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Meningeal Signs – It's Validity in Suspected Meningitis

Kumar M[1*], Das B[2] and Kumar D[2]

Abstract

Background: Meningitis, an inflammation of meninges, a common medical emergency. Meningeal signs like Kernig's sign, Brudzinski's sign, and neck rigidity are used specifically to assess a patient's with suspected meningitis. However, these signs are not pathognomonic for meningitis. The aim of study is to validate the meningeal signs in 75 adults with suspected meningitis.

Methods: Seventy-five patients admitted to our tertiary hospital with suspected meningitis were selected and divided into two groups: Patients with meningitis (n=62) and Patients without meningitis (n=13). Meningitis was considered to be present if the CSF WBC count was ≥ 6/cmm. The three meningeal signs Kernig's sign, Brudzinski's sign and nuchal rigidity noted in each patient prior to lumber puncture. The sensitivity, specificity and P-value calculated.

Results: Demography and clinical presentation of patients with meningitis (n=62) were similar to those without meningitis (n=13). Meningeal signs - Of the 62 patients with meningitis (WBCs/cmm of CSF ≥ 6) who were examined prior to lumbar puncture, neck rigidity in 46 (74.2%), Kernig's sign in 37 (59.68%) and Brudzinski's sign in 18 (29.03%) patients. None of the meningeal signs shown to have statistical significance (P<0.001). Kernig's sign had a sensitivity of 60% and specificity, 85% whereas Brudzinski's sign had 29% and 92% respectively. Sensitivity and specificity for nuchal rigidity were 74% and 77% respectively.

Conclusion: Our study suggest that Kernig's and Brudzinski's signs are not sensitive for detecting meningitis and therefore, if not present, it can't exclude the diagnosis of meningitis. Nuchal rigidity is the only meningeal sign with clinical usefulness.

Keywords

Meningeal signs; Diagnostic; Meningitis

Introduction

Meningitis, an inflammation of meninges, is life-threatening medical emergency. Quick and accurate evaluation by history and clinical examination is helpful to make a diagnosis of meningitis and starting early treatment. Kernig's sign, Brudzinski's sign, and neck rigidity are three bedside diagnostic signs used specifically to assess a patient's with suspected meningitis. The presence of these signs, however, is not pathognomonic for meningitis.1 the aim of study is to determine the validity of Kernig's sign, Brudzinski's sign, and neck rigidity for meningitis in 75 adults with suspected meningitis.

***Corresponding author:** Munish Kumar, Assistant Professor, Department of Neurology, Sri Krishna Medical College, Muzaffarpur, Bihar, India, Tel: 9102556521; E-mail: munishpmch@gmail.com

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Materials and Method

The study conducted between February 2016 and February 2017 at Sri Krishna Medical College and Hospital, Muzaffarpur, Bihar (India), a tertiary care center, in 62 patients had meningitis, were compared with 13 patients without meningitis after prior consent and ethical approval. The diagnosis of meningitis was made on the basis of clinical symptoms and signs like headache, fever, nausea, vomiting, nuchal rigidity, presence of Kernig's and/or Brudzinski's sign, altered sensorium, any focal neurological deficit with no other general medical condition explaining them. Patients were divided into two groups:

Group A - Patients with meningitis (n=62)

Group B - Patients without meningitis (n=13)

Patients with "no meningitis" had clinical symptoms and signs of meningeal irritation but normal cerebrospinal fluid findings and diagnosis other than meningitis made. Meningitis was considered to be present if the CSF WBC count was ≥ 6 WBCs/cmm. The three classic meningeal signs Kernig's sign, Brudzinski's sign, and nuchal rigidity noted in each patient prior to lumber puncture [1].

Clinical methods used to elicit the meningeal signs

1. **Kernig's sign 2** -Patient is kept in supine position, hip and knee are flexed to a right angle, and then knee is slowly extended by the examiner [2]. The appearance of resistance or pain during extension of the patient's knees beyond 135 degrees constitutes a positive Kernig's sign.
2. **Brudzinski's sign** -To elicit this sign, the examiner keeps one hand behind the patient's head and the other on chest in order to prevent the patient from rising [3]. Reflex flexion of the patient's hips and knees after passive flexion of the neck constitutes a positive Brudzinski sign.
3. **Nuchal rigidity** -Resistance felt while passively flexing the neck in supine position.

