Normal variants

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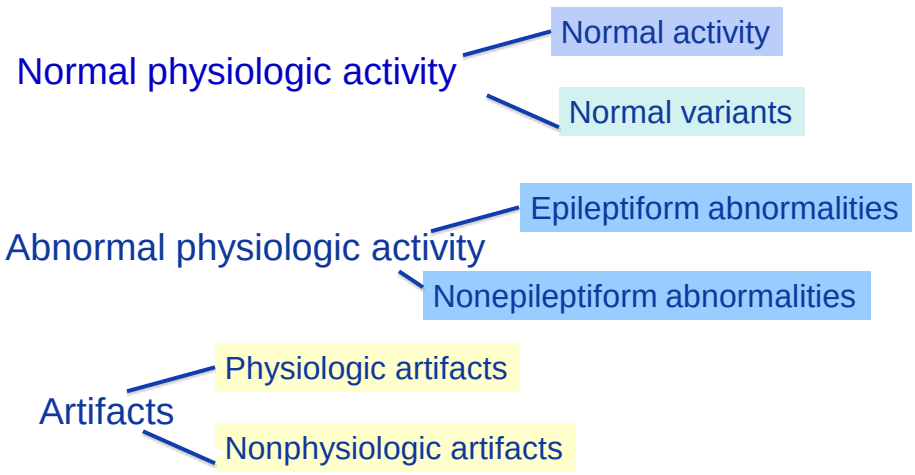
What do you need to know about the patients before reading their EEG?

- Patient's age
- State of consciousness

What do you see on EEG?

- Normal physiologic activity
- Abnormal physiologic activity
- Artifacts

What do you see on EEG?



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

Alpha variants

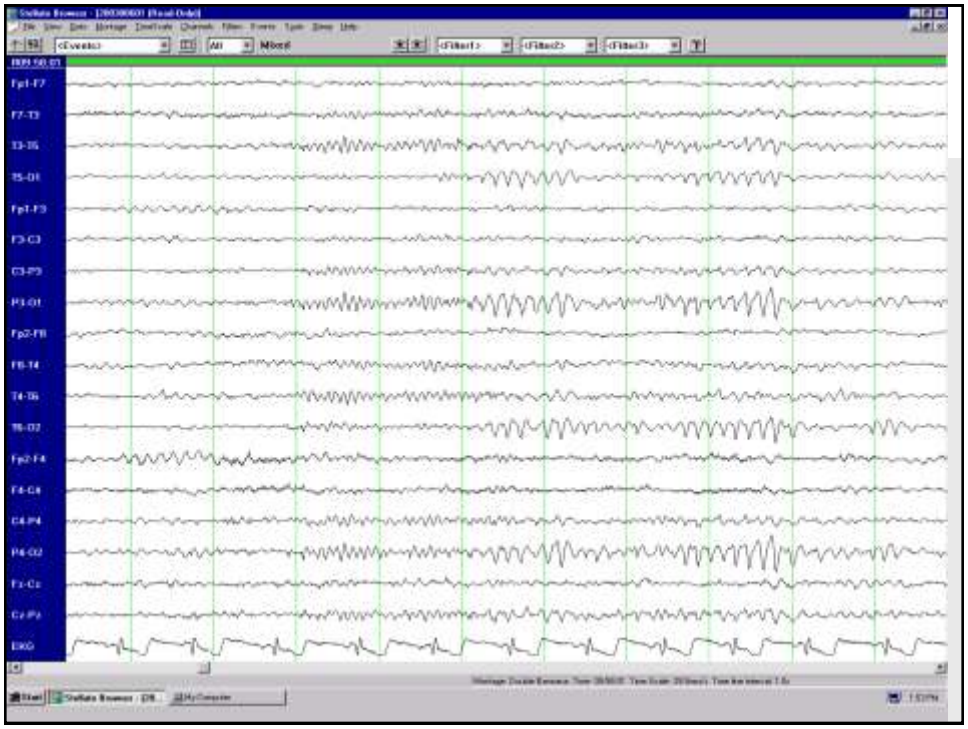
- Fast alpha variants
- Slow alpha variants

