Common EEG pattern in critical care
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EEG in critical care
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Causes
- Direct neuronal injury
- Cerebral dysfunction: encephalopathy
- Psychic problems

Normal EEG pattern

Awake

Drowsy

Sleep: Vertex sharp transients and sleep spindle
Definition of the abnormal EEG
An EEG is abnormal if it contains
- Epileptiform activity
- Slow waves
- Amplitude abnormalities
Or
- Certain patterns resembling normal activity but deviating from it in frequency, reactivity, distribution or other features

In most abnormal EEGs, the abnormal patterns appear
- only intermittently
- only in some channels
Or
- only superimposed on a normal background

Approach to the orderly visual analysis of EEG activity
Examine EEG

Background
- Normal for Age/State
- Abnormal
  - Generalized
  - Focal

Transients
- Cerebral
- Non-cerebral
  - Normal for Age/State
  - Non-specific
  - Epileptiform
    - Significant
    - Benign variants
      - Focal
      - Generalized
Common EEG pattern in critical care

• Focal slow waves
• Intermittent rhythmic delta activity
• Generalized asynchronous slow waves
• Excessive fast activity
• Amplitude abnormalities
• Monorhythmic activities
• Sleep pattern

Common EEG pattern in critical care

• Epileptiform activities
• Triphasic waves
• Periodic pattern
• Burst-Suppression activity
• Low-voltage, slow, nonreactive EEG
• Electrocerebral silence

Focal slow activity

<table>
<thead>
<tr>
<th>Intermittent slow</th>
<th>Continuous slow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theta</td>
<td>Theta or Delta</td>
</tr>
<tr>
<td>Focal</td>
<td>Focal</td>
</tr>
<tr>
<td>Reactive</td>
<td>Reactive or nonreactive</td>
</tr>
<tr>
<td>Focal brain dysfunction</td>
<td>Focal structural lesion</td>
</tr>
<tr>
<td>without structural lesion</td>
<td></td>
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</tbody>
</table>

Focal theta wave (4-7 Hz)

Focal delta wave (<4 Hz): PDA

Intermittent rhythmic delta activity

Deep midline gray matter involvement by

1. Diffuse dz damaging subcortical and cortical gray matter > white matter: presenile dementia, PSP
2. Local structural lesions which directly involve or compress deep midline structures: tumor or stroke
3. Metabolic, toxic, and endocrine encephalopathies
Frontal intermittent rhythmic delta activity (FIRDA)

Occipital intermittent rhythmic delta activity (OIRDA)

Generalized asynchronous slow waves
1. Mild to moderate slow waves in some cases (10-15%): no detectable abnormality
2. Wide spread structural damage including subcortical white matter
3. Generalized cerebral dysfunction: anoxia, syncope, coma, postictal condition

Generalized asynchronous slow waves

Excessive fast activity
- Toxic/metabolic effect: BDZ, PB overdose or withdrawal
- Beta coma pattern – good prognosis
Excessive fast activity

Local differences of amplitude

1. Local decreased EEG production:
   - structural cortical damage (infarction, contusion, bleeding, abscess, etc.)
   - cerebral dysfunction (TIA, migraine)
2. Local change of media between cortex and recording electrode
   - Increase: SDH, scalp swelling
   - Decrease: surgical skull defect (breach rhythm)

Background asymmetry

Breach rhythm

Generalized changes of amplitude

1. Generally decreased EEG production
   - No detectable abnormality (5-10% of normal adults)
   - Structural dz of cerebral cortex: postanoxia, Huntington's chorea
   - Disorder of cortical function: Hypothyroidism, intoxications, anxiety, etc.
2. Bilateral increase of media between cortex and recording electrodes: SDH

Diffuse low amplitude
Alpha coma pattern 1

Alpha coma pattern 2

Theta coma pattern 1

Theta coma pattern 2

Spindle coma pattern

Epileptiform discharges
- Focal irritative structural lesion: infection, tumor, bleeding
- Cerebral dysfunction: metabolic/toxic encephalopathy
- Epilepsy, Status epilepticus (CSE, NCSE)
Sharp wave

PSW SW

Sharp-slow wave complex

Triphasic waves

Periodic complexes

• Periodic lateralizing epileptiform discharges (PLEDs)
• Bilateral periodic lateralizing epileptiform discharges (BIPLEDs)
• Generalized periodic epileptiform discharges (GPEDs)
• Triphasic waves
Periodic lateralizing epileptiform discharges (PLEDs)

- PLEDs-proper
  relatively stable periodicity and no associated rhythmic discharges

- PLEDs-plus
  variable periodicity and associated rhythmic activity with the discharges

Generalized periodic epileptiform discharges (GPEDs)

- Periodic short-interval diffuse discharges (PSIDDs): interval 0.5-4 sec. >> CJD

- Periodic long-interval diffuse discharges (PLIDDs): interval 4-30 sec. >> SSPE

- Burst-suppression pattern
Burst-Suppress pattern

- Burst activity: 1-3 sec., Suppression: 5-10 sec.
- Ischemic/hypoxic encephalopathy, Hypothermia, Anesthesia/Sedative drugs
- Poor prognosis in postanoxia

Low-voltage, slow, nonreactive EEG

Electrocerebral silence