Lumbar puncture was done in each case and at least 2ml of CSF was collected in a sterile vial. Hemorrhagic CSF was excluded from the study. The CSF biochemical and microscopic examination done in each. SPSS 19.0 was used for statistical analyses. Patient's ages were described as mean ± standard deviation. Continuous variables were compared by the t-test and dichotomous variables were compared by Fisher's exact test for two by two comparisons or Pearson χ^2 for greater than two responses. P ≤ 0.001 was considered to be statistically significant.

Observation

A total of 75 adults (age ≥ 18 years) with suspected meningitis admitted to our hospital, underwent lumbar puncture; CSF study revealed that 62 (82.7%) had definitive evidence of meningitis (CSF WBC count ≥ 6 cells/cmm). Demography and clinical presentation of patients with meningitis (n=62) were similar to those of patients without meningitis (n=13) (Table 1). Overall fever was present in 73 (97.33%), headache in 56 (74.67%), and vomiting in 51 (68.0%) patients. Meningeal signs of the 62 patients with meningitis prior

to lumbar puncture, neck rigidity in 46 (74.2%), Kernig's sign in 37 (59.68%) and Brudzinski's sign in 18 (29.03%) patients (Table 2). None of the meningeal signs shown to have statistical significance (P<0.001). On CSF cytological and biochemical analysis the mean total white blood cell count was 200.89 ± 184.97/cmm, mean protein 147.56 ± 116.88 mg/dl and mean sugar 56.79 ± 18.81 mg/dl in patients with meningitis whereas in patients without meningitis 3.39 ± 1.39/cmm, 46.46 ± 11.64 mg/ dl, and 75.46 ± 13.59 mg/dl respectively (Table 3).

Validity of Kernig's and Brudzinski's signs

The 62 patients with meningitis (CSF WBC ≥ 6/cmm) who were examined prior to lumbar puncture, 37 had Kernig's sign (sensitivity 60%) of the 13 patients without meningitis, 11 did not have Kernig's sign (specificity 85%). Of 62 patients with meningitis, 18 had Brudzinski's sign (sensitivity 29%) of the 13 patients without meningitis, 12 did not have Brudzinski's sign (specificity, 92%). For Kernig's sign the positive and negative predictive values were 95% and 30% respectively and that for Brudzinski's sign 21% and 94% respectively (Table 2).

Validity of nuchal rigidity

Of the 62 patients with meningitis, 46 had nuchal rigidity (sensitivity 74%) of the 13 patients without meningitis, 10 did not have nuchal rigidity (specificity 77%) Table 2. The positive and negative predictive values were 94% and 38% respectively.

