Neurostimulation EEG artifacts: VNS, RNS, and DBS

Artefatos de neuroestimulação no EEG: VNS, RNS e DBS

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Accurately recognizing artifacts on electroencephalogram (EEG) is necessary to prevent EEG misinterpretation and epilepsy misdiagnosis. EEG artifacts generated by neurostimulation devices (Figures 1 and 2) can be identified based on their unique spatial and frequency properties¹. VNS and RNS artifacts display an electrical interferencelike "spiky" morphology with a distribution that is incompatible with a cerebral source and frequencies that mirror stimulation settings. DBS artifact features diffuse electrical interference with a relatively monomorphic appearance, and



Scalp EEG (top), extended longitudinal bipolar montage (with additional frontotemporal electrodes) showing a burst of low-voltage sharply contoured artifact mostly at the EKG channel but also at the across FT9-FT10 and A1-A2 bipolar channels. Invasive EEG (bottom), bipolar montage showing a burst of low-voltage 20 Hz sharply contoured artifact at the EKG channel. The artifacts' 20 Hz frequency corresponded to the stimulating frequency in both cases. **Figure 1.** Vagus nerve stimulation (VNS) EEG artifact. Scalp EEG: sensitivity 7 µV/mm, LF 1 Hz, HF 70 Hz, notch on; invasive EEG: sensitivity 100 µV, LF 0.53 Hz, HF 600 Hz, notch off.

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RNS (top, 15-second; middle, 5-second view): repetitive 200 Hz stimulation artifact (red rectangles) followed by C3-P3 device detection artifact (blue stars). RNS strip electrodes were in the left posterior temporal topography with generator in the left frontal region. DBS (bottom): continuous, diffuse, electrical interference without evolution.

Figure 2. Responsive neurostimulation (RNS) and deep brain stimulation (DBS) scalp EEG artifacts – extended longitudinal bipolar montages (with additional frontotemporal electrodes). EEG: sensitivity 7 µV/mm, LF 1 Hz, HF 70 Hz, notch on.

its frequency can vary depending on intermittent versus continuous neurostimulation – indicated for epilepsy and

movement disorders, respectively.

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