■ Clinical commentary

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Epileptic Disorders

The ventral precuneal-posterior cingulate region as a site of epileptogenicity

Lee Elisevich[1], Shan Abbas[2,3], David Burdette[2,3], Gabe Heredia[4], Kost Elisevich[2,3]

[1] School of Medicine, Central Michigan University, Mount Pleasant MI, USA
[2] Department of Clinical Neurosciences, Spectrum Health, Grand Rapids, MI, USA
[3] College of Human Medicine, Michigan State University, Grand Rapids, MI, USA
[4] Imaging Physics, Department of Radiology, Spectrum Health, Grand Rapids, MI, USA

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Introduction

- Ventral precuneus-posterior cingulate (VP-PC) region is anatomically sheltered
  - Difficult to study by noninvasive means

- VP-PC distant connections
  - Dorsal stream: ventromedial prefrontal cortex
  - Ventral stream: parahippocampal gyrus

- VP-PC functions
  - Default Mode Network

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Introduction

- Epilepsy arising from the VP-PC region has variable semiology
  - Connectivity provides multiple routes of ictal spread
  - Semiology may be characteristic of spreading pattern

- VP-PC sites of epileptogenicity can masquerade as other, well-characterized forms of epilepsy
  - Mesial temporal lobe

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Case 1: 14yo M w/ epilepsy since 6mo age

- Semiology
  - Epigastric discomfort w/o rising or experiential sensations
  - Behavioral arrest with staring and rightward versive eye motion
  - Intentional walking in a particular direction
  - Tonically flexed posture at waist with extension of right arm backward w/ upturned palm
  - Inarticulate or nonsensical vocalization
  - Postictal word finding difficulty and fatigue

- Medical management
  - Lamotrigine, carbamazipine, topiramate, perampanel, and clonazepam

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Case 1: 14yo M w/ epilepsy since 6mo age

- Imaging / Electrographic studies
  - MRI: no overt pathology
  - Phase 1 scalp EEG: parasagittal / centroparietal activity at ictal onset
  - MEG: unremarkable
  - fMRI: left hemispheric speech dominance
  - Phase 2 surface EEG: VP-PC and posterior parahippocampal gyrus sites of epileptogenicity (figure 1)

- Other studies
  - Neuropsychological: FSIQ -19pts; VCI -9pts (between ages 10 and 14)

Case 1: 14yo M w/ epilepsy since 6mo age

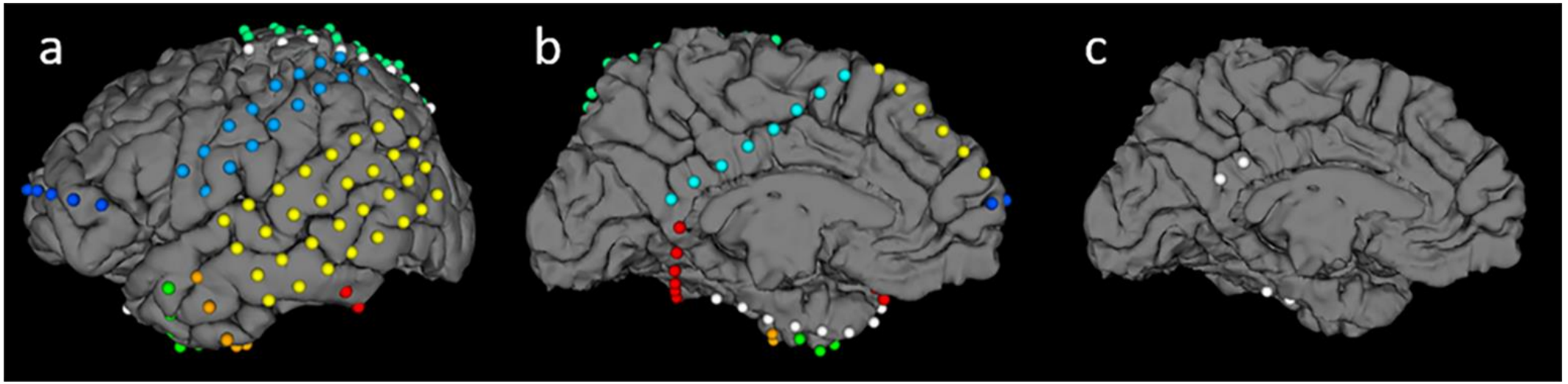

Figure 1. Case 1: phase-2 surface electrodes.

