

ACNS STANDARDIZED CRITICAL CARE EEG TERMINOLOGY 2021 (Condensed Version)

A. BACKGROUND EEG

1. **Symmetry:**

- Symmetric
- Mild asymmetry (consistent asymmetry in amplitude on referential recording of <50%, or consistent asymmetry in frequency of 0.5 - 1 Hz)
- Marked asymmetry ($\geq 50\%$ in amplitude or >1 Hz in frequency)

2. **Predominant background frequency:** Delta, Theta, and/or \geq Alpha. If 2 or 3 frequency bands are equally prominent, record each one.

3. **Posterior dominant "alpha" rhythm:** Specify frequency (to the nearest 0.5 Hz) or absent.

NOTE: When the background is asymmetric, describe the predominant frequency and posterior dominant rhythm separately for each hemisphere.

4. **Continuity:**

- Continuous.
- Nearly Continuous: continuous, but with occasional (1-9% of the record) periods of *attenuation* (periods of lower voltage $\geq 10 \mu V$ but $< 50\%$ of higher voltage background) or *suppression* (periods of lower voltage $< 10 \mu V$).
- Discontinuous: 10-49% of the record consisting of attenuation or suppression.
- Burst-suppression/Burst-attenuation: 50-99% of the record consisting of attenuation or suppression, with bursts alternating with attenuation or suppression; also specify the following:
 - Typical duration of bursts and interburst intervals
 - Sharpest component of a typical burst
 - Highly Epileptiform Bursts (present or absent): Present if 2 or more epileptiform discharges (spikes or sharp waves) occur within the majority ($>50\%$) of bursts and occur at an average of 1 Hz or faster within a single burst; OR a rhythmic, potentially ictal-appearing pattern occurs within the majority ($>50\%$) of bursts.
 - Identical Bursts (Present or absent): Present if the first 0.5 s or longer of each burst (or of each stereotyped cluster of 2 or more bursts) appears visually similar in all channels in the vast majority ($>90\%$) of bursts.
- Suppression: $>99\%$ of the record suppressed ($<10 \mu V$, as defined above).

NOTE: Bursts must average ≥ 0.5 s and have at least 4 phases (polyphasic); if shorter or fewer phases, then they are single discharges. Bursts within burst-suppression or burst-attenuation can last up to 30 s.

5. **Reactivity:** Change in cerebral EEG activity to stimulation: Yes, No, or Unclear/unknown/not applicable. Reactivity may include change in amplitude (including attenuation) or frequency. Note strength and/or nature of stimulation. Appearance of muscle activity or eye blink artifacts does not qualify as reactive. *If the only form of reactivity is SI-RDA, SI-PDs, SI-SW or SI-seizures, then categorize as "Reactive, SIRPIDs only".*

6. **State changes**

- Present with normal stage N2 sleep transients (K-complexes and spindles)
- Present but with abnormal stage N2 sleep transients
- Present but without stage N2 sleep transients
- Absent

7. **Cyclic Alternating Pattern of Encephalopathy (CAPE):** Present, Absent, or Unknown/unclear. Present if changes in background patterns, each lasting at least 10 s, and spontaneously alternating between the two patterns in a regular manner for at least 6 cycles (but often lasts minutes to hours). *If present, then describe whether seen in the patient's more awake/stimulated state or less awake state, the characteristics of each pattern, and the typical duration of each pattern.*

8. **Voltage:**

- Normal
- Low (most or all activity $<20 \mu V$ in longitudinal bipolar with standard 10-20 electrodes, [measured from peak to trough])
- Suppressed (all activity $<10 \mu V$). If nearly continuous or discontinuous, then this refers to the higher amplitude portion

9. **Anterior-posterior (AP) gradient:** Present, absent or reverse. An AP gradient is present if at any point in the epoch, there is a clear and persistent (at least 1 continuous minute) anterior to posterior gradient of voltages and frequencies such that lower amplitude, faster frequencies occur in anterior derivations, and higher amplitude, slower frequencies occur in posterior derivations. A reverse AP gradient is defined identically but with a posterior to anterior gradient of voltages and frequencies.

10. **Breach effect:** Present, absent, or unclear. *If present record location or hemisphere.*

B. SPORADIC EPILEPTIFORM DISCHARGES

Quantify spikes and sharp waves as:

- Abundant: ≥ 1 per 10 s, but not periodic
- Frequent: $\geq 1/\text{min}$ but less than 1 per 10 s
- Occasional: $\geq 1/\text{h}$ but less than 1/min
- Rare: $< 1/\text{h}$

C. RHYTHMIC OR PERIODIC PATTERNS (RPPs)

All patterns recorded must consist of main term # 1 followed by #2, with modifiers added as appropriate.

MAIN TERMS

1. Generalized (G) OR Lateralized (L) OR Bilateral Independent (BI) OR Unilateral Independent (UI) OR Multifocal (Mf)

Additional localizing information:

For **G**: Specify frontally, occipitally or midline predominant, or “generalized, not otherwise specified”

For **L**: Specify unilateral or bilateral asymmetric; and lobe(s) most involved or hemispheric

For **BI** or **Mf**: Specify symmetric or asymmetric; and lobe(s) most involved or hemispheric in both hemisphere

For **UI**: Specify unilateral or bilateral asymmetric; and lobe(s) most involved.

