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Prognostic Value of Facial Nerve Antidromic Evoked Potentials versus Blink Reflex in Bell's Palsy

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Abstract: Background: Bell's palsy is acute, unilateral, idiopathic, peripheral facial nerve paralysis, it is one of the most common neurologic disorders affecting the cranial nerves. Patients with facial paralysis can have impaired interpersonal relationships and may experience profound social distress, depression, and social alienation, for this reasons early management is necessary to hasten the recovery process and minimize the risk of complications. **Aim:** This study aimed to compare between value of Facial Nerve Antidromic Evoked Potential and Blink reflex in prognosis of patients with early Bell's palsy. **Patients and Methods:** This study included 30 patients with early diagnosed unilateral Bell's palsy, the patients were divided into three groups (mild, moderate, severe) according to Yanagihara grading system. **Results:** There was statistically significant difference between different grades of facial paralysis as regard the electrophysiological findings (FNAEP, blink reflex) at onset of illness, after 4 and 6 months. There was statistically significant difference between different grades of facial recovery outcome regarding the electrophysiological findings (FNAEP, blink reflex) after 4 and 6 months. There was close relationship between LD and AD and clinical recovery rate (CRR) after 4 and 6 months. There was close relationship between blink reflex and clinical recovery rate (CRR) after 4 and 6 months. Latency difference (LD) and Amplitude difference (AD) are both helpful in detecting prognosis of bell's palsy. Facial Nerve Antidromic Evoked Potential (FNAEP) is more sensitive than blink reflex in detecting the prognosis of bell's palsy. **Conclusions:** Different grades of facial paralysis showed significant improvement in electrophysiological studies (FNAEP and blink refex) at end of study, the severity of clinical grades of paresis was statistically significantly decreased in the three groups at the end of the study but the improvement was more superior in the patients with mild and moderate facial nerve paralysis than severe cases. FNAEP is more accurate than blink reflex in detecting prognosis in patients with early Bell's palsy.
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Keywords: Facial Nerve Antidromic Evoked Potentials, Blink Reflex, Bell's Palsy

1. Introduction:

Facial palsy is a condition of facial nerve paralysis usually resulting from traumatic, compressive, infective, inflammatory, or metabolic abnormalities. However, in many cases no etiology is identified, and the eventual diagnosis is idiopathic (Bell's palsy).[1,2]

Diagnosis of Bell's palsy is typically based on symptoms and by ruling out other disorders, such as central nervous system injury, facial tumors, certain cancers, and autoimmune diseases. [3]

The typical symptoms may include sudden onset, unilateral, weakness of the muscles of facial expression, asymmetric smile, slurring of words, inability to close an eye, post auricular pain, headache and ipsilateral disturbance of taste. Moreover, retroauricular pain may lead to impaired tolerance of noise, that develop over several hours or up to 2–3 days.[3,4]

For many patients, the questions that whether their facial function will return to normal one day and how long this is going to take are mostly concerned about. Evaluation of the prognosis of Bell's palsy is useful for counseling of patients and guiding further management.

The electrophysiologic tests such as electromyography (EMG), electroneurography (ENG), maximal nerve excitability testing, and facial motor nerve conduction (MNC) testing and Blink reflex are facial nerve orthodromic evoked potentials.[5]

These tests detect the degeneration process after extending to the extratemporal segment of the facial nerve with 1 to 2 weeks delay.[6]

Therefore, it is necessary to use a test that can diagnose degeneration within 1 week after the onset of paralysis to detect nerve degeneration and to predict facial function recovery during its early stages.

2. Patients and Methods:

This study was carried out on 30 patients with early diagnosed unilateral bell's palsy attending to the outpatient clinic of Physical Medicine, Rheumatology & Rehabilitation Department, Tanta University Hospitals.

Criteria of diagnosis of Bell's palsy includes:[7]

Acute onset of idiopathic unilateral facial muscle paralysis of lower motor neuron type.

Inclusion criteria:

The duration from onset to treatment is from 1 to 3 days.

