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THE CORRELATION BETWEEN CERVICAL PROVOCATION TESTS AND COMPRESSION SEVERITY IN EMG FINDINGS OF CERVICAL ROOT SYNDROME PATIENTS

Farah Shabri Alifia Zahra[1*], Shahdevi Nandar Kurniawan[2], Alfred Julius Petrarizky[3]

***Correspondence**: farah.shabri@student.ub.ac.id*
[1]Faculty of Medicine, Universitas Brawijaya, Malang, Indonesia
[2]Department of Neurology, Saiful Anwar General Hospital, Malang, Indonesia
[3]Department of Radiotherapy, Saiful Anwar General Hospital, Malang, Indonesia

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ABSTRACT

Background: Medical professionals are often found using cervical provocation tests and Electromyography (EMG) examination to diagnose Cervical Root Syndrome (CRS). Although EMG examinations are unavailable in primary health care facilities due to the lack of equipment, the results of cervical provocation tests are expected to correlate with the findings of the EMG examination.
Objective: This study aimed to investigate the correlation between cervical provocation tests (Lhermitte and Spurling) and compression severity of CRS.
Methods: 85 medical records that met the inclusion and exclusion criteria were selected using a stratified random sampling method. Subsequently, cervical provocation tests were scaled ordinal, stratified into negative, positive 1, and positive 2, while compression severity was grouped into mild, moderate, and severe. The data obtained was analyzed using SPSS, and correlation analysis was conducted using the Spearman method.
Results: The result showed that cervical provocation tests had a very weak negative correlation with the CRS compression severity, and the values obtained were not statistically significant (R = -0.105 and p = 0.341).
Conclusion: The results showed that there was no significant correlation between cervical provocation tests and CRS compression severity. Therefore, cervical provocation tests cannot be depended on as a representation of CRS compression severity.

Keywords: cervical root syndrome, electromyography, ihermitte test, provocation test, spurling test

Introduction

Neck or cervical pain is experienced from the top line of the shoulder to the skull's base. Pain in this region is a prevalent issue globally, with an average yearly prevalence of 37.2%. Based on recent estimations, neck pain is ranked fourth as the cause of disability, occurring due to trauma, muscle tenderness, nerve compression, irritation, as well as malposition of the head and neck.[1–3] Cervical Root Syndrome (CRS) is one of the causes of neck pain, which includes various symptoms such as pain and paresthesia, muscle spasms, sensory and motoric deficits in the cervical region spreading to certain parts of shoulders and arms according to the distribution of dermatomes. This pain associated with CRS is neurogenic, resulting from compression of the cervical nerve root by a disc or part of the vertebra. According to Kang et al. (2020), the prevalence of CRS is 83.2 per 100.000 people, with male domination. To diagnose CRS, several examinations are required, namely anamnesis, physical, radiological, and Electromyography (EMG) examination.[1,3,4,5]

Physical examination on suspected CRS is carried out by conducting provocation tests, such as the Lhermitte, Spurling, cervical distraction, and Valsalva

test. However, before considering an EMG examination, there is a need for good history taking and physical examination.[1,7–9] This EMG examination plays a significant role in the diagnosis of CRS, assessing compression severity, and facilitating an accurate diagnosis.[7,8]

According to the Indonesian Association of Neurologists (PERDOSSI) (2016), primary healthcare facilities have been authorized in CRS cases to diagnose, provide treatment, and refer patients to higher healthcare facilities. However, primary healthcare facilities can only carry out simple laboratory-supporting examinations to establish the diagnosis of diseases.[10] EMG examination also requires a substantial amount of money, adequate facilities, and special skills of the examiner. Based on patients' perspectives, an EMG examination is an invasive procedure that can cause discomfort and often requires a substantial amount of time. Consequently, provocation tests are an essential tool for establishing the diagnosis of CRS, representing EMG results.[11] Therefore, this study aimed to investigate the relationship between cervical provocation tests and compression severity in patients with CRS.

Methods

This retrospective analytical observational study used a cross-sectional method to determine the correlation between cervical provocation tests and compression severity. The analysis used secondary data from patients' medical records at Dr. Saiful Anwar Hospital Malang.

