

ANS/BSCN Guidelines for Hyperventilation During EEG Recordings

Hyperventilation (HV) is an activation technique used during EEG recording to elicit epileptiform abnormalities, and in some cases seizures, in order to enhance the diagnostic sensitivity of EEG. It is considered reasonably safe but carries a small risk of inducing potentially 'adverse events', including seizures, cardiac, respiratory and cerebrovascular.

In the prospective 2012 National Audit of an unselected population of 3,475 patients, from a wide age range, there were less than 3% of reported events, two thirds of which were seizures. When the clinical diagnosis of epilepsy or possible epilepsy was considered as a subgroup of 3,170 patients, there were 69 provoked seizures (2.2%), of which 56 were absences (81.2% of the total seizures), but only 1 (0.03%) was a Generalised Tonic Clonic Seizure. Other potential adverse events include dizziness, distress, confusion, paraesthesias, tetany and prolonged over breathing; but there were no reported significant cardiac, respiratory or cerebrovascular complications or sequelae thereof. These Guidelines have been informed by that Audit, other EEG Guidelines and a review of the literature on hyperventilation, with an emphasis on safety. Its principle role during EEG is in the diagnosis of epilepsy, and these Guidelines are intended for that application only. The diagnostic yield in terms of increased epileptiform discharges was 387 out of 3,170 patients (12.2%), some of which only occurred during hyperventilation

Standard 1 Hyperventilation (HV) is performed for 3 to 5 minutes in room air with a respiratory rate of approximately 20 to 30 breaths per minute, with the patient's informed consent (or that of the parent or carer), and the EEG recording continued for at least 3 minutes afterwards. The patient can stop HV if they wish.

Guideline Repeat or even prolonged HV is undertaken if clinically indicated (e.g. to induce seizures in a patient strongly suspected of having absences but whose initial HV is unremarkable, or a patient undergoing video-EEG monitoring for medically intractable epilepsy but not having any clinical seizures).

Standard 2 The patient's HV effort is qualitatively assessed (e.g. poor, moderate or good), bearing in mind that the technique may need to be modified according to the patient's age and ability to undertake the procedure. Children may need help and encouragement to HV, for example with the use of toy windmills or balloons.

Guideline The patient's effort is quantitatively assessed (e.g. plethysmography).

Standard 3 Any effects of HV on the EEG and any clinical events (i.e. seizures, non-epileptic attacks, symptoms) are documented and described, and preparations are made to manage them clinically.

Guideline In certain circumstances it may be valid to use HV as a provocation procedure to induce a non-epileptic attack or psychogenic non-epileptic seizure (formerly known as pseudoseizures).

Standard 4 A single lead ECG is contemporaneously recorded during HV. Mild tachycardia is to be anticipated, but HV is stopped if the patient develops chest pain, ST changes or other rhythm disturbances on the ECG.

Standard 5 Absolute contraindications to HV include: recent (i.e. within the last 12 months) stroke (intracranial or subarachnoid haemorrhage) or myocardial infarction (MI), significant cardiac disease (i.e. poorly controlled or unstable angina), pulmonary disease (i.e. COPD causing the patient to be breathless at rest), sickle cell disease or trait, and known moyamoya disease [modified from Guideline One. American EEG Society 1994. J.Clin.Neurophys.11 (1) 2-5].

Guideline Relative contraindications to HV include known stable cerebrovascular disease, ischaemic heart disease (previous MI and angina) and asthma, where a risk versus benefit assessment is undertaken with the referring physician and/or patient's involvement and their consent.

Guideline In situations when adequate HV may be not possible, e.g. the patient is unable to co-operate, has restrictive lung disease or is physically unable (e.g. pregnancy, frail elderly), recording Physiologists should use intuition and document their decision.

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References:

Hyperventilation during electroencephalography: Safety and efficacy Kane N, Grocott L, Kandler R, Lawrence S, Pang C Seizure 2014;23:129-134

The safety and efficacy of hyperventilation during routine EEG: a national survey Lawrence S, Kandler R, Kane N, Grocott L, Pang C Journal of the Association of Neurophysiological Scientists 2013;6:59-63