

Original Research Article

Utility of urine reagent strips in rapid bedside diagnosis of bacterial meningitis

Nanda Patil, Sujata Kanetkar, Garima Agarwal*, Supriya Karmakar

Department of Pathology, Krishna Institute of Medical Sciences Deemed to be University, Karad, Maharashtra, India

Received: 02 June 2020

Accepted: 02 July 2020

***Correspondence:**

Dr. Garima Agarwal,

E-mail: garimaho23@gmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Bacterial meningitis is a medical emergency and late diagnosis and treatment can lead to neurological damage and death. For definitive diagnosis of meningitis, laboratory based CSF analysis is required which is based on microscopy, protein and sugar estimation. This requires laboratory set up with experienced pathologist and long turn around time. Hence urinary reagent strips as a semiquantitative method can be applied for CSF analysis. This method can be used where laboratory set up is not available as well as bedside test for early diagnosis of bacterial meningitis. The present prospective study was undertaken to evaluate the utility of urine reagent strips in rapid diagnosis of bacterial meningitis. The aim of the present was to evaluate the role of urine reagent strips in the analysis of cerebrospinal fluid in suspected cases of meningitis.

Methods: The prospective study was carried out in the department of pathology in a tertiary care centre for a period of 6 months from September 2018 to February 2019. CSF analysis of suspected cases of meningitis was done with urine reagent strip as well as with standard laboratory method. The results of both were compared.

Results: Out of 79 cases of meningitis, 68.35% cases were of bacterial meningitis. The specificity and sensitivity of CSF analysis with reagent strip was 93.33% and 82.35% respectively, for cell count, 94.4% and 88.2% respectively for proteins and 91.3% and 60.2% respectively for glucose.

Conclusions: Semiquantitative analysis of CSF sample with urine reagent strips helps in rapid diagnosis of bacterial meningitis and can be useful to facilitate therapeutic decisions in resource constrained settings.

Keywords: Bacterial meningitis, CSF analysis, Reagent strips

INTRODUCTION

Bacterial meningitis involves the infection of brain and spinal cord. Timely diagnosis of meningitis with cerebrospinal fluid analysis and its prompt treatment is necessary to prevent further morbidity like permanent neurological damage and consequent mortality.^{1,2}

Serious consequences of bacterial meningitis as permanent neurological damage is observed in neonates. Also in paediatric population febrile convulsion make

allusion to meningitis creating a diagnostic dilemma.³ For definitive diagnosis of meningitis, laboratory based CSF analysis which involve microscopy, protein and sugar estimation.⁴ This test requires experienced pathologist and long turn around time. Hence urinary reagent strips as semiquantitative method can be used for the CSF analysis where sound laboratory tests are not available as well as bedside test for early detection of cases of bacterial meningitis.^{5,6}

The present study is a prospective study undertaken to evaluate the role of urinary reagent strip method in the

analysis of CSF for rapid diagnosis of bacterial meningitis.

The aim of present study was to evaluate the role of urine reagent strips in cerebrospinal fluid analysis in suspected cases of meningitis.

METHODS

The prospective study was conducted in the department of Pathology at a medical college and tertiary care hospital for a period of 6 months from September 2018 to February 2019. Ethical clearance was taken from an institutional ethical committee.

Inclusion criteria

All CSF samples from suspected cases of meningitis from September 2018 to February 2019 were included in the study. Demographic profiles such as age and sex were recorded. Both the definitive test and index test were carried out.

Exclusion criteria

Haemorrhagic samples and samples received after an hour of tap were excluded.

Definitive test

Leucocytes count was carried out using Neubauer's chamber. The differential count was done using smears prepared from centrifuged CSF sample stained with Leishman stain. Proteins and sugar estimation values were obtained using automated analyser.

Index test

Urit 14 G urinary reagent strip was used for semiquantitative analysis of test samples. Using micropipette 2-3 drops of undiluted CSF sample was added to leucocyte, nitrite, protein and sugar and the colour change was recorded.

Urit 14 G reagent strip is designed to detect the range of leucocyte from 15 to >500 cells/ul. It detects leucocytes by estimation of leucocyte esterase.

Depending on the colour changes leucocytes are graded as negative, of >15 neutrophils/ul, trace for 15 – 69 cells/ul, 1+ for 70 – 124 cells/ul, 2+ for 125 – 499 cells/ul, 3+ for >500 cells/ul.

The reagent strip detects proteins in the range of 30 mg/dl to 500 mg/dl. The observations for protein include no colour if proteins are <30 mg/dl, 1+ if it is between 30 to 100 mg/dl, 2+ in the range of 100 to 350 mg/dl and 3+ if >300 mg/dl. For glucose the observation is no colour for glucose level <50 mg/dl, trace for 50 – 100 mg/dl, 1+ for 100 to 250 mg/dl, 2+ for 250 to 500 mg/dl and 3+ for

>500 mg/dl. The result of index test were compared with those of definitive test and the sensitivity, specificity, positive predictive value and negative predictive value were determined.

RESULTS

We received total 231 cases of suspected meningitis out of which 79 cases (34%) proved to be of meningitis. Out of these 79 cases, 54 cases i.e 68.35% were of bacterial meningitis. The age group of these cases ranged from 3 days to 80 yrs.

Table 1: Age distribution of cases.

