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Original Article

# Study on Prognostic Value of Electrophysiological Tests in Bell's Palsy

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## Abstract

**Introduction:** Bell's palsy is an idiopathic peripheral disease of the seventh cranial nerve. More than 70% of patients attain complete clinical recovery, with no noticeable residua. Electrophysiological tests may offer valuable information in defining the severity of nerve injury and a possible subsequent dysfunction.

**Aim:** This study aims to assess the prognostic value of electrophysiological tests in the management of Bell's palsy.

**Materials and Methods:** All the patients with Bell's palsy and without clinical evidence of other cranial nerve damage or central nervous system diseases were included in the study. Nerve conduction study was performed on the 14th day or on the first visit of the patient to the hospital.

**Results:** In 101 patients, majority of patients come under Grade IV (43.6%) and next comes Grade V (31.7%). Eighty-two patients (81.2%) had normal latency, among these, 73 cases recovered within 6 months. Of 17 who had prolonged latency, seven patients recovered fully.

**Conclusions:** Electrophysiological studies can predict the duration of the clinical recovery and the outcome of the illness. The amplitude ratio of compound muscle action potential is the most reliable parameter in assessing the prognosis.

**Key words:** Bell's Palsy, Electromyography, Nerve conduction study

## INTRODUCTION

Bell's palsy is an idiopathic peripheral disease of the seventh cranial nerve. This is the most frequent cranial mononeuropathy with an annual incidence of 10–40 cases per 100,000 population with geographical variations.[1,2] It can occur at any age, but mostly in the third and fourth decade of life. The disease was described as a distinct entity by Sir Charles Bell in 1893, and since then, it has commonly been referred to as Bell's palsy. It is seen as often in men as in women. Those at high risk include pregnant women and people with diabetes mellitus. About 10% of those with Bell's palsy have a family history of the condition. More than 70% of patients attain complete clinical recovery, with no noticeable residua.[1] Persistent sequelae are usually noted in cases with profound axonal loss. Electrophysiological tests may offer valuable information in defining the severity of nerve injury and a possible residual dysfunction.[3]

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Electrophysiological tests may offer valuable information in defining the severity of nerve injury and possible subsequent dysfunction. Previous electrophysiological investigations point to a special prognostic value of the amplitude of compound muscle action potential (CMAP) in Bell's palsy since the CMAP amplitude depends on the number of excitable axons. The degree of degeneration of nerve fibers is directly proportional to the decrease in the CMAP amplitude.[4-7]

### Aims

This study aims to assess the prognostic value of electrophysiological tests in Bell's palsy.

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## MATERIALS AND METHODS

This prospective study was done on 101 patients with clinical signs of Bell's palsy, of both sexes, in various age groups who attended the Neurology Outpatient Department, Institute of Neurology, Madras Medical College and Government General Hospital, Chennai. All the patients underwent neurological and ENT evaluation.

### Inclusion Criteria

All the patients with Bell's palsy and without clinical evidence of other cranial nerve damage or central nervous system diseases were included in the study.

### Exclusion Criteria

Patients with middle ear disease or posterior cranial fossa disease and chronic illness such as diabetes mellitus, hypertension, and malignancy were excluded from the study.

Grading was done on the first visit and on the 14$^{th}$ day, 1$^{st}$, 2$^{nd}$, 3$^{rd}$, 6$^{th}$, 9$^{th}$, and 12$^{th}$ months to assess the improvement, response to treatment.

Nerve conduction study was performed on the 14$^{th}$ day or on the first visit of the patient to the hospital.

For the CMAP examination, supramaximal stimulation was applied for 0.2 ms duration over the trunk of the facial nerve, using the bipolar stimulating electrode with the anode between the ramus of the mandible and the mastoid and the cathode in front of the tragus of the ear. The CMAP was recorded with a plate electrode in the target muscles, orbicularis oculi, and orbicularis oris. The amplitude and the latency of the CMAP were analyzed.

The mean amplitudes on the affected side were computed as the percentage ratio of the normal amplitudes on the healthy side (taken as 100%). The patients were grouped according to the ratio into three groups:

1. A (30–100%)
2. B (10–30 %)
3. C (<10% or not stimulatable).

The latency of the CMAP was also recorded in the same muscles on both the healthy and affected side. The corresponding mean value was computed, and the patients were grouped according to the latency recorded into three groups.