2. Periodic Discharges (PDs) OR Rhythmic Delta Activity (RDA) OR Spike-Wave (SW; includes sharp-wave and polyspike-wave)

NOTE: A pattern can qualify as rhythmic or periodic as long as it continues for at least 6 cycles (e.g. 1/s for 6 s, or 3/s for 2 s).

NOTE: If a pattern qualifies as both PDs and RDA simultaneously, it should be coded as PDs+R rather than RDA+S

MAJOR MODIFIERS

- a. **Prevalence:** Specify % of record or epoch that includes the pattern. This should be based on the percent of seconds that include or are within the pattern. If ≥ 2 patterns are equally or almost equally prominent, record presence and persistence of each.
- Continuous $\geq 90\%$ of record or epoch
 - Abundant 50-89% of record or epoch
 - Frequent 10-49% of record or epoch
 - Occasional 1-9% of record or epoch
 - Rare $< 1\%$ of record or epoch
- b. **Duration:** Specify typical duration of pattern if not continuous.
- Very long ≥ 1 hour
 - Long 10-59 minutes
 - Intermediate duration 1-9.9 minutes
 - Brief 10-59 seconds
 - Very brief < 10 seconds
- c. **Frequency** = Rate (cycles per second): Specify typical rate and range (minimum-maximum) for all patterns. Categorize as $< 0.5/s$, $0.5/s$, $1/s$, $1.5/s$, $2/s$, $2.5/s$, $3/s$, $3.5/s$ and $4/s$.
NOTE: if $> 4/s$ would either be classified as a BIRD if < 10 s (section E) or a seizure if ≥ 10 s (section D).
- d. **Phases** = Number of baseline crossings of the typical discharge (in longitudinal bipolar and in the channel in which it is the most readily appreciated). Applies to PDs and the entire spike-and-wave or sharp-and-wave complex of SW (includes the slow wave) but not to RDA. Categorize as 1, 2, 3 or > 3 .
- e. **Sharpness:** Specify for both the predominant phase (phase with greatest amplitude) and the sharpest phase if different. Applies only to PDs and SW, not RDA. If SW, specify for the spike/sharp wave only. For both phases, describe the *typical* discharge.
- Spiky (duration of that component [measured at the EEG baseline] is < 70 ms)
 - Sharp (duration of that component is 70-200 ms)
 - Sharply contoured (> 200 ms but with sharp morphology)
 - Blunt (> 200 ms)
- f. **Voltage** [of PDs, SW or RDA; not background EEG]:
- Absolute:** Typical amplitude measured in standard longitudinal bipolar 10-20 recording in the channel in which the pattern is most readily appreciated. For PDs, this refers to the highest amplitude component. For SW, this refers to the spike/sharp wave. Amplitude should be measured from peak to trough (not peak to baseline). Specify for RDA as well. Categorize amplitude as:
 - Very low < 20 μ V
 - Low 20-49 μ V
 - Medium 50-149 μ V
 - High ≥ 150 μ V
 - Relative:** For PDs *only* (PDs require two amplitudes, absolute and relative). Typical ratio of amplitude of the highest amplitude component to the amplitude of the background between discharges measured in the same channel and montage as absolute amplitude. Categorize as ≤ 2 or > 2 .
- g. **Stimulus-Induced (SI) or Stimulus-Terminated (ST)** = Repetitively and reproducibly brought about by (Stimulus-Induced [SI]) or reproducibly terminated by (Stimulus-Terminated [ST]) an alerting stimulus, with or without clinical alerting, when the patient is in their less stimulated state; may also occur spontaneously. If never clearly induced by stimulation, then categorize as *spontaneous*. If unknown, unclear or untested, then categorize as “**unknown**”. Specify type of stimulus (*auditory; light tactile; patient care and other non-noxious stimulations; or noxious:* suction, sternal rub, nostril tickle or other).
- h. **Evolving OR Fluctuating OR Static:** Terms refer to changes in either frequency, location or morphology. If neither evolving nor fluctuating applies, then categorize as **static**.
- Evolving:** an unequivocal sequential change in frequency or location lasting for at least 3 cycles each or an unequivocal sequential change in morphology with each morphology or each morphology plus its transitional forms lasting for at least 3 cycles; The criteria for evolution must be reached without the pattern remaining unchanged in frequency, morphology and location for 5 or more minutes.
 - Evolution in frequency: a change in the same direction for 2 consecutive time periods by at least $0.5/s$
 - Evolution in morphology: at least 2 consecutive changes to a novel morphology
 - Evolution in location: sequential spread into or sequentially out of at least two standard 10-20 electrode locations
 - Fluctuating:** ≥ 3 changes, not more than one minute apart, in frequency (by at least $0.5/s$), ≥ 3 changes in morphology, or ≥ 3 changes in location (by at least 1 standard inter-electrode distance), but *not qualifying as evolving*. Change in amplitude or sharpness alone would not qualify as evolving or fluctuating.

