# Outline

<table>
<thead>
<tr>
<th>Speaker</th>
<th>Title</th>
<th>Affiliation</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jimmy Ghaziri</td>
<td>The structural and functional connectivity of the human PL</td>
<td>Université du Québec à Montréal</td>
<td>20 min</td>
</tr>
<tr>
<td>Dang Nguyen</td>
<td>The semiology of PL seizures</td>
<td>CHUM, Université de Montréal</td>
<td>20-25min</td>
</tr>
<tr>
<td>François Dubeau</td>
<td>The non-invasive and invasive investigations of PLE</td>
<td>Montreal Neurological Institute and Hospital, McGill University</td>
<td>20-25min</td>
</tr>
<tr>
<td>Andrew G. Parrent</td>
<td>The surgical treatment of PLE</td>
<td>Robart’s Research Institute in London, Western University</td>
<td>20-25min</td>
</tr>
<tr>
<td>Questions</td>
<td></td>
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<td>10-25min</td>
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</tbody>
</table>
PARIETAL LOBE EPILEPSY

Moderator: Dang K. Nguyen, MD, PhD
Neurologist, CHUM
Disclosure statement

• I have participated in a clinical trial by Sunovion/Upsher-Smith
Plan

• General statements
• Ictal semiology according to parietal areas
• Miscellaneous signs and symptoms
• Conclusion
General statements

• PLEs represent ~5-7% of focal epilepsies (surgical series) (underestimate?)

• Auras are reported by ~75% of patients

Shkurovich et al., 2003; Salanova et al., 1995; Salanova et al., 2012; Francione et al., 2014; Bartolomei et al., 2011; Abou-Khalil et al., 2008;
### Most common auras

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Somatosensory</td>
<td>62.5%</td>
</tr>
<tr>
<td>Visual</td>
<td>31.2%</td>
</tr>
<tr>
<td>Vertiginous</td>
<td>22.5%</td>
</tr>
<tr>
<td>Psychic/Cephalic</td>
<td>18.7%</td>
</tr>
<tr>
<td>Epigastric/thoracic</td>
<td>15.6%</td>
</tr>
<tr>
<td>Fear/anxiety</td>
<td>12.5%</td>
</tr>
<tr>
<td>Auditory</td>
<td>12.5%</td>
</tr>
<tr>
<td>Gustatory</td>
<td>6.2%</td>
</tr>
<tr>
<td>Pain</td>
<td>6.2%</td>
</tr>
<tr>
<td>Autonomic</td>
<td>3.1%</td>
</tr>
</tbody>
</table>

- Patients commonly exhibit more than one kind of aura (72% in Francione et al., 2014; not correlated with poor surgical outcome)

- Ictal polymorphism due to role of PL in the processing of multiple sensory information?

Francione et al., 2014
Most common signs

<table>
<thead>
<tr>
<th>Signs</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eye ± head deviation</td>
<td>55%</td>
</tr>
<tr>
<td>Contra (32%) / Ips (23%)</td>
<td></td>
</tr>
<tr>
<td>Automatisms</td>
<td>43%</td>
</tr>
<tr>
<td>Motor contralateral</td>
<td>87.5%</td>
</tr>
<tr>
<td>Clonic (45%)</td>
<td></td>
</tr>
<tr>
<td>Dyston (35%)</td>
<td></td>
</tr>
<tr>
<td>Myo (7.5%)</td>
<td></td>
</tr>
<tr>
<td>Version</td>
<td>7.5%</td>
</tr>
<tr>
<td>Contra (5%) / Ips (2.5%)</td>
<td></td>
</tr>
<tr>
<td>Autonomic</td>
<td>7.5%</td>
</tr>
<tr>
<td>Hypermotor</td>
<td>2.5%</td>
</tr>
<tr>
<td>Aphasia</td>
<td>12.5%</td>
</tr>
</tbody>
</table>

- Reflects the spread outside of the PL to either
  - Frontal or
  - Temporo-limbic structures
- Focal motor controlateral signs never occur as the leading ictal manifestation
- Unrelated to surgical outcome

Francione et al., 2014
Anatomico-clinical correlations

• PL seizures are often complex in nature but certain semiological patterns are reproducible and can help to define the likely subregion(s) involved

• The functional anatomical divisions of the PL provide a useful model for thinking about semiology

Bartolomei et al., 2011
Functional anatomical divisions

Balestrini et al., 2015
Post-central gyrus/S1

- Contralateral somatosensory symptoms (tingling, numbness, prickling, tickling, electric shock)
- Paresthesiae may spread in a Jacksonian manner (when this occurs, motor activity in affected body member follows the sensations in 50% of cases)
- Seizures w/o AOC due to considerable inhibitory circuit?

