

Artifacts Virtual EEG Course

18 September 2022 Kullasate Sakpichaisakul, MD Division of Neurology, Department of Pediatrics Queen Sirikit National Institute of Child Health

Outline



- What is an artifact?
- Approach to artifacts
- Physiologic artifacts
- Non-physiologic artifacts

Artifacts



- Unwanted electrical activity arising from different sources, other than cerebral activity
- Often contaminate the recording
- Can result in misinterpretation of the EEG



Clues to Artifact

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

Approach to Artifacts



- Appearance: Morphology, polarity, amplitude, duration, frequency, evolution, disruption of the background
- Distribution: Single electrode, beyond scalp
- Setting: ICU, EMU, OR
- State: Wakefulness, drowsiness, sleep, comatose
- Video recording: Tremor, patting, CPR



Artifacts



- Physiolocial/ biological artifacts: from patient's own physiological generator sources other than the brain
 - Eyes & eyelids: eye movement or blink artifacts
 - Tongue movement: glossokinetic, chewing, swallowing
 - EMG
 - ECG
- Nonphysiological artifacts: externally generated
 - Electrical phonemena
 - Devices in the recording environment



Physiologic Artifacts

- Ocular
- Cardiac
- Myogenic
- Glossokinetic
- Respiratory
- Sweat
- Movement
- Bone (breach)



Eye Movement Artifacts

- Corneo-retinal potentials
- Fp1, Fp2, F7, F8 are locations
- Frontopolar rhythmic slow wave activity: simulating brain activity



Corneoretinal Potential Eyeball



Blink Artifact





Blink Artifact





Left Lateral Eye Movement







Lateral Rectus Spikes



Ocular Flutter





Cardiogenic Artifact

- Electrical potential arising in the cardiac muscles, high amplitude
- Spread to scalp by volume conduction
- Prominent in babies, obese, short-neck, cardiomegaly

ECG Artifact





Pulse Artifact



Muscle (EMG) Artifacts



- Muscle contraction superimposed upon the EEG activity
- The motor unit action potential arising from the scalp muscles may cause misinterpretation by resembling spike or cortical activity
- Extremely short duration and spiky morphology
- During sleep EMG activity is reduced whereas cortical spikes increase

Myogenic Artifact



Chewing Artifact





Glossokinetic Artifact



Respiratory Artifact







Sweat Artifact

- Warm and humid recording room
- Anxiety and emotional tension
- Autonomic dysfunction
- Electrical potentials due to sweat glands
- Reduction in the skin resistance
- NaCl and lactic acid of sweat may produce large baseline sways

Sweat Artifact





Salt Bridge Artifact





Movement Artifacts



- Movement of head, body, and limbs produce irregualr high voltage potentials
- Movement of the head during HV or respiration can produce occipital electrode artifcats
- Movement associated with seizure may obscure cerebral activity
- Artifacts may occur in essential tremor and other movement disroders

Sternal Nub Artifact



CPR Artifact





Breach Rhythm



- Focal, asymmetrical, high voltage 6-11 Hz, admixed with lower or faster components
- Arch-like shaped waveforms, sometimes with spiky morphology
- Associated with skull defect
- "Conservative reading" should be emphasized
- No after-going slow waves

Breach Rhythm



FPI'- F7 m m m m m m m m m m m m m m m m m m
F7 - T3 - T3 - Martin Mar
T3 - T5 man marken Ma
To or many many many many many many many many
FP2 - F8 - warman - many many many many many many many many
F8-T4-man manue vous prover and and man man man man and and and and and and and and and a
T4-TBAMANANANANANANANANANANANANANANANANANANA
TG - O2 man man man man man and an and and and an and an and an and an and and
Epi * E3 m m MM
E3: C3. M.
c3: P3 mm mm mm how why with mm mm mm why why mm mm mm how why why why why why why why why why wh
P3-0100000000000000000000000000000000000
FP2 F4 man man man with a second seco
Fa-canan manan many and
Co-pommenter and a second and a
P4-02 man
rz-czhuman wanter wanter warden w
cz pzprowenie warman
T3 - T1
TI - TZY AND MANY MANY MANY MANY MANY MANY MANY MANY
T2 - T4 - T4 - T - T - T4 - T - T - T - T
REKG LEKGA A A A A A A A A A A A A A A A A A A
FPT-ATTIM MANANA MANA
LEYE - ATU 10292009 10:56:50 M Manus Manus Manus May Mar
FPZ-AZMWW Off MANNA WWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWWW
REYE - A2L W STOP STOP

