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USE OF URINARY DIPSTICK (LEUCOCYTE ESTERASE) FOR DIAGNOSIS OF SPONTANEOUS BACTERIAL PERITONITIS

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ABSTRACT Spontaneous bacterial peritonitis (SBP) a life-threatening complication of ascites needs rapid diagnosis and initiation of antibiotics. Diagnosis of SBP employs cytobacteriological analysis of ascitic fluid which requires good laboratory facilities that can take few hours to 1–2 days to report the results . 24 hr laboratory facilities are not widely available in India . We evaluated the diagnostic utility of reagent strip (Multistix 10 SG®) for rapid diagnosis of SBP. Ours was a cross-sectional diagnostic accuracy study prospectively carried out on patients of cirrhosis with ascites admitted in a tertiary care referral centre. Multistix 10SG strip testing was done on ascitic fluid. Cell count as determined by colorimetric scale of reagent strip was compared with counting chamber method. Sensitivity, specificity, positive and negative predictive values were calculated. Of the 100 patients with cirrhotic ascites, [7 females:93 males] 52 subjects were diagnosed as having SBP by the counting chamber method as compared to 51 patients detected to have SBP by Multistix 10 SG test (3+ positive). The sensitivity, specificity, positive and negative predictive values of reagent strip 3+ positive were 98%,100%, 100% and 97.9% respectively compared to counting chamber method. Multistix 10SG is very specific and sensitive when compared to counting chamber method in diagnosis of SBP. This can be done easily and rapidly giving the result in 2 minutes which allows its use as a diagnostic tool for SBP and permits rapid initiation of antibiotic therapy

KEYWORDS :

INTRODUCTION

Spontaneous bacterial peritonitis (SBP) is the most frequent and serious complication of ascites in cirrhotic patients(1). It is characterized by infection of the ascitic fluid in the absence of a definitive intra-abdominal source such as abscesses or gastrointestinal perforation(1,2). Similarly, conditions causing peritoneal inflammation, like pancreatitis or cholecystitis, must also be excluded(2). The pathophysiology typically involves translocation of gut bacteria into mesenteric lymph nodes and eventually into the bloodstream, leading to systemic infection(3).

Clinically, SBP should be suspected in cirrhotic patients who experience sudden clinical decline. Common presentations include hepatic encephalopathy, jaundice, increased abdominal girth, or new-onset pain in previously painless ascites(4,5). Diagnosis relies on either a polymorphonuclear (PMN) leukocyte count >250 cells/mm^3 in ascitic fluid or a positive fluid culture(6). Prompt antibiotic treatment—usually with third-generation cephalosporins—is essential once SBP is confirmed(7).

Despite its clinical urgency, SBP diagnosis is often delayed due to limited laboratory access, particularly in primary health centers. PMN counts can take hours to process in well-equipped settings and up to a day or more in less resourced centers. Cultures require 48 hours for results(7). These delays may hinder timely antibiotic initiation.

Leukocyte esterase reagent strips (LERS), commonly used in urinary tract infection (UTI) diagnosis, offer a quick, low-cost alternative. These strips detect leukocyte esterase activity by producing a color change on contact with neutrophils. Multistix 10 SG, for example, assesses 10 urine parameters, including leukocyte count, with results available in under two minutes(8,9). This approach has been extended to other fluids, including cerebrospinal and synovial fluids(9). Given its rapid turnaround, LERS may be particularly useful in remote or resource-constrained settings for early SBP detection and treatment.

Several studies have investigated the diagnostic utility of LERS in SBP. Sapey et al. compared dipstick readings with laboratory PMN counts in 245 samples from 51 patients across American and European centers, reporting a sensitivity of 64.7%, specificity of 99.6%, PPV of 91.7%, and NPV of 97.4%(8). The first U.S.-based study using Multistix strips on 136 cirrhotic patients showed sensitivity and specificity of 83% and 99%, respectively, with corresponding PPV and NPV of 91% and 98%(10).

Vanbiervliet et al. later validated the diagnostic accuracy of Multistix 8SG in a full publication(11). In contrast, a multi-center French study by Nousbaum et al., involving 70 centers, questioned the reliability of Multistix and the overall concept of dipstick-based SBP diagnosis(12). Nonetheless, Castelote et al. highlighted their clinical utility due to low cost and acceptable accuracy(13). Some studies have also examined combining the leukocyte esterase pad with nitrite detection.

