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– Abstract –

Estimation of Normal H-Reflex in Flexor Carpi Radialis Using Meta-analysis

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Objective : H-reflex is noted in the flexor carpi radialis muscle of the upper limb and can be used in the diagnosis of C6 and C7 radiculopathies. Despite a number of normative studies of FCR H-reflex, each laboratory have one's own test method and normative database. Obvious difficulties arise in attempting to compare data from one laboratory to another. there is a need to established a standardized test method with normal references. We initiated this study to overcome these difficulties.

Method : We searched through 18 sources, which had been previously published from 1975 to 1999, concerning FCR H-reflex. The search provided a common test method using all 18 sources and side to side difference (latency, amplitude) and obtained a normal reference value of latency through the meta-analysis technique by researching 7 sources stated normal reference values.

Results : 1) The most common test method on surface recording technique used active surface electrode which was applied to over about one-third of the distance between the medial epicondyle and the radial styloid. the stimulation site was median nerve on cubital fossa. the stimulation duration was 0.5~ 1.0 msec. the stimulation frequency was 0.2 pps.

 2) From a meta-analysis of data on 3 domestic articles, estimated latency which were examined at fore-arm 1/3 site was 13.9± 1.9 msec and from a meta-analysis of data on 4 articles outside the country, esti-mated latency which were examined at forearm 1/3 site was 15.7± 1.4 msec.

Conclusion : We present most common test method and the standard reference value through meta-analysis. This values is helpful to increase accuracy for diagnosing C6 and C7 radiculopathies.

Key Words : Meta-analysis, Flexor carpi radialis H-reflex, Normative data

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H-   Hoffman   (1918)[1]
, 1950   Magladery   (1950)[2]   3, 4,   (flexor
                 ,   carpi radialis muscle)   [5].

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(1996)[6]   .

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7   ,   6, 7
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                ,   ,   (Pub Med)
                        6, 7   " flexor carpi radialis H-reflex" " flexor carpi
                                              radialis H-reflex and normotive data"   "
              [6].   1   flexor carpi radialis H-reflex and reference"
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                                    (Table 1).

Table 1. Demographic Characteristics of Subjects Including Studies

No. of study	Author	Year of publication	No. of reference	No. of subjects	Age
1		1989	8	40	21~ 50
2		1994	9	20	M:34.7
3		1996	6	60	19~ 63
4		1998	10	50	16~ 76
5	Jabre	1981	11	39	15~ 56
6	Miller	1995	12	50	22~ 54
7	Sabbahi	1990	13	50	20~ 50
8	Sabbahi	1999	14	22	39± 9
9	Tarkka	1987	15	10	M:22
10	Deschuytere	1976	16	50	18~ 64
11	Deschuytere	1975	17	20	-
12	Baldissera	1983	18	8	24~ 44
13	Ongerboer	1984	19	52	20~ 85
14	Schimsheimer	1985	20	143	20~ 86
15	Schimsheimer	1987	21	80	14~ 83
16	Panizza	1989	22	6	23~ 50
17	Burke	1989	23	10	-
18	White	1991	24	25	21~ 64

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$$\mu_2 = \frac{1}{0.9973\sum_i n_i} \sum_i \left[n_i \int_{\mu_i-3\sigma_i}^{\mu_i+3\sigma_i} x f_i(x)\, d(x) \right]$$

$$\sigma_2^2 = \frac{1}{0.9973\sum_i (n_i-1)} \sum_i \left[(n_i-1) \int_{\mu_i-3\sigma_i}^{\mu_i+3\sigma_i} (x-\overline{x_i})^2 f_i(x)\, d(x) \right]$$

, $f_i(x)$

$$\frac{1}{S_i\sqrt{2\pi}}\, e^{\frac{-(x-\overline{x_i})^2}{2S_i^2}}$$

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1)

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, , sweep , gain

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2)
Kim (1994)[7]

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$$\boldsymbol{\mu_i} = \frac{n_i \cdot \overline{x_i}}{n_i}$$

$$\sigma_1^2 = \frac{(n_i-1)s_i^2}{(n_i-1)}$$

$u_i,\ \sigma_1, n_i,\ x_i,\ s_i$

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8 (44%)

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(Table 2, 4).