All the patients were subjected to the following:

1. Demographic data collection: (name, age, sex and occupation).
2. History taking: (complaint, present history and duration of illness).
3. Examination: local facial nerve assessment (facial muscle function was assessed clinically at onset of illness, after 4 months, after 6 months using the stennert system score)
4. Electrophysiological study in the form of facial nerve antidromic evoked potential and blink reflex, both done at onset of illness, after 4 months and after 6 months.

Ethical consideration

- Approval for the study was taken from the ethical committee of faculty of medicine, Tanta University.
- Informed consent was obtained from all subjects after full explanation of benefits and risk.
- Privacy of all patient's data was granted and there is code number for every patient file that includes all investigations.
- The data would be confidential and used only for scientific research purposes.

Statistics:

Statistical analysis and presentation of data was conducted using SPSS (Statistical Package for the Social Sciences) version 22 computer program. Normally distributed numerical variables were presented as mean ±SD, and differences between the two groups were tested using Independent F- test. Categorical variables were summarized as frequencies and percentages. A p-value of < 0.05 was considered statistically significant and < 0.001 was considered highly significant.

3. Results:

Recovery outcome of facial nerve function after 6 months follow up showed that 17 cases (56.6%) revealed excellent results, 8 cases (26.7%) showed good results and 5 cases (16.7%) revealed poor results Table 1.

Table 1: Recovery outcome of facial nerve function in studied cases after 6 months (n=30)

Recovery outcome of facial nerve function		After 6 months
Poor	N	5
	%	16.7%
Good	N	8
	%	26.7%
Excellent	N	17
	%	56.6%
Total	N	30
	%	100.0%

There is significant decrease in amplitude and latency difference between normal, moderate and severe cases after 6 months. FNAEP after 6 months showed significant decrease in AD and LD in studied cases with significant difference in AD between normal & moderate, normal & severe cases and moderate & severe cases ($p < 0.01$) and significant difference in LD between normal, moderate & severe ($p < 0.01$), moderate and severe cases ($p < 0.01$) Table 2.

Table 2: Comparison between studied cases according to facial nerve antidromic evoked potential (FNAEP) after 6 months (n=30)

FNAEP after 6 months		Range	Mean ± SD	F. test	p. value	Tukey's test	
Amplitude difference%	Normal (n=17)	-3.22 – -26.23	-11.82 ± -5.85	143.551	0.001*	P1	0.001*
	Moderate (n=8)	-28.68 – -49.19	-36.38 ± -6.07			P2	0.001*
	Severe (n=5)	-56.74 – -81.4	-69.28 ± -10.81			P3	0.001*
Latency difference%	Normal (n=17)	4.75 – 19.89	12.04 ± 5.06	108.513	0.001*	P1	0.001*
	Moderate (n=8)	22.98 – 47.88	37.93 ± 8.08			P2	0.001*
	Severe (n=5)	46.99 – 51.4	48.94 ± 1.70			P3	0.002*

P1: Normal compared with moderate P2: Normal compared with severe P3: Moderate compared with severe

There is significant decrease in amplitude and latency difference of FNAEP after 6 months in studied cases with good and excellent outcomes compared with cases with poor outcome. After 6 months, FNAEP showed a statistically significant decrease in amplitude and latency difference in cases with good and excellent outcomes compared with cases with poor outcome ($p < 0.01$) Table 3.

There is significant difference between normal & moderate and moderate & severe as regard to ipsilateral R1, contralateral R2 and between normal, moderate and severe cases as regard ipsilateral R2. N.B: 2 cases (13.3%) with severe facial paralysis showed absent ipsilateral R1 and contralateral R2. After 6 months. There is significant difference between normal & moderate, normal & severe as regard to ipsilateral R1 ($p < 0.01$), between normal, moderate and severe as regard ipsilateral R2 ($p < 0.01$) and between normal & moderate, normal & severe as regard contralateral R2 ($p < 0.01$) Table 4.

