What do you need to know about the patients before reading their EEG?

- Patient’s age
- State of consciousness
What do you see on EEG?

- Normal physiologic activity
- Abnormal physiologic activity
- Artifacts

Normal physiologic activity
- Normal activity
- Normal variants

Abnormal physiologic activity
- Epileptiform abnormalities
- Nonepileptiform abnormalities

Artifacts
- Physiologic artifacts
- Nonphysiologic artifacts
EEG waveform characteristics

- Frequency: delta (<4 Hz), theta (4-7 Hz), alpha (8-13 Hz), Beta (>13 Hz)
- Voltage
- Waveform
- Occurrence: intermittent, continuous
- Location
- Reactivity
- Interhemispheric coherence: symmetry, synchrony

Normal variants in the posterior head region
Alpha variants

- First described by Goodwin in 1947

-- Fast alpha variants
-- Slow alpha variants
Fast Alpha variants

- Superimposed harmonic rhythm, twice the frequency of basic posterior background

Slow alpha variants

- Superimposed subharmonic rhythm (half of the frequency of the posterior background)
Alpha variants

- Both patterns show the same reactivity to eye opening and eye closure as normal posterior background
- Unknown significance
- Not correlate with epilepsy or other disorders
Normal variants that mimic sharp waves

Small Sharp spikes

- Anterior to mid temporal single transients
- Wide spread electrical field
- Occur in drowsiness, light sleep
- Amplitude <50 uV, duration <50 msec
- No disruption of background
- Unilateral or bilateral (if the record duration is long enough)
Small Sharp spikes

- Occur in 3 to 20-25% of normal person, more common between age 30-60 years old
- Also known as benign epileptiform transients of sleep (BETS)
### Wicket spikes

- Monophasic, Archiform 6-11 Hz temporal sharp transients
- No disruption of background, no following sharp waves
- Always temporal in location
- Amplitude 60-200 μV, may occur in runs

### Wicket spikes

- Seen in awake or drowsy states
- Unilateral or bilateral
- Usually seen more on one side
- Seen in 1-3% of normal adult >30 yo.
RMTD (Rhythmic midtemporal discharges)

- Rhythmic 4-7 Hz temporal burst of monophasic sharp transients with notched appearance
- Maximum over the midtemporal region
- May be some spreading to the parasagittal region
- Unilateral or bilateral
- Awake or drowsy states
RMTD (Rhythmic midtemporal discharges)

- May occur in trains
- Not evolve in frequency but may evolve in amplitude
- Occur 0.5-2% of normal
- In younger or middle age adults
- Also known as rhythmic theta bursts of drowsiness
Normal variants that were seen as bursts of rhythmic activities

- Rhythmic, archiform, positive waves, maximal amplitude over posterior temporal region
- 14 Hz (more common) or 6-7 Hz
- Occur in burst, lasting 0.5-1 sec
- “Comb like” shape
- Unilateral or bilateral
- Deep drowsy state or light sleep
- Best seen on referential montage

14 and 6 positive spikes
14 and 6 positive spikes

- Best seen in reference
- 10-30% of normal adolescents
6 Hz spike and waves (Phantom spikes)

- Burst of 5-7 Hz slowing intermixed with low amplitude sharp transients
- Burst last 1-2 seconds
- Awake or drowsy states
- Sharp transients are very small do not map out nicely

6 Hz spikes and waves (Phantom spikes)

Two spatial distribution patterns

- WHAM
  - W: waking record
  - H: high amplitude
  - A: anterior
  - M: males

- FOLD
  - F: female
  - O: occipital
  - L: low amplitude
  - D: drowsy record
**6 Hz spikes and waves (Phantom spikes)**

- Seen in 0.5 -1 to 2-3% of normal adults
- During relax wakefulness or drowsiness
Rhythmic midline theta

- Rhythmic 6-8 Hz midline activity
- Smooth, archiform, spiky or mu like appearance
- Wax and wane in amplitude
- Central vertex electrodes
- Occur during drowsiness and sleep
- Can occur in wakefulness
SREDA (subclinical rhythmic electrographic discharges of adult)

- Rhythmic 5-7 Hz burst of sharp transients
- Seen in parietal or posterior temporal region
- Abrupt onset, lasting 40-80 seconds
- May evolve in pattern or amplitude, resemble seizure
SREDA (subclinical rhythmic electrographic discharges of adult)

- Occur in old age (>50 yo)
- Seen in awake, drowsy
- May be enhanced by hyperventilation
- Rare!!
Artifacts

- Type?
Artifacts

- Nonphysiologic artifacts
- Physiologic artifacts

Nonphysiologic artifacts

**Artifacts from instrument**
- Amplifier’s Noise
- Small random fluctuation of the electricity within the amplifier
- Seen only when sensitivity is low 1-2 uV/mm
- Amplifier’s noise should not exceed 2 uV
Nonphysiologic artifacts

Artifacts from instrument
- Problem with pin connection, loose board contact
- Improper alignment of pen
- Error in setting amplifier, low and high frequency filter of each channel

Electrode artifacts
- Electrodes’ impedance mismatch
- When using differential amplifier, the amplifier will receive signals from 2 electrodes, which impedance between 2 electrode should match quite well to reduce artifacts
Nonphysiologic artifacts

- Causes of altered impedance
- Changes in composition of the electrolyte eg. Sweating
- Poor contact of the electrode to the skin
- Movement of the electrode
- Guideline of the American EEG society suggested that impedance for each electrode should not be >5000 ohms

Nonphysiologic artifacts

Electrodes artifacts

- Electrode “popping”
- Most common type of electrode artifacts
- Occur from abrupt changes in electrode’s impedance when the electrode moves
- Seen as single or multiple spike like discharges with very steep upslope (abrupt take off)
- Sometimes seen as an irregular slow activity that strictly confined to that electrode
Nonphysiologic artifacts

Electrode artifacts

- Photoelectric response
- Occur during photic stimulation from photochemical reaction of the electrode with high impedance
- Seen as brief spike like sharp transients happens simultaneously with the flash
Nonphysiologic artifacts

Environmental artifacts
- Cutting/coagulating electrode in the operating room
- Static or capacitative potentials
- IV drips
- Machines
- Respirators
Physiologic artifacts

- EKG
- Ocular artifacts
  - Arise from steady (DC) potentials in the eyeball and sometimes together with EMG potentials from muscles in/around the orbit
  - Positive pole towards cornea and negative pole towards retina
  - Lateral rectus spikes
Physiologic artifacts

- EMG
- Glossokinetic artifacts
Thank You!