SEIZURES: CLINICAL MANIFESTATIONS

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Patients with epilepsy have seizures that can be classified as **focal** or **generalized**.

Focal seizures originate at one specific location within the brain. They are capable of spreading to other areas. A focal seizure that secondarily generalizes to involve the entirety of both hemispheres and results in a tonic-clonic seizure is described as a **focal-to-bilateral tonic-clonic** (FBTC) seizure.

Generalized seizures have clinical involvement of both hemispheres of the brain from the onset of seizure activity.

Patients can also have **epilepsy syndromes** and experience multiple seizure types.

Some **focal epilepsy syndromes** include:

CHILDHOOD EPILEPSY WITH CENTROTEMPORAL SPIKES

1. Brief focal motor hemifacial seizures
2. Nocturnal focal motor seizures evolving to bilateral tonic-clonic seizures

PANAYIOTOPOULOS SYNDROME

1. Prolonged focal autonomic seizures
2. EEG findings of focal occipital high-amplitude, sleep-activated spikes

E.G. vomiting, pallor, mydriasis, incontinence, hypersalivation

Some **idiopathic epilepsy syndromes** include:

CHILDHOOD ABSENCE EPILEPSY

Seizure types:

1. Absence seizures
2. GTCs (rare)

JUVENILE MYOCLONIC EPILEPSY

Seizure types:

1. Myoclonic seizures
2. GTCs
3. Absence seizures (rare)

JUVENILE ABSENCE EPILEPSY

Seizure types:

1. Absence seizures
2. GTCs
3. Myoclonic seizures (rare)

EPILEPSY WITH GENERALIZED TONIC-CLONIC SEIZURES ALONE

Seizure types:

1. GTCs

FOCAL SEIZURES

TEMPORAL

Temporal lobe seizures are the most common type of focal seizures.

MESIAL TEMPORAL

AURAS: Psychic sensations (deja vu, jamais vu), gastric rising sensations, sensations of butterflies, fear, olfactory symptoms (unpleasant chemical or burning smell)

MOTOR MANIFESTATIONS: Oral and manual automatisms are common.
LATERALIZING MOTOR BEHAVIORS: Contralateral dystonic limb posturing. Ipsilateral ictal unilateral eye blinking and piloerection. Ipsilateral manual (hand) automatisms and postictal nose wiping (the hand doing the wiping is typically ipsilateral).

LEVEL OF AWARENESS: Dominant temporal lobe seizures will have loss of awareness with more prominent postictal confusion and disorientation. Non-dominant temporal lobe seizures can have preserved awareness.

OTHER FEATURES: Non-dominant temporal lobe seizures may also feature ictal spitting, vomiting, and urinary urge.

DURATION: 60-90 seconds

SPREAD: Can spread to contralateral temporal lobe or ipsilateral cerebral hemisphere. If generalization occurs, it occurs late in the seizure compared to lateral temporal and extratemporal seizures.

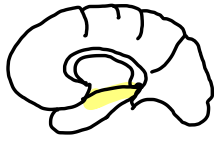
NOTE: auras are focal seizures too!

LATERAL TEMPORAL

ORIGINATING FROM TEMPORAL POLE OR ANTERIOR BASAL TEMPORAL SURFACE:
Auras and clinical features will be **similar to mesial temporal seizures**, likely due to early secondary spread to the region.

ORIGINATING FROM LATERAL OR PERISYLVIAN FOCI:
AURAS: Auditory (from involvement of primary and secondary auditory cortex).
INVOLVING DOMINANT TEMPORAL LOBE: Aphasic seizures.

ORIGINATING FROM TEMPOROOCCIPITAL JUNCTION:
AURAS: Visual and vertiginous (dizziness). Often followed by bland staring and unresponsiveness, then rapid secondary generalization.
MOTOR: During generalization to motor cortex, patient may have contralateral clonic jerking of the face and upper extremity.



MESIAL
(Hippocampal)

LATERAL
(Neocortical)

FOCAL SEIZURES

FRONTAL

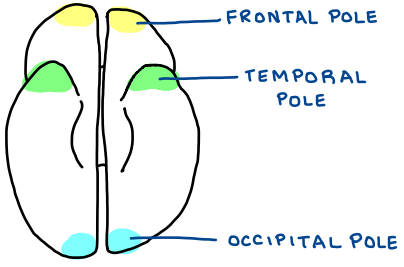
Frontal lobe seizures are the second most common type of focal seizures. Compared to temporal seizures, they are often shorter and have more motor involvement.

GENERAL FEATURES

Commonly occur **out of sleep**.

Can **appear unusual** or **bizarre** with complex behaviors and may be misdiagnosed as psychogenic non-epileptic seizures or parasomnias.

Patients have **quick return to baseline** postictally and may have **subtle postictal paresis** or **frank paralysis**.



DEFINITIONS

The CHAPEAU de GENDARME, or ictal pouting, is a grimace that can be seen on initiation of some frontal seizures.

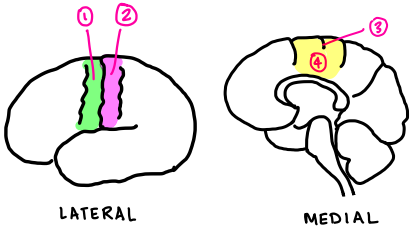
FENCING SEIZURES are seizures with asymmetric tonic involvement of the arms, with one arm flexed and the other extended like the pose of a fencer. The extended arm is typically contralateral to the seizure locus.

The JACKSONIAN MARCH is characterized by spread of clinical sensory or motor seizure manifestations from its physical origin to other parts of the ipsilateral body as the electrical activity moves through the sensory or motor homunculus.

