Goals

• This will very video heavy workshop
• Review a basic classification of seizures
• Review video of various different seizures, and increase confidence in identifying different seizure types
• By having knowledge of semiology of epileptic seizures, develop confidence for when to non-epileptic seizures
Generalized seizures

- Conceptualized as originating at some point within, and rapidly engaging, bilaterally distributed networks. ...can include cortical and subcortical structures, but not necessarily include the entire cortex.
Focal seizures

- *Conceptualized* as originating within networks limited to one hemisphere. These may be discretely localized or more widely distributed....
Seizure Classifications

- **Generalized seizures**
  - Myoclonic seizures
    - Myoclonic-atonic
    - Myoclonic-tonic
  - Tonic seizures
  - Atonic seizures
  - Absence
    - Typical
    - Atypical
    - Special features
      - Myoclonic
      - Eyelid myoclonia
  - Clonic
  - Tonic-Clonic

- **Focal seizures (Localization-related)**
  - NO impairment of consciousness
    - “Simple partial”
    - Subjective symptoms only OR
    - Observable motor/autonomic features only
  - WITH impairment of consciousness or awareness;
    (Dyscognitive)
    - “Complex partial”
  - Evolving to bilateral convulsive seizure
    - “Secondarily generalized”
<table>
<thead>
<tr>
<th>TABLE 1. <em>Semiological seizure classification</em></th>
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<tbody>
<tr>
<td><strong>Epileptic seizure</strong></td>
</tr>
<tr>
<td>Aura</td>
</tr>
<tr>
<td>- Somatosensory aura$^a$</td>
</tr>
<tr>
<td>- Auditory aura$^a$</td>
</tr>
<tr>
<td>- Olfactory aura</td>
</tr>
<tr>
<td>- Abdominal aura</td>
</tr>
<tr>
<td>Autonomic seizure$^a$</td>
</tr>
<tr>
<td>Dialeptic seizure$^b$</td>
</tr>
<tr>
<td>- Typical dialeptic seizure$^b$</td>
</tr>
<tr>
<td>Motor seizure$^a$</td>
</tr>
<tr>
<td>- Simple motor seizure$^a$</td>
</tr>
<tr>
<td>- Myoclonic seizure$^a$</td>
</tr>
<tr>
<td>- Epileptic spasm$^a$</td>
</tr>
<tr>
<td>- Tonic-clonic seizure</td>
</tr>
<tr>
<td>- Complex motor seizure$^b$</td>
</tr>
<tr>
<td>- Hypermotor seizure$^b$</td>
</tr>
<tr>
<td>- Automotor seizure$^b$</td>
</tr>
<tr>
<td>Special seizure</td>
</tr>
<tr>
<td>- Atonic seizure$^a$</td>
</tr>
<tr>
<td>- Hypomotor seizure$^b$</td>
</tr>
<tr>
<td>- Negative myoclonic seizures$^a$</td>
</tr>
<tr>
<td>Paroxysmal event</td>
</tr>
</tbody>
</table>

$^a$ Left/right/axial/generalized/bilateral asymmetric.

$^b$ Left hemisphere/right hemisphere.
Example Video 1
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Myoclonic seizures

- Muscle jerks <400ms, non-rhythmical
- Generalized epilepsies – JME, LGS, MERRF
- Focal epilepsies – motor or premotor cortex lesions
- Usually bilateral limb movements, occasionally unilaterally
Example Video 2
Seizure Classifications

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Tonic seizures

- Sustained contraction of muscle groups lasting >3 seconds

- Generalized tonic seizures
  - Common in LGS, lasting 3-10 s
  - EEG – low voltage fast activity
Example Video 3
- Tonic seizures of focal epilepsies
  - Bilateral 75% of the time
  - Usually frontal lobe
    - Esp primary motor or supplementary sensorimotor areas
Example Video 4
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Example Video 5
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Absence seizures

- 3Hz Spike and Wave activity
- Usually sudden onset, offset within seconds
- Usually no post-ictal confusion unless prolonged
- Automatisms only if very prolonged
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Tonic-clonic seizures

• Different phases
  – Pre-ictal
  – Ictal
    • Tonic phase
    • Clonic phase
  – Immediate post-ictal
  – Late post-ictal
Tonic clonic seizures - PGE

