

**RHYTHMIC OR PERIODIC PATTERNS**

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

**MAIN TERMS**

- Generalized (G) OR Lateralized (L) OR Bilateral Independent (BI) OR Multifocal (Mf)**  
Additional localizing information:  
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 **G**: Specify frontally predominant, occipitally predominant, midline predominant or “truly” generalized
- Periodic Discharges (PDs) OR Rhythmic Delta Activity (RDA) OR Spike-Wave (SW; includes sharp-wave and polyspike-wave)**  
*NOTE 1:* A pattern can qualify as rhythmic or periodic as long as it continues for at least 6 cycles (e.g. 1/s for 6 seconds, or 3/s for 2seconds).  
*NOTE 2:* If a pattern qualifies as both GPDs and RDA simultaneously, it should be coded as GPDs+ rather than RDA+ (see modifier 8 below)

**MODIFIERS**

- 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  $\geq 2$  patterns are equally or almost equally prominent, record presence and persistence of each.
  - $\geq 90\%$  of record/epoch (“Continuous”)
  - 50-89% of record/epoch (“Abundant”)
  - 10-49% of record/epoch (“Frequent”)
  - 1-9% of record/epoch (“Occasional”)
  - $< 1\%$  of record/epoch (“Rare”)
- Duration:** Specify typical duration of pattern if not continuous.
  - $\geq 1$  hour (“Very long”)
  - 5-59 minutes (“Long”)
  - 1-4.9 minutes (“Intermediate duration”)
  - 10-59 seconds (“Brief”)
  - $< 10$  seconds (“Very brief”)
- 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  $\geq 4/s$ .
- 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  $> 3$ .
- 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)
- Amplitude** [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:
    - $< 20 \mu V$  (“very low”)
    - 20-49  $\mu V$  (“low”)
    - 50-199  $\mu V$  (“medium”)
    - $\geq 200 \mu V$  (“high”)
  - Relative:** For PDs only (PDs require 2 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  $\leq 2$  or  $> 2$ .
- Polarity:** Specify for the predominant phase (phase with the greatest amplitude) only. Describe the typical discharge. Applies only to PDs and the spike/sharp component of SW, not RDA. Categorize as the following:
  - Positive
  - Negative
  - Dipole, horizontal/tangential
  - Unclear
- Stimulus-Induced (SI)** = repetitively and reproducibly brought about by an alerting stimulus, with or without clinical alerting; may also be seen spontaneously. If never clearly induced by stimulation, report as *spontaneous*. If unknown, unclear or untested, report 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).
- Evolving OR Fluctuating:** both terms refer to changes in *either frequency, location or morphology*. If neither term applies, report 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:**  $\geq 3$  changes, not more than one minute apart, in frequency (by at least 0.5/s),  $\geq 3$  changes in morphology, or  $\geq 3$  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.
- 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:
  - “+F”: superimposed *fast* activity. Can be used with PDs or RDA.

- b. “+R”: superimposed *rhythmic* or *quasi-rhythmic* activity. Applies to PDs only.
- c. “+S”: superimposed *sharp* waves or *spikes*, or *sharply contoured*. Applies to RDA only.
- d. “+FR”: superimposed *fast* activity and *rhythmic* or *quasi-rhythmic* activity. Applies to PDs only.
- e. “+FS”: superimposed *fast* activity and *sharp* waves or *spikes*, or *sharply contoured*. Applies to RDA only.
- f. “No +”

**NOTE 3: Re: 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 4: Re: +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.

## MINOR MODIFIERS:

1. **Quasi-:** Used to modify rhythmic or periodic, as in *quasi-periodic* or *quasi-rhythmic*. (Quasi preferred over pseudo- or semi-). This distinction between quasi- and not quasi is to be applied only if determined by quantitative computer analysis (not by visual impression). Quasi is defined as having a cycle length (i.e., period) varying by 25-50% from one cycle to the next in the majority (>50%) of cycle pairs. If >50% variation in the majority of cycles, the pattern would not qualify as rhythmic or periodic and would not be included in this nomenclature. If the variation is <25%, the modifier quasi- would not be appropriate. When not using computer analysis, quasiperiodic is coded as periodic, and quasirhythmic as rhythmic.
2. **Sudden onset OR gradual onset.** Sudden onset is defined as progressing from absent to well developed within 3 seconds.
3. **Triphasic morphology:** Either two or three phases, with each phase longer than the previous, and the positive phase of highest amplitude. If three phases, this must be negative-positive-negative in polarity; if two phases, positive-negative. Note that a biphasic waveform may be categorized as “triphasic” by this definition.
4. **Anterior-posterior lag or reverse lag:** Applies if a consistent measureable delay of  $\geq 100$  msec appears to be present from anterior derivations to posterior derivations; specify typical delay in msec from anterior to posterior (negative = posterior to anterior lag) in both longitudinal bipolar and in a referential montage, preferably with an ipsilateral ear reference.

