Benign epileptiform variants

Seyed M Mirsattari, MD, PhD, FRCPC
Departments of Clinical Neurological Sciences, Medical Biophysics, Diagnostic Imaging, Psychology
University of Western Ontario
London, Ontario

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Learning Objectives

- To define Benign Epileptiform Variants (BEVs)
- To be able to classify BEVs into broad major categories
- To know the prevalence of BEVs
Disclosure Statement

☐ Dr. Mirsattari has nothing to disclose.
Definition of a Benign Epileptiform Variant in the EEG

EEG pattern that is morphologically epileptiform but is not associated with epilepsy.
Significance of correctly identifying the BEVs in the EEG

- To avoid misdiagnosis of the subjects with epilepsy based on these waveforms
- To avoid unnecessary treatments of these subjects with anti-epileptic drugs or epilepsy surgery.
- To avoid other negative impact of epilepsy on the lives of these individuals, e.g. driving
International 10-20 system of electrode placements

EEG montages

Bipolar

Coronal

Common Average Reference Point = CAR

Referential
EEG scalp recording: normal, awake
Classification of BEVs

- Two major categories
  - Sharply contoured BEVs:
    - Wicket waves
    - Benign sporadic sleep spikes (BSSS)
  - BEVs occurring in bursts or trains:
    - 6 Hz spike-waves
    - 14 & 6 Hz positive spikes
    - Rhythmic temporal theta bursts of drowsiness (RTTD)
    - Subclinical rhythmic electrographic discharge of adults (SREDA)

- To know the prevalence of BEVs
Sharply contoured BEVs

- Wicket waves
- Benign sporadic sleep spikes (BSSS)
Wicket waves

- Arciform, resembles Greek letter $\mu$
- Negative phase apiculate
- Positive phase rounded
- Single or clusters
- T3,4 or T3,4 & F7,8
- No after-coming slow wave
- No distortion of background rhythms
- ↑ in drowsiness or sleep
- Unilateral or independent bilateral
Wicket waves

Sharply contoured BEVs

- Wicket waves
- Benign sporadic sleep spikes (BSSS)
  - a.k.a “small sharp spikes” (SSS)
Benign Sporadic Sleep Spikes
BETS – Benign Epileptiform Transients of Sleep

- Abrupt ascending slope
- Steeper descending slope
- Usually short duration <50 msec
- Single after coming slow wave or dip in background
- Do not occur in trains
- Broad field → seen best in long inter-electrode distances
- Often bilateral, with max amplitude on 1 hemisphere
- Cancellation A1,2, and posterior temporal T5-6
- Oblique dipole with opposite polarity both sides of head
- Do not disturb background
- Light NREM sleep; diminishes with deeper sleep
- Adults and adolescents
Benign Sporadic Sleep Spikes

BETS – Benign Epileptiform Transients of Sleep

BEVs occurring in bursts or trains

- 6 Hz spike-waves
- 14 & 6 Hz positive spikes
- Rhythmic temporal theta bursts of drowsiness (RTTD)
- Subclinical rhythmic electrographic discharge of adults (SREDA)
6 per second spike-waves
(Phantom Spike and Wave)

- 5 – 7 Hz
- Brief low amplitude spike
- Slow wave has wider field than spike
- Adolescents and adults
- Awake, drowsiness, not sleep
- Bisynchronous
- <1 sec duration
6 Hz SW (cont.)

- FOLD – Female Occipitally-predominant Low-amplitude Drowsiness
- WHAM – Wake High-amplitude Anterior Male
- FOLD appearance more benign
- WHAM appearance more suggestive of underlying generalized seizure disorder
- Benign 6 Hz SW should disappear in sleep, whereas pathological SW is often enhanced by sleep
6 Hz SW (cont.)

14 & 6 Hz positive spikes

- Positive component apiculate or arciform
- Negative component smooth
- 13-17 Hz or 6-7 Hz; principally 14 or 6Hz
- Drowsiness and light sleep
- Posterior temporal and adjacent areas
- Widespread field
- Best recorded: coronal or referential montages
- Adolescents, young adults
14 & 6 Hz positive spikes

Cortical Location of Benign Paroxysmal Rhythms in the Electrocorticogram

- 6 Hz SW (8/61)
- 14&6 Hz positive spikes (4/61)
- BETS (3/61)

Rhythmic Temporal Theta of Drowsiness
(Psycomotor Variant)

- 5-7 Hz
- Sharply contoured, often notched
- Mid-anterior temporal regions
- Parasagittal spread
- Bursts or runs
- Bilateral or independent either side or shifting emphasis side to side
- Can have a gradual onset and offset
- Monomorphomic (no evolution)
- During relaxed wakefulness and drowsiness
- Mainly adolescent and adults
Rhythmic Temporal Theta of Drowsiness (Psychomotor Variant)