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

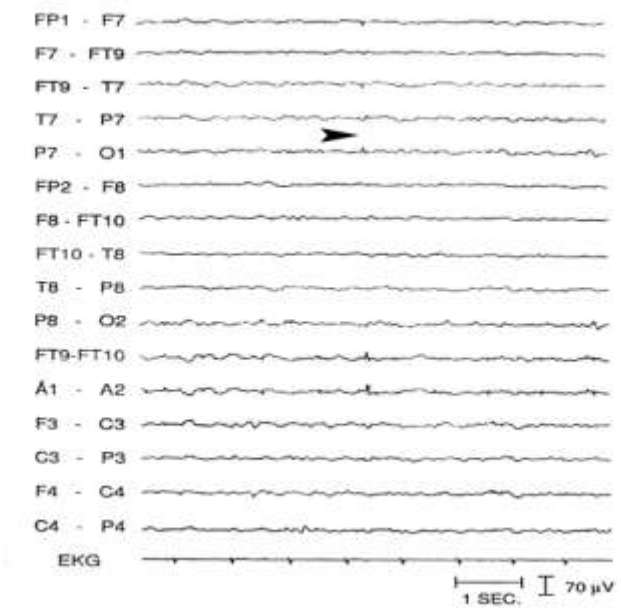
Normal variants that mimic sharp waves

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)

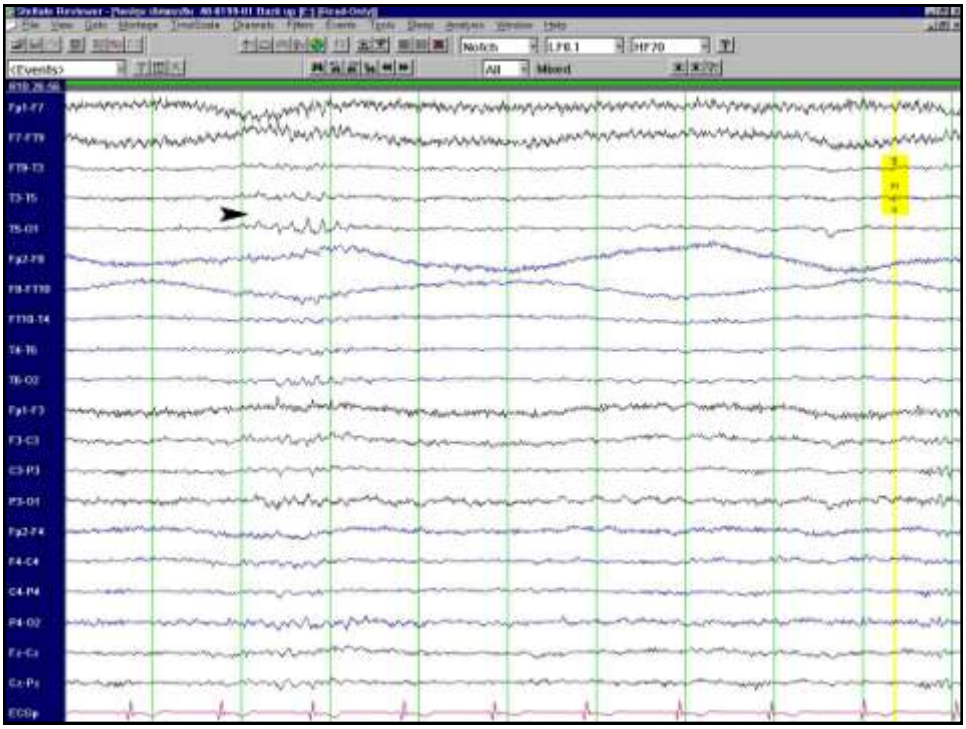


Wicket spikes

- 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.

