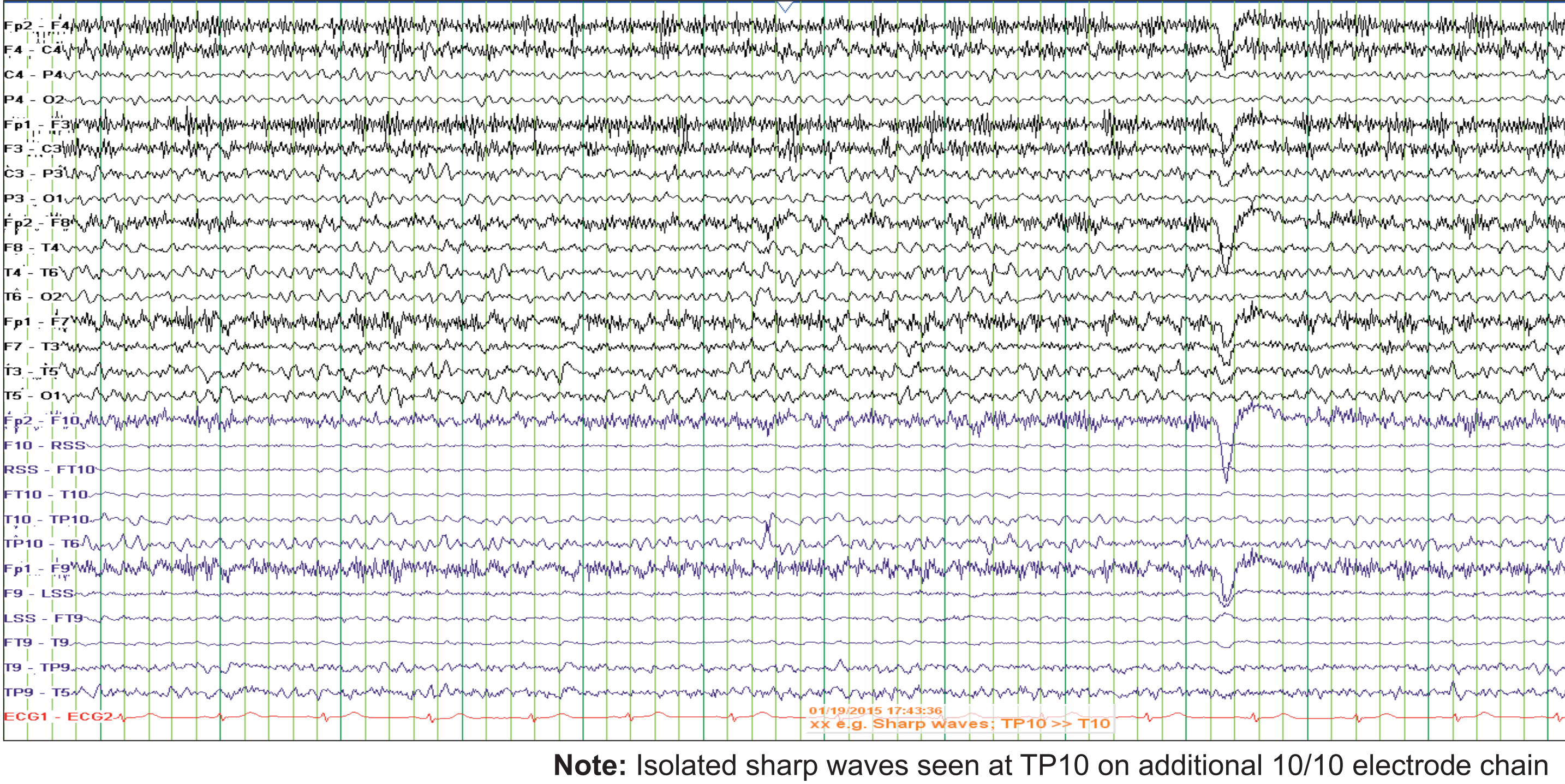
## Results

- 26/29 (89.7%) of patients had a known lesion on neuroimaging, including: mesial temporal sclerosis (MTS), tuberous sclerosis (TS), cavernoma, encephalomalacia, dysembryonic neuroepithelial tumour (DNET) and glioma
- 15/29 (51.7%) of patients had habitual clinical seizures during VT

### (a) Previous electrode placement

- 29/29 (100%) of patients had interictal abnormalities, including: sharp waves/spikes, focal slow activity
- Lateralisation/localisation was possible in 10/15 (66.7%)

