

DETERMINATION OF F-WAVE LATENCY IN INDIVIDUALS AGED 20 YEARS AND OLDER

H. R. Hatamian¹ and M. R. Imamhadi^{*2}

1) Department of Neurology, School of Medicine, Guilan University of Medical Sciences, Rasht, Iran

2) Department of Neurosurgery, School of Medicine, Guilan University of Medical Sciences, Rasht, Iran

Abstract- Determination of F-wave latency is a simple and valuable method in evaluating proximal part of peripheral nerves. The aim of this study was to determine the mean minimal peroneal F wave (F min) in healthy individuals. A total of 282 individuals were studied. The mean age was 45.6 years. The F min (\pm SD) for 564 peroneal nerves was 47.09 ± 4.51 ms. The F min for the age group of 20-45 and height group of 160-180 cm were 47.63 ± 4.50 and 49.77 ± 3.76 , respectively. This study demonstrates that the mean F min of our samples was not significantly different from other important similar studies. Age and particularly height had a major role in determination of F min value and these two parameters must be considered in clinical evaluation of patients.

Acta Medica Iranica, 43(3): 212-214; 2005

Key words: Nerve conduction study, electrodiagnosis, F-wave

INTRODUCTION

Neurologic disorders are common and costly. According to one recent estimate, 180 million Americans suffer from a nervous system disorder, resulting in an annual cost of 634 billion dollars (1). Because useful therapies now exist for many neurologic disorders, a skillful approach to their diagnosis is important. The electrodiagnostic evaluation is actually an extension of the neurologic portion of the physical examination. Both require a detailed knowledge of a patient and his/her disease.

Nerve conduction studies (NCS) or nerve conduction velocity primarily evaluates large myelinated fibers. An electrical stimulation is delivered to a nerve at various locations along the course of the nerve and the response is recorded from a corresponding muscle in motor studies, or from a distant portion of the nerve in sensory studies. The

electrical response is processed and displayed on a computer screen for analysis (2). Patients with suspected motor or sensory peripheral neuropathy, *i.e.*, peripheral mononeuropathy, polyneuropathies, carpal tunnel syndrome (3, 4), brachial plexus disorders (5), as well as multilevel radiculopathies need NCS.

It is often valuable to test conduction status in proximal segments of peripheral nerves. H-reflex, F-wave and blink reflex tests accomplish this task better than distal NCS. The F-wave is a late reflex recorded from extremity muscles following electrical stimulation of corresponding nerve. When symptoms and/or signs of spinal canal stenosis (6), myelopathy, radiculopathy or radicular irritation on history or physical examination (7, 8) and spasticity (9, 2) are present, F wave testing is indicated. It also helps to identify exit zone root lesions, when peripheral motor NCV is normal such as in chronic radiculopathies (2). Determination of mean F-wave latency in healthy subjects is valuable for comparison, as an important value of NCV normative data.

The purpose of this study was to determine the mean peroneal F-wave minimum latency in healthy individuals aged 20 years and older in our region; thus, we compared our results with other similar studies.

Received: 14 Dec. 2004, Revised: 16 Jan. 2005, Accepted:

*** Corresponding Author:**

H.R. Imamhadi, Department of Neurology, Poursina Hospital, School of Medicine, Guilan University of Medical Sciences, Rasht, Iran
Tel: +98 131 7723083, Fax: +98 131 7723083
E-mail: imamhadi@gums.ac.ir

MATERIALS AND METHODS

This study was performed in Rasht Poursina educational and therapeutic center. A total of 282 subjects gave informed consent to participate in this study. All of volunteers were residents, interns, students and, hospital clerks or medical staff.

Ethical approval was considered exactly. All individuals had no relevant medical history and attended the laboratory. Subjects were in supine position on bed. The laboratory room temperature was 25 °C.

Nerve study was performed by an expert technician supervised by a neurologist. We used Medelec premiere plus, system Sotwa version E-01 standardized with 0.5 Hz stimulation, stimulus duration of 100 μ s and 200 μ v sensitivity.

The recorder surface electrode was placed over extensor digitorum brevis (EDB) muscles and reference electrode over the proximal portion between third and fourth metatarsophalangeal joints. F waves were determined after 10 supramaximal stimuli given at 4-s intervals to peroneal nerves on each side. The minimal F wave latency was known as F min. Data were collected and stratified by age and height. We used SPSS 10 software.

RESULTS

A total of 564 peroneal nerves from 282 healthy subjects were studied. The mean age of subjects was 45.61 \pm 4.2 years. The mean height of subjects was 165.13 \pm 5.1 cm. The F min for 564 peroneal nerves was 47.09 \pm 4.51 (mean \pm SD) ms. Table 1 and table 2 show the mean F values by age and height, respectively. Table 3 demonstrates mean F values by both height and age.

Table 1. Statistical indices of F min (ms) in our subjects by age groups

Age (years)	Mean \pm SD	Min	Max	Range
20-45 (n=364)	47.63 \pm 4.50	37	58	21
> 45 (n=200)	46.12 \pm 4.36	37	59	22
Total (n=564)	47.09 \pm 4.51	37	59	22

Abbreviations: SD, standard deviation; min, minimum; max, maximum.