Age group	No. of cases	Percentage (%)
0 – 10 yrs.	20	25.3
11 – 20 yrs.	06	9.6
21 – 30 yrs.	11	13.9
31 – 40 yrs.	11	13.9
41 – 50 yrs.	15	18.9
51 – 60 yrs.	10	12.66
61 – 70 yrs.	02	2.53
71 – 80 yrs.	04	5.1
Total	79	100

There are 56 cases (70.88%) were adults while 29.11% i.e. 23 cases were in the paediatric age group among which 4 cases were neonates. Three cardinal parameters including leucocytes, proteins and glucose test of the reagent strip were compared with the results of definitive test.

The specificity and sensitivity for leucocytes by the strip method for >15 cells/cumm were 93.33% and 82.35% respectively. PPV was 93.33 while NPV was 82.35. The reagent strip test had a specificity of 94.4% and sensitivity of 88.2% for proteins. Level >15 mg/dl which increased with higher cut off detection of 2+. For sugar taking 50 mg as cut off. Specificity was 91.3% and sensitivity was 60.2%. Also the reagent strip when applied for patients with suspected meningitis which turned normal with standard test revealed similar results and no false positive observation

DISCUSSION

Urinary reagent strips can be easily applied for semiquantitative analysis of CSF for cell count and chemistry and it is less time consuming than the standard methods applied in today's practice.⁷ Bacterial meningitis is more common than viral meningitis. Although bacterial meningitis is seen in all age groups, paediatric age group is more vulnerable as observed in the present study. Similar observation is made by other authors.³ Delay in the treatment in such cases can result in high fatality as well as neurological sequelae. Hence rapid diagnosis of meningitis with the help of semiquantitative CSF analysis with urine reagent strip will be of great help. In the

present study we observed high specificity for cell counts, proteins and sugar levels with reagent strip method. With increasing cut off values of proteins and decreasing cut for glucose. Sensitivity also increased. Similar observation is made by Chikkannanjanp et al, Joshi et al, Mazumdar et al, and Romanelli et al.^{5,8,3,9}

All the three tests revealed very high specificity and this will definitely help clinicians to rule out doubtful cases of meningitis. So that cases of febrile convulsions and hypoxic seizures will be diagnosed and treated earlier. The test can be of great help in avoiding unnecessary over treatment in such cases. The procedure is easy to perform and can be utilized as a bedside test for rapid diagnosis of bacterial meningitis. It is especially helpful in rural set ups where laboratory facilities are not available.

The only short limitation of this method is mild variation in the cut off normal values for protein and sugar compared to urine. Higher levels of leucocyte esterase and protein patches of the reagent strip were associated with higher levels of leucocyte and protein levels. By designing strips specific for CSF analysis, the limitation can be overcome. The leucocyte esterase patch identifies granulocytes, hence for the diagnosis of aseptic meningitis, this is not a sensitive test.^{9,10} In most circumstances a lumbar puncture is done to exclude bacterial meningitis and a negative strip test with a clear CSF sample will help focus on such cases.

CONCLUSION

Semiquantitative analysis of CSF sample with urine reagent strip helps in bedside diagnosis of bacterial meningitis. This will also help to rule out bacterial meningitis in case of febrile convulsions and can facilitate therapeutic decisions in resource constrained settings.

ACKNOWLEDGEMENTS

The authors would like to acknowledge Krishna Institute of Medical Sciences deemed to be University, Karad for allowing the study to carry out by providing the necessary resources, research department for sanctioning the project and providing necessary guidance and the hospital laboratory technicians for their cooperation in sample processing.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Kumar A, Debata PK, Ranjan A, Gaind R. The role and reliability of rapid bedside diagnostic test in early diagnosis and treatment of bacterial meningitis. *Indian J Pediatr.* 2015;82:311-4.
2. Scarborough M, Thwaites GE. The diagnosis and management of acute bacterial meningitis in resource-poor settings. *Lancet Neurol.* 2008;7:637-48.
3. Sujaya Mazumder, BS Ramya, Dayananda S Biligi. Utility of urine reagent strips in cerebrospinal fluid analysis: An aid to bedside diagnosis of meningitis. *Indian J Pathol Microbiol.* 2018;61(3):356-9.
4. Valmari P, Peltola H, Ruuskanen O, Korvenranta H. Childhood bacterial meningitis: Initial symptoms and signs related to age, and reasons for consulting a physician. *Eur J Pediatr.* 1987;146:515-8.
5. Chikkannaiah P, Benachinmardi KK, Srinivasamurthy V. Semi-quantitative analysis of cerebrospinal fluid chemistry and cellularity using urinary reagent strip: An aid to rapid diagnosis of meningitis. *Neurol India.* 2016;64:50-5.
6. Molyneux E. Where there is no laboratory, a urine patch test helps diagnose meningitis. *J Neurosci Rural Pract* 2013;4:117-8.
7. Parmar RC, Warke S, Sira P, Kamat JR. Rapid diagnosis of meningitis using reagent strips. *Indian J Med Sci.* 2004;58:62-6.
8. Joshi D, Kundana K, Puranik A, Joshi R. Diagnostic accuracy of urinary reagent strip to determine cerebrospinal fluid chemistry and cellularity. *J Neurosci Rural Pract.* 2013;4:140-5.
9. Romanelli RM, Thome EE, Duarte FM, Gomes RS, Camargos PA, Freire HB. Diagnosis of meningitis with reagent strips. *J Pediatr (Rio J)* 2001;77:203-8.
10. Boney V, Gledhill RF. Use of reagent strips to diagnose bacterial meningitis. *Lancet.* 1997;349:287-8.

Cite this article as: Patil N, Kanetkar S, Agarwal G, Karmakar S. Utility of urine reagent strips in rapid bedside diagnosis of bacterial meningitis. *Int J Res Med Sci* 2020;8:2947-9.