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Retrospective Analysis of Continuous EEG Monitoring in Spontaneous Intracerebral Hemorrhage

Dr. I.D. Chaurasia[1] (Asst. Prof.), Dr. Vijay Nandmer[2*] (Assoc. Prof.), Dr. Arvind Rai[3] (Prof.) & Dr. M C Songara[4] (Prof & Head)

[1, 3 & 4]Department of Surgery (Neurosurgery), Gandhi Medical College & Associated Hamidia Hospital, Bhopal, India
[2]Dept. of Medicine, Gandhi Medical College & Associated Hamidia, Hospital, Bhopal, India

***Corresponding author**
Dr. Vijay Nandmer

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Abstract: The goal of our retrospective observational study is to look for the EEG changes in different location of ICH and to identify electrographic seizures. The current study brings into attention that seizures are frequent complication of intracerebral hemorrhage and may be a target for improving ultimate outcome. They occur in both lobar and deep hemorrhage and with or without associated intra ventricular extension. The study calls for need of prospective study to correlate the electrographic abnormalities with location of bleed and also the usage of prophylactic antiepileptic drugs in patients

Keywords: EEG, Intracerebral & Hemorrhage.

INTRODUCTION

The spontaneous intracerebral hemorrhage (ICH) is often a life threatening lesion and is associated with poor outcomes in presence of progressive mass effect and neuronal damage [1] Seizures are well known to occur at the onset of ICH and it can be focal or generalized, or usually brief, and are associated with loss of consciousness. In a prior study done by Vespa *et al.*, [1] reported electrographic seizures in 28% of 63 patients with ICH and found seizures to be associated with increased midline shift on 48- to 72-hour follow-up head CT scans, with a trend toward worse outcome.

EEG provides insight into the thalamocortical functions in patients with impaired consciousness. Continuous EEG monitoring will help to detect the subclinical seizures before clinical manifestation and at the time of reversible stage [2].

MATERIALS & METHODS

This study was conducted in rural based neurology intensive care unit of Gandhi Medical College & Associated Hamidia Hospital, Bhopal located in central India. We retrospectively studied all patients with spontaneous ICH who underwent continuous EEG monitoring at the time of admission from January 2012-March 2017. All the included patients were managed on the basis of published guidelines for treatment of ICH [3, 4]. Prophylactic antiepileptic medications were not given routinely; only those who developed clinical seizures were treated.

Continuous EEG recording was done on RMS (21 channel Maximus version 4.2.54) with electrodes placed according to international 10-20 placement system by trained EEG technician and reported by experienced faculty of Department of Neurology. The continuous EEG monitoring was started on the day of admission and was continued for duration upto 48 hours.

All acute intracerebral hemorrhage patients presenting with baseline metabolic profile, Brain imaging and continuous EEG record were included.

Those with traumatic ICH or subarachnoid hemorrhage and incomplete data were excluded.

After the evaluation of EEG record the predesigned proforma consisting of demographic details (including name, age, gender, residential address, contact details, date of admission, length of hospital stay) was filled and clinical, radiological diagnosis was noted from clinical records.

Outcome of patient were subdivided into expired, left against medical advice, discharge after physician advice (from ICU/Ward) and entered in to proforma.

Metabolic parameters were also entered in this proforma which consisted of random blood sugar

(mg/dl), serum sodium, potassium, blood urea (mg/dl), serum creatinine (mg/dl).

Electrographic seizures was defined as rhythmic discharges or a spike-and-wave pattern with definite evolution in frequency, location, or morphologic features lasting at least 10 seconds; evolution in amplitude alone did not qualify [5].

Stages of ICH [9] were divided intohyperacute with less than 24 hours duration, acute with 1-3 days duration, early subacute withmore than 3 days duration and late subacute of more than 7 days duration.

Definition

1. Intracerebral Hemorrhage (ICH): Bleeding within the brain parenchyma confirmed with the help of Brain imaging (CT/MRI).
2. ICH Location: Classified as 'Deep' if located within the basal ganglia, thalamus, posterior fossa and into 'lobar' if hemorrhage extending into cortex [6].