Figure 2: Additional interictal information

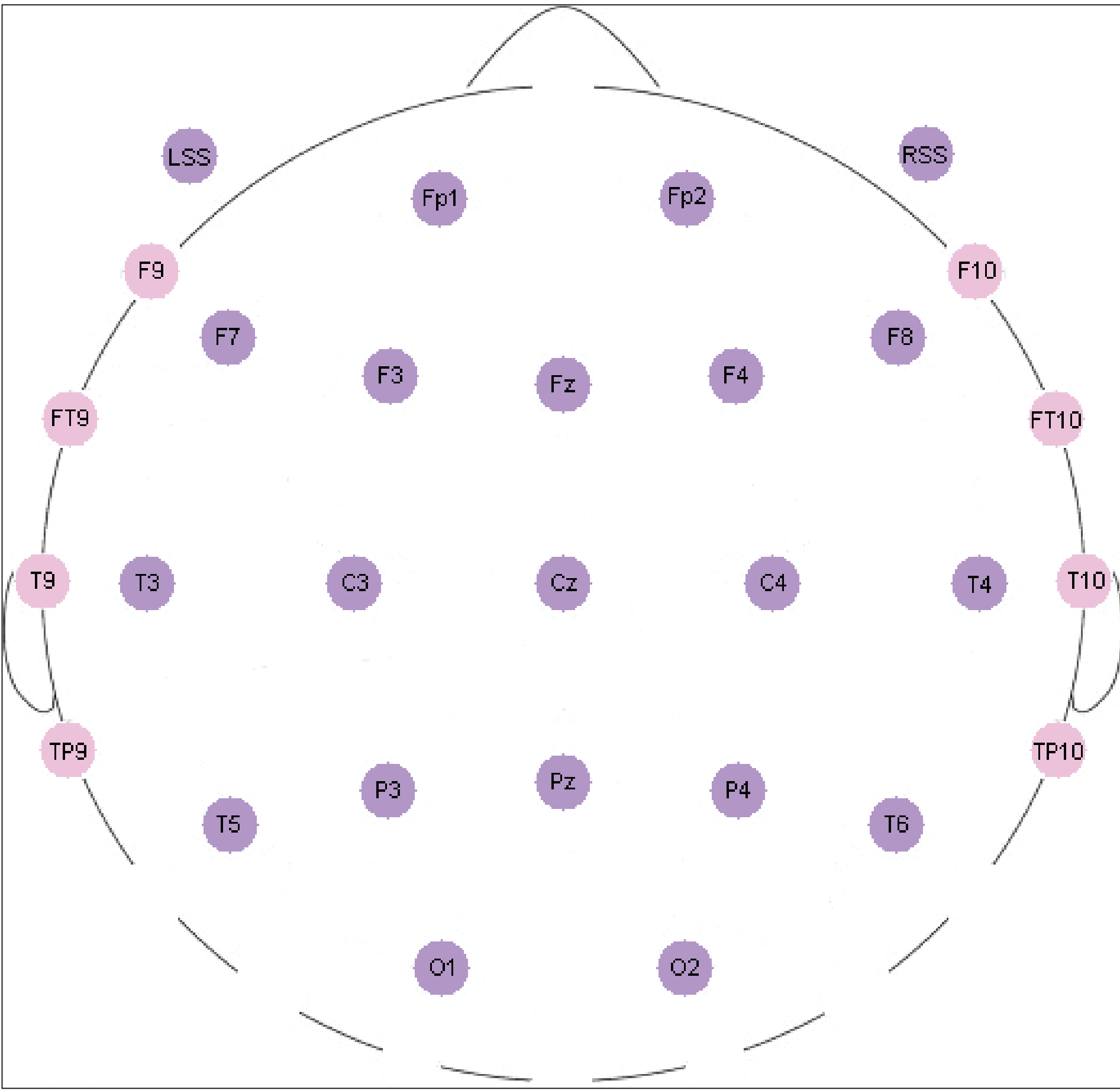


## Summary

- (1) Additional interictal information was obtained in 4/29 (13.8%) of studies
- (2) Additional ictal information was obtained in 2/15 (13.3%) of studies

The results demonstrate that modification of the pre-surgical electrode placement system can provide extra information in patients undergoing pre-surgical work-up for intractable epilepsy. Modified electrode placement now used for all diagnostic and pre-surgical VT recordings

Figure 1: Conventional 10/20 vs new electrode placement



Note: The purple electrodes represent the previous system of electrode placement. The pink electrodes represent the additional 10/10 electrodes applied during the current system of electrode placement.

