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Correlation Study on H-Reflex with Leg Length in Indian Population

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Abstract

This was a co-relational study done to determine the relationship of H-reflex with leg length and limb length in Indian population. Sixty females between 19-25 years of age were included in the study according to the inclusion criteria. H-reflex of all the subjects having leg length between 27 to 49 cm and limb length ranging from 75-99 cm was recorded. Correlation was derived between H-reflex latency and leg length & H-reflex latency and limb length using Karl Pearson formula. A significant correlation was observed between the H-reflex latency and leg length & and limb length.

Keywords: H-Reflex Latency, Leg Length, Limb Length

Introduction

The H-reflex is a monosynaptic reflex elicited by sub maximal stimulation of the tibial nerve and is recorded from the calf muscle. This reflex involves conduction of impulses from the periphery to and from the spinal cord and occurs at latencies that are considerably longer than the latency of direct motor response. This conduction can occur only with central amplification of the motor response due to reflex activation of motor neurons. The arc of the H-reflex includes conduction in large fast conducting Ia fibers.

H-reflex is extensively used both as a research and a clinical tool *(Wang, 2002).* H-reflex is a sensitive test of poly neuropathies and may be abnormal in mild neuropathies. This can be important in the electrodiagnostic evaluation of radiculopathies even when needle EMG is unrevealing *(Buschbacker, 1999).*

Several factors contribute to H-reflex parameters such as age, gender, body mass index, skin temperature and height *(Buschbacker, 1999; Stetson and Albers, 2002; Scaglioni et al, 2003).* It is found that there is no age influence on H-reflex parameters for subjects in the range of 20 to 40 years of age. Latency of reflex response increases significantly in advanced ages. As far as gender is considered, reflex differences are observed among sexes, due to morphological and functional features, stronger stimulus intensity being necessary for women. Latency for men is longer because men have longer legs *(Peterson, 2005).* The H-reflex latency shows increase with cooling and decreases with warming *(Preston & Shaprio, 1992).* The most important factor affecting H reflex is leg length *(Riccardo et al, 2001).* There is significant correlation found between leg length and H-reflex in normal subjects.

Various studies have been done in this regard, but few studies are done on Indian population. This study will help us to determine the correlation between H

reflex and leg length in normal subjects among Indian population.

Material and Methods

One hundred and two female students studying at Sardar Bhagwan Singh Post Graduate Institute of Biomedical Sciences & Research were chosen as the population of the study. Sixty healthy volunteers participated in the study. Informed consent was obtained from each and every individual.

Before beginning with the procedure, the selected subjects were explained the entire procedure in detail. Leg length was measured between the middle of mid popliteal line and the medial malleolus. Limb length was measured from the most prominent point on anterior superior iliac spine to the medial malleolus. The subject was made to lie prone comfortably on a couch with leg and thigh comfortably supported. The feet were allowed to hang freely with dorsum at right angle to tibia. The resistance of the skin of forearm was reduced using cotton dipped in alcohol. The recording electrodes were placed at the distal edge of the calf muscle and the reference electrode on Achilles tendon. The ground electrode was placed between the stimulation electrodes and the recording electrodes. The tibial nerve was stimulated in popliteal fossa with a submaximal stimulus by the use of bipolar surface electrode. The cathode was kept proximal to the anode to avoid anodal block.

The latency of H-reflex was measured from the stimulus artifact to the first deflection from the baseline and the amplitude was measured from the base to the peak of the negative phases. The stimuli were adjusted so as to evoke maximum H-response amplitude. At this strength a small M-response was also observed sometimes. Attention to M-response helped in monitoring the strength of stimulation. At least five H-responses were studied for analysis.

Karl Pearson correlation was used to analyze the relationship between leg and limb lengths with the H-reflex latency. The significant value was fixed at $p < 0.05$ with confidence interval of 95%.

Results

Table 1 describes the physical characteristics of the subjects. The age of the subjects' ranged between 19-25 years (mean 21.03, SD ± 1.52).

Table 1: Description of the subjects

VARIABLE	MEAN	±SD
Age, yrs	21.03	1.52
Height, meter	1.60	0.91
Weight, kg	54.29	8.89
Body Mass Index	21.28	1.26

Table 2: Correlation between leg and limb length with H-latency

	LIMB LENGTH	H-LATENCY
Leg Length	**1.000***	**0.957***
Limb Length		**0.949***

** Significant at 0.01 level of confidence*

Table 2 enlists the observed values of correlation coefficients of leg length (range 27-49 cm) and limb length (range 75-99 cm) of 60 subjects with H-latency. A very high degree of significant positive relationship was found indicating that H-Latency increased with increase in the leg and limb lengths.

Discussion

This study was designed to analyze the effects of leg length and limb length on H-reflex latency on Indian subjects.

When correlation was drawn between leg length and H-reflex latency, a positive and highly significant correlation (r = 0.957) was obtained meaning that as the leg length increased H-latency also increased. When the correlation was drawn between limb length and H-reflex latency a positive and highly significant correlation (r=0.949) was obtained that indicates that as the limb length increased the H-latency also increased suggesting that as the length of the conduction pathway increased the time taken for excitation to traverse also increased. H-reflex measures the efficacy of synaptic transmission as the stimulus travels in afferent (Ia sensory) fibers through the motor neuron pool of the corresponding muscle to the efferent (motor) fibers. The afferent (sensory) portion of the H-reflex begins at the point of electric stimulation and results in action potentials traveling along afferent fibers until they reach and synapse on α motor neurons (αMNs). The efferent portion of the H-reflex pathway results from action potentials generated by the αMNs, traveling along efferent fibers until they reach the neuromuscular junction and produces an H-reflex, suggesting that as the pathway for reflex arc increases the time taken for excitation of motor neuron pool also increases. This delays the onset of wave and finally affects the H-latency. The findings of the present study are in general agreement with the results of some earlier studies done by *Shahram & Ghavanini (2004) and Riccardo et al (2001).*

Ghavanini & Ghavanini (2001) studied the role of various constitutional factors influencing H-reflex latency. But among them leg length was the only variable strongly correlated with H-reflex latency. There are two methods of measuring leg length. In this study leg length was measured from mid popliteal line to medial malleolus. Another method is to measure from cathode to medial malleolus. The former method has more reliability and reproducibility. *Frank et al (2004)* did a study on H-reflex latency where they found that a high correlation was present between leg length and H-reflex latency. In a study done by *Buschbacker (1999)* it was concluded that there was a significant correlation between height and H-latency. The data of this study supported the concept that there is a significant correlation between leg length and H-latency which is also shown in a study done by *Aminoff (1999).* The findings of this study were interpreted in the light of previous studies and one can say that this study will help to further determine various neurological diseases with different leg lengths and limb lengths. This study will also help in making a normative data for diagnosing various neurological diseases.

Conclusion

From the correlation of variables between the leg length and H-latency a positive and highly significant (r = 0.957) value was obtained. When limb length and H-latency was correlated, a highly significant positive correlation (r = 0.949) was obtained. Out of leg and limb lengths, it was further found that leg length is significantly more related with H-latency than the limb length. It was suggested that alternate statement can be drawn from the conclusion.

a. H-latency is significantly correlated with leg length.

b. H-latency is significantly correlated with limb length.

c. H-latency increases as the leg and limb length increases.

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