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11 (61%) ,
7 (39%) .

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11 (61%) ,
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5 cm

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4)
                          15   14   (Table 3, 4).
     0. 5 pps   .   0. 2 pps   8 (44%)
          (Table 3, 4).   2.

5)   6
                    15   Paniz   . 6
za (1989)[25]   0. 5~ 1. 0   42%~ 100%   .
msec   . 0. 5 msec   1. 0 msec   2   . Miller
      7 (39%)   , 0. 5~ 1. 0 msec   (1995)[2]   42%   92% ,   (1989)[10]
   1   (Table 3, 4).   74%   100%
                                                                   (Table 5).
6) Filter
  Low filter   1~ 100 Hz   3.
High filter   500~ 10, 000 Hz
           (Table 3, 4).   + 2
                                                              5   .
7) Sweep   (1996)[6]   0. 54 msec   ,
                          4   (1994)[9]   1. 62 msec   5   4
5 msec   (Table 3, 4).   1. 0 msec   .

8)   (Gain)   3
          4   2 (50%)   1 mV

Table 2. Electrode Setting and Stimulation Site Differences Among Collected Archives

No. of study	Electrode type	Electrode position	Stimulation site
1	surface	forearm 1/3	cubital fossa
2	surface	forearm 1/3	cubital fossa
3	surface	forearm 1/3	cubital fossa
4	surface	forearm 1/3	cubital fossa
5	surface	forearm 1/3	cubital fossa
6	surface	forearm 1/3	cubital fossa
7	surface	forearm 1/4	3FB proximal to medial epicondyle
8	surface	forearm 1/4	medial 1/3 of proximal arm
			above cubital fossa
9	surface	forearm 1/3	5cm above cubital fossa
10	coaxial needle	-	cubital fossa
11	needle	-	-
12	surface/needle	-	-
13	coaxial needle	-	cubital fossa
14	needle	-	cubital fossa
15	coaxial needle	-	cubital fossa
16	coaxial needle	-	cubital fossa
17	-	-	-
18	surface	forearm 1/3	-

forearm: between the medial epicondyle and radial styloid

FB: finger breath

Table 3. Characteristics of Filtering and Stimulation Method Among Collected Archives

No. of study	Stimulation duration(msec)	Stimulation frequency(pps)	Sweep speed (msec/division)	Gain (mV/division)	Filter(Hz)
1	-	0.5	5	1	-
2	0.5	0.2	5	1	-
3	0.5	0.2	-	0.2~ 0.5	1~ 10000
4	0.5	0.2	5	0.5~ 5	3~ 30000
5	0.5~ 1.0	<0.5	5	-	-
6	1.0	<0.3	-	-	2~ 10000
7	1.0	0.2	-	-	1~ 10000
8	0.5	0.2	-	-	10~ 1000
9	1.0	1/8~ 10seconds	-	-	-
10	1.0	-	-	-	-
11	-	-	-	-	-
12	-	0.5	-	-	-
13	0.5	0.2	-	-	-
14	0.5	0.2	-	-	-
15	0.5	0.2	-	-	-
16	1.0	1/6seconds	-	-	100-2000
17	1.0	0.1~ 4	-	-	-
18	1.0	-	-	-	arly:1.6~ 16000 late: 2~ 5000

Table 4. The Order Frequency in the Use of a Examination Method in Collected Archives