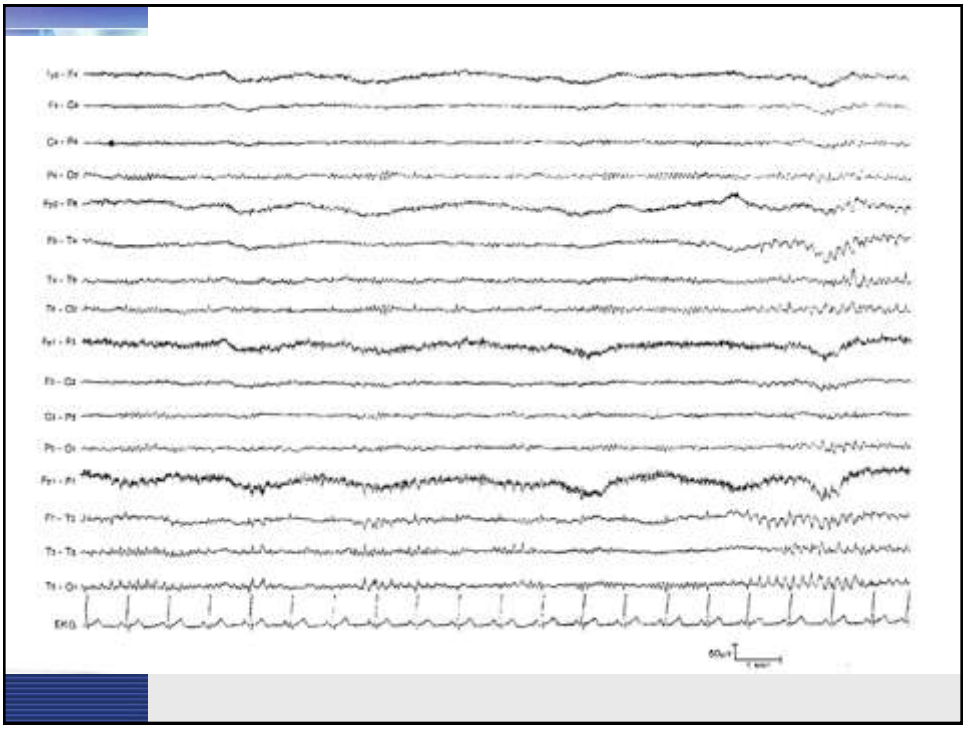


RMTD (Rhythmic midtemporal discharges)

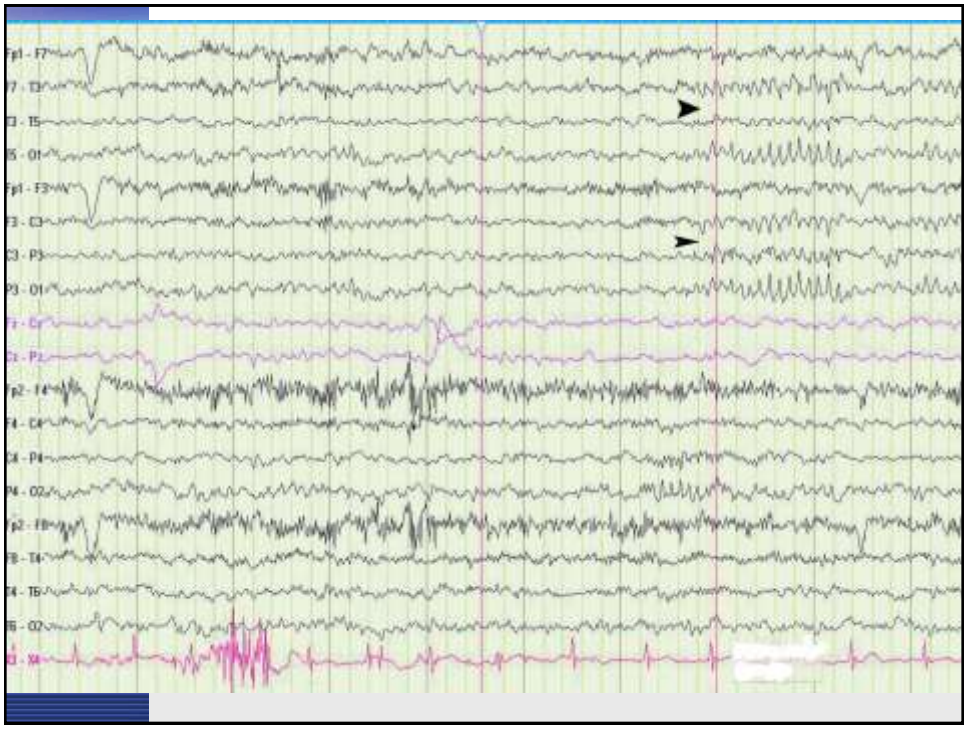
- Rhythmic 4-7 Hz temporal burst of monophasic sharp transients with notched appearance
- Maximum over the midtemporal region
- May be some spreading to the parasagittal region
- Unilateral or bilateral
- Awake or drowsy states

RMTD (Rhythmic midtemporal discharges)

- May occurs 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




Fp2-F8
F8-T4
T4-T6
T6-O2
Fp1-F7
F7-T3
T3-T5
T5-O1
PG-PG
PG-PG
F7-C7
C7-P7
PG-PG
PG-PG
Fp2-F4
F4-C4
C4-P4
P4-O2
Fp1-F3
F3-C3
C3-P3
P3-O1
Photic
ECG