1) A (<4 ms)
2) B (More than 4 ms) and
3) C with no CMAP recorded.

To estimate prognostic values, the electrophysiological parameters, of amplitude and latency of the CMAPs, were correlated with the duration of clinical recovery.

## RESULTS

One hundred and one patients with signs of the Bell's palsy were included in this study. Most of the cases belong to the age group of 31–40. Only 2.9% of patients belonged to the age group of 61–70. In the present study, sex ratio was almost even. Forty-seven were female (46.6%) and 54 were male (53.4%). Majority of patients come under Grade IV (43.6%) and next comes Grade V (31.7%), III (19.8%), and the least in Grade VI (4.9%).

Of 26 patients in Group A, 23 patients had complete recovery. Of eight patients in Group B, three patients recovered and the one patient in Group C had recovered within 6 months.

All the patients in Group A had complete recovery. Ten patients showed complete improvement in Group B and of 10 cases in Group C, only one recovered Table 1 and 2.

During the 1$^{st}$ week, the CMAP latency was within normal limits and of the 35 patients, 10 had an incomplete recovery Table 3.

Eighty-two patients (81.2%) had normal latency, among these, 73 cases recovered within 6 months. Of 17 who had prolonged latency, seven patients recovered fully and two patients in Group C did not show any improvement Table 4.

## DISCUSSION

Matthews in his study observed that older age could badly influence the course of the illness.[8] Heath *et al.*[9] presented the results of their research showing that the average age of patients who had a rapid and complete recovery was 35.8 ± 15.9 years, while patients with an incomplete recovery were 55.4 ± 18.8 years old. The results of this study had not shown the existence of a correlation between the age and the duration, degree of clinical recovery. However, it is necessary to point out that older individuals had poor recovery when compared to younger individuals. However, in these individuals, the other factors responsible for poor recovery such as severe degree of weakness and very low CMAP amplitude were present.

Djordjević and Djurić have shown in their clinical research that in a certain number of patients had a changing neurological deficit, during the first 2 weeks of the illness. They were suggesting that the prognosis based on the degree of the motor deficit was significantly limited in the early stage of the illness.[10]

The poor correlation between the degree of the paresis in the early stage of the illness, and duration and degree of recovery was observed in the present series also.

It was noted by May *et al.*[11] and Hauser *et al.*[12] that majority of patients with signs of incomplete facial paralysis of the third and fourth degree, on the 14th day of the illness, had a rapid and complete recovery.

The present study shows that patients with signs of incomplete facial paralysis of the third and fourth degree, on the 14th day of the illness, had a rapid and complete recovery.

These results showed that an incomplete facial paralysis had a complete clinical recovery, while a complete paralysis indicated bad prognosis, which is consistent with literature data.[11,12] An absolute bad prognostic sign was the lack of any movement of the mimic musculature during the first 4 weeks.

### CMAP Amplitude

#### *1st week*

Analyzing the CMAP recorded in the 2nd week of the illness in the above 35 patients, all the patients in Group A had complete recovery. Of 11 patients in Group B, 10 patients showed complete improvement and of 10 cases in Group C, only one recovered. This observation showed that CMAP recorded in the 2nd week was very helpful in assessing the prognosis of the disease.[10] This observation correlates with Esslen's reports[13] who showed that the CMAP amplitude decrease is recorded from the 3rd to the 10th day, while Tojima *et al.*[14] in their results showed that this decrease occurred in the first 7 days and remained stable thereafter.

