

PROGNOSTIC VALUE OF LATE RESPONSE (F WAVE AND H REFLEX) IN SURGICAL MANAGEMENT OF LUMBER DISC HERNIATION (L5-S1)

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ABSTRACT

Background: The diagnosis of lumbar disc herniation is based on clinical history and examination, imaging studies, and electrophysiologic studies. Many factors have been reported as affecting recovery following surgical decompression. Electrophysiological studies has role in the diagnosis and predicting the prognosis of lumbar disc herniation. **Aims and Objectives:** To study the prognostic value of the late response (F wave and H reflex) in lumbar disc herniation (L5-S1) treated surgically. **Materials and Methods:** The study was conducted from January 2014 to April 2015 on fifty patients presented with lumbar disc herniation (L5-S1) and admitted in the department of spine surgery for surgical decompression. Both preoperative and 3 months postoperative electrophysiological studies were done. **Results:** Preoperative F wave were abnormal in 74% of patients while H reflex were abnormal in all patients. 3 months follow up postoperative, 82% of patients had good outcome and improved neurological symptoms and 18% of patients still complaining of low back pain and sciatica. Postoperative F wave results showed 56% of patients had abnormal F wave response while H reflex results showed 52% of patients had abnormal H reflex. There were significant difference between both groups regarding to age, BMI, duration of disease, preoperative F wave and H reflex. **Conclusion:** Old age patients with high BMI, long duration of neurological symptoms, absent F wave and H reflex response had unfavorable outcome postoperative.

INTRODUCTION

Disc herniation is one of the most common causes of low back pain (LBP) and is responsible for about 20% of the cases of LBP specially in working age adults¹. About 20% of patients presented with disc herniation indicated for surgical decompression². Lumbar disc herniation surgery is most commonly performed electively in patients where conservative therapies have failed to gain improvement of leg pain and disability³. Electrophysiological studies are simple methods for diagnosis of radiculopathies and can help to determine the severity, and prognosis of a radiculopathy. They are also noninvasive and performed on outpatients⁴. The role of

electrophysiological studies including late response (F wave and H reflex) in the assessment of patients with proximal root disorders are well known⁵. F waves are late responses involving the motor axons and axonal pool at the spinal cord level. The assessment and classification of F wave can be done by using the minimal latency, mean latency, and chronodispersion or scatter⁶. F wave like H reflexes has low sensitivities and are not specific for radiculopathy. The reported sensitivities of F wave range from 13-69%^{7 8 9}. The proximal segment of the peripheral nerve inaccessible to be assessed by routine surface stimulating and recording techniques. The H-reflex are useful for evaluating the nerve

conduction through the entire length of the afferent and efferent pathways, assessment of proximal part of nerve and also suitable for evaluation of the potential entrapment of the S1 nerve root¹⁰. The common findings in studying S1 radiculopathy are prolonged latency or absence of the H-reflex response¹¹. Also asymmetrical prolongation of H reflexes with interside difference more than 1.2 ms may be present and considered abnormal¹².

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AIMS OF THE STUDY

To study the prognostic value of late response (F wave and H reflex) in surgical management of L5-S1 disc herniation.

PATIENTS AND METHODS

The study was conducted from January 2014 to April 2015 on fifty patients admitted in the department of spine surgery of Al-Jedaani Hospital that belong to Ibn Sina Faculty of Medicine in Kingdom of Saudi Arabia. This study has been approved by ethical committee of Al-Jedaani Hospitals. Patients included in the study were presented with confirmed diagnosis lumbar disc herniation (L5-S1) and all these patients were subjected to surgery. A detailed history, complete physical, neurological examinations and BMI were carried out to all patients at time of presentation and 3 months after surgery. Postoperative, patients were divided into two groups: group (A) who had good outcome after surgery (improved neurological symptoms) and group (B) who still complaining of neurological symptoms after surgery. Patients who had multiple level disc herniation, recurrence of disc herniation, traumatic disc herniation or

polyneuropathy whatever the cause were excluded from the study. Magnetic resonance imaging scan of the lumbosacral vertebra was done for all patients. Electrophysiological studies including nerve conduction study (NCS), H reflex and F wave were carried out both preoperatively and 3 months postoperative. NCS was performed on both common peroneal, tibial, and sural nerves, F wave were obtained from both common peroneal, tibial nerves and H-reflexes from soleus muscles bilaterally.

