Journals Pub

International Journal of
Nursing Science
Practice and Research

ISSN: 2455-6351
Volume 10, Issue 1, 2024
DOI (Journal): 10.37628/IJNSPR

https://journalspub.com/journal/ijnspr/

Review IJNSPR

EEG for Nursing: Knowledge gaps and opportunities

Sachin[1,*], Archana Verma[2], Ashutosh Mishra[3], Alok Kumar[4]

Abstract

***BACKGROUND**: Electroencephalography (EEG) is a non-invasive diagnostic method used to identify particular locations of seizure activity in the brain. EEG has been demonstrated in both adult and paediatric populations to be a safe and effective technique for preoperative decision making and batter prognosis. **METHODS**: This is used in patients who have Seizure Diagnosis and Monitoring, Brain Function Evaluation, Preoperative Assessment, Sleep Disorders, Psychiatric Disorders, Research and Cognitive Studies, and Monitoring Brain Function in Critical Care. It is chosen over other non- invasive diagnostic procedures due to lesser risk, less discomfort, and shorter operating periods. **RESULTS**: It has a specific function in gathering valuable data that leads to more accurate surgical alternatives such as localization and lateralization. All of this leads to better seizure management and a higher quality of life for the patients. **CONCLUSION**: Nurses must have a complete awareness of EEG, including its advantages, disadvantages, and the critical role of neuroscience nurses. This knowledge is critical for enhancing surgical patient care and outcomes. The significance of EEG extends beyond epilepsy to a variety of neurological and mental diseases, emphasising the value of EEG for nurses in improving overall patient well-being.*

Keywords: EEG, Epilepsy, Nurses, seizures, ILAE

INTRODUCTION

Epilepsy is a common, often chronic neurological illness that can be dangerous to one's physical health as well as have emotional, social, and economic consequences that decrease one's quality of life. There are more than 50 million People with Epilepsy (PWE) globally, with more than 10 million in India, according to estimates [1].

***Author for Correspondence**
Archana Verma
E-mail: archanashiva2010@rediffmail.com

[1]EEG Technologist Department of Neurology All India Institute of Medical Science Raebareli, 229405, India.
[2]Professor and Head Department of Neurology, All India Institute of Medical Sciences, Munshiganj, Dalmau Road, Raebareli (U.P.) 229405, India.
[3]Assistant Professor Department of Neurology, All India Institute of Medical Sciences Raebareli Munshiganj, Dalmau Road, Raibareli, India.
[4]Professor & Head, Forensic Medicine & Toxicology, UP university of Medical Sciences, Saifai,
Etawah., India.

Received Date: February 26, 2024
Accepted Date: May 10, 2024
Published Date: May 20, 2024

Citation: Sachin, Archana Verma,Ashutosh Mishra,Alok Kumar. EEG for Nursing: Knowledge gaps and opportunities. International Journal of Nursing Science Practice and Research. 2024; 10(1): 5–10p.

An epileptic seizure is a transient occurrence of signs and/or symptoms due to abnormal excessive or synchronous neuronal activity in the brain. Epilepsy is defined as at least two unprovoked seizures occurring more than 24 hours apart.

Seizures are classified according to their location and symptoms [2]. Epilepsy is diagnosed through a thorough process that comprises a medical history evaluation, clinical examination, and diagnostic tests [3]. Despite significant advances in structural and functional neuroimaging techniques, as well as better spatial and temporal resolution of neurodiagnostic studies, Electroencephalography (EEG) remains an important tool for assessing electrical brain signals and neurologic function[4]. The EEG has been widely utilised in the diagnosis and monitoring of individuals with neurologic diseases, but it is particularly well adapted to evaluating PWE. EEG studies are either standard (short-term) inpatient/outpatient recordings or long-term studies [5]. When clinical examination and routine EEG are followed by diagnostic evaluation and treatment challenges, long-term EEG with video (video-EEG) plays a crucial role in the assessment of the patient.

Inpatient procedures in epilepsy monitoring units or continuous electroencephalogram (cEEG) monitoring in hospitals or special care units are commonly used for this; cEEG can assist in the real-time detection of nonconvulsive seizures, brain ischemia, and other disturbances, and can offer the chance to modify anticonvulsant therapy or reverse focal ischemia [6].

In this brief review we will discuss the overview of EEG, routine activation techniques, common artefacts, and characteristics of both normal and pathological interictal EEGs, uses of adult EEG and also considering the significance of EEG knowledge for nursing.

