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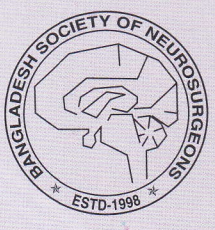

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Original Article

Determination of Sensitivity and Specificity of Hoffmann's Sign in the Diagnosis of Patients with Compressive Cervical Myelopathy

Milton Kumer Saha[1], K Hafiz Uddin[2], Monsur Ahmed[3], Shafiul Alam[4], Asifur Rahman[5], Dhiman Chowdhury[6], M Afzal Hossain[7]

Abstract

Background: *Many signs are used to diagnose a case of cervical myelopathy. Among them Hoffman's sign is very important and it has been in clinical use for approximately one hundred years. The sign is attributed to Johann Hoffmann, professor of Neurology at Heidelberg, Germany in the late nineteenth and early twentieth centuries, a pupil of Erb.*

Objectives: *The objective of this study is determination of sensitivity and specificity of Hoffmann's sign in the diagnosis of patients with compressive cervical myelopathy.*

Materials and Methods:*This study was a cross sectional type of observational study. The study was carried out in the Department of Neurosurgery, Bangabandhu Sheikh Mujib Medical University Hospital during the period of May, 2015 to October, 2016. Total 45 patients were taken as sample and were analyzed.*

Results:*We found the Hoffmann's sign to have sensitivity-61.9%, specificity-33.3%, accuracy-60%, positive predictive value-92.9%, negative predictive value of 5.9%.*

Conclusion:*Hoffmann's sign has a great significance in the diagnosis of patients with compressive cervical myelopathy. But it cannot be used as a single sign for compressive cervical myelopathy.*

Key Words*: Hoffmann's sign, compressive cervical myelopathy, sensitivity and specificity.*

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Introduction

Cervical myelopathy encompasses a range ofsymptoms and examination findings including motor and sensory abnormalities related to dysfunction of the cervical spinal cord. Many signs are used to diagnose a case of cervical myelopathy[1]. Among them Hoffman's sign is very important and it has been in clinical use for approximately one hundred years. Today each neurological and even each complete physical examination includes the test for this sign, because its presence is considered to be an excellent sign of hyperreflexia, similar to the Babinski phenomenon. The sign is attributed to Johann Hoffmann, professor of Neurology at Heidelberg, Germany in the late nineteenth and early twentieth centuries, a pupil of Erb. Hoffmann was reported to demonstrate the sign routinely in lectures and clinics, although he did not discuss it through publication. Hoffmann's assistant, Hans Curschmann, who became professor of Medicine at the University of Rostock, Germany, described the reflex in the literature in 1911, and named it Hoffmann's Sign. It was felt to be a test for disease of the corticospinal pathways. It has also been described as the digital reflex, the snapping reflex, Tromner's sign and Jakobson's sign[2]. The test is performed by supporting the patient's hand so that it is completely relaxed and the fingers are partially flexed. The middle finger is firmly grasped, partially extended, and the nail snapped by the examiner's thumbnail. The sign is

1. Assistant Registrar, Department of Neurosurgery, ShahidZiaurRahman Medical College and Hospital, Bogra
2. Registrar, Department of Clinical Neurosurgery, National Institute of Neurosciences and Hospital, Dhaka
3. Resident Surgeon, Department of Neurosurgery, National Institute of Neurosciences and Hospital, Dhaka
4. Associate Professor, Department of Gamma Knife, National Institute of Neurosciences and Hospital, Dhaka
5. Associate Professor, Department of Neurosurgery, Bangabandhu Sheikh Mujib Medical University, Dhaka
6. Associate Professor, Department of Neurosurgery, Bangabandhu Sheikh Mujib Medical University, Dhaka
7. Professor, Department of Neurosurgery, Bangabandhu Sheikh Mujib Medical University, Dhaka