Case 1: 14yo M w/ epilepsy since 6mo age

- Management
  - Responsive Neurostimulation (RNS) implantation targeting sites of epileptogenicity
  - Discharge medications: lamotrigine, carbamazepine, topiramate, levetiracetam

- Outcome
  - Clinically seizure-free x 5yrs
  - RNS recordings continue to show interictal spike activity
  - Medication tapered: lamotrigine, brivaracetam
  - Improvements in FSIQ, visual spatial index, working memory index
  - Employed as mechanic

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Case 2: 21yo F w/ 1-year history of focal unaware seizures

- Semiology
  - Aura: nausea, malaise
  - Tendency to walk with intent
  - Mumbling, spitting
  - Rubbing, pinching nose w/ R hand
  - Postictal fatigue

- Medical management
  - Lamotrigine, oxcarbazepine, levetiracetam, clonazepam

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Case 2: 21yo F w/ 1-year history of focal unaware seizures

- Imaging / Electrographic studies
  - Phase 1 scalp EEG: R anterior/mid temporal ictal onset
  - MRI: no lateralizing or localizing features
  - PET: no lateralizing or localizing features
  - Phase 2 surface EEG: appeared to confirm R mesial temporal epilepsy (figure 2)
    - Note: R mesial frontoparietal cerebral surface not sampled

- Other studies
  - Neuropsychological: no significant discrepancy between VCI and PRI, average scores

Case 2: 21yo F w/ 1-year history of focal unaware seizures

Figure 2: Case-2 phase-2 surface recordings revealed R mesial temporal spike activity

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Case 2: 21yo F w/ 1-year history of focal unaware seizures

- Initial management
  - R mesial temporal resection

- Initial outcome
  - Three generalized seizures at 7mo
  - Subsequent return to original seizure pattern w/ decreased intensity

- Further studies
  - MRI: slowly evolving enhancing lesion in R posterior VP-PC region (figure 3a-c)
  - Intraoperative depth electrocorticography: interictal discharges arising from lesion (figure 3d)
  - Lesion pathology: pilocytic astrocytoma w/ adjacent cortical dysplasia

