EEG Artifacts

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Conflicts of Interest

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Outline

• What is an artifact?
• Approach to artifacts
• Physiologic artifacts
• Non-physiologic artifacts
• Reducing artifacts
• Conclusions
Artifacts

- Electrical potentials stemming from extracerebral sources
- Often contaminate the recording
- Rarely helpful
- Can result in misinterpretation of the EEG
Ictal mimics

- Generalized
  - Eye flutter
  - Tongue movements
  - Neurostimulators
  - Head jerks
  - Ventilator
  - Psychogenic nonepileptic spells

- Focal
  - Tremor
  - Tapping
  - Focal facial movements
  - Electrode artifacts

McKay and Tatum (2019)
### Approach to Artifacts

<table>
<thead>
<tr>
<th>Appearance</th>
<th>Morphology, polarity, amplitude, duration, frequency, evolution, disruption of the background</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distribution</td>
<td>Single electrode, beyond scalp</td>
</tr>
<tr>
<td>Setting</td>
<td>Ambulatory, ICU, EMU, OR</td>
</tr>
<tr>
<td>State</td>
<td>Wakefulness, drowsiness, sleep, comatose</td>
</tr>
<tr>
<td>Video Recording</td>
<td>Tremor, patting, tooth brushing, CPR</td>
</tr>
</tbody>
</table>
Clues to Artifact

- A restricted to only 1 channel
- Noncontiguous head regions
- Affects non-scalp electrodes
- Complex waveforms
- Atypical generalized waveforms
- Precise periodicity and uniformity
- Very fast (>70 Hz) or very slow (<1Hz)

Tatum (2013)
EEG Artifacts

Physiologic

Non-physiologic

Extrinsic

Intrinsic (Implanted devices)

Equipment

Environmental
Physiologic Artifacts

- Ocular
- Cardiac
- Myogenic
- Glossokinetic
- Respiratory
- Sweat
- Movement
- Bone (breach)
Eye movements - blink
Asymmetric eye movements
Lateral eye movements
Eye movements- lateral rectus spikes
Eye movements- ocular flutter
Cardiac- EKG
Cardiac- pulse
Myogenic

Patient relaxes
Chewing
Asymmetric chewing
Glossokinetic
Respiratory
Sweat
Salt bridge
Movement
Tremor
Toothbrushing
Psychogenic nonepileptic spell

Shaking starts

Shaking stops
Patting
Sternal rub
CPR
Breach
Non-physiologic Artifacts

- Electrode pop
- Electrode disconnection
- 60 cycle
- Drips
- Ventilator
- Cell phone
- Neurostimulators
Electrode pop
Electrode disconnection
60-cycle

Notch off

Notch on
IV Drip
Ventilator/tubing
Cell phone
Neurostimulation devices

DBS

RNS
Artifact Reduction

- Manual Rejection
- Automated Artifact Rejection/Subtraction
- Band Pass Filtration
Automated artifact subtraction
Bandpass filtration

**It can mask focal or generalized slowing**
Bandpass filtration
Bandpass filtration

**Filtering can lead to erroneous interpretation of myogenic artifact as cerebral activity**
Preferential to rejection/subtraction/filtering, find and eliminate source of artifact when possible.
Conclusions

- EEG artifacts are commonly encountered
- Many artifacts can be easily identified, but others may be difficult to identify and may mimic brain activity including ictal or interictal findings.
- Video can often be helpful in identifying the source
- Identifying and interpreting EEG artifact is essential to proper EEG interpretation
- Artifact reducing techniques can be helpful, but should not replace a solid understanding of neurophysiologic principles
- When possible, attempts should be made to rectify source.
Questions?
References/additional reading


• Mathias, Sally V.; Bensalem-Owen, Meriem. Artifacts That Can Be Misinterpreted as Interictal Discharges, Journal of Clinical Neurophysiology: July 2019 - Volume 36 - Issue 4 - p 264-274


