



## SSEP CHANGES IN STROKE AND PROGNOSTIC VALUE IN RELATION WITH ACTIVITY OF DAILY LIVING (ADL) AND RECOVERY

### Neurology

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### ABSTRACT

**Background:** Stroke is the most prevalent cause of disability that impairs ambulation and the ability to perform the activities of daily living. The common deficits following stroke are limb paresis and postural imbalance and these can significantly impact physical ability and health. The ability to evaluate degree of weakness after a stroke may help in planning rehabilitation. Although several factors like severity of neurological deficit, lesion size, location, age have been suggested as predictors of recovery after stroke, evoked potentials provide an objective and direct method to assess the integrity of sensory and motor pathways of the central nervous system. Somatosensory evoked potentials (SSEP) can predict recovery after stroke. **Aim:** To assess the predictive value of median SSEP in acute stroke patients and in long term recovery. **Methodology:** Prospective study of 1 year. 25 patients who fulfilled inclusion and exclusion criteria were taken and subjected to history, clinical examination, imaging and SSEP studies and compared the results with controls. **Results:** Out of 25 patients, 20 men and 5 women. 24 patients had an ischaemic stroke and 1 had a hemorrhagic stroke. 15 patients had left hemiparesis and 10 had right hemiparesis. Most of the patients with stroke had prolonged N20 latency when compared with those of the control group. The medium value of latency of N20 was increased at the level of the “injured” hemisphere (21.18) when compared with “uninjured” hemisphere (19.3) which was statistically significant ( $p < 0.05$ ). It was observed that those patients with minimal alterations or close to normal value of N20 latency (18.73) had the best rates of recovery and those with significantly increased N20 latency ( $> 22$ ) had delayed and little recovery. **Conclusion:** The study of SSEP can be useful in complement with imaging in stroke and can be an indicator of the recovery potential in stroke.

### KEYWORDS

Stroke, SSEP

### INTRODUCTION

Stroke is the most prevalent cause of disability that impairs ambulation and the ability to perform the activities of daily living (ADL). The common deficits following stroke are limb paresis and postural imbalance and these can significantly impact physical ability and health.

The ability to evaluate degree of weakness after a stroke may help in planning rehabilitation. Several clinical and demographic factors, including the severity of initial neurological deficit, lesion size, lesion location and age, have been suggested as predictors of recovery after stroke.<sup>(1,2)</sup>

Somatosensory evoked potentials (SSEPs) evaluate the proprioceptive pathways. The major advantage lies in evaluating the relatively long sensory pathway from the peripheral nerve to the spinal cord and the cerebral cortex and are vulnerable to number of pathologies because of their length.<sup>(3,4)</sup> SSEP values are reliable indicators of post-stroke prognosis.<sup>(5,6)</sup>

### METHODOLOGY

**Study design:** Prospective study from Dec 2021 to Nov 2022

**Inclusion criteria:** All the patients with Computed tomography (CT) confirmed stroke.

**Exclusion criteria:** Traumatic /surgical patients and age less than 13yrs of age

### Data source:

After getting approval from the Institutional ethical committee, patients who are admitted in Government Mohan Kumaramangalam Medical College, Salem and who satisfied the inclusion criteria were included in the study. Informed consent was obtained from each patient.

25 patients who fulfilled inclusion and exclusion criteria were taken and subjected to history, clinical examination and imaging.

Median SSEP was done in all patients and compared the results with controls of similar age.

The patient's power was assessed with medical research council (MRC) scale and improvement/ disability using modified Rankin scale at 1 month and at 3 months.

The median nerves were stimulated by surface electrodes at both wrists with the stimulus intensity necessary to evoke a clearly visible muscle twitch causing abduction of the thumb. The stimulus pulse duration was 0.2 ms, and the stimulus rate was 3.1 Hz. SSEP recordings were obtained from surface electrodes placed at Erb's point, C5 spinous process, and 2cm posterior to C3' or C4' in accordance with the 10–20 international system, and the impedance was kept below 5 kΩ. The reference electrode was placed on the midfrontal area (Fz). We defined N9 from distal brachial plexus at Erb's point, N11 from cervical cord at C5 spinal level. N20 latency was measured to the point of maximum negativity just preceding the steep drop of P25 trough. The N20 wave signified the activation of primary somatosensory cortex. The prolonged N20 wave latency, low peak amplitude and a low amplitude generally was found in patients with stroke when compared to the control group. The absence of SSEP implied no recovery after stroke and the near normal SSEP values indicated a successful recovery. The follow-up SSEP were recorded after 1 month and 3 month.