Table 3: Comparison between studied cases with different grades of facial recovery outcomes according to facial nerve antidromic evoked potential after 6 months (n=30)

FNAEP		Range	Mean ± SD	F. test	p. value	Tukey's test	
Amplitude difference %	Excellent (n=17)	-3.22 – -26.23	-11.82 ± 5.85	143.551	0.001*	P1	0.001*
	Good(n=8)	-28.68 – -49.19	-36.38 ± 6.07			P2	0.001*
	Poor(n=5)	-56.74 – -81.4	-69.28 ± 10.81			P3	0.001*
Latency difference %	Excellent (n=17)	4.75 – 19.89	12.04 ± 5.06	108.513	0.001*	P1	0.001*
	Good(n=8)	22.98 – 47.88	37.93 ± 8.08			P2	0.001*
	Poor(n=5)	46.99 – 51.4	48.94 ± 1.70			P3	0.002*

P1: Poor compared with good P2: Poor compared with excellent P3: Good compared with excellent

Table 4: Comparison between studied cases with mild, moderate and severe paralysis of facial nerve according to blink reflex after 6 months (n=30)

Blink reflex		Range	Mean ± S. D	F. test	p. value	Tukey's test	
Ipsilateral R1	Normal (n=17)	8.1 – 12.9	11.37 ± 1.47	19.828	0.001*	P1	0.001*
	Moderate (n=8)	13 – 14.9	13.95 ± 0.69			P2	0.001*
	Severe (n=3)	15.1 – 15.3	15.20 ± 0.10			P3	0.147
Ipsilateral R2	Normal (n=17)	38.3 – 42.2	39.72 ± 0.95	48.975	0.001*	P1	0.001*
	Moderate (n=8)	40.1 – 42.5	41.48 ± 0.89			P2	0.001*
	Severe (n=5)	43.3 – 44.9	44.18 ± 0.73			P3	0.001*
Contra lateral R2	Normal (n=17)	34.5 – 43.1	38.65 ± 2.19	38.800	0.001*	P1	0.001*
	Moderate (n=8)	43.3 – 44.9	44.23 ± 0.50			P2	0.001*
	Severe (n=3)	45.1 – 46.8	45.83 ± 0.87			P3	0.195

P1: Normal compared with moderate P2: Normal compared with severe P3: Moderate compared with severe

There is significant difference in ipsilateral R1, ipsilateral R2 and contralateral R2 after 6months in studied cases with excellent and good outcomes compared with cases with poor outcome. In different grades of facial recovery outcomes after 4 and 6 months, blink reflex showed a statistically significant difference in ipsilateral R1, ipsilateral R2 and contralateral R2in studied cases with excellent and good results than cases with poor results ($p < 0.01$) Table 5.

Table 5: Comparison between studied cases with different grades of facial recovery outcomes according to blink reflex after 6 months (n=30)

FNAEP		Range	Mean ± S. D	F. test	p. value	Tukey's test	
Ipsilateral R1	Excellent (n=17)	8.1 – 12.9	11.37 ± 1.47	19.828	0.001*	P1	0.001*
	Good (n=8)	13 – 14.9	13.95 ± 0.69			P2	0.001*
	Poor (n=5)	15.1 – 15.3	15.20 ± 0.10			P3	0.147
Ipsilateral R2	Excellent (n=17)	38.3 – 42.2	39.72 ± 0.95	48.975	0.001*	P1	0.001*
	Good (n=8)	40.1 – 42.5	41.48 ± 0.89			P2	0.001*
	Poor (n=5)	43.3 – 44.9	44.18 ± 0.73			P3	0.001*
Contralateral R2	Excellent (n=17)	34.5 – 43.1	38.65 ± 2.19	38.800	0.001*	P1	0.001*
	Good (n=8)	43.3 – 44.9	44.23 ± 0.50			P2	0.001*
	Poor (n=5)	45.1 – 46.8	45.83 ± 0.87			P3	0.195

P1: Poor compared with good P2: Poor compared with excellent P3: Good compared with excellent

4. Discussion:

Recovery outcome of facial nerve function after 6 months follow up showed that 17 cases (56.6%) revealed excellent results, 8 cases (26.7%) showed good results and 5 cases (16.7%) revealed poor results.

This is in agreement with Dong, (2016)[8] who explained that the pathology of different grades of facial paralysis affected course and recovery of Bell's palsy. Mild cases are mostly neuropraxia in which axon and supporting tissues remain intact, no wallerian degeneration with complete recovery. Moderate cases may be neuropraxia or axonotemesis in which there is loss of continuity of the axon, wallerian degeneration with complete recovery. Severe cases mostly neurotemesis in which injury involves endoneurium, wallerian degeneration occurs with increasing risk of complications and incomplete recovery.

