Effect of Wrist Joint Angle on the Examination of Hoffmann's Sign

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Research Article

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Abstract

Objective

To study the effect of different wrist flexion and extension angles on the results of Hoffmann's sign.

Methods

Thirty-seven patients with cervical spondylotic myelopathy and fifty objectives as control group were examinated at 15° palmar flexion, 0° neutral, 30° back extension, and 60° back extension of the wrist joint to observe Hoffmann's sign.

Results

The patients with cervical spondylotic myelopathy did not present significantly different results of Hoffmann's sign at 0° neutral, 30° back extension, and 60° back extension, but significantly different at 15° palmar flexion ($P<0.05$). In control group, there is no significant difference at 15° palmar flexion, 0° neutral, 30° back extension, but significantly different at 60° back extension ($p<0.05$).

Conclusion

The different angles of wrist flexion and extension present a significant impact on the results of Hoffmann's sign examination. For the patients with cervical spondylotic myelopathy, it is reliable to test Hoffmann's sign at 30° wrist back extension.

Introduction

Hoffmann's sign is one of the pathological signs that reflect the dysfunction of the cortical motor zone or pyramidal tract. The method of examination is that the examiner pronates the examinee's forearm, faces down the palm, and flicks the middle finger nail. If other fingers (mainly the index finger) quickly flex and extend, the Hoffmann's sign is positive[1]. However, this method does not consider the impact of different angles of wrist flexion and extension on the result of Hoffmann's sign. Thus, this study aims to explore examine different angles of the wrist flexion and extension on the results of the Hoffmann's sign of the patients with cervical spondylotic myelopathy and normal people.

Patients

In the cervical spondylotic myelopathy group, there were 37 cases, 21 males and 16 females, aged from 38 to 67 years old, with an average of 51 years old. All patients performed weakness in hand grip, numbness of both upper limbs, unsteady walking, and positive Babinski sign on both lower limbs. Cervical X-ray presented abnormal curvature, narrowed intervertebral space, and bone hyperplasia. MRI confirmed that there was cervical spinal cord compression and signals change. A total of 74 hands were examined on both sides.

There were 50 cases in the normal group, 28 males and 22 females, aged 18-40 years old, with an average of 31 years old. The inclusion criterion: (1) No clinical history of cervical spondylosis; (2) No pain in the neck, no abnormality in limb sensation, muscle strength, muscle tension, muscle reflex, and movement; (3) Voluntary test. A total of 100 hands were examined on both sides.

Methods

Hoffmann's sign examination was performed at 15° palmar flexion, 0° neutral, 30° back extension, and 60° back extension of the wrist joint (when the wrist joint is positioned, the corresponding middle finger naturally flexes or extends with the force).

Statistical analysis

χ^2 test and 2×K χ^2 test were performed to analyze the difference between the results. P 0.05 was considered statistically significant.

Results

In the cervical spondylotic myelopathy group, there were significant differences in the results of Hoffmann's sign under different wrist angles ($\chi^2 = 50.54$, $p < 0.01$). The inspection results at various angles were analyzed using χ^2. There was no significant difference between the inspection results of 0° neutral, 30° back extension, and 60° back extension, but there was a significant difference at 15° palmar flexion ($\chi^2 = 16\ 32$, $P < 0.05$).

The results of the control group were also analyzed by 2×K χ^2. There were significant differences in the Hoffmann sign examination results at different wrist angles ($\chi^2 = 33.16$, $P < 0.01$). The difference between the results of different angles were analyzed by a four-grid χ^2 test. Both 30° back extension and 60° back extension presented a certain positive rate ($\chi^2 = 6.22$, $p < 0.05$). There was the difference between 15° palmar flexion and 0° neutral, 30° back extension (p0.05).