A study at RNT Medical College, Udaipur, involving 100 cirrhotic patients, compared Multistix 10 SG with manual PMN counts. It reported 77.17% sensitivity, 95.12% specificity, and PPV and NPV of 95.12% and 92%, respectively(14). A recent single-center study at PGIMS Rohtak tested 103 cirrhotic patients and reported sensitivity of 95%, specificity of 96.4%, and PPV and NPV of 86.4% and 98.8%(15).

A Chinese single-center study involving 84 patients found a sensitivity of 92.8% and specificity of 84.7%(16). A Brazilian dual-center study over two years included 200 samples from 106 cirrhotic patients and demonstrated 71% sensitivity, 99% specificity, and high predictive values (PPV 91%, NPV 98%) (17). Another Chinese study using 75 samples from 53 patients

reported a specificity and NPV of 100% and 87%, respectively, though sensitivity was lower at 50%(18). Gaya et al. reported perfect sensitivity and NPV (100%), with 91% specificity and 92% overall accuracy(19). In a study from Abbottabad using 94 samples, Multistix 10 SG demonstrated sensitivity of 92%, specificity of 95%, PPV of 96%, and NPV of 90%(20).

These findings suggest that LERS, despite being a qualitative tool, could serve as a rapid, cost-effective method for SBP screening, especially in settings lacking immediate lab access.

METHODS

The study was carried out over a span of three years at a tertiary care centre in south india under the guidance of Department of General Medicine with aid from the department of Gastroenterology after ethics approval and informed consent.

Inclusion Criteria

Men and women with chronic liver disease and ascitis.

Exclusion Criteria

1. History of any gastro-intestinal surgical procedure in the proceeding 4 weeks
2. Presence of any other condition that can lead to an increase in the neutrophil count in the ascitic fluid like

- Pancreatitis
- Peritoneal carcinomatosis
- Tuberculosis

Once the suitable cases had been identified the individual profile was recorded and the relevant findings were recorded In each cases abdominal paracentesis was done under aseptic precautions and the samples were taken for Multistix 10 SG testing and also sent for calculation of the total and differential counts. The samples were simultaneously drawn and sent for culture studies too. For the Multistix 10 SG testing the dipstix was dipped in the ascitic fluid sample such that the the colorimetric strip used for the calculation of polymorphonuclear cell count was in contact with the ascitic fluid . The strips were then withdrawan and read after 2 minutes to look for the colour change. The colour change was recorded and the results were recorded as 0, trace, 1+, 2+, 3+ signifying 0, >15, >70, >125 and >500 PMN cells respectively. The results of the total and differential cell count in the ascitic fluid sample were then compared with the results of Mulltistix 10 SG strips.

Data analysis was done using MS Excel for data entry and SPSS v20 for further analysis. validity parameters namely sensitivity, specificity & predictive values of positive and negative & accuracy of urinary dipstick test with respect to PMN count & ascitic fluid culture were computed

RESULTS

A 100 cases of cirrhotic ascites fulfilling the inclusion & exclusion criteria were studied and analyzed. Ninety-three of the cases were males and the rest were females. The cause of cirrhosis was documented. Ethanol intake accounted for majority of cirrhotic patients (62 in number), followed by hepatitis B & C (12 cases). One case was attributed to have non-alcoholic steatohepatitis and one was found to have hemochromatosis. No etiology could be ascertained in 19 of the patients and these were classified as cryptogenic. Spontaneous bacterial peritonitis was diagnosed based on the differential count in the drawn samples. The samples were sent for total counts, culture studies and LERS testing. Fifty-two patients were found to have spontaneous bacterial peritonitis. Among these, 46 were males and the rest were females. Six samples out of 100 grew micro-organisms on cultures. These were among the 52 which were found to have spontaneous bacterial peritonitis on initial testing. Three of the samples grew E. coli, 1 grew Klebsiella, 1 grew a mixture of enterobacter & klebsiella and 1 grew only enterococcus (Table3). As per the multistix 10SG testing, a cell counts in excess of 500 polymorphonuclear cells was suggestive of spontaneous bacterial peritonitis. Fifty-one cases were positive for SBP as per this criterion. Three cases had >125 neutrophils, 10 had >75 neutrophils, 6 had trace cells and 30 had no cells.