EEG Terminologies:

a) Amplitude: Voltage of EEG waves expressed in Microvolts (mV), measured peak-to-peak [7].

b) Frequency: Number of complete cycles of repetitive waves or complexes in 1 s. Measured in cycles per second (c/s) or Hertz (Hz) [7].

- Beta rhythm: In general: any EEG rhythm between 14 and 40 Hz.
- Alpha band: Frequency band of 8±13 Hz.
- Theta band: Frequency band from 4 to under8Hz.
- Delta band: Frequency band under 4 Hz.

c) Sharp wave: A transient clearly distinguished from background activity, with pointed peak at a conventional paper speed or time scale and duration of 70±200 ms [7].

d) Slow wave: Wave with duration longer than 200 milliseconds [7].

e) Spike: A transient clearly distinguished from background activity, with pointed peak at a conventional paper speed or time scale and a duration from20 to under 70 ms [7].

f) Triphasic wave: High-amplitude (over 70 mV) positive sharp transients, which are preceded and followed by relatively low-amplitude negative waves [7].

h) Periodic lateralized epileptiform discharges (PLEDs): PLEDs are sharp transients such assharp waves or spikes, which repeat in a periodical orsemi periodical fashion [7].

i) Bilateral PLED: PLED occurring bilaterally, but independent and (BIPLED) asynchronously [9].

j) Generalized PED (GPED): bilateral and synchronous PED with no consistent lateralization [7].

k) Distribution

- Generalized-refers to any bilateral, bisynchronous and symmetric pattern.
- Lateralized - includes unilateral and bilateral synchronous but asymmetric; includes focal, regional and hemispheric patterns
- Frontally predominant -(defined as having an amplitude in anterior derivations that is at least 50% greater than that in posterior derivations on an ipsilateral ear, average, or non-cephalic referential recording)
- Occipitally predominant -(defined as having an amplitude in posterior derivations that is at least 50% greater than that in anterior derivations on an ipsilateral ear, average, or non-cephalic referential recording)

Midline predominant- (defined as having an amplitude in midline derivations that is at least 50% greater than in parasagittal derivations on an average or non-cephalic referential recording) [8].

m) Epoch: A period of time in an EEG record [8].

n) Quantity/Prevalence [8]: Specify percent of record or epoch that includes the pattern

a. >90% of record/epoch ("Continuous")
b. 50-89% of record/epoch ("Abundant")
c.10-49% of record/epoch ("Frequent")
d.1-9% of record/epoch ("Occasional")
e. <1% of record/epoch ("Rare")

4.Coma: state of unconsciousness in which person fails to respond to painful stimuli, light, sound, lacks a normal sleep wake cycle and does not initiate voluntary action.

OBSERVATIONS & RESUTLS

Table-1: Demographic table

Variables	Number of patients	Percentage (%)
a)**Gender**		
Male	29	63
Female	17	37
b)**Age**		
≥50 years	29	63
<50years	17	37
c)**Stage of presentation**		
Hyperacute	26	56.5
Acute	11	24
Early subacute	6	13
Late subacute	3	6.5
d)**Clinical seizures**		
GTCS	9	19.6
Focal	3	6.5
No	34	73.9

Table-2: Site of bleed and associated electrographic abnormalities

Site of bleed	EEG abnormalities	Number of patients	Percentage (%)
1. Brainstem (Pons) without intraventricular extension	Low amplitude beta activity	2	4.4
	Normal	1	2.2
2. Cerebellum without intraventricular extension	Normal	1	2.2
3. Cerebellum with intraventricular extension	Normal	1	2.2

DISCUSSION

This study reports the profile of ICH patients and EEG findings with its role in identification of subclinical seizure done at a rural based single tertiary care hospital in Central India. Deeply located bleeds in cerebral hemisphere was the commonest of all sites whereas intraventricular was rarest one. Hypertension was the commonest cause of intracerebral hemorrhage.

CONLCUSION

The current study brings into attention that seizures are frequent complication of intracerebral hemorrhage and may be a target for improving ultimate outcome. They occur in both lobar and deep hemorrhage and with or without associated intra ventricular extension. The study calls for need of prospective study to correlate the electrographic abnormalities with location of bleed and also the usage of prophylactic antiepileptic drugs in patients of ICH**.**

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