The F-wave was elicited by placing the recording electrode over an intrinsic muscle of foot. Stimulation was supramaximal appropriate for each nerve. Stimulation frequency of 1/s was done. Because F-wave minimum latency is dependent on limb length, F-wave latency was estimated by using the following formula: F-wave (ms) = $[2 \times F \text{ distance (mm)}/CV \text{ (m/s)}] + DL \text{ (ms)} + 1 \text{ ms}$. Greater than two standard deviations from the mean or side-to-side latency differences of 2 msec in F-waves or absence of F-wave response were considered abnormal¹³.

H-reflex was done according to the method of Sabbahi and Khalil¹⁴ (active electrode was placed over the median gastrocnemius half way between the popliteal crease and the proximal medial malleolus, reference electrode over the Achilles tendon and ground electrode being lateral to the active electrode. stimulating electrode placed at popliteal fossa with the cathode proximal. Patients were instructed to relax completely during test while keeping the head in the neutral position. Simulation was started with stimulus of short duration (0.05 ms) at a frequency no greater than once every 2 s. The H-reflex appeared and became maximum with a submaximal stimulation and the amplitude decreased with increase

stimulation to supramaximal. The measurement of latency was to the first deflection from the baseline when a maximal response was obtained. The amplitude of H-wave, H-latency and interside difference were determined. Prolongation of H-reflex latency, absence of response or interside difference more than 1.2 ms in the latency were considered abnormal. H-latency was estimated by the following formula: H-latency (ms) = 9.14 + 0.46 leg length (cm) + 0.1 age (years) + 5.5¹⁵.

RESULT

The study was included fifty patients (41 males and 9 females) with mean age 35.48 ± 7.26 years and BMI 32.61 ± 3.62 were included in the study. Preoperative F wave results showed 74% of patients had abnormal F wave response (58 % had prolonged latency and 16 % had absent F wave response) and remaining 26% had normal F wave response. Preoperative H reflex results showed all patients had abnormal H reflex (82 % had prolonged latency and 18 % had absent H reflex). After 3 months follow up postoperative, 82% of patients had good outcome and improved neurological symptoms (group A) and 18% of patients still complaining of low back pain and sciatica (group B). Postoperative F wave results showed 56% of patients had abnormal F wave response (44 % had prolonged latency and 12 % had absent F wave response) while H reflex results showed 52% of patients had abnormal H reflex (34 % had prolonged latency and 18 % had absent H reflex). There were significant difference between both groups regarding to age, BMI, duration of disease, preoperative F wave and H reflex.

Table (1): Demographic and clinical data

Variable	Number	Percent
Sex		
Male	41	82%
Female	9	18%
Side		

Right	21	42%
Left	29	58%
Age (Y)	37.68 ± 8.05	
BMI	32.81 ± 3.75	
Duration (Y)	2.26 ± 1.23	

Table (2): Preoperative and postoperative results of electrophysiology (F wave and H reflex)

Variable	Preoperative	Postoperative		P Value
		Improved	Not improved	
F wave latency				0.033
Normal	13 (26%)	22 (53.66%)	0 (00%)	
Prolonged	29 (58%)	17(41.46%)	5 (5.56%)	
Absent	8 (16%)	2 (4.88%)	4 (44.44%)	
H reflex latency				0.013
Normal	0 (00%)	24 (58.54%)	0 (00%)	
Prolonged	41 (82 %)	12 (29.27%)	5 (55.56%)	
Absent	9 (18%)	5 (12.2%)	4 (44.44%)	