Address of Correspondence: Dr. Milton Kumer Saha, Assistant Registrar, Department of Neurosurgery, ShahidZiaurRahman Medical College and Hospital, Bogra

present if quick flexion of both the thumb and index finger result[3,].The spinal cord is responsible for sending signals to and receiving signals from the arms and legs. These signals within the spinal cord are responsible for pain, sensation and motor strength in the armsand legs. In some people the compressionof the spinal cord does not lead tosymptoms.On the other hand, spinal cordcompression can cause a complex variety of symptoms. Thus, the diagnosis is made by the presence of the clinical syndrome and compression of the spinal cord[4,5]. Cervical myelopathy is a clinical diagnosis made with imaging confirmation. Cervical myelopathy has no single 'pathognomonic' sign or symptom, the onset is often insidious with long periods of episodic, stepwise progression, and may present with a vast array of clinical findings from patient to patient. Cervical myelopathy is a clinical diagnosis that may involve lower extremities first (with subsequent gait related changes), weakness of the legs, and spasticity. As spinal cord degeneration progresses, lower motor neuron findings in the upper extremities such as loss of strength, atrophy, and difficulty in fine finger movements, may present. Additional clinical findings may include: neck pain, radiating pain, paresthesia in one or both arms or hands, or radiculopathic signs. In addition to identifying the initial presence of myelopathy, selected tests are used in concert with appropriate MRI findings to justify a clinical diagnosis of cervical myelopathy[4]. An MRI is the suggested reference standard with reference to imaging, because it expresses the amount of compression placed on the spinal cord, and demonstrates relatively high levels of sensitivity (79%-95%) and specificity (82%- 88%) in identifying selected abnormalities such as space occupying tumors, disc herniation and ligamentous ossification[5]. Cervical myelopathy can be a progressive process. In most patients it will worsen, then not progress for an extended period, then worsen again. If some of these symptoms are present, even in a mild fashion, and physical signs are noted on the examination, an x-ray and MRI will be ordered[6]. MR imaging depicts the spinal cord directly, assesses its contour and internal signal intensity characteristics reliably and noninvasively. MR imaging is the study of choice in cervical myelopathy whenspondylosis or disc herniation is the most likely cause[7].There are some studies where the significance of Hoffmann's sign was evaluated in relation with MRI in diagnosis of compressive cervical myelopathy. Some variations were observed among the results of those studies[8]. The objective of this study is determination ofsensitivity and specificity of Hoffmann's signin the diagnosis of patients with compressivecervical myelopathy.

Materials and Methods

This study was a cross sectional type ofobservational study.The study was carried out in the Department ofNeurosurgery, Bangabandhu Sheikh Mujib Medical University Hospital during the period of May, 2015 to October, 2016. All patients presenting with clinical features suggestive of cervical myelopathy were included in this study. Patients with history of surgery at same level and with peripheral neuropathywere excluded from the study. Total 45 patients were taken as sample andwere analyzed.Sampling Procedurewas Purposive. Data collection sheet was usedto collect the necessary information. Data were collected and analyzed in theDepartment of Neurosurgery, BangabandhuSheikh Mujib Medical University usingComputer software.Than the results were presented in tables.

Results

Table-I

Distribution of Respondents according to age(n=45)

Age (in years)	Number of patients	Percentage
10	0	0
11-20	3	6.7
21-30	5	11.1
31-40	17	37.8
41-50	9	20
51-60	9	20
>60	2	4.4

Table II

Distribution of patients according to sex (n=45)

Sex	Number of patients	Percentage
Male	33	73.3
Female	12	26.7

Table III

Distribution of the study patients byHoffmann's sign

Hoffmann's sign	Number of patients	Percentage
Positive	28	62.2
Negative	17	37.8

Table IV

Comparison between Hoffmann's signwith age (n=45)

Age (in years)	Hoffmann's sign				P value
	Positive (n=28)		Negative (n=17)		
	N	(%)	N	(%)	
=30	3	10.7	5	29.4	
31-40	12	42.9	5	29.4	
41-50	7	25.0	2	11.8	
51-60	5	17.9	4	23.5	
>60	1	3.6	1	5.9	
Mean±SD	41.7±11.6		41.3±16.2		0.923ns
Range (min, max)	15,65		19,62		

Ns= not significant

P value reached from unpaired T-test

Table V

Comparison between Hoffmann's signwith sex (n=45)

Sex	Hoffmann's sign				P value
	Positive		Negative		
	N	(%)	N	(%)	
Male (n=33)	21	63.6	12	36.4	0.710ns
Female (n=12)	7	58.3	5	41.7	

Ns= not significant

P value reached from chi-square test

Table VI

Comparison between Hoffmann's sign and MRI findings of patients with compressive cervical myelopathy (n=45)

Hoffmann's sign	MRI	
	Positive (n=42)	Negative (n=3)
Positive (n=28)	26 (True positive)	2 (False positive)
Negative (n=17)	16 (False negative)	1 (True negative)

Table VII

Sensitivity, specificity, accuracy, positiveand negative predictive values of the Hoffmann'ssign and MRI findings of patients with compressivecervical myelopathy.