Subclinical Rhythmic Electrographic Discharge of Adults (SREDA)

- Sequential monophasic or biphasic apiculate waves mixed with rhythmic theta or delta
- No evolution
- Abrupt onset and gradual offset
- Usually in wakefulness, occasionally in sleep
- May occur during HV
- Principally parietal, posterior temporal
- Bisynchronous or unilateral
- Duration ~ 20 sec to a few minutes
- Occurs elderly or middle age
SREDA

First described by Westmoreland BF and Klass DW (1981)

- 65 patients (37 F; 28 M) between 1959 & 1978
- Mean age 61 years (42-80 years)
- Non-evolving θ rhythm
- Widespread, maximal over the P-post T
- Duration: few seconds to a minute

Unusual variants of SREDA

- Study interval: 1959-1995
- N=108 patients (191 EEGs)
- 49 Males; 59 Females
- Mean age=62 years (range= 35-89 years)
- Prevalence=1/2500 recordings
- 89 with typical SREDA pattern
- Unusual variants (19/108)
  - 10 Males; 9 Females
  - mean age 61 (range= 35-89 years)
  - Predominant Δ frequencies
  - Frontal or more focal distribution
  - Notched waveforms
  - Longer duration
  - Atypical evolution
  - Presence in younger individuals
  - Occurrence in sleep

Decharges paroxystiques

Naquet et al. 1961
Paroxysmal discharges of the parieto-temporo-occipital junction
Reliably induced by:
- HV
- pure relative hypoxia associated with nitrogen inhalation
- Mild relative ischemia from carotid artery compression
Postulated that it was associated with cerebrovascular disease

SREDA in Children

- Case report
- N=2
- 11 YO F presenting with HUS
- 10 YO F with learning difficulties and HA

SREDA in REM sleep

- Case report
- 48 YO M
- CAD, high Chol, HTN, Obstructive sleep apnea

SREDA and acute brain insults

- 4/340 patients
- Syncope
- TGA
- GTC
- R TLE

Case report (65 YO M)

Posterior hemisphere source localization using statistical non-parametric mapping (SNPM) of low resolution electromagnetic tomography (LORETA)

Localized to the vascular watershed between MCA, ACA and PCA

Parietal lobe source localization in a patient with SREDA

Prevalence of benign epileptiform variants observed in an EEG laboratory from Canada

# Prevalence & Demographics

<table>
<thead>
<tr>
<th>BEVs</th>
<th>Frequency</th>
<th>% of BEVs (N = 1279)</th>
<th>% of total (N = 35249)</th>
<th>Age (years)**</th>
<th>Gender (male:female)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Outpatients</td>
<td>35249</td>
<td></td>
<td></td>
<td>0 - 100</td>
<td>17492 : 17757</td>
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<tr>
<td>BSSS</td>
<td>652</td>
<td>50.977</td>
<td>1.850</td>
<td>39.76 +/- 17.78</td>
<td>345 : 307</td>
</tr>
<tr>
<td>Wicket waves</td>
<td>13</td>
<td>1.016</td>
<td>0.037</td>
<td>55.36 +/- 13.31</td>
<td>5 : 8</td>
</tr>
<tr>
<td>14 and/or 6 Hz positive spikes</td>
<td>185</td>
<td>14.464</td>
<td>0.525</td>
<td>23.31 +/- 10.48</td>
<td>82 : 103</td>
</tr>
<tr>
<td>6 Hz spike-waves</td>
<td>360</td>
<td>28.147</td>
<td>1.021</td>
<td>28.84 +/- 13.04</td>
<td>159 : 201</td>
</tr>
<tr>
<td>RTTD</td>
<td>43</td>
<td>3.362</td>
<td>0.122</td>
<td>27.52 +/- 15.82</td>
<td>19 : 24</td>
</tr>
<tr>
<td>SREDA</td>
<td>25</td>
<td>2.033</td>
<td>0.074</td>
<td>52.25 +/- 15.28</td>
<td>9 : 17</td>
</tr>
<tr>
<td>Total BEVs</td>
<td>1279</td>
<td>100.000</td>
<td>3.628</td>
<td></td>
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</tbody>
</table>
Conclusions

- The prevalence of BEVs among Canadian subjects is not too different from those reported from other developed countries.
- Their mere presence in a record does not justify the diagnosis of epilepsy or the institution of anticonvulsant therapy.
- Suitable candidates should not be denied epilepsy surgery due to the misinterpretation of these benign variants.