Patting Artifact





м



Psychogenic Nonepileptic Events (PNES)





Non-Physiologic Artifacts

- Electrode pop
- Electrode disconnection
- Drip
- Ventilator
- Cell phone
- Neurostimulators

Electrode Artifacts



- The scalp-electrode junction is an important and delicate link in the whole system
- Electrode artifacts occure due to the change in the resistance or electrode potential betweent the scalp and the electrode
- Poor contact, improper electrolyte application, broken lead, poor contact at the junction box, dry out of electrode paste
- Strictly confined ot one lead or channels having input from this electode
- Wave morphology may change from time to time

Electrode "pop" Artifact



Fp1-F3	
F3-C3	
C3-P3	Single electrode
P3-01	Mirror image
Fp2-F4	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
F4-C4	
C4-P4	men man Marken
P4-02	man man MMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM
Fp1-F7	mentioned and the second of th
F7-T3	water and the show and the second an
T3-T5	the production of the second o
T5-O1	May man a man and a second of the property of
Fp2-F8	where we want that and the second where we we want the second was a second where we we want the second was a second where we want the second was a second where we want the second was a second where we want the second was a second was a second where we want the second was a seco
F8-T4	man we we have a second and the second of the second th
T4-T6	
T6-O2	



Electrode Disconnection

	A LA LA LA LA	V	1					1)) ()	
Ep1-EZ E7-T3 Amp Sat T3-T5 Amp Sat T5-01	urated for the	Martin	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		Defentionen man	My man	man and a second a		
Fp2 - F8pMW/W/W F8 - T4/Vywwy-ym T4 - T6~1M~~~yw	man with the	White where which the the	pelenterroralistan warderroterroralistan	alaahayhaalaalaan ahaan aha Ahaan ahaan ahaa	man mana mana mana mana mana mana mana	an and the second se	ward half and a second	www.www.www.	With a mark the work the work of the work
T6 - 02		whender and a second and a second and a second a							
EDZ - FAMILY MAN	have all my	MAMAMANAMANAMANA MANAMANAMANA MANAMANAMA	man have have have have have have have have	annalineer anne the		PORCHATAL	multiplestimeter		Marken work working
F4 - C4-1/4-14-14/4/44/44/44/44/44/44/44/44/44/44/44/44		manning		Ministration of the second	un alphandurk				······································
ECGL - ECGR	h			γ		$\langle \cdot \rangle$	v		

60-Cycle



att FP1 - F7----F7 - T3-----T3 - T5 -----15 - 01,...... FP2 - F8-----FP1 - F3mme F3 - C3----C3 - P3 P3 - Olverning monorman FP2 - F4-----F4 - C4 FZ - CZYWWARA CZ - PZ-FP1 - F7-----F7 - T3----T3 - T5 15 - 01/ FP2 - F8-----TA - TELLAN TE - 02 FP1 - F3-----F3 - C3-C3 - P3~~~ P3 - 01 FP2 - F4----F4 - C4 C4 - P4-----

Notch off

Notch on

P4 - 02-

FZ - CZ-----

IV Drip



Ventilator





Cell Phone



Conclusion



- EEG artifacts are commonly encountered
- It is essential to avoid misinterpretation of EEG
- Many artifacts can be easily identified, but others maybe difficult to identify and may mimic brain activity including ictal or interictal findings
- Video can often be helpful in identifying the source
- Single electrode, nonreasonable field, or positive phase reversal indicate artifactual in nature
- Solid understanding of neurophysiologic principle is helpful