Neuroscience, 4th Edition; Duncan, 2015
Post-central gyrus/S1

Videos IV-5 and IV-5
Parietal operculum/S2

- Consider S2 if somatosensory sx:
  - are widespread
  - are bilateral
  - are axial
  - have a painful component
  - have a thermic component
  - are w/ speech disturbances

Penfield, 1954; Mazzola, 2006; Mazzola, 2011; Balestrini, 2014; Maesawa, 2016;
Parietal operculum/S2

Videos V-1 + TDH.
Precuneus

• Nothing clearly specific but consider involvement of:
  • Ant part (sensorimotor processing):
    • If somatosensory symptoms
    • If bilat tonic asymm seizures
  • Central part (cognitive processing):
    • If motion sensation
  • Inf. part
    • If hypermotor seizures
  • Post. part (visual information processing):
    • If visual illusions/hallucinations

Harroud et al., 2017; Zhang et al., 2011; Mailo, 2015; Umeoka, 2007; Wiest, 2004; Wikipedia
Precuneus

Video IV-9;
Precuneus

Courtesy of S. Gibbs
Posterior cingulate gyrus

- Function: integration of visual info, spatial orientation and spatial memory
- CS: heterogeneous (motor, somatosensory, vertigo, neurovegetative, OBEs—out of body experiences, being in a parallel world, depersonalization, derealisation)

Balestrini, 2015; Fink, 1997; Vogt 2005; Enatsu, 2007; Alkawadri, 2013; Dolezalova, 2017
Posterior cingulate gyrus

- Hence, early sx may be OBE or falling
- However, frequent cases w/o auras or TL-like auras (déjà vu, abdominal, gustatory)
- Signs:
  - FL-like (bilateral asymmetric tonic or hypermotor)
  - TL-like (dialectic)
- Suspect if:
  - MRI negative
  - IEDs fail to remain limited to ant TL

Enatsu, 2007; Alkawadri, 2013; Dolezalova, 2017
Posterior cingulate gyrus

Video IV-6

Onset

44s later...
Superior parietal lobule

- Includes BA 5 anteriorly (somatosensory association cortex) and BA 7 posteriorly (superior polymodal parietal cortex) (area 7 extends to PreCu)
- **CS**: sensory illusions/hall., body scheme alteration, motor symptoms
- **Function**: attention towards visual/tactile stimuli, integration of visual stimuli, visually guided reaching, sensorimotor integration in relation to body image representation

Bartolomei, 2011; Pardo, 1991; Corbetta, 1993; Rizzolatti, 1997
Superior parietal lobule

- Semiology: as usual...somatosensory, visual, vertigo
- But also: fear, body scheme alteration

Bartolomei, 2011
Superior parietal lobule

Videos IV-11 and IV-1
Inferior parietal lobule

- **Function**: processing data from visual, auditory and somatosensory association cortices, in selective attention and in visuo-spatial processing
- **CS**: same as SPL + language disturbances if dominant; more vestibular responses than other areas according to Kahane (2003) who suggested the term ‘temporo-peri-Sylvian vestibular cortex (TPSVC)’
  - Pitch plane illusions = lat. T
  - Yaw plane = P op, IPL

Bartolomei, 2011; Kahane, 2003
Inferior parietal lobule

- Semiology: same as SPL...somatosensory, visual, vertigo (sic),
- Including: fear, body scheme alteration
- But: 50% w/o aura, hyperkinetic/ipsi ballism more w/ IPL > version?

Bartolomei, 2011; Zollner, 2017
Inferior parietal lobule
Sup./Inf. parietal lobule

• Pathological sensations of position (vestibular), movement, perceived completeness of one’s own body (body scheme alterations) and out-of-body experiences (autoscopy) often together
  • Vestibular (vertigo, floating, flying, elevation, rotation)
  • Ictal asomatognosia = inability to recognize’s own body part; estrangement of a body part (usually non-dominant hemisphere)
  • Ictal macrosomatognosia = sensation of inflation of body/body part (nose, head) (usually non-dominant hemisphere)
  • Ictal autoscopy = perception of one’s body or one’s face within space, either from an internal point of view (as in a mirror) or from an external point of view (OBE)
  • Ictal kinetopsia = Illusionary movement of stationary objects

Fan, 2014; Hoepner, 2014; Devinsky, 1989, Blancke, 2004
Reflex seizures

• Cognition/Praxis induced reflex seizures
  • Board games (Mah-jongg, chess)
  • Calculation
  • Spatial tasks
  • Writing
  • Reading

Goossens, 1990; Fukuma, 2016; Racicot, 2016
Reflex epilepsies

Racicot, 2016
Miscellaneous

• Epileptic nystagmus
  • Fast phase almost always directed away from focus
  • Often preceded by gaze deviation (contraversive >>>ipsi)
  • Occipital > Parietal > Temporo-occipital > Frontal > Temp

• Paroxysmal alien hand syndrome

• Ictal palinopsia = persistence of image of an object seen a few seconds before

Lee, 2014, Leiguarda, 1993;
Postictal deficits

- Todd’s (rolandic)
- Hemineglect (non-dominant)
- Hemianopia/blindness
- Phonagnosia (impairment of voice recognition) (non-dominant IPL)
- Conduction aphasia (dominant angular gyrus)

Shahar, 2001; Rocha, 2015;
Conclusion

• Aura in 75%
  • Somatosensory
  • Pathological sensations of position (vestibular), movement, perceived completeness of one’s own body (body scheme alterations) and out-of-body experiences
  • Visual illusions/hallucinations
• Late signs related to local or remote propagation (temporal or frontal lobe)
• Distinction between subregions difficult but some clues

Thank you