Population and Sample

The study population included cervical root syndrome (CRS) patients at Dr. Saiful Anwar Hospital Malang, who were selected through stratified random sampling. This method divided the population into smaller groups based on cervical provocation tests: negative, positive 1, and optimistic 2. Subsequently, some representatives were randomly selected from each group, resulting in a total sample size of 85.

The sample inclusion criteria were patients diagnosed with CRS through examination and supported by EMG findings in the Neurology Department Saiful Anwar General Hospital, with medical records containing Lhermitte, Spurling, and EMG test results. The exclusion criterion was CRS patients with another disease capable of altering provocation results and EMG tests, such as hemiparesis, acute trauma to the cervical region and arms, brachial plexus injury, diabetic polyneuropathy, etc. Additionally, the exclusion criteria were CRS patients with expected EMG results.

Cervical Provocation Tests

Cervical provocation tests are part of a physical examination to induce pain in the region innervated by specific cervical-level nerves.[11,12] The Lhermitte test is carried out by flexing the neck, while Spurling is performed by passively extending the neck with rotation and flexion toward the affected side.[13] In this study, cervical provocation tests were measured using Lhermitte and Spurling tests, with the results showing

a. Negative: Both Lhermitte and Spurling tests are negative.
b. Positive 1: One of the Lhermitte or Spurling tests is positive.
c. Positive 2: Both Lhermitte and Spurling tests are positive.

Compression Severity

Compression severity is the degree of nerve compression observed from the EMG findings. This variable is divided into ordinal scales consisting of mild, moderate, and severe.

a. Mild: Neuropraxia and demyelinated injury.
b. Moderate: Axonotmesis, conduction block, and axonal damage.
c. Severe: Neurotmesis, complete conduction block.

Data Analysis

The results obtained from the study were meticulously processed and extensively analyzed using the Statistical Product and Service Solution Software (SPSS) to ensure accuracy and reliability. After the data analysis phase was completed, the Spearman correlation test was subsequently applied to examine, measure, and establish the potential relationship or connection between the two variables being investigated, providing a comprehensive understanding of their association.

Results

Characteristics of the Research Subject

The detailed characteristics of the study subjects were categorized based on their sex and age range, with the corresponding results comprehensively displayed in Tables 1 and 2.

Table 1. Sex Analysis of Research Subjects

Sex	Sum	Percent
Males	36	42,4%
Females	49	57,6%
Total	85	100%

Table 2. Age Range Analysis of Research Subjects

Age Range	Sum	Percent
<30 years old	8	9,4%
30-39 years old	8	9,4%
40-49 years old	15	17,6%
50-59 years old	30	35,3%
60-69 years old	16	18,8%
≥70 years old	8	9,4%
Total	85	100%

Table 1 showed that females dominated CRS cases with 49 patients (58%). According to age distribution in Table 2, 30 (35.3%) of CRS patients were 50-59 years, followed by 60-69 years consisting of 16 (18.8%), and 40-49 years had 15 patients (17.6%).

Descriptive Analysis of Cervical Provocation Tests and Compression Severity

Table 3. Cervical Provocation Tests Result and Compression Severity Analysis

Result	Compression Severity			
	Mild	Moderate	Severe	Total
Negative	20	8	1	29
Positive 1	21	5	1	27
Positive 2	23	6	0	29
Total	64	19	2	85
	(75,3%)	(22,35%)	(2,35%)	

Table 3 shows the correlation analysis between provocation tests and compression severity. Among 29 samples with negative results, 20 had mild compression, eight were moderate, and one experienced severe compression. Additionally, out of 27 samples with positive one result, 21 were mild, five were moderate, and 1 experienced severe compression. Positive two results had 29 samples in total, where 23 were mild, and 6 had moderate compression.

Correlation Analysis of Cervical Provocation Test and Compression Severity

Correlation analysis between cervical provocation tests and compression severity was performed using Spearman. This analysis was carried out to establish the correlation between CRS compression severity and cervical provocation tests such as Lhermitte and Spurling.

The result showed a correlation coefficient of -0.105, indicating a weak relationship between the two variables. This suggested the compression severity would decrease as the cervical provocation tests variable increased. However, its significance value was 0.341 (α=0.05), indicating an insignificant relationship between the two variables. This showed that there was no correlation between cervical provocation tests and CRS compression severity.