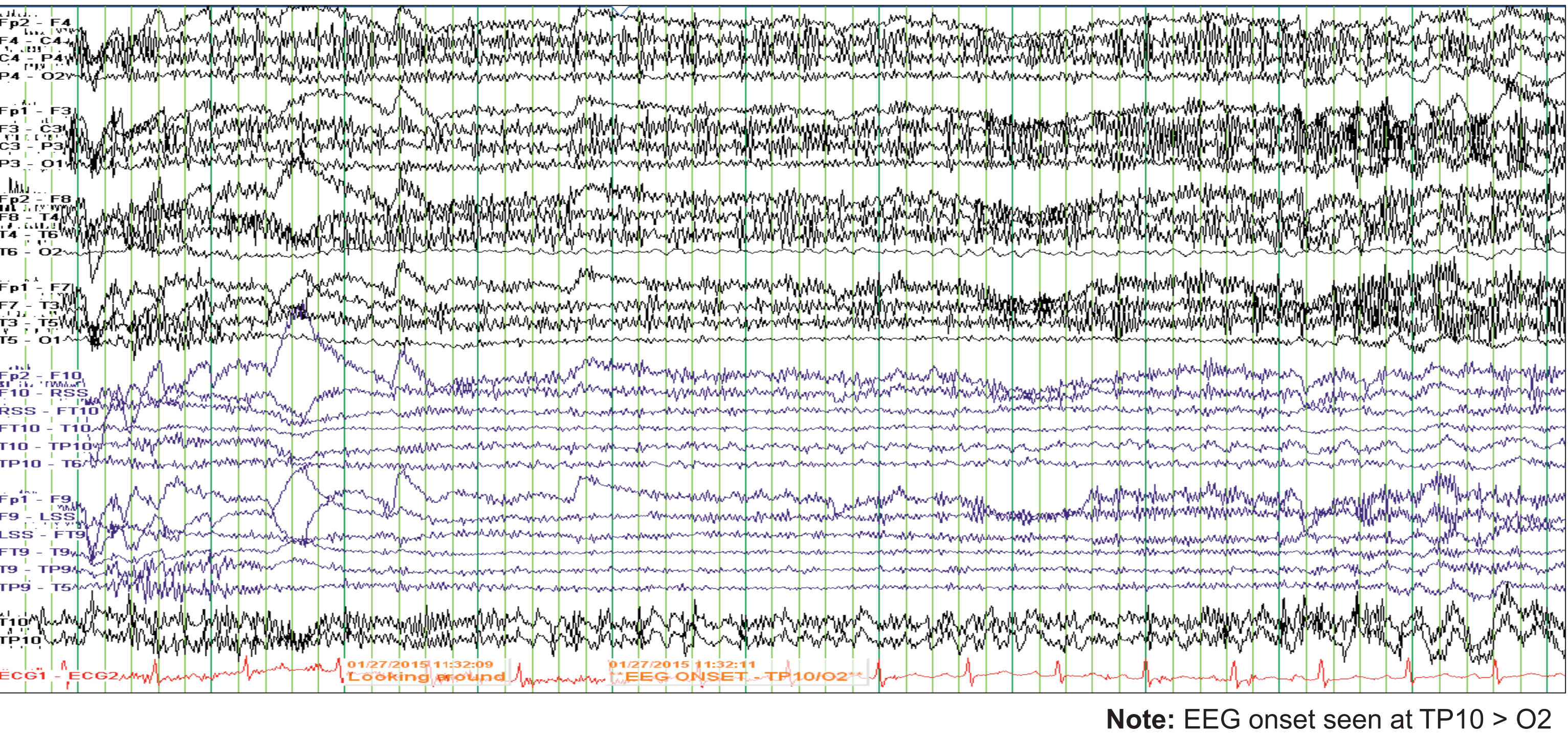
## Method

- Consecutive sampling between March 2014 and March 2015
- Included all adult patients undergoing scalp VT for pre-surgical evaluation
- All studies were reviewed using the previous and current electrode placement system
- Sample size: 29 studies with extra electrode placement

### (b) Current electrode placement

- Additional interictal information was obtained in 4/29 (13.8%) (Figure 2)
  - Independent epileptiform abnormalities seen on 10/10 electrodes
- Additional ictal information was obtained in 2/15 (13.3%) (Figure 3)
  - First clear ictal abnormalities on 10/10 electrodes

Figure 3: Additional ictal information



## References

Jurcaki V, Tsuzuki D and Dan I. 10/20, 10/10 and 10/5 systems revisited: Their validity as relative head-surface-based positioning systems. Neuroimage. 2007. **34**; 1600-1611.

Lantz G, Grave de Peralta, Spinelli L, Seeck M and Michel CM. Epileptic source localisation with high density EEG: how many electrodes arte needed? Clinical Neurophysiology. January 2003. **114** (1); 63-69.