Fp1 - F7
F7 - T3
T3 - T5
T5 - O1
Fp1 - F3
F3 - C3
C3 - P3
P3 - O1
Fz - Cz
Cz - Pz
Fp2 - F4
F4 - C4
C4 - P4
P4 - O2
Fp2 - F8
F8 - T4
T4 - T6
T6 - O2
EKG - X4

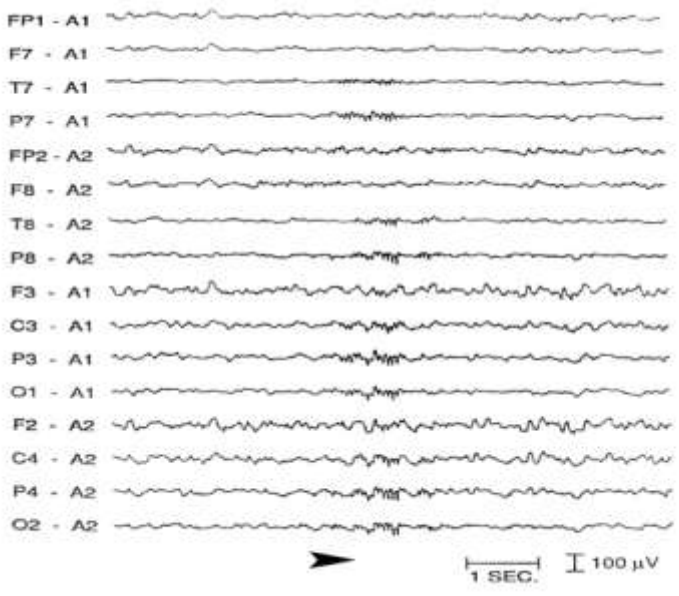
Normal variants that were seen as bursts of rhythmic activities

14 and 6 positive spikes

- 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

- Best seen in reference
- 10-30% of normal aldolescents



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)

