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Prediction of Epileptic Seizure: A Review

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Abstract: *Epilepsy is a neurological disorder affecting about 50 million people worldwide. Many techniques have been developed for predicting the basic features of epileptic seizures. Techniques used to forecast seizures include frequency-based methods, statistical analysis of EEG signals, devices to warn seizures etc.. Effective treatments require reliable prediction of seizures to increase their effectiveness and quality-of-life. One of the most dangerous aspects of seizures is its unpredictability. Seizure prediction is an important aim of clinical management and treatment in completely controlling a patient's epilepsy. This paper reviews the prediction of epileptic seizure used during last decade.*

Keywords : *Epilepsy, Partial Seizure, Generalized seizure, Seizure Prediction*

I. Introduction

Seizure prediction has a long history, starting in the 1970s [1] with very small data sets looking only at preseizure (preictal) events minutes to seconds before seizures. It has progressed over the past almost 40 years up to current methods, which use mathematical to analyze continuous days of multiscale intracranial electroencephalogram (IEEG) recordings. [2]

Seizure prediction research, most important, has given hope for new warning and therapeutic devices to the 25% of epilepsy patients who cannot be successfully treated with drugs or surgery. One of the most insidious aspects of seizures is their unpredictability. In this light, in the absence of completely controlling a patient's epilepsy, seizure prediction is an important aim of clinical management and treatment.

1.1 Epilepsy

Epilepsy is a chronic neurological disorder of the brain that affects around 50 million people of all ages in every country in the world. According to the World Health Organization (WHO), epilepsy is characterized by recurrent seizures, which are physical reactions to sudden, usually brief, excessive electrical discharges in a group of brain cells [3]

People are considered to have epilepsy when they suffer from more than one seizure which is not related to a clear cause such as fever, a head injury or drug use. A seizure is caused by a sudden brief excess surge of electrical activity in the brain. Epilepsy is one of the most common neurological disorders which affect almost 1% of the world's population. 25% to 30% of epileptic patients cannot be treated by medication or surgery, they suffer from so-called refractory epilepsy [4]

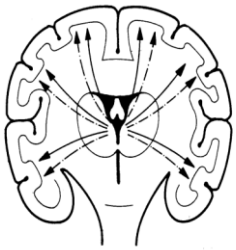
Epileptic seizures mainly occur at a sudden, unexpected timing. The frequency of the seizures varies from patient to patient. Some patients suffer from multiple seizures during the day and/or night, while others only have one a month or less.

1.2 Classification of Seizures

An epileptic seizure is defined as "a transient occurrence of signs and/or symptoms due to abnormal excessive or synchronous neuronal activity in the brain" [5] The diagnosis of epilepsy requires only one epileptic seizure along with an enduring alteration in the brain capable of giving rise to other seizures. Many types of seizures exist and accurate classification is important for prescribing the appropriate therapy.

In 1981, the International League Against Epilepsy (ILAE) formulated an international classification of epileptic seizures that divided seizures into two major classes: Partial seizures and generalized seizures [6]

This classification is based on clinical and electroencephalographic (EEG) observations of the extent to which the brain is affected by the ictal discharges. Recently, the ILAE revised the terminology and concepts for organization of seizures [7], but no major changes were introduced.

Partial Seizure: Epileptic discharge remains localized	**Generalized Seizure:** Epileptic discharge affects both hemispheres
	

According to this latest proposal, focal seizures are perceived as originating within neural networks from only one side of the brain. They may affect a distinct region or be widely distributed. Moreover, focal seizures may originate in cortical or subcortical structures.

On the other hand, generalized seizures are thought to originate within rapidly recruiting bilaterally distributed networks. These networks can include cortical and subcortical structures and do not necessarily involve the entire cortex.

The generalized seizures can be divided into 6 subcategories:

- Absence: impairment of consciousness
- Clonic: repetitive jerks, rhythmic muscle contractions
- Tonic: sudden stretching of muscles
- Tonic-Clonic: the seizure starts with a tonic phase that evolves in a clonic phase
- Atonic: brief loss of muscle tension
- Myoclonic: single jerk or twitch

1.3 Seizure Prediction and Detection

Patients with epilepsy often describe seizures as occurring "like a bolt from the blue" which accentuates the apparent sudden, unforeseen way in which seizures tend to strike [8]. This represents one of the most disabling aspects of the disease, especially for those unable to achieve complete seizure control. It can lead to an intense feeling of helplessness that has a strong impact on the everyday life of a patient. In addition, abrupt episodes of staring, loss of muscle control or loss of consciousness can pose a serious injury risk and can even be life-threatening if they occur while the patient is driving, crossing a busy street, bathing, swimming or climbing stairs. Therefore, a method capable of forecasting the occurrence of seizures could significantly improve the quality of life for epilepsy patients.

Irrespective of whether seizures can be robustly predicted, a device that can detect seizures and trigger an alarm has important utility. Since seizures often cause loss of consciousness, most patients have trouble accurately reporting the occurrence of seizures.

Treatment decisions are primarily based on seizure frequency, thus inaccurate self reports can lead to ineffective therapy. A seizure detection device would provide objective measurements for quantification of seizure frequency.