OVERVIEW

An EEG is a tool used in the electroencephalography procedure, which records the electrical potential in the brain. An analogue to digital converter, amplifiers, conductive gel, and electrodes makes up this apparatus. The electrodes or leads transport electrical activity from the scalp of the brain. For EEG analysis, a variety of electrode types are typically used. A reusable disc can serve as an electrode [7]. The electrodes are made of tin, silver, and gold, and before placing them on the scalp, a small amount of conductive gel (Ag-C1) is applied underneath the disc Fig1.

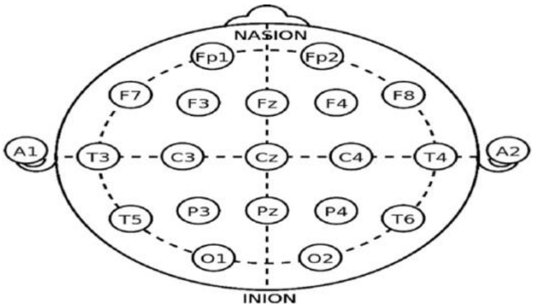


Figure1: An IFCN-adapted system for placing 10–20 electrodes for an EEG. [The numbers correspond to the cerebral hemisphere (even for the right hemisphere and odd for the left), and the letter indicates the region of the brain where the electrode will be implanted (F-frontal, P-parietal, C-central, T-temporal, O-occipital).

ACTIVATION PROCEDURE

The EEG activation protocols relate to specific tasks or stimuli used to elicit and observe specific brain responses. These techniques aid academics and doctors in evaluating many aspects of brain function. To induce certain patterns or anomalies in EEG recordings, activation techniques are routinely used [8]. Here are some popular EEG activation procedures:

HYPERVENTILATION

Hyperventilation (HV), often known as over-breathing, was the first EEG activation technique. It is often used in clinical EEG laboratories and is recommended as a routine component of EEG recording by the most accepted global standards[9]. For a brief time, the client is encouraged to breathe deeply and fast. This can cause variations in blood gases and pH levels, which can lead to changes in brain activity. It is frequently used to cause epileptiform discharges in PWE.

International Journal of Nursing Science Practice and Research
Volume 10, Issue 1
ISSN: 2455-6351

INTERMITTENT PHOTIC STIMULATION

For the majority of patients referred for routine EEGs, photic stimulation is performed in most EEG laboratories. Brainwave patterns and certain reactions in the visual cortex can be influenced by flashing lights, which are usually delivered at varying frequencies. Photoparoxysmal responses, which are aberrant reactions observed in specific forms of epilepsy, are frequently elicited by photic stimulation [10].

AROUSALS, SLEEP, SLEEP DEPRIVATION

Sleep EEG recording is recommended by the American Clinical Neurophysiology Society whenever practicable, even if it cannot be done in conjunction to waking recording. Keeping the person awake for an extended period of time before an EEG session can improve the chances of catching aberrant brain activity, particularly epileptiform discharges. Sleep deprivation may be used to record sleep-related disorders. Sleep-related epileptic episodes or parasomnias can be detected using EEG recordings during sleep [11].

EEG WAVEFORMS

The EEG detects electrical activity in the brain using electrodes put on the scalp. The resulting EEG waves are classified into distinct categories based on their frequency and amplitude. These waves are related with various states of consciousness, activities, and disorders. The following are the various forms of EEG waves (Fig 2)

1. ***Delta (0.5 - 4 Hz)***

Delta rhythm is physiologically observed in deep sleep frontocentral head regions. A pathological delta rhythm emerges in awake situations when there is localized brain damage and widespread encephalopathy.

2. ***Theta (4-7 Hz)***

This rhythm is caused by drowsiness and the N1 and N2 stages of early sleep. Due to early tiredness, it is most noticeable in the fronto-central head regions and eventually migrates backward, replacing the alpha rhythm. The existence of focused theta activity while awake is symptomatic of focal brain damage [12].