Discussion

This analytical observational study was conducted retrospectively with a cross-sectional method to determine the relationship between cervical provocation tests (Lhermitte and Spurling) and Cervical Root Syndrome (CRS) compression severity. A previous study has shown that the prevalence of CRS reached 83,2 per 100,000 people with male domination.[4] However, this study showed a dominance of female cases, accounting for 49 (57.6%) among 85 samples, and the remaining 36 (42.4%) were males. The difference in results is attributed to a shift in the trend of CRS patients in the last decade. Another cause is the difference in population compared to the previous study.

According to national data released by the Badan Pusat Statistik (BPS) (2022), in Indonesia, the percentage of females over 50 is higher than males in the same age range.[14] Kang et al. (2020) stated that the peak age of experiencing CRS is 50-54.[4] Therefore, in the study conducted in Malang, Indonesia, the number of females whose age is at the peak of CRS incidence (50-54 years old) is more than males. This shows the need for an in-depth investigation of the epidemiology of CRS, specifically in Indonesia. Data from BPS (2022) shows the sex ratio of those experiencing disease complaints and receiving outpatient treatment. The results show more females (44,03%) than males (42,01%) seeking treatment when experiencing health problems.[14] Consequently, the population and sample of this study were dominated by females.

Economic and socio-cultural factors contribute to the variations in results. According to WHO and the Ministry of Health, disability is a risk factor for injury, predominantly prevalent in Indonesia among those who are poor, less educated, elderly, and female.[15] Furthermore, the females' education is lower than males, [14,] which contributes significantly to a higher prevalence of disability. Neck pain is also a significant risk factor, ranking fourth among the highest disease-causing disability globally.[2]

Based on the analysis of sample characteristics, CRS patients showed various ages, ranging from less than 30 years to over 70 years. Additionally, the highest age range for CRS was 50-59 years, consistent with previous studies where the peak incidence was in the fifth decade of life.[4]

Correlation analysis between the cervical provocation test and compression severity showed no significant relationship between both variables. This was shown by the significance value of the correlation of two variables, which was 0.341 (α=0.05). A value exceeding 0.05 confirmed the insignificance of the relationship despite the presence of an inversely related correlation value (-0.105).

This suggested that a more favorable result in provocation tests did not indicate lower compression severity and vice versa. The variation in result could occur due to the low sensitivity and high specificity of the Spurling test in establishing the diagnosis of CRS.[8] This phenomenon resulted in the Spurling test tending to give accurate negative results for people who did not have CRS and false negative results for those positive for CRS.

Another factor contributing to the lack of correlation between cervical provocation tests and CRS compression severity is the inability to distinguish acute from chronic CRS. The acute phase of CRS has a higher tendency to show a positive Spurling test due to an escalated inflammatory process facilitated by inflammatory markers, potentially leading to pain. In the chronic phase, the inflammatory process has been reduced, and the pain has regressed. This statement is highly supported by the result of chronic CRS, which has a sensitivity value of 14.7% in the Spurling test, while acute CRS is at 46.51%. Consequently, several chronic CRS cases do not show positive results on the Spurling test.[16–18]

The lack of correlation in this study is attributed to the timing of the EMG examination, which shows positive when there are active changes—performing an EMG test before denervation has occurred or after reinnervation is complete results in a negative outcome.[17,19] According to Jinringht et al. (2021), in the diagnosis of cervical radiculopathy, EMG is considered to have high specificity yet moderate sensitivity.[20]

This study's limitations include using medical records as the data source. This phenomenon results in certain uncontrollable variables, such as the lack of standards in executing provocation tests. Consequently, the results of provocation tests conducted on the same patients might vary depending on the examiner.

Conclusion

In conclusion, this study showed that there was no significant correlation between cervical provocation tests and CRS compression severity among patients. The results showed a correlation coefficient -0.105 and a significance value of 0.341. Consequently, cervical provocation tests cannot be depended on as a representation of CRS compression severity.

Based on the results, further studies were recommended to investigate the relationship between cervical provocation tests and CRS compression severity, considering several factors. These included the nature of CRS based on time (acute or chronic), sensory or motor nerve root compression, the level and number of compressed vertebrae, and unilateral or bilateral compression. Furthermore, primary data should be considered to reduce biases by controlling certain factors.