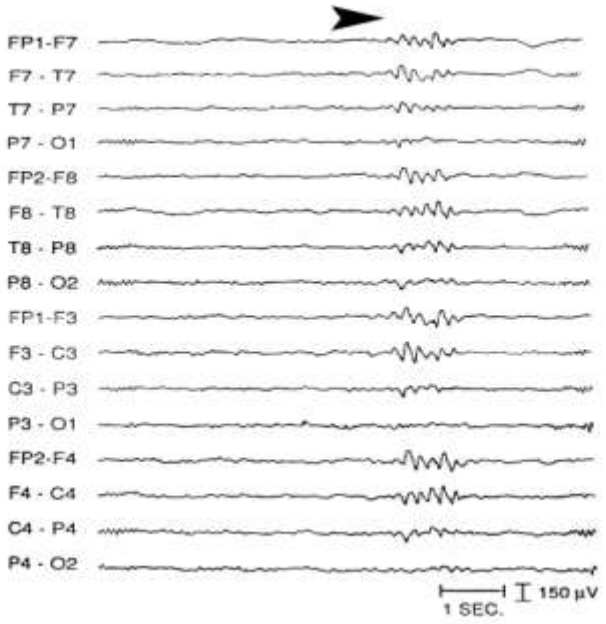
Two spatial distribution patterns

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

- FOLD
- F: female
- O: occipital
- L: low amplitude
- D: drowsy record

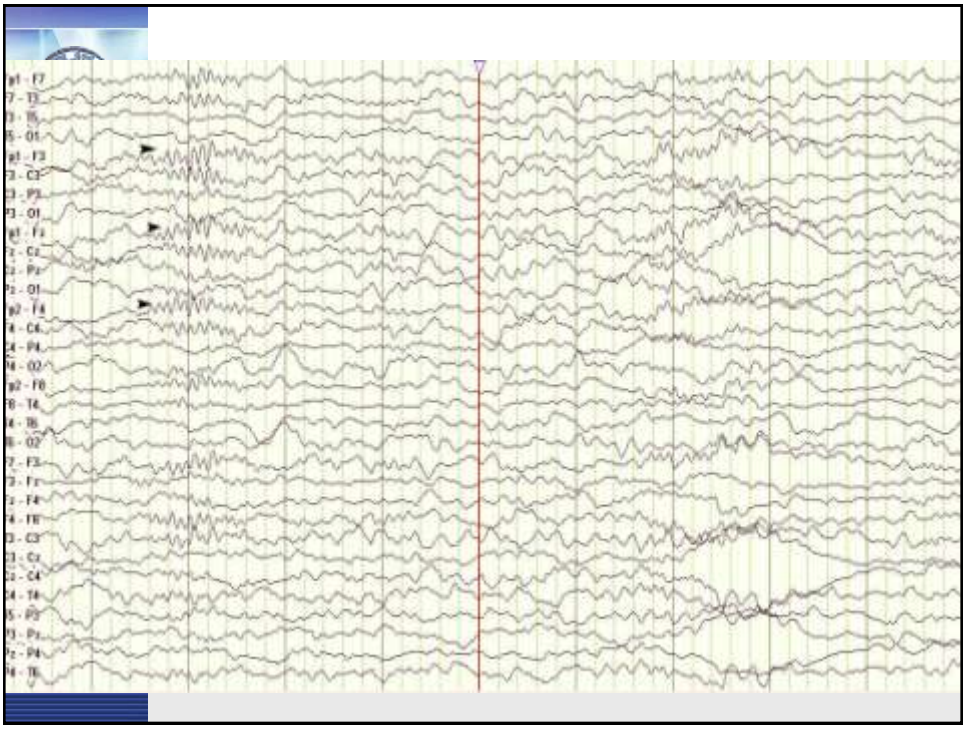
6 Hz spikes and waves (Phantom spikes)

- 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

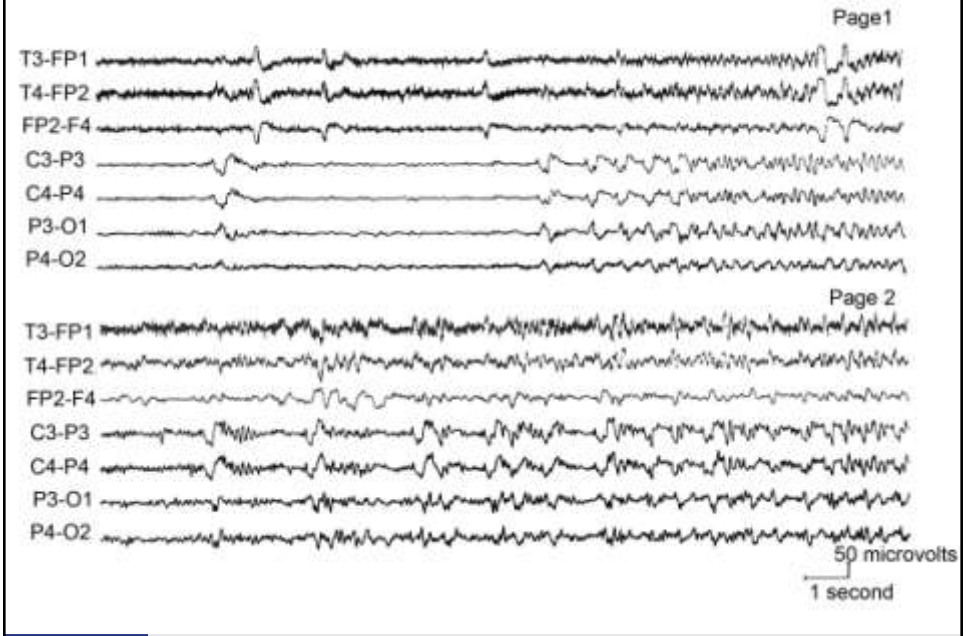


SREDA (subclinical rhythmic electrographic discharges of adult)