ANATOMY PEARL:

The perirolandic cortex consists of the:

1. Primary motor cortex (precentral gyrus)
2. Primary somatosensory cortex (postcentral gyrus)
3. Central sulcus
4. Paracentral lobule



PERIROLANDIC CORTEX

FOCAL SEIZURES

FRONTAL

FEATURES BY LOCATION

FRONTOPOLAR
Initial presentation: "absense-like" features with staring, unresponsiveness, motor arrest. Can have forced thinking.
Possible late motor manifestations: complex automatisms, versive head/eye movements (see frontal eye fields below). **Hyperkinetic/hypermotor seizures** (large, vigorous proximal muscle movements, e.g. bicycling of the legs, windmilling of the arms).

ORBITOFRONTAL
Aura: olfactory hallucinations and illusions, autonomic features
Seizures: staring, unresponsiveness. Complex motor automatisms.

FRONTAL EYE FIELDS
Forced contralateral head and eye version, with unnatural upward and lateral movements. Occasionally, the entire body will turn with the head and eyes, and the patient may spin around the long axis of their body several times.

BROCA'S AREA
Aphasic seizure

NEGATIVE MOTOR CORTEX (posterior aspect of inferior frontal gyrus)
Seizures with paralysis of a limb or body part

PERIROLANDIC & PRIMARY MOTOR CORTEX
Focal clonic motor seizure with or without **Jacksonian march**, speech arrest or dysphasia, vocalizations

SUPPLEMENTAL SENSORIMOTOR
Focal asymmetric tonic posturing, versive head and eye movements, speech arrest, and vocalizations.

DORSOLATERAL CORTEX
Focal tonic or clonic activity, versive head and eye movements, speech arrest or dysphasia. Can see **fencing seizures** (see previous page) with retained awareness.

OPERCULAR
Aura with epigastric feelings, feelings of fear, autonomic features. Facial clonic activity, mastication, salivation, swallowing, laryngeal symptoms. Speech arrest or dysphasia. Gustatory hallucinations.

FOCAL SEIZURES

OCCIPITAL / PARIETAL

Rich connections between parietal and occipital lobes can make it challenging to differentiate from nearby regions non invasively.

OCCIPITAL
Visual auras, ictal blindness, blinking, ocular movement**.**

Complex visual scenes suggest spread.
Patterns of spread:
Below calcarine sulcus → preferentially spreads to the temporal lobe
Above calcarine sulcus → preferentially spreads to parietal and frontal lobes

PARIETAL
Contralateral or bilateral **somatosensory auras**. Additional corresponding symptoms will manifest as seizures quickly spread to the motor/premotor cortices and the temporooccipital region. *Identification of the presence of a somatosensory aura can help detect a possible parietal origin of such seizures.*

OTHERS

Other seizure foci originating in the insular and cingulate gyri can be difficult to differentiate or detect on scalp EEG monitoring and may require more invasive monitoring to evaluate.

INSULAR
AURA: Painful somatosensory. **MOTOR:** Contraction or choking sensation of the oropharynx/larynx.

CINGULATE
Fear, vocalization, emotional or mood changes, complex motor automatisms, autonomic features.

FOCAL-TO-BILATERAL TONIC-CLONIC

Focal-to-bilateral tonic-clonic (FBTC) seizures differ from generalized tonic clonic (GTC) seizures in that FBTCs can have **asymmetric involvement** of the limbs, whereas **GTCs** typically have **symmetric involvement**.

FBTCs can have certain **lateralizing features**:
- In FBTCs with **Figure-4 posturing**, one arm is extended and the other is flexed in a figure of 4. The extended arm is contralateral to the seizure locus.
- In FBTCs with **head version** or **eye version**, the head and eyes turn away from the side of the seizure locus.

When patients with focal seizures experience secondary generalization of their seizures, oftentimes the seizure will be referred to as a GTC, although in actuality they are FBTC seizures.

GENERALIZED SEIZURES

Typically classified as motor or non-motor (i.e. absence) seizures.

MOTOR

GENERALIZED TONIC-CLONIC (GTC)
Tonic phase (with immediate loss of consciousness and/or ictal cry, tongue biting) followed by clonic phase (rhythmic jerking of limbs). Can be followed by bowel or bladder incontinence when body relaxes.

CLONIC
Bilateral sustained rhythmic jerking of the limbs

TONIC
Stiffening of all limbs

MYOCLONIC
Irregular (can be asynchronous) bilateral jerking of the limbs, face, eyes, or eyelids

MYOCLONIC-TONIC-CLONIC
Irregular jerking on both sides, followed by a GTC. Commonly seen in Juvenile Myoclonic Epilepsy.

MYOCLONIC-ATONIC
Initial irregular jerking, followed by loss of tone bilaterally. Seen in Doose Syndrome.

ATONIC
Bilateral loss of tone. Patient will fall if seizure begins while standing.

EPILEPTIC SPASMS
Brief spasms consisting of flexion of the trunk and flexion or extension of the limbs. Often occur in clusters.

NON-MOTOR (ABSENSE)

TYPICAL ABSENCE
Sudden cessation of activity +/- eyelid fluttering, head nodding, or other automatisms, followed by **immediate recovery** to baseline. EEG will show generalized spike-wave activity.

ATYPICAL ABSENCE
Similar to a typical absence seizure but with features such as slower onset, prolonged recovery, or more pronounced changes in tone.

MYOCLONIC ABSENCE
A few irregular myoclonic jerks, followed by an absence seizure.

EYELID MYOCLONIA
Jerks of eyelids with upward deviation of the eyes. Can be triggered by light and/or closing of the eyes. Seen in Jeavons Syndrome.

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