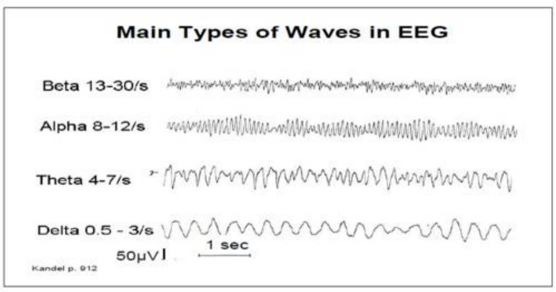
3. ***Alpha (8-12 Hz) Alpha (8-12 Hz)***

Regular awake EEG recordings in the occipital head area frequently exhibit the posterior dominant alpha rhythm. It is the defining feature of the usual background rhythm detected by adult EEG. A slowdown of the background alpha rhythm is assumed to signify widespread brain damage [13].

4. ***Beta (12–30 Hz)***

The beta rhythm is the most prevalent rhythm in children and healthy adults. As it goes rearward, it becomes less obvious and is most prominent in the frontal and central head regions. The majority of sedative medications, such as barbiturates, benzodiazepines, and chloral hydrate, increase beta activity in the body of the patient[14].

Figure2: Normal EEG waveforms



INTERICTAL EEG CHANGES (ABNORMAL EEG WAVEFORMS)

The diagnosis of epilepsy requires the identification of epileptiform discharges in the interictal EEG. An interictal epileptiform discharge is an abnormal synchronous electrical discharge generated by a group of neurons in the vicinity of the epileptic focus . Regular 30-minute EEG recordings show a moderate level of sensitivity; however, the yield increases with more frequent and longer EEG recordings. PWE may experience the following pattern of interictal epileptiform discharges:

a) Spike and wave **-** Spikes are extremely short, lasting about 20 to 70 milliseconds at their peak. GABA-b mediated currents provide a wave component that follows a spike [15].

b) Sharp waves **-** Despite amplitude changes, an epileptiform transient can be easily distinguished from background activity. A sharp peak having a duration of 70-200 ms on a standard time scale, often with a steeper ascending phase than a descending phase. When compared to other places, the major component is frequently negative, and a slow wave with the same polarity may follow[16].

c) Rhythmic Delta (Slowing) Activity (RDA): RDA is a rhythmic, often monomorphic delta activity seen in certain pathological conditions, such as brain tumors.

COMPLICATIONS

The EEG is a process that is generally safe and non-invasive, but it can have some consequences. These include the possibility of discomfort or skin irritation from the application of electrodes, allergic reactions to the materials used, and annoyance during the operation. False positives and negatives in EEG recordings are possible, and there is a small danger of inducing seizures, especially during some stimulating procedures. Invasive EEG monitoring, which involves placing direct electrodes on or within the brain, poses significant hazards.

Nursing Role

Nurses play an important role in facilitating EEG procedures, assuring patient comfort, safety, and reliable data gathering. For nursing staff, understanding key aspects of EEG is crucial to providing optimal patient care during and after the procedure[17]. Here's a quick rundown of the nurse function in EEG:

1. Education of Patients:

Patients are given education by nurses regarding the EEG technique, including its goal, duration, and anticipated outcomes. This covers details regarding the use of electrodes as well as any possible discomfort or feelings.

2. Preparing the Patient:

Nurses help the patient get ready for the EEG by making sure their scalp is clean and clear of any products that could prevent the electrodes from sticking to it.

3. Electrode Positioning:

Nurses collaborate with EEG technologists to put electrodes on the patient's scalp in accordance with the International 10-20 system. They guarantee secure attachment in order to obtain high-quality signals while minimising artefacts.

4. Comfort and monitoring:

Nurses monitor the patient for any signs of discomfort or anxiety during the EEG process. They reassure the patient and cater to their requirements in order to maintain a peaceful and pleasant environment, which helps to reliable test findings.

5. Patient Safety:

Nurses safeguard patient safety during EEG, especially if provocative methods are utilised. They are taught to recognise and respond to any adverse events, such as seizures, and to adopt necessary measures to keep patients safe.

6. Documentation:

Nurses record pertinent information prior to, during, and after the EEG procedure. This covers any patient complaints, adverse occurrences, or observations that the healthcare staff may find useful.

7. After-Procedure Care:

After the EEG, nurses assist patients in removing the electrode gel from their scalp and provide any post-procedure care instructions that may be required. They make patients feel at ease and address any worries they may have.

CONCLUSION

In conclusion, the paper reinforces that an informed nursing team significantly contributes to the quality of EEG procedures. The comprehensive understanding of EEG techniques, applications, and potential challenges ensures optimal patient care, positive experiences, and effective collaboration within the healthcare team.

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