Electrode	
Type	surface(61%)/needle(39%)
Position	forearm 1/3(44%)/not presented(44%)
Stimulation site	cubital fossa(61%)/not presented(22%)
Stimulation duration	0.5~ 1.0msec(100%)
Stimulation frequency	<0.5pps(93%)
Sweep speed/Gain	5msec/division(100%)/1mV/division(50%)
Filter	low filter: 1~ 100Hz
	high filter: 500~ 10,000Hz

Table 5. Flexor Carpi Radialis H-reflex Prevalence Among Collected Archives

	No. of reference	Resting(%)	Facilitation(%)
(1989)	8	100	-
(1996)	6	100	-
Jabre(1981)	11	90	-
Sabbahi(1990)	13	90	-
Miller(1995)	12	42	92
(1989)	10	74	100

Table 6. Side to Side Difference of Latency Among Collected Archives(unit: msec)

Mean+ 2SD		Maximal value	
(1996)	0.54	Miller(1995)	0.6
(1989)	0.72	Sabbahi(1990,1999)	1.0
Shimsheimer(1987)	0.85	Deschytere(1976)	<1.0
Jabre(1981)	1.0		
(1994)	1.62		

Table 7. Estimated Means and Standard Deviation of Latencies Using Meta-analysis

Recording Electrode	Latency(msec)	C.V.(%)
Surface(forearm 1/3)- domestic articles	13.9± 1.9	13.3
Surface(forearm 1/3)- articles outside the country	15.7± 1.4	9.1
Surface(forearm 1/4)- articles outside the country	16.1± 1.6	10.1
Needle- outside the country	16.9± 1.6	9.3

C.V.: Coefficient of variation: S.D./Mean*100(%)

Table 8. Estimated Reference Values(Mean+2SD) of Latencies Using Meta-analysis

Recording Electrode	Latency(msec)
Surface(forearm 1/3)- domestic articles	17.6
Surface(forearm 1/3)- articles outside the country	18.5

. Miller (1995)[12] 0. 6 msec , Sab-   17. 6 msec,   18. 5 msec (Table 8).
bahi (1990, 1999)[13, 14] Deschytere (1976)[16]
1. 0 msec   1. 0 msec
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8 7 1. 0 msec   (Table 6).
                                          (1996)[6]
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Schimsheimer (1985)[20]   3   1   .
                ,   ,
      .   (1998)[10]
  97. 5%   0. 45   ,
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  5.   ,
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                13. 9 msec,   ,
1. 9 msec   ,   13. 3%   .   ,
   15. 7 msec,   1. 4 msec   ,   H-
   9. 1%   .   ,   ,
                  (Table 7).   6, 7
          97. 5 percentile
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0. 1~ 4 pps
1 0. 5 pps 0. 5
pps
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0. 2 pps .
15 0. 5~ 1. 0 msec
. Panizza (1989)[25]
M H-

0. 5~ 1. 0 msec

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Low
filter 1~ 100 Hz High fil-
ter 500~ 10, 000 Hz .

6
H 42% 100%

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92% 100%
. Burke (1989)[17]
256 sweeps
(background acitivity)

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6 Miller
(1995)[12] 42% , (1989) 10 74%
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,   0. 2 pps   .
0. 5~ 1. 0 msec   , Low filter
1~ 100 Hz   High filter
500~ 10, 000 Hz   .

2)   42% ~ 100%
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1. 0 msec
.   Schimsheimer
(1985)[20]   3   1   ,
(1998)[10]   0. 45   .

3)   97. 5 percentile
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3   17. 6 msec
18. 5 msec   .