Validity test	Percentage
Sensitivity	61.9
Specificity	33.3
Accuracy	60.0
Positive predictive value	92.9
Negative predictive value	5.9

Discussion

Compressive cervical myelopathy is acommon problem in our population.Many symptoms and signs are observedin this disease. In traditional clinicalpractice, MRI is used to confirm thepresence of compressive cervicalmyelopathy.In this study, all patients presenting withclinical features suggestive of cervicalmyelopathy were included. History andrelevant physical examinations wereevaluated. Then we have examined theHoffmann's sign on each patient.Hoffmann's sign was examined in both handsof the study population and it was takenpositive when it was found positive either inone side or both sides. Then we haveevaluated the sensitivity and specificity ofHoffmann's sign in relation with MRI findingsfor cervical spinal cord compression.The total number of our study population was45. Among them 17.8% (8) of patients werebelow age 30 years, 37.8% (17) in age 31-40years, 20% (9) in age 41-50 years, 20% (9) inage 51-60 years 4.4% (2) above age 60 yearsand mean age was 41.6±13.4 years (Table I). It was found that theaverage age 55 years which showed slightelder prevalence than our mean[3].Our study showed that 33 patients were male amongwhich 63.6 %(21) of patients showed Hoffmann's signpositive and 36.4% (12) showed negative Hoffmann'ssign. 12 patients were female among which 58.3 %(7)patients showed Hoffmann's sign positive and 41.7 %(5)in negative group (Table IV). The difference wasstatistically not significant ($p<0.05$) between two groupswhich is in agreements with the result of the study doneby Ray A. Grijalva (2015).We found the Hoffmann's sign to havesensitivity-61.9%,specificity-33.3%,accuracy-60%,positive predictive value-92.9%,negative predictive value of 5.9% (Table VII).Sensitivity refers to how good

a test is atcorrectly identifying people who have thedisease. When calculating sensitivity we aretherefore interested in only the diseasedgroup of people[9].Sensitivity 61.9% means, the Hoffmann's signcan diagnose 62 patients among 100 patientsof compressive cervical myelopathy andcannot detect 38 patients of compressivecervical myelopathy. Specificity, on the other hand, is concerned withhow good the test is at correctly identifyingpeople who are well[9].The specificity of this study is 33.3%. Means, theHoffmann's sign can correctly identify 33normal people out of 100 disease freepopulation. From these points of views we cansay that, Hoffmann's sign is good in diagnosisof diseased population but not so good toexclude the normal population. The negative predictivevalue observed in our study 5.9 is much lowerthan75% of other study[8].One possible explanation for the false negativefindings is the coexistence of both spinal cord andnerve root pathology. For the Hoffmann's sign to bepresent it may be that the reflex arc of the relevantnerve root needs to be fully functional. Compressionof the root in the foramen, or anywhere along itscourse, may suppress the Hoffmann's reflex, leadingto a false negative finding[8].Our findings indicate that the Hoffmann's signsingly cannot demonstrate values for screeningpurposes not to confirm the diagnosis. Inaddition to identifying the initial presence ofmyelopathy, selected tests were used in concertwith appropriate MRI findings to justify theclinical diagnosis of cervical myelopathy.We have found the sensitivity 61.9% which issignificant for clinical use but the specificity is33.3% which is not significant for clinical use.So only Hoffmann's sign is not diagnostic forcompressive cervical myelopathy rather withother clinical features and imaging it has agreat clinical importance in diagnosingcompressive cervical myelopathy[10,11].

Conclusion

Hoffmann's sign has a great significance in thediagnosis of patients with compressive cervicalmyelopathy. But it cannot be used as a single signfor compressive cervical myelopathy. This simpleexamination, which does not include anyexpensive devices should be used with otherclinical examination in larger population andassess the end result.

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