Statistical analysis of data was performed with software SPSS Version 29.0. Categorical variables were expressed as frequencies with percentages. Continuous variables were presented as mean and standard deviation (SD). P value of less than 0.05 was considered as statistically significant.

### RESULTS

Out of 25 patients studied, 20 were men and 5 were women. Among them, 24 patients had an ischaemic stroke and 1 had a hemorrhagic stroke. 15 patients had left hemiparesis and 10 had right hemiparesis.

The values of the latency of N20 waves were measured and statistically analysed because N20 translates the activation of primary

somatosensory cortex in relation with evolution of level of motor injury post-stroke. The medium value of latency of N20 was increased at the level of the “injured” hemisphere (21.18) when compared with “uninjured” hemisphere (19.3) which was statistically significant ( $p < 0.05$ ) as shown in table 1.

**Table 1** showed mean values of N20 latency of SSEP from patients with motor impairment post-stroke and healthy subjects.

| SSEP                          | Normal | Injured hemisphere after stroke | Uninjured hemisphere after stroke |
|-------------------------------|--------|---------------------------------|-----------------------------------|
| Mean value of N20 latency(ms) | 18.73  | 21.18                           | 19.3                              |
| Std deviation                 | 0.3    | 1.5                             | 0.68                              |

In our study, 24% patients were found to have normal N20 latencies even though they have lesion in the brain and corresponding weakness clinically as shown in table 2.

**Table 2** showed the values of the N20 wave latency of the SSEP recordings from patients with motor impairment post-stroke.

| N20 Latency (ms) | Number of patients |
|------------------|--------------------|
| 18-19            | 6                  |
| 19-20            | 5                  |
| 20-22            | 12                 |
| >22              | 2                  |

The patients with N20 latencies (19-20) - recovered fully (100%) and patients with N20 latencies (20-22) – 50% recovered at 1 month, 25% recovered at 3 months. The patients with N20 latencies (>22) – did not recover even in 3 months. So, our study showed SSEP values were a good predictive value in prognostic value of stroke management as shown in table 3.

**Table 3** showed acute stroke patients with N20 latencies and their recovery at 1 month and 3 months

| N20 latency(ms) | Number of patients | Number of patients recovered at 1 month | Number of patients recovered at 3 months |
|-----------------|--------------------|-----------------------------------------|------------------------------------------|
| 19-20           | 5                  | 5                                       | -                                        |
| 20-22           | 12                 | 6                                       | 3                                        |
| >22             | 2                  | 0                                       | 0                                        |

## DISCUSSION

Out of 25 patients, 20 were men and 5 were women. 24 patients had an ischaemic stroke and 1 had a hemorrhagic stroke. 15 patients had left hemiparesis and 10 had right hemiparesis. Most of the patients with acute stroke had prolonged N20 latency (21.18) when compared with those of the control group. The latency of the N20 wave in SSEP was increased at the level of the affected hemisphere with a mean value of 21.18ms.

The mean value of latency of N20 was increased at the level of the “injured” hemisphere (21.18) when compared with “uninjured” hemisphere (19.3) which was statistically significant ( $p < 0.05$ ). Similar results were observed by Zeman et.<sup>(6)</sup>

The increased values of the latency are consistent with the values calculated in the test group and with those calculated at the level of the uninjured hemisphere

It was observed that those patients with minimal alterations or close to normal value of N20 latency (18.73) had the best rates of recovery and those with significantly increased N20 latency (>22) had delayed and little recovery and these were consistent with the previous studies.<sup>(5,7-10)</sup>

## CONCLUSION

Severe motor deficit and associated sensory pathway involvement led to prolonged N20 latency and poor recovery. N20 latency may be evaluated for prognostication of severity and recovery of stroke. The study of SSEP can be useful in complement with imaging in stroke and can be an indicator of the recovery potential in stroke.

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