Table 1
Hoffmann's sign examination results at different angles of wrist flexion and extension

Angle	Cervical spondylotic myelopathy(n = 74)		Control group(n = 100)	
	Positive(n)	Rate(%)	Positive(n)	Rate(%)
15° palmar flexion	42	67.0	0	0
0° neutral	65	87.8	0	0
30° back extension	68	91.9	2	2.0
60° back extension	75	95.9	12	12.0

Discussion

The influence of different wrist flexion and extension angles on Hoffmann's sign is determined by the its' pathological mechanism. When the middle finger nail is plucked, the deep flexor muscle of the middle finger is pulled quickly. The stretch receptor muscle spindles in the muscle receive the stimulation and transport it into the gray matter of the spinal cord through the afferent nerve. The α cells in the gray matter emit impulses through the efferent nerve to finger deep flexors. Under normal circumstances, due to the regulation of upper neurons, the above processes generally do not cause muscle contraction. Once the motor area of the large cortex or the pyramidal tract is damaged, the inhibition from the upper neurons is weakened or disappears, which will cause deep flexor muscles to contract[2]. From the above process, it can be seen that Hoffmann's sign is essentially a hyper-stretch reflex, which can be affected by many factors, resulting in false positives or false negatives. Different wrist flexion and extension angles have different initial lengths of the deep finger flexor muscles, which will affect the tension of the deep finger flexors. When the fibers in the muscle spindle are stretched and become longer, the muscle spindle firing impulse will increase. Otherwise, the impulse will be reduced. The frequency is proportional to the degree to which the muscle spindle is stretched. Sometimes when Hoffmann's sign is checked for patients with cervical myelopathy, flexion contraction occurs just after raising the wrist and fingers without flicking the middle finger, which is the manifestation of this mechanism. Therefore, when the wrist joint back extension, the deep flexor muscle tension increases and the sensitivity of the muscle spindle increases, resulting in an increase in the false positive Hoffmann sign. On the contrary, the false negative rate of Hoffmann sign will increase. The greater the wrist back extend, the greater the deep flexor muscles tend, which will cause the higher false positive rate. In fact, different people have great differences in their maximum back extension and flexion angles, which determine the difference in the effect of different angles on the tension of the deep flexors. When the wrist back extension reachs 30°, the tension of the deep flexor muscles of the fingers is in a natural state. At the same time, it should also be considered that the muscle tension of the deep digits is also affected by the flexion of the fingers. The degree of flexion and extension of the fingers during the Hoffmann sign examination is generally changed with the angle of the wrist joint.

Hoffmann's sign is far more than the present understanding of most clinicians. Some doctors specifically perform a large back extension of the wrist for examination, which will definatly lead to different results. According to the results of Hoffmann's sign at different angles of wrist flexion and extension of the two groups of people in this study, there is a significant difference in the effect of increasing the angle of the wrist back extension to 60° and less than 30° on the test results in normal people, which can be considered to increase the false positive rate. There is no significant difference when the angles of the wrist joint back extension is 30° and less than 30° in patients with cervical spondylotic myelopathy. The results of Hoffmann's sign showed no significant difference in the neutral position and back extension of the wrist. It was significantly different when the neutral position and back extension of the wrist were compared to the wrist flexion. It can be considered that wrist flexion increased the false negative rate.

Thus, the examination of the two groups at 30° wrist back extension is able to reflect relatively accurate result of Hoffmann's sign.

Nevertheless, the results under different wrist flexion and extension angles can be used as a reference. After all, the sensitivity of the Hoffmann's sign is increased when the wrist joint is extended, and the specificity of the sign is increased if the Hoffmann's sign is positive when the wrist is flexed. It is can not be ignored is when judging its specificity, other factors that affect the results of Hoffmann's sign examination should also be considered. For example, healthy people with active reflexes may be positive, but this situation is mostly bilateral symmetrically positive. Another example is the compression of different spinal cord segments of cervical spondylotic myelopathy may produce different Hoffmann sign examination results. The level of the spinal cord that innervates the finger flexor is between C7 and T1. The American Spinal Injury Association established the neurological and functional grading standard for spinal cord injury in 1992. The deep finger flexor is the key muscle reflecting the C8 spinal cord. If the spinal cord segment is damaged, the reflex arc of the stretch reflex is interrupted, and the Hoffmann sign will have a negative result. If the compression range of the spinal cord is at the level of the c3-c6, and the Hoffmann sign test will be positive. If the spinal cord is compressed or damaged at the level of the c7 to T1, the Hoffmann sign may have a negative result.

Declarations

Ethics approval and consent to participate

There was no objection from the institutional ethical committee for the above study.

Consent for publication

All authors are consent for publication.

Availability of data and materials

All data and materials are available.

Competing interests

The authors declare that they have no confict of interest.

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