1. Hoffman P: Uber die Beziehungen der Sehnenreflexe zur willkuriichen bewegung und zumtonus. Z Biol 1981: 68: 351-370

2. Magladery JW, McDougal DB: Electrophysiological studies of nerve and reflex activity in normal man. Bull Johns Hopkins Hosp 1950: 28: 265-290

3. Hodes R, Gribetz J: Normal electrically induced reflexs(H reflexes") in a 2-week-old infant with acrania and cerebral dysgenesis. Electroencephalogr Clin Neurophysiol 1963: 15: 1033-36

4. Thomas JE, Lambert EH: Ulnar nerve conduction velocity and H-reflex in infants and children. J Appl Physiol 1960: 15: 1-9

5. Deschuytere J, Rosselle N, De Keyser C: Monosynaptic reflexes in the superficial forearm flexors in man and their clinical significance. J Neurol Neurosurg Psychiatry 1976: 39: 555-565

6.   ,   :   6,7
H-   .   1996: 20: 456-463

7. Heon Kim, Soo-Hun Cho: Estimation of the geometric means and the reference values of blood lead levels among koreans. J Korean Med Sci 1994: 9: 304-312

8.   ,   ,   ,   :
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1989: 13: 303-310

9.   ,   ,   ,   ,   :
H-   .   1994: 18: 352-358

10.   ,   ,   :   H
.   1998: 22: 1288-1292

11. Jabre JF: Surface recording of the H-reflex of the flexor carpi radialis. Muslce Nerve 1981: 4: 435-438

12. Miller TA, Newall AR, Jackson DA: H-reflexes in the upper extremity and the effects of voluntary contraction. Electromyogr Clin Neurophysiol 1995: 35: 121-128

13. Sabbahi M, Khalil M: Segmental H-reflex studies in upper and lower limbs of healthy subjects. Arch Phys Med Rehabil 1990:71: 216-222

14. Sabbahi M, Abdulwahab S: Cervical root compression monitoring by flexor carpi radialis H-reflex in healthy subjects. Spine 1999: 24: 137-141

15. Tarkka IM, Andreo Larsen T: Changes of electrically elicited reflexes in hand and forearm muscles in man. Am J Phys Med 1987: 6: 308-314

16. Deschuytere J, Rosselle N, Dc Keyser C: Monosynaptic reflexes in the superficial forearm flexors in man and their clinical significance. J Neurol Neurosurg Psychiatry 1976: 39: 555-565

17. Deschuytere J, Rosselle N: Clinical uses of the proprioceptive reflexes in the superficial forearm flexors (Abstract). Electroencephalogr Clin Neurophysiol 1975: 39: 301

18. Baldissera F, Campadelli, Cavallari P: Inhibition from radial group I afferents of H-reflex in wrist flexors. Electromyogr Clin Neurophysiol 1983: 23: 187-193

19. Ongerboer de Visser BW, Schimsheimer RJ, Hart AAM: The H-reflex of the flexor carpi radialis muscle: a study in controls and radiation induced brachial plexus lesions. J Neurol Neurosurg Psychiatry 1984: 47: 1098-1101

20. Schimsheimer RJ, Ongerboer de Visser BW, Kemp B: The flexor carpi radialis H-reflex in lesions of the sixth and seventh cervical nerve roots. J Neurol Neurosurg Psychiatry 1985: 48: 445-449

21. Schimsheimer RJ, Ongerboer de Visser BW, Kemp B, Bour LJ: The flexor carpi radialis H-reflex in polyneuropathy: relation to conduction velocities of the median nerve and soleus H-reflex latency. J Neurol Neurosurg Psychiatry 1987: 50: 447-452

22. Panizza M, Lelli S, Hallett M: H-reflex in nonhomonymous muscles in the human forearm. Neurology 1989: 39: 785-788

23. Burke D, Adams RW, Skuse NF: The effects of voluntary contraction on the H-reflex of human limb muscles. Brain 1989: 112: 417-433

24. White JC: The ubiquity of contraction enhanced H reflexes: normative data and use in the diagnosis of radiculopathies. Electroencephalogr Clin Neurophysiol 1991: 81: 433-442

25. Panizza M, Nilsson J, BSEE, Hallett M: Optimal stimulus duration for the H reflex. Muscle Nerve 1989: 12: 576-579

26. , , : . , 2000: 2(2): 110-119

27. : Meta-analysis . 1999