Discussion

We analyzed 75 patients with suspected meningitis. On the basis of clinical features and cerebrospinal fluid examination findings patients were divided into two groups: Patients with meningitis (n=62) and Patients without meningitis (n=13). On CSF analysis the mean total white blood cell count was 200.89 ± 184.97/cmm and 3.39 ± 1.39/cmm in patients with meningitis and patients without meningitis respectively. In this study, the three meningeal signs Kernig's sign, Brudzinski's sign, and nuchal rigidity were of not much significance in diagnosing adults with suspected meningitis. None of the meningeal signs shown to have statistical significance. (P<0.001) In our study, the sensitivity of both Kernig's sign and Brudzinski's sign was low (60% and 29% respectively), which suggests that these signs can't negate the need for lumbar puncture among patients with meningitis. Although the specificity of both signs were high (85% and 92% respectively), that could be due to smaller number of positive results for meningeal signs. Brudzinski, in his original article entitled "Uber die kontralateralen Reflexe van den unteren Extremitatenbei Kindern" ("A New Sign of the Lower Extremities in Meningitis of Children"), reported the sensitivity of Brudzinski's neck and Kernig's signs were 97% and 42%, respectively [4]. We found that around three- fourth patients with meningitis had nuchal rigidity. Elmore JG et al. found only 39% patients with meningitis had nuchal rigidity [5]. The sensitivity and specificity for nuchal rigidity is high (74% and 77% respectively), which suggest that it could be the only meningeal sign with clinical usefulness. In 1991, a prospective study by Uchihara and Tsukagoshi reported a sensitivity of 9% and specificity of 100% for Kernig's sign [6]. The sensitivity and specificity was 15% and 100%, respectively, for nuchal rigidity in the same study. A recent study, by Thomas et al. analyzing 297 adults with suspected meningitis, reported a sensitivity of 5% and specificity of 95% for both Kernig's and Brudzinski's signs [7]. Waghdhare et al. in a blinded study of 190 patients diagnosed with meningitis found that Kernig's sign had a sensitivity of 14.1%, specificity of 92.3% and that for Brudzinski sign 11.1% and 93.4% respectively [8]. Puxty et al. noted that Kernig's sign was present in 12% and Brudzinski's sign

Table 1: Demography and clinical features of all patients with meningitis.

Characteristic	Patients with meningitis N=62 (%)	Patients without meningitis (Group C) N=13 (%)	P-value
Sex (Male)	50 (80.6%)	10 (13.3%)	
Age (Mean ± SD), Years	37.32 ± 16.67	36.84 ± 14.98	
Fever	60 (96.8%)	13 (17.3%)	0.98
Headache	49 (79.0%)	7 (9.3%)	0.08
Vomiting	44 (71.0%)	7 (9.3%)	0.327
Seizure	06 (9.7%)	0(0%)	0.582
Neck rigidity	46 (74.2%)	03 (23.07%)	0.058
Kernig's sign	37 (59.7%)	2 (15.4%)	0.004
Brudzinski's sign	18 (29.0%)	1 (7.7%)	0.029

Table 2: Diagnostic accuracy of Kernig's sign, Brudzinski's sign, and nuchal rigidity for patients with suspected meningitis before lumbar puncture was done.

Sign	With meningitis (N=62)	Without meningitis (N=13)	Total (N=75)
Neck rigidity			
Present	46	03	49
Absent	16	10	26
Kernig'g sign			
Present	37	02	39
Absent	25	11	36
Brudzinski's sign			
Present	18	01	19
Absent	44	12	56

Table 3: CSF analysis of 75 patients.

Characteristic	Patients with meningitis (N=62)	Patients without meningitis (N=13)
CSF WBC Count, MEAN ± SD (/cmm)	200.89 ± 184.97	3.39 ± 1.39
CSF Protein, MEAN ± SD (mg/dl)	147.56 ± 116.88	46.46 ± 11.64
CSF Sugar, MEAN ± SD (mg/dl)	56.79 ± 18.81	75.46 ± 13.59

in 8% of elderly patients without meningitis [9]. Nuchal rigidity has been noted in up to 30% of the normal elderly population [10]. In a study among children with meningitis by Guraraj et al. Brudzinski's and Kernig's signs were found in only 18% and 19% [11]. This shows that the sensitivity and specificity vary with age. Our study suggest that Kernig's and Brudzinski's signs are insensitive for detecting meningitis and therefore, when not present, should not be used to exclude the diagnosis of meningitis. The limitation of present study was that the number of patients studied was too small, so the findings can't be generalized.

Conclusion

Although both Kernig's and Brudzinski's signs have low sensitivity and high specificity, they are not sensitive for detecting meningitis and therefore, can't be used to exclude the diagnosis of meningitis. Nuchal rigidity with high sensitivity and specificity could be of clinically useful. A larger number of patients need to be studied with standardization of clinical method for elicitation of meningeal signs.

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Author Affiliations

Top

[1]*Department of Neurology, Sri Krishna Medical College, Muzaffarpur, Bihar, India*
[2]*Department of Medicine, Sri Krishna Medical College, Muzaffarpur, Bihar, India*