## Quantification of SPORADIC (non-rhythmic and non-periodic) EPILEPTIFORM DISCHARGES

Includes sharp waves and spikes.

- Abundant:  $>1/(10s)$ , i.e. averaging at least one per typical EEG page, but not periodic
- Frequent:  $>1/min$  but less than  $1/(10s)$
- Occasional:  $> 1/h$  but less than  $1/min$
- Rare:  $<1/h$

## BACKGROUND EEG

1. **Symmetry:**
  - a. Symmetric
  - b. Mild asymmetry (consistent asymmetry in amplitude on referential recording of <50%, or consistent asymmetry in frequency of 0.5 - 1 Hz)
  - c. Marked asymmetry ( $\geq 50\%$  amplitude or  $>1$  Hz frequency asymmetry)
2. **Breach effect** (note presence, absence, or unclear).  
*When any of the following features are asymmetric, they should be described separately for each hemisphere.*
3. **Posterior dominant “alpha” rhythm:** Specify frequency (to the nearest 0.5 Hz) or absence.
4. **Predominant background EEG frequency:** Delta, Theta, and/or  $\geq$ Alpha. If 2 or 3 frequency bands are equally prominent, record each one.
5. **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 are seen in anterior derivations, and higher amplitude, slower frequencies are seen in posterior derivations. A reverse AP gradient is defined identically but with a posterior to anterior gradient of voltages and frequencies.
6. **Variability:** Yes, No, or unknown/unclear/not applicable. The last choice might apply, for example, in a 30-minute awake record.
7. **Reactivity:** Change in cerebral EEG activity to stimulation: Yes, No, or Unclear/unknown/not applicable. This may include change in amplitude or frequency, including attenuation of activity. Strength and/or nature of stimulus should be noted. 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, categorize as “Reactive, SIRPDs only”.*
8. **Voltage:**
  - a. Normal
  - b. Low (most or all activity  $<20 \mu V$  in longitudinal bipolar with standard 10-20 electrodes, [measured from peak to trough])
  - c. Suppressed (all activity  $<10 \mu V$ ). If discontinuous, this refers to the higher amplitude portion
9. **Stage II sleep transients (K-complexes and spindles):**
  - a. Normal (K-complexes and spindles both present and normal)
  - b. Present (at least one) but abnormal
  - c. Absent (both absent).
10. **Continuity:**
  - a. Continuous.
  - b. Nearly Continuous: continuous, but with occasional ( $\leq 10\%$  of the record) periods of attenuation or suppression. Describe typical duration of attenuation/suppression as above.
    - i. Nearly continuous with attenuation: periods of lower voltage are  $\geq 10 \mu V$  but  $<50\%$  of the background voltage
    - ii. Nearly continuous with suppression: periods of lower voltage are  $<10 \mu V$
    - iii. If suppressions/attenuations are stimulus-induced, code as “nearly continuous with SI-attenuation” or “...with SI-suppression”
  - c. Discontinuous: 10-49% of the record consisting of attenuation or suppression, as defined above.
  - d. Burst-attenuation/Burst-suppression: more than 50% of the record consisting of attenuation or suppression, as defined above, with bursts alternating with attenuation or suppression; specify the following:
    - i. Typical duration of bursts and interburst intervals
    - ii. Sharpest component of a typical burst using the sharpness categories defined above under modifiers
    - iii. Presence or absence of Highly Epileptiform Bursts: Present if multiple epileptiform discharges (traditional definition) are present  $>1/sec$ , or a rhythmic, potentially ictal-appearing pattern  $>1$  Hz is seen within the majority (>50%) of bursts; record typical frequency (using categories above) and location (G, L, BI or Mf).
  - e. Suppression: entirety of the record consisting of suppression ( $<10 \mu V$ , as defined above).

**NOTE 5:** Bursts must average more than 0.5 seconds and have at least 4 phases (polyphasic); if shorter or fewer phases, they should be considered single discharges. Bursts within burst-suppression or burst-attenuation can last up to 30 seconds.

## Other terms for Research Use:

1. “Daily Pattern Duration” is defined as total duration of a pattern per 24 hours.
2. “Daily Pattern Index” is defined as Daily Pattern Duration X Mean Frequency (Hz).