FNAEP after 6 months showed significant decrease in AD and LD in studied cases with significant difference in AD between normal & moderate, normal & severe cases and moderate & severe cases ($p < 0.01$) and significant difference in LD between normal, moderate & severe ($p < 0.01$), moderate and severe cases ($p < 0.01$).

This is in agreement with Lee et al. (2014)[9] who assessed the practical diagnostic value of facial nerve antidromic evoked potential (FNAEP) in Bell's palsy in 20 patients with unilateral Bell's palsy within 17th days after the onset of facial palsy. They found that FNAEP showed prolonged latencies on the affected side versus the unaffected side with no significant difference between sides in the normal control group. So, they concluded that increase in FNAEP latency is useful to detect facial nerve damage at an early stage.

After 6 months, FNAEP showed a statistically significant decrease in amplitude and latency difference in cases with good and excellent outcomes compared with cases with poor outcome ($p < 0.01$).

This is in agreement with Zhang et al. (2012)[10] who investigated FNAEP in predicting recovery from Bell's palsy with duration from onset to test from 1 to 3 days. LD and AD of excellent and good groups were decreased after recovery, demonstrating a significant improvement in LD and AD after recovery ($p < 0.01$).

Our findings revealed that both latency and amplitude of facial nerve were affected between different grades of facial paralysis indicating that lesion of facial nerve in our studied cases was demyelinating and axonal lesions. This is in agreement with Finsterer, (2008) [11] who illusterated that reduction of the compound muscle action potential suggests axonal degeneration whereas increase in latency suggests demyelination of the nerve.

However, AD and LD were both decreased in mild, moderate and severe cases during period of follow up to be more decreased after 6 months than at onset of illness. The decrease in AD between diseased and healthy sides denoting increase of amplitude on affected side during period of follow up which indicated reinnervation of facial nerve on affected side and clinical improvement of cases. So amplitude can be used as an indicator of prognosis.

This is in agreement with Nassar et al. (2018)[12] who assessed the value of facial nerve temporal recording in the diagnosis and prognosis of facial nerve palsy. They studied 42 patients with acute unilateral Bell's palsy and 43 healthy volunteers as a control group. They noticed that there is an increase in the amplitude of FNAEP during period of follow up associated with clinical improvement of cases. They concluded that Facial nerve temporal recording should be considered as a complementary tool for early diagnosis and follow-up of Bell's palsy.

After 6 months, there is significant difference between normal & moderate, normal & severe as regard to ipsilateral R1 ($p < 0.01$), between normal, moderate and severe as regard ipsilateral R2 (p

<0.01) and between normal & moderate, normal & severe as regard contralateral R2 (p <0.01).

This study showed that delayed or absent ipsilateral R1 and contralateral R2 are useful in diagnosing Bell's palsy in mild, moderate and severe cases.

This is in agreement with Xie et al. (2014)[13] who detect the value of blink reflex in early diagnosis and prognosis of Bell's palsy using 58 patients with Bell's palsy within one week after symptom onset. Blink reflex and facial nerve conduction were examined in all patients. They excluded that efferent anomalies of blink reflex occurred in all of the 58 patients concluding that blink reflex can play a significant role in early diagnosis of bell' palsy.

Also our study showed that there was significant improvement in blink reflex after 4 and 6 months than at onset indicating that blink reflex was of significant value in detecting prognosis of bell's palsy. This is in agreement with Mikula et al. (2002)[14] who determined the value of the blink reflex as a predictor of outcome of idiopathic peripheral partial facial paresis in 30 patients with acute idiopathic peripheral facioparesis.

They noticed that latency and amplitude of R1 immediately and one week after the onset were the best predictors of residual motor deficit concluding that the blink reflex is a valuable tool for follow-up and recovery prognosis of the partial idiopathic facial paresis especially in the early recovery phase.

In different grades of facial recovery outcomes after 4 and 6 months, blink reflex showed a statistically significant difference in ipsilateral R1, ipsilateral R2 and contralateral R2in studied cases with excellent and good results than cases with poor results (p <0.01).

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