- 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

Nonphysiologic artifacts

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

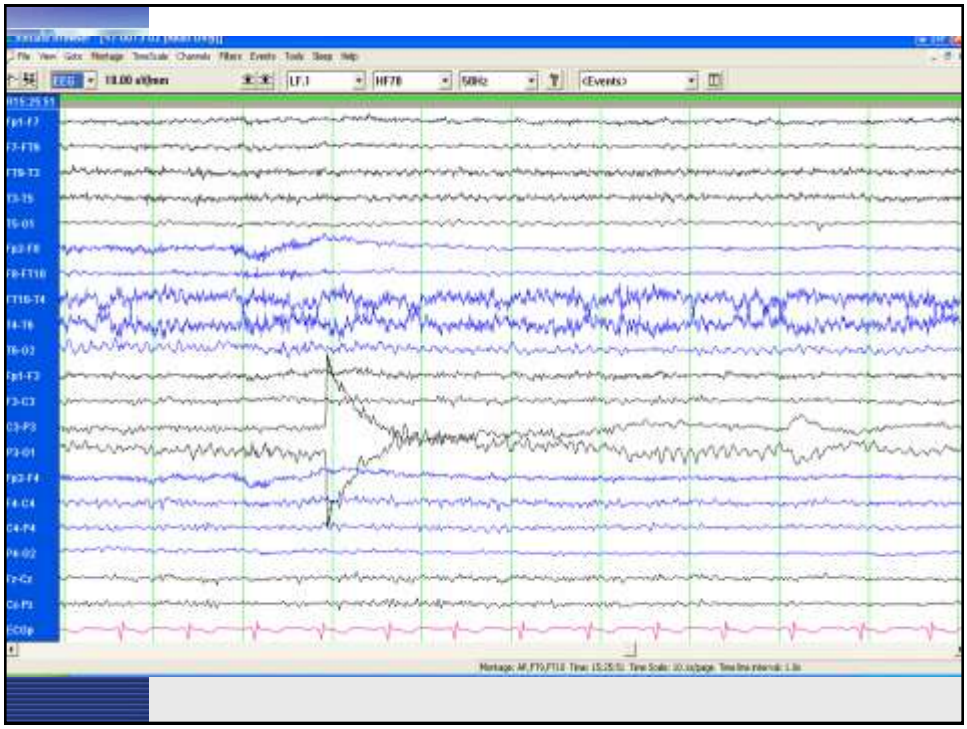
Nonphysiologic artifacts

- 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

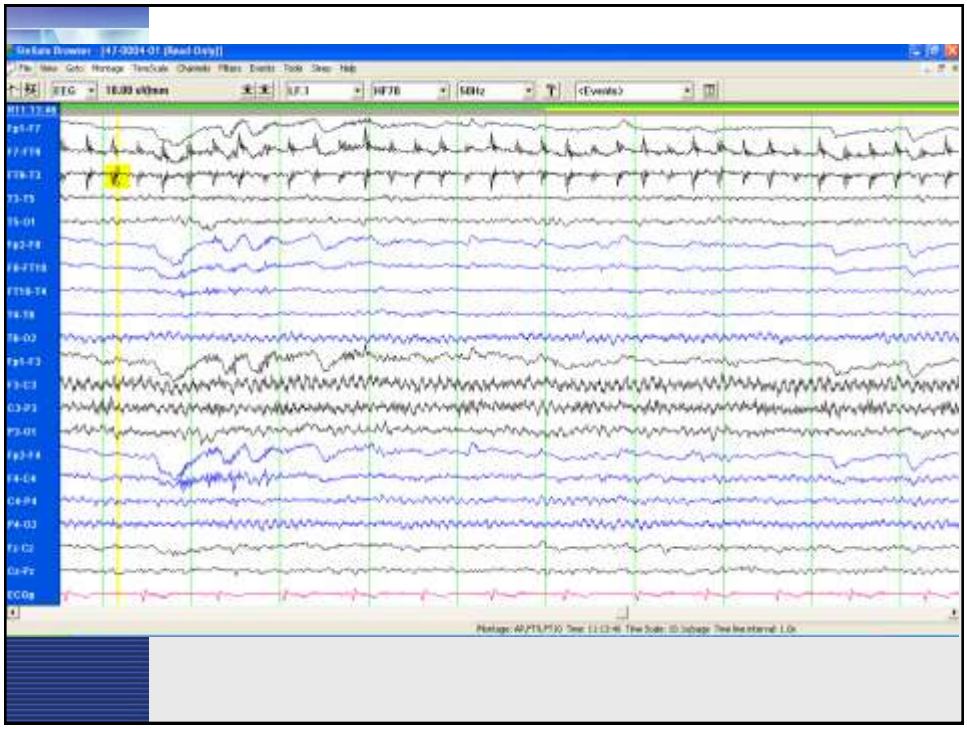
- Electrode “popping”
- Most common type of electrode artifacts
- Occur from abrupt changes in electrode’s impedance when the electrode moves
- Seen as single or multiple spike like discharges with very steep upslope (abrupt take off)
- Sometimes seen as an irregular slow activity that strickly confined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