Table 2. Statistical indices of F min (ms) in our subjects by height groups

Height (cm)	Mean \pm SD	Min	Max	Range
< 160 (n=256)	43.68 \pm 2.29	37	49	12
160-180 (n=302)	49.77 \pm 3.76	41	57	16
> 180 (n=6)	57.83 \pm 0.75	57	59	2
Total (n=564)	47.09 \pm 4.51	37	59	22

Abbreviations: SD, standard deviation; min, minimum; max, maximum.

DISCUSSION

Electrodiagnosis (EDX) is a functional procedure that tests neuromuscular junctions, muscles, peripheral nerves, plexus, root or central pathways. The choice and need for a particular diagnostic procedure should be based on indications from an adequate history and examination. EDX is an extension of neurological examination and as integral a tool as the tuning fork and reflex hammer. The F-wave and H-reflex tests are types of nerve conduction procedures usually performed as an integral part of EDX (2).

Our study shows that the mean F wave latency in peroneal ankle was 47.09 ms. It is similar to the results of other important studies.

Buschbacher (10), Kimura (11), Delisa (12), Oh (13) and their colleagues have reported F wave latency for peroneal nerve as 50.8, 48.4, 51.3 and 46.88 ms, respectively. These results are comparable with our study results.

Some of the studies showed that room temperature (14), age (15), height (16) and gender (10) influence F wave latency. In our study, there was no significant difference between age groups, but with increasing age, the F min was decreased minimally.

As subject's height were increased, the length of nerve was increased, thus the latency of conduction was also increased. For this reason the F min value of subjects with height <160 cm was significantly less than height >180 cm in our study. Since height has major effects on normal value of F-wave latency, there are some differences in F-wave values measured in different studies, so it is better to interpret F wave latency in each person according to normal values determined in each region or clinic.

Table 3. Mean F min latency (ms) by age and height on each side

Height (cm)	Right lower limb			Left lower limb		
	Age (years)			Age (years)		
	20-45	> 45	Total	20-45	> 45	Total
< 160	43.68	43.65	43.66	43.68	43.71	43.70
160-180	49.77	49.92	49.81	49.71	49.84	49.74
> 180	57.50	59.00	58.00	57.50	58.00	57.68
Total	47.65	46.12	47.11	47.61	46.12	47.08

This study demonstrates that the F min latency of our samples was not significantly different from other important studies. As mentioned above, age and particularly height had major roles in determination of F min value, thus we should consider these two parameters in clinical evaluation of our patients.

REFERENCES

1. Martin JB, Hauser SL. Approach to the patient with neurologic disease. In Braunwald E, editor. Harrison's principles of internal medicine. 15th ed. New York: McGraw-Hill; 2001. p.2326-2331.
2. True JM. Medical validity of selected diagnostic tests for use in diagnosis and treatment of bodily injured patients, submitted to Florida Department of Health. p.2-12.
3. Sesto ME, Radwin RG, Salvi FJ. Functional deficits in carpal tunnel syndrome. *Am J Ind Med.* 2003 Aug; 44(2):133-140.
4. Chang MH, Wei SJ, Chen LW. The reason for forearm conduction slowing in carpal tunnel syndrome: an electrophysiological follow-up study after surgery. *Clin Neurophysiol.* 2003 Jun; 114(6):1091-1095.
5. Zanetas PD. Brachial plexus injuries and the electrodiagnostic examination. *Curr Sports Med Rep.* 2003 Feb; 2(1):7-14.
6. Tsai CT, Chen HW, Chang CW. Assessments of chronodispersion and tacheodispersion of F waves in patients with spinal cord injury. *Am J Phys Med Rehabil.* 2003 Jul; 82(7):498-503.
7. Toyokura M, Murakami K. F-wave study in patients with lumbosacral radiculopathies. *Electromyogr Clin Neurophysiol.* 1997 Jan-Feb; 37(1):19-26.
8. Tsur A, Glass I, Solzi P. Exhausting fatigue influences F-wave and peripheral conduction velocity, following lumbar radiculopathy. *Disabil Rehabil.* 2002 Sep 10; 24(13):647-653.
9. Eisen A, Odusote K. Amplitude of the F wave: a potential means of documenting spasticity. *Neurology.* 1979 Sep; 29(9 Pt 1):1306-1309.
10. Buschbacher RM. Tibial nerve F-waves recorded from the abductor hallucis. *Am J Phys Med Rehabil.* 1999 Nov-Dec; 78(6 Suppl):S43-47.
11. Kimura J. *Electrodiagnosis in diseases of nerve and muscle: Principles and practice.* 2nd ed. Philadelphia: F.A. Davis company; 1989.
12. DeLisa JA, Lee HJ, Baran EM, et al. *Manual of nerve conduction velocity and clinical neurophysiology.* 3rd ed. New York: Raven Press; 1994.
13. Oh SJ. *Clinical Electromyography: Nerve Conduction Studies.* 2nd ed. Baltimore: Williams and Wilkins; 1993.
14. Aminoff MJ. *Electromyography in clinical practice.* 3rd ed. Churchill Livingstone; 1998.
15. Oh SJ. *Principles of Clinical electromyography, case studies.* Baltimore: Williams and Wilkins; 1998.
16. Cai F, Zhang J. Study of nerve conduction and late responses in normal Chinese infants, children, and adults. *J Child Neurol.* 1997 Jan; 12(1):13-18.