- Pre-ictal myoclonic phase
- Tonic phase with brief flexion
- Tonic phase with extension
- Leading into fine tremulousness
- Then clonic phase
Tonic-clonic seizure - PGE

- Can get focal features in idiopathic generalized epilepsies
  - Head turning
  - Asynchronous, asymmetric motor activity
Example Video
Example Video
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Tonic-Clonic seizure - secondary

• Initial phase lateralizing features
  – Forced head version
  – Figure 4 sign (90% correct)

• Asymmetry, asynchrony of motor activity during seizure
  – More common in focal, but can be seen in generalized epilepsies too

• Last clonic jerk
  – ~80% of GTCs end asynchronously
  – Usually ipsilateral to side of onset
Example
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“Automotor” seizures

- MOST common type of complex motor seizures

- Characterized by
  - Impaired consciousness
  - Automatisms
    - Oral, gestural, sexual
    - Peri-ictal behaviours

- Much more common in TLE vs FLE
Oral automatisms

- Swallowing, lip smacking, kissing, tongue movements
- Usually TLE, or with spread from elsewhere to TLE
- Release phenomena, or activation of limbic system? (unknown)
Gestural automatisms

- Most commonly in TLE
  - Combination of:
    - Ipsilateral automatisms
    - Contralateral tonic, dystonic or immobile
  - Can get ipsilateral automatisms in neocortical TLE or contralateral automatisms in mTLE
    - So unilateral automatisms *in isolation* are not useful unless associated with the contralateral dystonic posturing
Limb posturing

• Dystonic or tonic limb posturing
  – Very reliable lateralizing sign in TLE
  – Contralateral to epileptogenic zone in 60-90%

• Unilateral immobile limb (ictal paresis)
  – Contralateral in almost all
Versive seizures

- Sustained, unnatural turning of the eyes and head to one side
  - Activation of contralateral frontal eye field after spread from ictal onset region
  - <18 seconds → extratemporal
  - >18 seconds after sz onset → temporal
  - Highly lateralizing to the contralateral hemisphere... if you look at FORCED, UNNATURAL head turning just prior to secondary generalization
Clonic seizures

- Just like myoclonic seizures… except RHYTHMICAL, occurring 0.2 to 5Hz
- May demonstrate a Jacksonian march, often involves the distal hands or face, spreading proximally

**Figure 51.5.** Seizure types preceding and following clonic seizures in 162 seizure evolutions of 127 patients who underwent EEG-video monitoring. Clonic seizures were the initial seizure manifestation in 33 seizure evolutions. The frequency of preceding and following seizure types are given in parenthesis. Clonic seizures were preceded by other seizure types in 129 seizure evolutions.
Clonic seizures

- **Unilateral** – usually imply focal epilepsies
  - Usually associated with altered awareness if preceded by spread from occipital/temporal lobe to frontal lobe
- **Generalized clonic seizures** – *very rarely* associated with preserved consciousness\(^1\)
  - ?bilateral spread limited to sensorimotor pathways sparing consciousness?
  - NOT always indicative of NEPS

Clonic seizure activity

- If seen in frontal lobe epilepsy, it is early, with preserved awareness
- If seen in temporal lobe epilepsy, it is late, preceded by automatisms
- Can be seen with benign childhood focal epilepsy (usually with sensory aura of face)
- Can be seen in Rasmussen’s encephalitis, with focal clonic status
Head turning

• Forced versive head movements
  – Contralateral 90%

• Nonversive head movements
  – Controversial value
  – Early → Ipsilateral
Other automatic behaviours

• Ictal nose-wiping – ipsilateral 75-90%
• Ictal vomiting – nondominant TLE
• Ictal spitting – often nondominant TLE
• Ictal urinary urge – nondominant ?insula/mesial frontal/operculum
• Ictal drinking - nondominant
Eye movements

- **Eye version**
  - Usually contralateral

- **Unilateral eye blinking**
  - Rare
  - Usually ipsilateral

- **Nystagmus**
  - Rare
  - Usually due to activation of posterior, ipsiversive smooth pursuit region, causing fast fast nystagmus contralateral
Example (start at 37s)
Hypermotor seizures