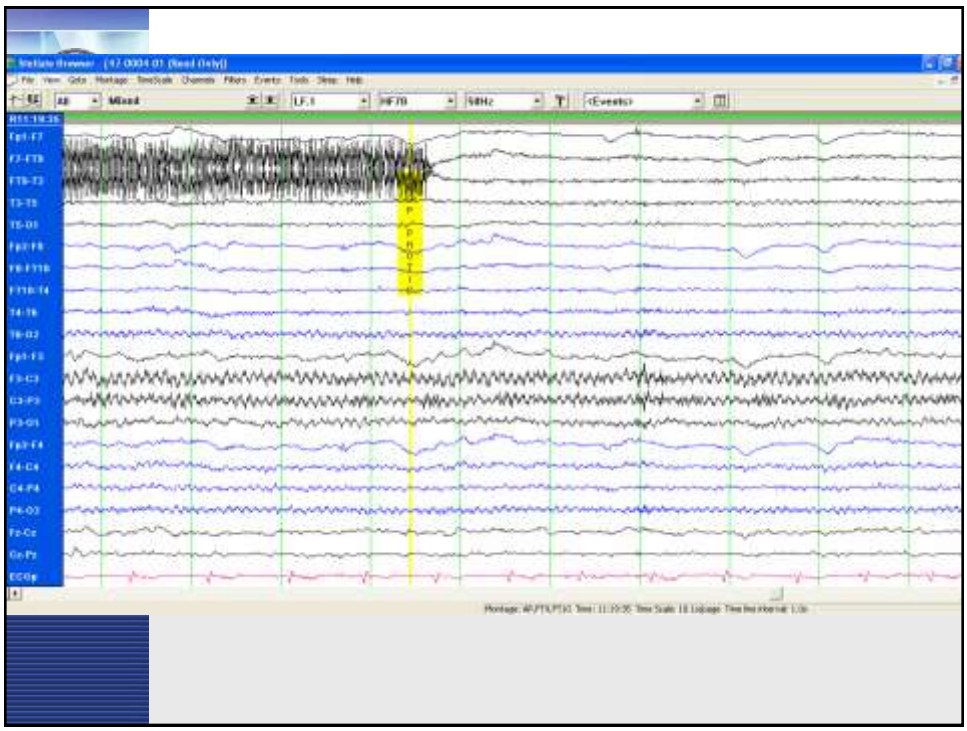


Nonphysiologic artifacts

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

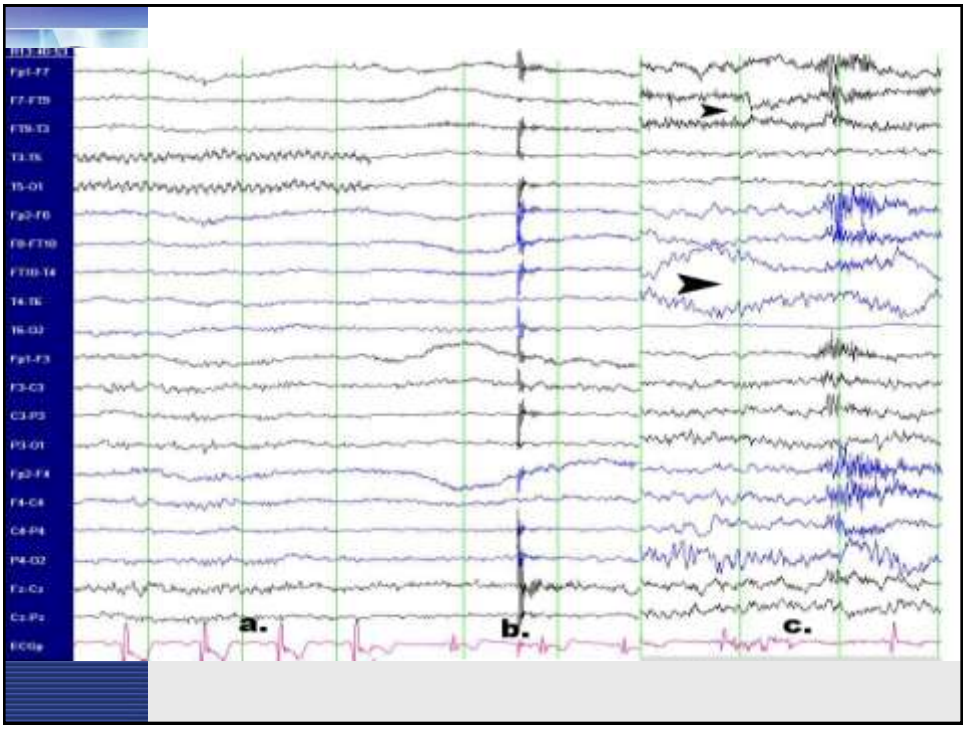




Nonphysiologic artifacts

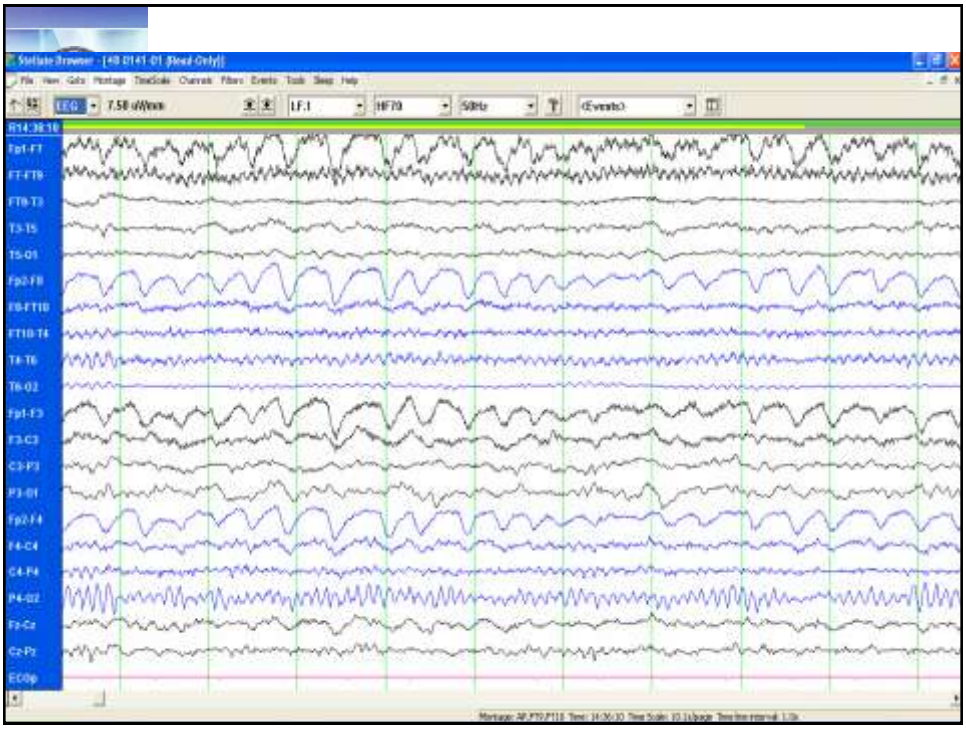
Environmental artifacts