Declaration of Interests

The authors declare that no conflict of interest could potentially bias the results or influence the interpretation. This study was conducted without financial support from any external organization, government agency, or private entity.

References

1. Runtuwene T. Assesmen Nyeri Leher. In: Purwata TE, Emril DR, Yudiyanta, editors. Nyeri Leher. Medan: Pustaka Bangsa Press; 2017. p. 22–37.
2. Cohen SP. Epidemiology, Diagnosis, and Treatment of Neck Pain. Mayo Clin Proc [Internet]. 2015 Feb;90(2):284–99. Available from: http://www.ncbi.nlm.nih.gov/pubmed/25659245
3. Anwar Y. Patomekanisme Nyeri Leher Muskuloskeletal. In: Purwata TE, Emril DR, Yudiyanta, editors. Nyeri Leher. Medan: Pustaka Bangsa Press; 2017. p. 38–43.
4. Kang KC, Lee HS, Lee JH. Cervical Radiculopathy Focus on Characteristics and Differential Diagnosis. Asian Spine J. 2020;14(6):921–30.
5. Mansfield M, Smith T, Spahr N, Thacker M. Cervical Spine Radiculopathy Epidemiology: A Systematic Review. Musculoskeletal Care. 2020 Dec 25;18(4):555–67.
6. Sleijser-Koehorst MLS, Coppieters MW, Epping R, Rooker S, Verhagen AP, Scholten-Peeters GGM. Diagnostic Accuracy of Patient Interview Items and Clinical Tests for Cervical Radiculopathy. Physiotherapy [Internet]. 2021 Jun 1;111:74–82. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0031940620303 93X
7. Preston DC, Shapiro BE. Electromyography and Neuromuscular Disorders: Clinical-Electrophysiologic Correlations. 4th ed. London: Elsevier; 2020.
8. Iyer S, Kim HJ. Cervical radiculopathy. Curr Rev Musculoskelet Med. 2016 Sep 1;9(3):272–80.

9. Popescu A, Lee H. Neck Pain and Lower Back Pain. Medical Clinics of North America. 2020 Mar;104(2):279–92.
10. Perhimpunan Dokter Spesialis Saraf Indonesia. Panduan Praktik Klinis Neurologi. 2016.
11. Childress MA, Becker BA. Nonoperative Management of Cervical Radiculopathy. I am a FAM physician. 2016 May 1;93(9):746–54.
12. Corey DL, Comeau D. Cervical Radiculopathy. Medical Clinics of North America. 2015 Jul;98(4):791–9.
13. Saini A, Mukhdomi T. Cervical Discogenic Syndrome. StatPearls Publishing; 2022. 1–12 p.
14. Badan Pusat Statistik. Perempuan dan Laki-laki di Indonesia 2022. Chamami A, Sahara I, editors. Jakarta: Badan Pusat Statistik; 2022.
15. World Health Organization. State of Health Inequality: Indonesia. Geneva; 2017.
16. Peene L, Cohen SP, Brouwer B, James R, Wolff A, Van Boxem K, et al. Cervical Radicular Pain. Pain Practice [Internet]. 2023 Sep 4;23(7):800–17. Available from: https://onlinelibrary.wiley.com/doi/10.1111/papr.13252
17. Li JM, Tavee J. Electrodiagnosis of Radiculopathy. In: Levin K, editor. Handbook of Clinical Neurology. 3rd ed. Elsevier; 2019. p. 305–16.
18. Wang T. Validity of The Spurling Test in The Diagnosis of Cervical Radiculopathy: A Systematic Review. Res Sq. 2022.
19. Thoomes EJ, van Geest S, van der Windt DA, Falla D, Verhagen AP, Koes BW, et al. Value of Physical Tests in Diagnosing Cervical Radiculopathy: A Systematic Review. The Spine Journal. 2018 Jan;18(1):179–89.
20. Jinright H, Kassoff N, Williams C, Hazle C. Spurling's test – Inconsistencies in Clinical Practice. Journal of Manual & Manipulative Therapy. 2021 Jan 2;29(1):23–32.