



Article

Detection of Brain Injuries Through Eeg and the Working Principle of Eeg

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Abstract: In progress electroencephalography The fundamental working of the method principles and his/her different level brain injuries in diagnosis place analysis The neurons bioelectric activity record to grow through brain injuries , post-traumatic epilepsy and cognitive of functions violation early determination opportunities seeing Also , modern in neurology electroencephalography - EEG diagnostic importance and his/her visualization with methods (MRI, CT) integration issues is illuminated.

Keywords: Electroencephalography, Brain Injury, Brain Damage, Bioelectric Activity, Neurons, Alpha Rhythm, Beta Rhythm, Delta Waves, Theta Waves, Post-Traumatic Epilepsy, Neurology, Diagnosis, MRI, CT, Brain Activity, Hypoxia, Postsynaptic Potential, Young Factor, Epidemiology

1. Introduction

Human central nerve system complicated bioelectric signals chain based on Brain injuries not only his/her anatomical to the whole, perhaps functional serious about their activity damage [1,2,3]. Traumatic brain injury (TBI) or pathological) external mechanic forces , various diseases and life style factors impact shows . They two to the group divided into: *external injuries* and *internal (organic)* causes. Main reasons and impact provider factors:

External mechanic Effects : Fall , head injury hard to something collision , car accidents and sports injuries .

Strong violence and unhappy Events: Unfortunate events, power use cases and electricity till beat.

2. Materials and Methods

This study was conducted using a theoretical-analytical approach to investigate the role of electroencephalography (EEG) in the detection and evaluation of brain injuries and to explain the fundamental working principles of EEG. The research methodology included literature review, comparative analysis, and interpretation of neurophysiological data obtained from previously published scientific sources. Scientific articles, monographs, and clinical guidelines related to EEG, traumatic brain injury (TBI), neurology, and neurophysiology were systematically analyzed.

The study focused on EEG signal generation mechanisms, electrode placement according to the international 10–20 system, and the diagnostic significance of alpha, beta, theta, and delta rhythms in different pathological conditions. Particular attention was given to EEG changes associated with traumatic brain injuries, post-traumatic epilepsy, hypoxia, and diffuse cerebral dysfunction.

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Comparative analysis between EEG and structural imaging methods such as MRI and CT was also performed to determine their complementary diagnostic value in clinical neurology and neurotraumatology. The obtained information was synthesized to evaluate EEG effectiveness in early diagnosis and functional assessment of brain injuries.

3. Results and Discussion

Blood of the cycle Disorder: In the brain blood stroke, blood of the veins rupture or stuck to remain and arterial hypertension (high blood pressure sharp rise) [4,5,6].

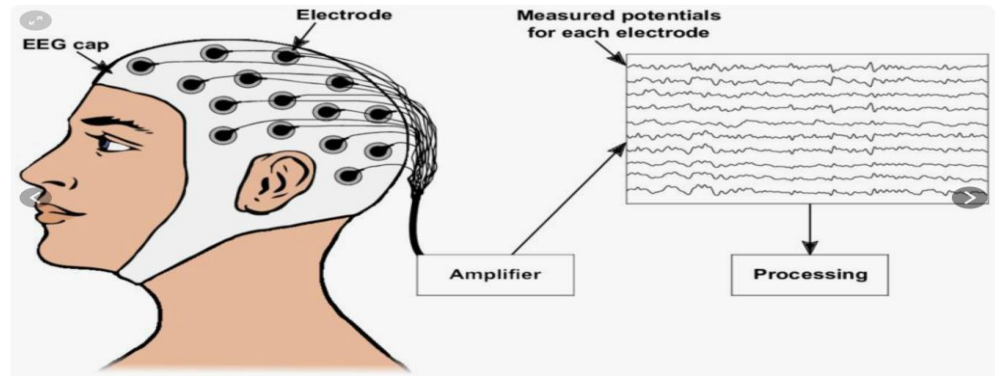


Figure 1. Working Principle of the Electroencephalography (EEG) System

Infections and Inflammations : Meningitis, encephalitis or other viral and bacterial infections.

Hypoxia (oxygen deficiency): Heart when stopped, choking or carbon with carbon monoxide (carbon dioxide) when poisoned brain of cells perish to be

Tumors (tumors): In the brain dangerous and safe tumors to the tissues pressure passed, there to work impact does.

Poisoning and substances exchange Disorder: Alcoholic drinks, drugs substances or heavy metals with far time poisoning.