- Cutting/coagulating electrode in the operating room
- Static or capacitative potentials
- IV drips
- Machines
- respirators



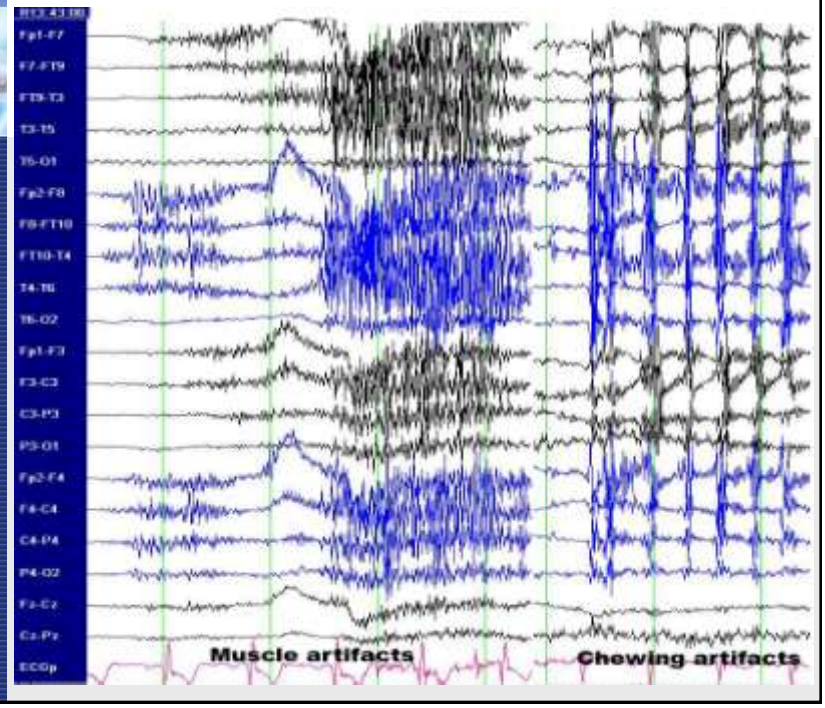
Physiologic artifacts

- 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




ชื่อภาควิชา
Thank You !