The results were analysed and the Multistix 10SG dipstick was found to have a sensitivity of 98% with a specificity of 100%. The positive and negative predictive values were found to be 100 and 97.9% respectively. The P value, calculated as per the Mc Nemar's test was found to be 0.98. This implies that, there is minimal disagreement between the results of the gold standard test and Multistix 10SG test. This concludes that the agreement between the two tests is statistically significant.

DISCUSSION

Cirrhosis of liver is a disease widely prevalent in our country. There are a number of etiologies for the same. As per our study ethanol consumption was found to be the most common etiology (62 patients), this highlights the fact that ethanol consumption continues to be the major contributor to the cirrhotic load in the country. With the total counts samples had been also sent for the culture studies. Our study revealed 6 samples to grow microorganisms, 3 of which grew E.coli , this validates the fact that continues to be amongst the most common organisms implicated. Once the cirrhosis develops it often leads to the development of different complications.

Rapid diagnosis and treatment are very important in the management of SBP, a potentially dangerous complication of cirrhosis. The yield of bacterial culture is usually low (up to 40%) in these groups of patients, and that test results can earliest be reported in 48 hours. Therefore, a (PMN) cell counts in AF >250/mm3, is primarily used to decide on initiation of antibiotics[9].

However, the AF manual cell count is not always available in all hospitals, especially on an emergency basis. Reporting even with a good lab takes about an hour and in absence of a 24 hour on-call pathologist may be delayed even by a day, there can also be a leukocyte clump formation that gives spurious results.

Reagent strips have the ability to detect esterase activity of PMN cells. Numerous independent studies have evaluated the diagnostic value of LERS (Multistix, Combur, Nephur, UriScan and Aution strips) in settings involving SBP. The published studies have shown widely variable results in terms of sensitivity specificity, PPV and NPV. Compared with the manual PMN count ('gold standard'), LERS were found to have sensitivity ranging from 45 to 100%, specificity ranging from 81 to 100%, PPV value ranging from 42 to 100% and NPV ranging from 87 to 100%. [9-20] Similarly in the published studies, Multistix reagent strips have shown widely variable test results

A study was done in RNT medical college Udaipur [14]. In this study 100 cases of cirrhosis were taken. They were tested for SBP using Multistix 10 SG. In this study the results of the dipstix were compared with the counting chamber [14].This study revealed a sensitivity of 77.17% , specificity of 95.12% , positive and negative predictive values of 95.12% and 92% respectively.

A single centre study was done in PGIMS Rohtak [15] where 103 patients who had been diagnosed with cirrhosis of liver were taken. The Multistix 10 SG was then used in the ascitic fluid samples. Out of the 103 patients SBP was diagnosed in 20 patients by manual cell count. The sensitivity and specificity of this study was reported as 95% and 96.4% resp. with the positive and negative predictive value being reported as 86.4% and 98.8% [15]

Our study showed a sensitivity of 98% and a specificity of 100% with positive and negative predictive values of 100% and 97.9% respectively. In some of the mentioned studies multiple samples were taken from the same patient [18,19] Taking samples from the same patients cannot effectively rule out the effect of antibiotics that might have been previously used. In our study a single sample was taken from 1 patient for analysis ones. Our study expands the previous findings of the potential utility of the LERS test as a rapid, simple and inexpensive means for testing of SBP.. As there is a wide variation in sensitivity and PPV between reported studies, some authors have raised doubt over the use of LERS as a valid surrogate marker of SBP[14].However, because of the consistently excellent NPV (>95% in the majority of the studies) of LERS, others have advocated its place in the ascitic tap diagnostic algorithm specially as a preliminary screening tool for SBP diagnosis. With use of bedside LERS test early antibiotic therapy can be initiated in asymptomatic SBP patients. Also, it is cheaper than the manual cell count. However more studies with a greater number of patient enrollment are warranted.

CONCLUSION

Summarizing this LERS can be used as a cheap and reliable tool for early diagnosis of SBP and can be used for the initiation of antibiotic therapy without delay. Also as 24 hour good laboratory facilities are not available in many remote areas of the country LERS can be used at-least to initiate the antibiotic therapy with the further management to be planned once the cytobacteriological results are available.

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