

Jolt accentuation of headache in diagnosis of acute meningitis

Zohreh Aminzadeh*, Amir Roudgari

Infectious Diseases and Tropical Medicine Research Center, Shahid Beheshti University, M.C., Tehran, Iran

ABSTRACT

Background: Optimal use of the clinical examination aids physicians in identifying patients at risk for meningitis. The low specificity of the meningeal signs may be due to the presence of cervical arthritis and spondylosis. One of the most sensitive maneuvers in the diagnosis of meningitis is jolt accentuation of headache.

Patients and methods: A descriptive research was performed on suspected acute meningitis patients. The patients were evaluated for presence of meningeal signs before lumbar puncture. Sensitivity, specificity, positive and negative predictive values, likelihood-ratio-positive (LR+), and likelihood-ratio-negative (LR-) were determined. A p-value of <0.05 was considered to be statistically significant.

Results: Totally, 14 patients were evaluated. Neck stiffness, Kernig, Brudzinski and jolt accentuation sign were positive in 78.6%, 14.3%, 14.3%, and 64.3% of patients, respectively. The prevalence, sensitivity, specificity, PPV, NPV, LR+, and LR- of neck stiffness in comparison with pleocytosis was 50%, 100%, 57%, 70%, 100%, 2.33, and 0, respectively. The prevalence, sensitivity, specificity, PPV, NPV, LR+, and LR- of jolt accentuation sign in comparison with neck stiffness was 78.5%, 82%, 60%, 100%, 60%, 0, and 0.18, respectively, however, when jolt accentuation sign was compared with pleocytosis these parameters were 50%, 100%, 71.5%, 78%, 100%, 1, and 0, respectively.

Conclusion: When evaluating suspected cases of meningitis with limitations for neck stiffness examination, we can alternatively evaluate jolt accentuation sign. The LR- of 0.18 for jolt accentuation sign when compared with neck stiffness revealed that jolt accentuation sign is an appropriate maneuvers in the diagnosis of meningitis.

Keywords: Meningitis, Neck stiffness, Pleocytosis, Jolt accentuation sign.

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INTRODUCTION

As early as the 5th century BC clinicians recognized the seriousness of bacterial meningitis (1). In the 20th century, the annual incidence of bacterial meningitis ranges from approximately 3 per 100,000 populations in the United States (2), to 45.8 per 100,000 in Brazil (3), and 500 per 100,000 in the "meningitis belt" of Africa (4). Despite the availability of antibacterial therapy, meningitis-

related case-fatality rates remain high, with a 17% all-cause mortality rate between 1980 and 1988 reported for community-acquired and nosocomial bacterial meningitis among patients aged 16 years and older (5). Among previously healthy patients who survive pneumococcal meningitis, up to 18% may experience long-term sequelae including gait ataxia, dizziness, and excessive fatigue (6). Clinical symptoms and signs at presentation may predict prognosis (7). Thus, early clinical recognition of meningitis is imperative to allow clinicians to efficiently complete further investigations and initiate appropriate therapy with a goal of

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Reprint or Correspondence: Zohreh Aminzadeh, MD.

Infectious Diseases and Tropical Medicine Research Center
Shahid Beheshti University, M.C., Evin, Tehran, Iran.

E-mail: zohrehaminzadeh@yahoo.com

minimizing these adverse outcomes. Optimal use of the clinical examination aids physicians in identifying patients at sufficient risk for meningitis to require further definitive diagnostic testing with a lumbar puncture. Patients in whom meningitis is suspected require this invasive procedure to effectively establish or rule out the diagnosis (7). The frequency with which patients presented with the classic clinical triad of fever, neck stiffness, and a change in mental status (or headache) was assessed in 3 studies (8). Although the sensitivity for the presence of all 3 symptoms was low, 95% of patients had 2 or more symptoms (8) and 2 studies reported between 99% and 100% of patients had at least one of these clinical findings (5,9). Thus, the diagnosis of meningitis may be effectively eliminated in adult patients presenting without any of the symptoms of fever, neck stiffness, or a change in mental status.

Neck stiffness is also a relatively useful clinical finding, with a pooled sensitivity of 70%. Kernig sign had a sensitivity of 57%, while Brudzinski sign had a sensitivity of 97% and the contra lateral reflex sign had a sensitivity of 66% (10). Totally, 13% of the acute-care patients and 35% of the geriatric patients had nuchal rigidity despite the absence of meningitis. Kernig sign was present in 1.5% of the acute-care and 12% of the geriatric populations. The low specificity of the meningeal signs may be due to the frequent presence of spondylosis and cervical arthritis among older patients (11).

One of the most sensitive maneuvers in the diagnosis of meningitis is jolt accentuation of headache (12). Jolt accentuation of headache has had a sensitivity of 97% and specificity of 60%. Jolt accentuation is achieved by asking the patient to turn his or her head horizontally at a frequency of 2 to 3 rotations per second. Worsening of a baseline headache represents a positive sign (12,13).

Thus, there is under diagnosis of meningitis in adult patients presenting without any of the

symptoms of fever, neck stiffness, or a change in mental status. The aim of this study was to determine prevalence, sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), likelihood-ratio-positive (LR+), and likelihood-ratio-negative (LR-) of jolt accentuation of headache in comparison with neck stiffness and CSF pleocytosis.

PATIENTS and METHODS

It was a descriptive study. All patients in whom acute meningitis was suspected were enrolled if aged at least 14 years. Physical examination was achieved with special attention towards meningeal signs and symptoms including neck stiffness, Kernig, Brudzinski signs and jolt accentuation of headache (10,12,14). Patients were evaluated for the presence of these meningeal signs before lumbar puncture. Those with mental status abnormalities or focal neurological findings were excluded.