Table (3): Correlation between clinical data and postoperative outcome

Variable	Improved	Not improved	P Value
Sex			0.483
Male	33 (80.49 %)	8 (88.89 %)	
Female	8 (19.51 %)	1 (11.11 %)	
Side			0.554
Right	19 (46.38 %)	3 (33.33 %)	
Left	23 (53.62 %)	6 (66.67 %)	
Age	36.46 ± 7.78	43.22 ± 7.28	0.021
BMI	31.94 ± 3.41	35.66 ± 3.64	0.005
Duration	2.02 ± 1.12	3.33 ± 1.22	.003

Table (4): Comparison between preoperative and postoperative electrophysiological results (F wave and H reflex)

Variable	Preoperative	Postoperative	P Value
F wave latency (M±SD)	59.73 ± 6.77	54.2 ± 3.67	0.01
H reflex latency (M±SD)	38.67 ± 2.41	34.07 ± 4.22	0,027

Table (5): Correlation between preoperative electrophysiological results (F wave and H reflex) and postoperative outcome

Variable	Improved	Not improved	P Value
F wave latency			0.033
Normal	22 (53.66%)	0 (00%)	
Prolonged	17(41.46%)	5 (5.56%)	
Absent	2 (4.88%)	4 (44.44%)	
H reflex latency			0.013
Normal	0 (00. %)	0 (00. %)	
Prolonged	35 (85.36 %)	5 (66.66%)	
Absent	6 (14.64 %)	4 (44.44%)	

DISCUSSION

Lumbar disc herniation is most common causes of lower back pain and radiating leg pain. Conservative treatment may be the first option unless severe motor and sphincter symptoms, surgical treatment is considered the first option. Early surgery leads to rapid symptom recovery¹⁶. Electrophysiological studies can help in diagnosis, severity, and prognosis of a radiculopathy⁴. Late responses provide

objective evidence of L5 and S1 nerve root compression³¹. The study was carried out on fifty patients presented with clinical picture of lumbar disc herniation (L5-S1). Preoperative F wave response was abnormal in 74% of patients. Three months postoperative, F wave was abnormal in 52% of patients. Western literature¹⁹ reveals prolonged F-wave latency between 18% and 65% of patients while Hans et al;¹⁴ reported abnormal F wave in 82% of patients.

Preoperative H reflex, all patient had abnormal H reflex latency and three months postoperative, H reflex had abnormal latency in 52% of patients. Braddom and Johnson¹⁸ and Aiello et al.¹⁷ found H-reflex tests were positive in 100% patients with L5–SI disc herniation (H-reflex latencies greater than 2 standard deviations above the mean for the control group).

In the present study, 82% of the patients had improvement in neurological symptom 3 moths postoperative. Good short-term outcome after lumbar disc herniation surgery have been reported in up to 90% of the patients in many studies^{20 21 22 23}.

In the present study, postoperative outcome was significantly correlated with age of patients, BMI and preoperative duration of neurological symptoms. Old age patients, high BMI and with long duration of neurological symptoms had unfavorable outcome postoperative. Also patients had preoperative absent F wave or H reflex response, postoperative outcome was unfavorable. Preoperative absent F wave and H reflex response may be indictors for severity that associated with unfavorable outcome postoperatively. Nygaard et al;²⁴ Kitze et al;¹ and Silverplats et al;²⁵ reported patients with a long sick leave time preoperatively were found to have a less

favourable outcome. Also Ng et al;²⁶ in his study found that patients with sciatica for more than 12 months have a less favourable outcome. Many studies reported that, age, the duration of the initial deficit and comorbid medical illnesses have been postulated to influence neurological recovery^{27 28 29 30}.

CONCLUSION

Old age patients with high BMI, long duration of neurological symptoms and absent F wave and H reflex responses had unfavorable outcome postoperative.

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