Case 2: 21yo F w/ 1-year history of focal unaware seizures

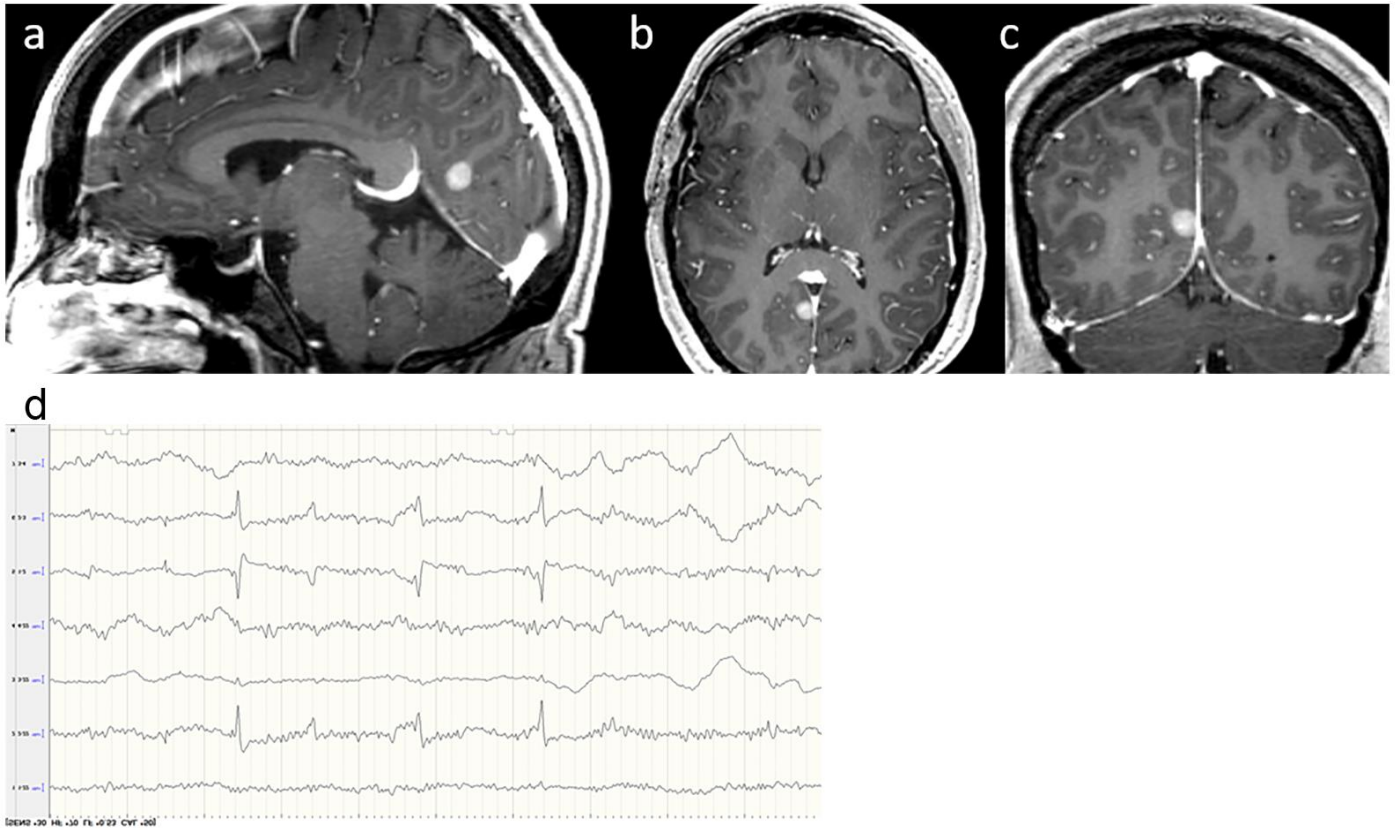

Figure 3. Case 2: post-resection MRI (a, b, c) showing R posterior VP-PC lesion and subsequent intraoperative depth electrocorticography (d) with interictal discharges

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Case 2: 21yo F w/ 1-year history of focal unaware seizures

- Further management
  - VP-PC lesion ablated via stereotactically-guided laser interstitial thermal therapy (LITT)

- Outcome
  - Clinically seizure-free x 3yrs
  - Medication tapered: clobazam
  - Employed part-time
  - Subsequent analysis of tractography showed projections from VP-PC lesion to region of temporal lobe initially thought to be the site of epileptogenicity (figure 4)

Case 2: 21yo F w/ 1-year history of focal unaware seizures

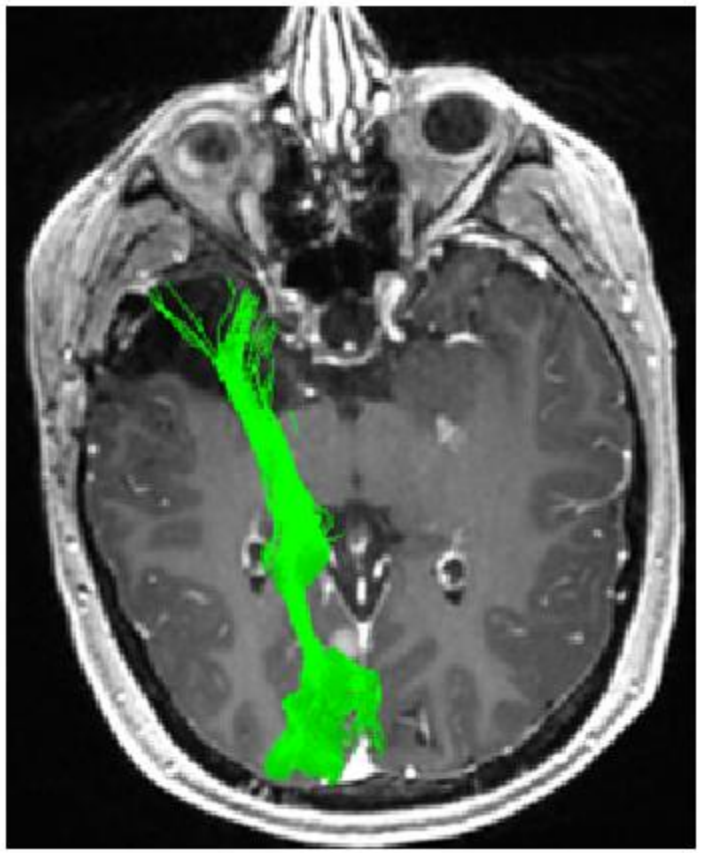

Figure 4. Case 2: tractography demonstrating projections from VP-PC lesion to ipsilateral temporal lobe.

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Key Points

1. The ventral precuneal-posterior cingulate area (VP-PC) represents a salient hub within the default mode network with extensive connectivity along two primary streams – dorsal and ventral – targeting both frontal and temporal lobes, respectively.

2. Ictal expression may manifest both intrinsic features characteristic of local attribution or instigate remotely-activated semiologies suggestive of distant spread.

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Key Points

3. Of particular concern, may be a propensity for expressing a mesial temporal epileptogenicity which may be difficult to discern from the more common primary condition.

4. The deep location of the VP-PC within the mesial ventral parietal surface, in the absence of an overt lesion, makes the diagnosis problematic. Reliance on clinical acumen to reconcile the variability in ictal expression with such a location and quantitative neuroimaging measures that may discount a primary temporal lobe epilepsy must guide appropriate decision-making.

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