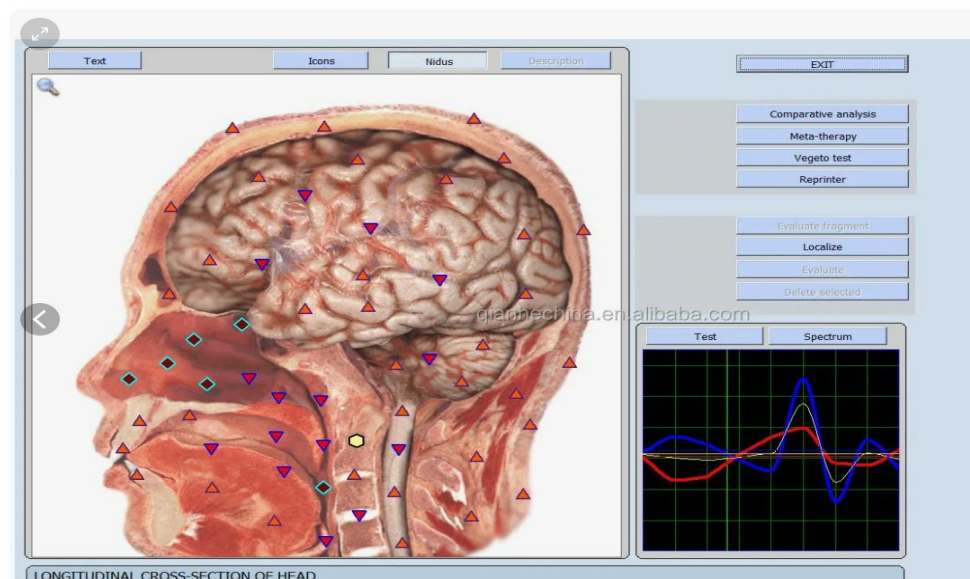


Figure 2. Brain Visualization and EEG Signal Analysis Interface

Traumatic brain injury (TMSH) every how at the age of meeting possible, but statistically to the information according to, injury danger the highest was young groups and their features available [7,8,9]:

1. 0-4 years old (Infants) and preschool aged children). Reason: Often falls, carelessness and unhappy events as a result to the surface comes. All brain injuries approximately (15%) organization does. Children death and disability main from the reasons one.

2. 15-24 years old (Teenagers) and youth) Cause: Car accidents, sports injuries, falls and physical violence. This group of injury the highest percent has. World on a scale all brain of injuries about (35%) nearby exactly this young between right comes. Men this at the age of women 1.5-3 times more than more injured [10,11].

3. 25-64 years old (Adults) Reason: Work in place unhappy accidents, road traffic accidents. This age in the group injury danger relatively stable will be (all) (25-30%) of cases).

4. 65 years old and from it big (Elderly) Reason: Mainly at home falls, loss of balance loss and unhappy events. Elderly people with TMSH to the hospital (32%) of the beds and death of the circumstances almost (28%) organization does .

Brain injury mainly using EEG Electroencephalography (EEG) – brain half balloons of the bark general electricity activity head bone on the surface electrodes using record to grow method is , it is neurophysiological real -time status in mode observation opportunity gives [12,13,14]. Today EEG brain per day injuries weight level determination and in forecasting the most safe and effective from methods one is considered .

EEG work Principle: Bioelectric signals nature

EEG machine neurons between synaptic transfers as a result harvest to be postsynaptic potentials measures [15,16].

- ✓ Signal generation to be: Separate neuron electricity signal very weak However, thousands of parallel pyramidal cells one When they move in time (synchronously), their gathered signal head bone to the surface arrived is coming.
- ✓ Electrodes System: Usually according to the "10-20 system " placed electrodes in microvolts measurable voltages the difference record will reach.
- ✓ Waves Types: Healthy brain activity known rhythms with is described [17]:
- ✓ Alpha (alpha): Peaceful in the case, eyes closed (8-13 Gs).
- ✓ Beta (beta): Active thinking and attention in the center (14-30 Gs).
- ✓ Theta (θ) and Delta (δ): Sleep during or pathological in cases observable slowly waves.



Figure 3. EEG Examination Procedure with Electrode Placement

Brain injuries through EEG determination

the brain is damaged (lat. to eat, to splash or hematoma), neurons between connection is interrupted and normal electricity rhythm changes. Brain of injury initial in stages In EEG general braking or diffuse slowdown Alpha rhythm is observed . disappearance and his/her instead high amplitude delta waves possession brain of the bark heavy at the level from being injured evidence If the brain known one in part hematoma or with a stove Latin to eat if so, exactly that's it industry on top on the electrodes theta and delta activity sharp increases. This is what neurologist's injury put it in the MRI machine appeal guess without doing to do opportunity gives. From injury then harvest was scar "pathological" tissues agitation to the hearth rotation possible. EEG method this from the hearths spreading paroxysmal discharges (sharp peaked waves) detection through in the patient from trauma next seizure the risk evaluates [18,19,20].

Diagnostic importance and advantages

EEG other diagnostics methods (MRI, CT) are the main difference is that it is functional the situation shows.

* Speaker Observation: Patient coma in the case of if yes, through EEG brain of activity recovery dynamics every day observation possible [21].

* High time Temporal resolution: The brain out of a thousand one in the share happened happening to changes how answer giving shows [22,23].

*Non-invasiveness: Inspection absolutely painless and radiation-free This will pass. and children and heavy current situation patients for very important .

4. Conclusion

Electroencephalography modern neurotraumatology and clinical neurology inseparable , high informative is part of the Structural changes CT and MRI imaging methods different EEG brain of activity functional and dynamic status microseconds at the level reflection bring This is him/her different aged in patients , especially resuscitation and coma in cases brain of activity recovery potential in evaluation unequaled to the method Brain injuries to age circle to oneself characteristics , for example , children of the brain high plasticity or in the elderly chronic degenerative processes into account received without EEG monitor pathological the hearths and post-traumatic epilepsy the risk early determination opportunity In the future this of the method opportunities further expansion is expected . In particular, artificial intelligence (AI) and deep Learning

algorithms for EEG signals analysis to do integration to do through, human eye advanced unobtainable the smallest functional and paroxysmal automated breakdowns in a way determination system is created.

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