SPSS software (version 11.5, SPSS Inc., Chicago, USA) was used for data analysis and determination of sensitivity, specificity, positive and negative predictive values, likelihood-ratio-positive, and likelihood-ratio-negative. A p-value of <0.05 was considered to be statistically significant.

RESULTS

Study population included 6 males and 8 females with the mean age of 28.5 ± 12.5 years. Demographic data of patients are shown in table 1.

Neck stiffness, Kernig sign, Brudzinski sign and jolt accentuation of headache were found in 11(78.6%), 2(14.3%), 2(14.3%), and 9(64.3%) patients, respectively. There was a significant association between positive neck stiffness with positive jolt accentuation sign ($p < 0.05$), since 9 patients with positive neck stiffness showed positive jolt accentuation sign and 3 patients with

negative neck stiffness showed negative jolt accentuation sign. However, there was no significant association between jolt accentuation sign and either Kernig or Brudzinski signs.

Ratio of CSF to serum glucose was less than 50% in three (21.5%), while it was 50-60% in 3 (21.5%), and above 60% in 8 (57%) patients. This ratio was not significantly associated with jolt accentuation sign. Furthermore, no significant association was found between jolt accentuation sign and the level of CSF protein.

The prevalence, sensitivity, specificity, PPV, NPV, LR+, and LR- of neck stiffness in comparison with pleocytosis was 50%, 100%, 57%, 70%, 100%, 2.33, and 0, respectively. The prevalence, sensitivity, specificity, PPV, NPV, LR+, and LR- of jolt accentuation sign in comparison with neck stiffness was 78.5%, 82%, 60%, 100%, 60%, 0, and 0.18, respectively, however, when jolt accentuation sign was compared with pleocytosis these parameters were 50%, 100%, 71.5%, 78%, 100%, 1, and 0, respectively.

Table 1. Demographic data of patients with suspected acute meningitis

Temperature (°C)	38.6±0.7
Systolic blood pressure (mmHg)	122.0±15.5
Diastolic blood pressure (mmHg)	75.0±8.5
Respiratory rate (/min)	16.3±2.5
Pulse rate (/min)	91.5±8.5
Duration of fever (hr)	48.9±60.8
Duration of headache (hr)	46.3±60.0
CSF White Blood Cell count (/ml)	249.5±380.0
CSF Protein (mg/ml)	46±65
CSF glucose (mg/ml)	74.9±36.2
CSF poly morphonuclear (PMN) (/ml)	26.0±38.4
CSF to serum glucose ratio	0.61±0.15

DISCUSSION

The meningeal inflammation elicit a protective reflex to prevent stretching of the inflamed nerve roots, which is detectable clinically as nuchal rigidity or Kernig or Brudzinski signs (10,15), however, it is associated with cranial nerve palsies

and headache (16). If the inflammatory process progresses to cerebral vasculitis or causes cerebral edema and elevated intracranial pressure, then alterations in mental status, vomiting, headache, seizures, and cranial nerve palsies may ensue (17). CSF evaluation is the single most important route of the laboratory diagnosis of meningitis (18). In this research, there was neck stiffness, Kernig, Brudzinski and jolt accentuation of headache in 11(78.6%), 2(14.3%), 2(14.3%), and 9(64.3%) of patients, respectively. There was a significant association between positive neck stiffness and jolt accentuation sign.

As noted in our research, the sensitivity of neck stiffness as compared with CSF pleocytosis was 100%. It is in agreement with Thomas (18) study. The specificity of neck stiffness as compared with pleocytosis is 57%. Meanwhile, the positive predictive value of neck stiffness in comparison with pleocytosis was 70%. In other words, if neck stiffness is positive in suspected meningitis patients, CSF pleocytosis reports in 70%. The negative predictive value of neck stiffness is 100%. This means that if neck stiffness is negative there is a 100% chance of negative CSF pleocytosis in suspected meningitis patients. Thomas reported a NPV of 100%, too (18).

In our setting, likelihood-ratio-positive and negative of neck stiffness were 2.33 and 0, respectively. It means that neck stiffness is the best sign in diagnosis of meningitis.

Moreover, sensitivity and specificity of jolt accentuation sign in comparison with neck stiffness was 82% and 60%, respectively. PPV of jolt accentuation sign in comparison with neck stiffness was 100%. In other words if jolt accentuation sign is positive in a suspected meningitis patients, neck stiffness will be positive, too. NPV of jolt accentuation sign in comparison with neck stiffness was 60%, hence, in suspected meningitis patients, if jolt accentuation sign is negative there is a 60% chance of negative neck stiffness sign. Likelihood-ratio-positive and -negative of jolt accentuation

sign were 0 and 0.18, respectively, thus, jolt accentuation sign is an appropriate sign.

Finally, the sensitivity, specificity and PPV of jolt accentuation sign in comparison with CSF pleocytosis were 100%, 71.5%, and 78%, respectively. Thus, if jolt accentuation sign is positive in suspected meningitis patients, CSF pleocytosis will be positive in 78%. On the other hand, NPV of jolt accentuation sign in comparison with CSF pleocytosis was 100%, hence, in suspected meningitis patients, if jolt accentuation sign is negative there is a 100% chance of negative CSF pleocytosis. Likelihood-ratio-positive and -negative of jolt accentuation sign were 1 and 0, respectively. Therefore, jolt accentuation sign is an appropriate sign.

In conclusion, according to 100% PPV of jolt accentuation sign in comparison with neck stiffness and 100% NPV of jolt accentuation sign in comparison with CSF pleocytosis, in suspected cases of meningitis evaluation of jolt accentuation sign will be helpful if examination of neck stiffness is impossible. Meanwhile, with respect to LR+ and LR- of jolt accentuation sign it is an appropriate maneuver for diagnosis of patients in whom meningitis is suspected.

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