• Complex movements of proximal limb and trunk; giving rise to large, violent-appearing movements

• Axial components:
  – Thrashing, jumping, body rocking

• Extremities
  – Thrashing, bicycling, pedalling, hand flapping

• Sexual automatisms – pelvic thrusting, genital manipulation
Hypermotor seizures – frontal lobe

- Brief, sudden onset/offset
- Occur in clusters
- Occur during sleep
- Can rapidly generalize
- Bilateral limb movements, e.g. thrashing, crossing of legs, pedaling
- Coarse, irregular complex movements of proximal muscles
- Yell, shout, bark, whistle
Hypermotor seizures – temporal/insular

- Hypermotor activity only seen in 2-3% of TLE
- Can be seen in insular onset seizures
- May be due to spread of ictal discharge to frontal structures such as orbitofrontal, anterior cingulate cortex
Another example of hypermotor
Genital/Sexual automatisms

- Non-lateralizing
- Aggressive pelvic truncal movements $\rightarrow$ FLE
- Subtle fondling, grabbing genitals $\rightarrow$ TLE
Example
Psychogenic nonepileptic events

- Suggestive historical features

<table>
<thead>
<tr>
<th></th>
<th>PNES</th>
<th>ES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Started &lt;10 yrs age</td>
<td>Unusual</td>
<td>Common</td>
</tr>
<tr>
<td>Sz in doctors presence</td>
<td>Common</td>
<td>Unusual</td>
</tr>
<tr>
<td>Recurrent “status”</td>
<td>Common</td>
<td>Rare</td>
</tr>
<tr>
<td>Multiple unexplained physical symptoms</td>
<td>Common</td>
<td>Rare</td>
</tr>
<tr>
<td>Multiple operations/invasive tests</td>
<td>Common</td>
<td>Rare</td>
</tr>
<tr>
<td>Psychiatric treatment</td>
<td>Common</td>
<td>Rare</td>
</tr>
<tr>
<td>Prior abuse</td>
<td>Common</td>
<td>Rare</td>
</tr>
</tbody>
</table>

From Benbadis, Lafrance. Ch. 4 Clinical features and the role of video-EEG monitoring. In: Gates and Rowan’s Nonepileptic Seizures.
Psychogenic nonepileptic events

- Ictal semiology
  - Gradual onset/termination
  - Discontinuous (stop and go)
  - Asynchronous activity
    - Side to side head mov’t,
  - Pelvic thrusting,
  - Opisthotonic posturing
  - Stuttering
  - Weeping

- Ictal eye closure
- Preserved awareness and ability to interact with bilateral limb movements*
- Post-ictal drama
  - Whispering voice
- Can have self-injury
  - Tongue biting, falls, fractures
Psychogenic nonepileptic events

• Inductions
  – Can be very useful esp with provocative maneuvers
    • E.g. hyperventilation, photic stimulation, strong verbal suggestion

• Suggestibility is helpful in suggesting psychogenic nature
  – For example if you have uninterpretable or normal EEG and symptoms compatible with SPS
Psychogenic nonepileptic events

- Coexisting epilepsy?
  - Prior reports of high percentages based on loose criteria for epileptic seizures (e.g. prior abnormal EEG)
  - When strictly defined, coexisting epilepsy occurs in 9-15% of patients with PNES
PNES pitfalls of diagnosis

• Simple partial seizures
  – Often no EEG changes with auras
  – Can get frontal lobe hypermotor seizures without EEG changes – hard to prove as psychogenic

• Complex partial seizures
  – Very, very rarely are without EEG correlate
  – Medial structures or inferior frontal lobe

• “Negative” ictal EEG
  – Has to be interpreted in the context of the video
### PNES

- **Prolactin**
  - Peaks 20 minutes after an epileptic seizure
  - May be useful measured 20 minutes after event
  - Apparently does not distinguish syncope

<table>
<thead>
<tr>
<th></th>
<th>Sensitivity</th>
<th>Specificity</th>
</tr>
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<tbody>
<tr>
<td>GTC</td>
<td>60%</td>
<td>(pooled) 96%</td>
</tr>
<tr>
<td>CPS</td>
<td>46%</td>
<td></td>
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Ended here after an hour