II. Literature Review

Seizure detection and prediction provide new and individually targeted opportunities for the diagnosis and intervention in the management of epilepsy. These systems may allow for the detection of seizures prior to their clinical onset. Furthermore, these systems might be used in accident prevention and seizure tracking and could further be useful to facilitate seizure abortion. There by permitting improved seizure prediction and risk factor assessment. [9]

Stereotypic movements may vary from individual to individual but are consistent from seizure to seizure within any individual patient with epilepsy. Quantitative video analysis of movement patterns of adult patients with epilepsy during seizures has previously been undertaken using image processing techniques [10]

More recently, the suitability of wearable sensors (accelerometers), positioned on the trunk and the four limbs, to detect seizure events in patients exhibiting different types of seizures (myoclonic, clonic, and tonic seizures) has been evaluated by Nijsen et al [11] There is an obvious need for a seizure-detection system that can be used for long periods and in the home situation in order to facilitate early intervention for and prevention of seizure-related side effects. [12]

III. Importance Of Prediction

Patients with epilepsy never know when the next seizure will strike. Patient could lose consciousness while swimming, or driving a car. The fear of these typically unpredictable episodes can shadow every part of patient's life – from work to social activities

The sudden and seemingly unpredictable nature of seizures is one of the most compromising aspects of the disease epilepsy. Most epilepsy patients only spend a marginal part of their time actually having a seizure and show no clinical signs of their disease during the time between seizures, the so-called inter-ictal interval. But the constant fear of the next seizure and the feeling of helplessness associated with it often have a strong impact on the everyday life of a patient (Fisher et al. 2000). So seizure should be predicted to prevent its complications.

To avoid abrupt episodes of staring, loss of muscle control or loss of consciousness, by forecasting the occurrence of seizures could significantly improve the quality of life for epilepsy patients Because of the accidents occurring during epileptic attacks the person's morbidity increases which may lead to patient's functional impairments for ex.: Fractures or head injuries

Another importance of early predictability may help relatives and friends feel relax regarding monitoring of patients signs and symptoms to avoid any unwanted consequences of the epileptic attacks. Early prediction will make the patient feel secure and psychologically stable to fulfill social and family responsibilities

Early predictability leads to good quality of life with productive work

If a parent or caregiver is alerted when a seizure will occur, especially during work or sleep, the patient can receive timely treatment if injured, be placed in the recovery position and avoid airway obstruction that could be fatal.

IV. Conclusion

Any seizure is a frightening experience, especially for the parents and for the close relatives of anyone with epilepsy. The impact of epilepsy logically is a source of stress. Throughout the world and through the ages epilepsy has been regarded as a supernatural happening as it is inexplicable and unpredictable. Prediction of seizures will increase patient's effectiveness and quality-of-life

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References

[1]. Viglione S, Ordon V, Martin W, Kesler C, inventors; US government, assignee. Epileptic seizure warning system. US patent 3 863 625. November 2, 1973.
[2]. Lehnertz K, Litt B. The First International Collaborative Workshop on Seizure Prediction: summary and data description. 2005;116(3):493-505.
[3]. World Health Organization, 2011.Available: http://www.who.int/mediacentre/factsheets/fs999/en/
[4]. A. Dalton, S. Patel, A.R. Chowdhury, M. Welsh, T. Pang, S. Schachter, G. ´ Olaighin, P. Bonato, "Detecting epileptic seizures using wearable sensor technologies," In Proc. of the First AMA-IEEE Medical Technology Conference on Individualized Healtcare, 2010.
[5]. Fisher, R., Boas, W., Blume, W., Elger, C., Genton, P., Lee, P., and Engel, J. Epileptic seizures and epilepsy: Definitions proposed by the International League Against Epilepsy (ILAE) and the International Bureau for Epilepsy (IBE). Epilepsia 46, 4 (2005), 470-472.
[6]. ILAE. Proposal for revised clinical and Electroencephalographic classification of epileptic seizures. Epilepsia 22, 4 (Aug 1981), 489-501.
[7]. A.T. Berg, S.F. Berkovic, M.J. Brodie, J. Buchhalter, J.H. Cross, W. van Emde Boas, J. Engel, J. French, T.A. Glauser, G.W. Mathern, S.L. Mosh´e, D. Nordli, P. Plouin, I.E. Scheffer, Revised terminology and concepts for organization of seizures and epilepsies: report of the ILAE Commission on Classification and Terminology, 2005-2009, Epilepsia, Vol. 51(4), pp. 676-85, 2006.
[8]. Mormann, F., Andrzejak, R., Elger, C., and Lehnertz, K. Seizure prediction: the long and winding road. Brain 130, 2 (2007), 314.
[9]. Sriram Ramgopal, Sigride Thome-Souza, Michele Jackson, "Seizure detection, seizure prediction, and closed-loop warning systems in epilepsy" Epilepsy & Behavior 37 (2014) 291–307
[10]. Li, Z, da Silva, AM, Cunha, JPS. (2002) Movement quantification in epileptic seizures: a new approach to video-EEG analysis. IEEE Trans BiomedEng. 49(6):565 – 573.
[11]. Nijsen TM, Arends JB, Griep PA, Cluitmans PJ. (2005) "The potential value of three-dimensional accelerometry for detection of motor seizures in severe epilepsy". Epilepsy Behav. 7(1):74-84.
[12]. Anouk Van de Vel Kris Cuppens, Bert Bonroy "ReviewNon-EEG seizure-detection systems and potential SUDEP prevention: State of the art" Seizure 22 (2013) 345–355