The results observed on the 14th day of the illness showed a strong positive correlation between the rate of recovery and CMAP amplitude. The more the amplitude is decreased, the slower was the recovery. Most of the patients whose amplitude was more than 30% of the normal side recovered completely during the first 2 months, suggesting mild damage of the nerve (neuropraxia). The patients whose amplitude values were between 10% and 30% recovered within 6 months which corresponded to the second type of nerve damage (axonotmesis). The distinct amplitude decreases to 0–10% pointed to severe nerve damage (neurotmesis) and an incomplete clinical recovery. The above observation correlated well with the observations made by others.[10]

In this study, there was a decrease of CMAP amplitude in seven patients in the clinically normal side which did not show any motor deficit. Among the seven cases, five cases showed this abnormality in the 1st week and the other two cases on the 9th and 11th days, respectively, depicting subclinical involvement on the other side also. Since electrophysiological studies were done only in 35 patients in the 1st week, this may be an underestimation. If electrophysiological studies were done in the 1st week in all cases, the identification of the subclinical cases might be high. A similar observation was made by Natarajan and Dhas[15] who had documented 20% of subclinical cases in their study.

**Table 1: Analysis of compound muscle action potential recorded in the 1st week in 35 patients and recovery**

| Amp ratio | Recovery in months | | | In complete recovery in 12 months | Total |
|---|---|---|---|---|---|
| | <2 | 2–6 | >6 | | |
| A | 15 | 8 | 0 | 3 | 26 |
| B | 0 | 3 | 0 | 5 | 8 |
| C | 0 | 1 | 0 | 0 | 1 |
| Total | 15 | 12 | 0 | 8 | 35 |

**Table 2: Analysis of compound muscle action potential recorded after 2 weeks in same 35 patients and recovery**

| Amp ratio | Recovery in months | | | In complete recovery in 12 months | Total |
|---|---|---|---|---|---|
| | <2 | 2–6 | >6 | | |
| A | 13 | 1 | 0 | 0 | 14 |
| B | 1 | 9 | 0 | 1 | 11 |
| C | 0 | 1 | 0 | 9 | 10 |
| Total | 14 | 11 | 0 | 10 | 35 |

**Table 3: Analysis of compound muscle action potential latency recorded in during 1 week and rate of recovery**

| Latency | Recovery in months | | | In complete recovery in 12 months | Total |
|---|---|---|---|---|---|
| | <2 | 2–6 | >6 | | |
| A | 17 | 8 | 0 | 10 | 35 |
| B | 0 | 0 | 0 | 0 | 0 |
| C | 0 | 0 | 0 | 0 | 0 |
| Total | 0 | 0 | 0 | 0 | 35 |

**Table 4: Analysis of compound muscle action potential latency recorded in after 2 weeks and rate of recovery**

| Latency | Recovery in months | | | In complete recovery in 12 months | Total |
|---|---|---|---|---|---|
| | <2 | 2–6 | >6 | | |
| A | 49 | 24 | 0 | 9 | 82 |
| B | 3 | 2 | 2 | 10 | 17 |
| C | - | - | - | 2 | 2 |
| Total | 52 | 26 | 2 | 21 | 101 |

### CMAP Latency

The role of the CMAP latency in the early diagnosis and prognosis of Bell's palsy is uncertain. Although some researchers showed that abnormal latency could point to a bad prognosis, it is believed that this factor has a limited significance. Since the latency reflects the function of the

fastest fibers, it can stay within normal values for a long time even in cases of a distinct axonal loss. Gilliat and Taylor[16] reported that latency stays within normal values until the M potential is lost. However, some studies have demonstrated that abnormal latency can be suggestive of a bad prognosis. Langworth and Taverner[17] emphasized that the electrical stimulation in facial palsy it is argued that the pathological process is probably ischaemia secondary to compression of the nerve in the facial canal. Danielides *et al.* have provided the results of their study made in 1994 and 1996[18] which showed that the latency extension results in a bad prognosis of the illness. They also claim that the reliability of this feature was less important than CMAP amplitude for the prognosis. This observation showed that even though latency measurement as an independent factor is not much helpful in assessing the prognosis, if combined with the amplitude predicts the prognosis.

## CONCLUSIONS

Electrophysiological studies can predict the duration of the clinical recovery and the outcome of the illness. The amplitude ratio of CMAP is the most reliable parameter in assessing the prognosis. Latency measurement as an independent factor is not much helpful in assessing the prognosis, however, when combined with the amplitude ratio predicts the prognosis. Simultaneous subclinical facial nerve involvement does occur on the contralateral side in 16% of the cases. Bell's palsy patients with incomplete facial paralysis have excellent outcomes.

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