- i. **Plus (+)** = additional feature(s) rendering a pattern more ictal-appearing than the usual term without the plus. Applies to PDs and RDA only. Categorize as follows:
- i. “+F”: superimposed *fast* activity. Can be used with PDs or RDA.
 - Extreme Delta Brush (EDB)**: A specific subtype of +F:
 - Definite EDB**: Consists of either abundant or continuous:
 - A. RDA+F, in which the fast activity has a stereotyped relationship to the delta wave (e.g., always maximal on the upstroke, crest, or downstroke of the wave); OR
 - B. PD+F, in which each PD contains a single blunt delta wave with superimposed fast activity, and in which the fast activity has a stereotyped relationship to the delta wave (i.e., periodic delta brushes)
 - Possible EDB**: Satisfying criterion A) or B) above EXCEPT either:
 - a) only occasional or frequent (rather than abundant or continuous) OR
 - b) the superimposed fast activity lacks a stereotyped relationship to the delta wave; continuous, invariant fast activity during RDA would fall into this category.
 - ii. “+R”: superimposed *rhythmic* or *quasi-rhythmic* activity. Applies to PDs only.
 - iii. “+S”: superimposed *sharp* waves or *spikes*, or *sharply contoured*. Applies to RDA only.
 - iv. “+FR”: superimposed *fast* activity and *rhythmic* or *quasi-rhythmic* activity. Applies to PDs only.
 - v. “+FS”: superimposed *fast* activity and *sharp* waves or *spikes*, or *sharply contoured*. Applies to RDA only.
 - vi. “No +”

NOTE: Bilateral “+” vs. unilateral: If a pattern is bilateral and qualifies as plus on one side, but not on the other, the overall main term should include the plus (even though one side does not warrant a plus).

NOTE: “+F”: If a pattern qualifying as RDA or PDs has superimposed continuous fast frequencies, this can and should be coded as +F if the fast activity is not present in the background activity when the RDA or PDs is not present. In other words, if the superimposed fast activity is part of the RDA or PD pattern and not simply part of the background activity.

D. ELECTROGRAPHIC AND ELECTROCLINICAL SEIZURES

1. Electrographic seizure (ESz) (largely based on the Salzburg criteria)^{11,12} is defined as either:

- a. Epileptiform discharges averaging >2.5 Hz for ≥ 10 s (>25 discharges in 10 s), OR
- b. Any pattern with definite evolution as defined above and lasting ≥ 10 s.

2. Electrographic status epilepticus (ESE) is defined as an electrographic seizure for ≥ 10 continuous minutes or for a total duration of $\geq 20\%$ of any 60-minute period of recording.

3. Electroclinical seizure (ECSz) is defined as:

Any EEG pattern with either:

- a. Definite clinical correlate time-locked to the pattern (of any duration), OR
- b. EEG **AND** clinical improvement with a parenteral (typically IV) anti-seizure medication.

4. Electroclinical status epilepticus (ECSE) is defined as an electroclinical seizure for ≥ 10 continuous minutes or for a total duration of $\geq 20\%$ of any 60-minute period of recording. An ongoing seizure with bilateral tonic-clonic (BTC) motor activity only needs to be present for ≥ 5 continuous minutes to qualify as ECSE. In any other clinical situation, the minimum duration to qualify as SE is ≥ 10 mins.

4b. Possible ECSE is a RPP that qualifies for the IIC that is present for ≥ 10 continuous minutes or for a total duration of $\geq 20\%$ of any 60-minute period of recording, which shows EEG improvement with a parenteral anti-seizure medication **BUT** without clinical improvement.

E. BRIEF POTENTIALLY ICTAL RHYTHMIC DISCHARGES (BIRDS)

Focal (including L, BI, UI or Mf) or generalized rhythmic activity >4 Hz (at least 6 waves at a regular rate) lasting ≥ 0.5 to <10 s, not consistent with a known normal pattern or benign variant, not part of burst-suppression or burst-attenuation, without definite clinical correlate, and that has at least one of the following features:

- a. Evolution (“evolving BIRDS”, a form of definite BIRDS)
- b. Similar morphology and location as interictal epileptiform discharges or seizures in the same patient (definite BIRDS)
- c. Sharply contoured but without (a) or (b) (possible BIRDS)

F. ICTAL-INTERICTAL CONTINUUM (IIC)

A pattern on the IIC is a pattern that does not qualify as definite seizure, but there is a reasonable chance that it may be contributing to impaired alertness, causing other clinical symptoms, and/or contributing to neuronal injury. Such patterns include:

1. Any PD or SW pattern that averages >1.0 Hz and ≤ 2.5 Hz over 10 s (>10 and ≤ 25 discharges in 10 sec); or
2. Any PD or SW pattern that averages ≥ 0.5 Hz and ≤ 1 Hz over 10 s (≥ 5 and ≤ 10 discharges in 10 sec), and has a plus modifier or fluctuation; or
3. Any lateralized RDA averaging >1 Hz for at least 10 s (at least 10 waves in 10 s) with a plus modifier or fluctuation

AND

4. Does not qualify as an ESz or ESE.