



Original Article

Diagnostic Accuracy of Leucocyte Esterase Dipstick Test for The Diagnosis of Spontaneous Bacterial Peritonitis in Children with Nephrotic Syndrome

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ABSTRACT

Spontaneous bacterial peritonitis (SBP), which has a high fatality rate if antibiotics are not given promptly, is one of the most serious side effects of nephrotic syndrome and ascites. Therefore, it is essential for survival to diagnose and treat SBP early. A quick dipstick test for leucocyte esterase can identify the SBP. **Objective:** To determine the diagnostic accuracy in detection of SBP using leucocyte esterase dipstick test in children with nephrotic syndrome taking ascitic fluid neutrophil count as gold standard. **Methods:** A Cross Sectional Study was carried out Khyber teaching hospital and LRH Peshawar Pakistan. This research covered patients of either gender with nephrotic syndrome and ascites. On admission, diagnostic paracentesis was performed. The ascitic fluid collected at the bedside was examined immediately using a reagent strip. The PMN cell count in ascitic fluid was then determined. A positive +3 result on a leucocyte esterase dipstick was declared positive for SBP while absolute neutrophil count more than 250 cells per mm³ was considered confirmatory. **Results:** A total of 107 patients were enrolled. Age of the patients ranged from 4 to 14 years. Mean age of the patients was 6.68 ± 1.239 years. Male to female ratio was 1.7: 1. The sensitivity, specificity, positive and negative predictive value of leucocyte esterase dipstick test were 86.4%, 92.0%, 73.1% and 96.4% respectively. **Conclusion:** It is concluded that reagent strips are quick, practical, and low-cost diagnostics with good sensitivity and specificity for identifying SBP in children with nephrotic syndrome

INTRODUCTION

An ascitic fluid infection without a clear peritoneal surgically treatable cause is referred to as SBP. Nephrotic syndrome and ascites can both result in the serious condition of spontaneous bacterial peritonitis (SBP) [1]. 10% to 30% of people with nephrotic syndrome and ascites also have SBP [2]. This consequence has a 30–50% mortality rate if not addressed, and death may occur within a few hours. Antibiotics can elicit a recovery within as short as 48 hours [3]. SBP must be diagnosed and treated as soon

as possible to avoid death [4]. SBP symptoms are vague. Fever, gastric discomfort, nausea, and vomiting are some of the symptoms [5]. A diagnostic abdominocentesis is an ordinary therapeutic procedure for these reasons in any child with recently diagnosed ascites associated with nephrotic syndrome or previously diagnosed ascites patient who manifests symptoms and signs of SBP. Regardless, culture of ascitic fluid, which is inconsistently positive in 40–90% of patients, an ascitic fluid

polymorphonuclear (PMN) count of 250 cells/mm³ is the typical for SBP diagnosis SBP [6]. The diagnosis is typically delayed because the ascitic fluid PMN and total leukocyte count are typically not performed right away. Therefore, a quick, straightforward screening test is necessary for the precise diagnosis of SBP. Leucocyte esterase activity may be checked using a strip test [7]. The test is founded on the granulocytes' esterase activity. The substrate, 3-hydroxy-5-phenyl-pyrrole esterified with utilization of amino acid. This ester is hydrolyzed by the esterase to create 3-hydroxy-5-phenyl-pyrrole, which interacts with the proper diazonium salt to create a violet azo dye whose intensity is correlated with the leukocyte count [8]. Leucocyte esterase reagent strip testing has been recommended for the rapid detection of meningitis, urethritis, and peritonitis in cirrhotic patients [9]. With ascitic fluid neutrophil count serving as the gold standard, the goal of this study is to evaluate the diagnostic performance of the leucocyte esterase dipstick test for the identification of spontaneous bacterial peritonitis in children with nephrotic syndrome.

METHODS

This cross sectional study was conducted at Paediatrics department, Khyber Teaching Hospital Peshawar Pakistan during March 2019 to November 2019. After taking approval from the research review board of the hospital. Informed consent was taken from the parents of all study contributors. A total 107 patients were involved in this study. A sample size was calculated using WHO online calculator. Patients with nephrotic syndrome and ascites complaining of fever and abdominal pain were enrolled. Patients with concomitant liver disease like congenital hepatic fibrosis, endocrine disorder like hypothyroidism and Cushing syndrome, congenital cardiac anomalies, cardiomyopathies, abdominal tuberculosis and patients with secondary bacterial peritonitis were excluded. Nephrotic syndrome was confirmed based on the presence of triad including 1) clinical finding – edema (peripheral or central) 2) serum albumin less than 3gm/dl 3) 24 hour urinary proteins more than 3.5 gm. Presence of ascites confirmed clinically with abdominal examination. Ultrasound guided 10cc ascitic fluid was drawn under local anesthesia and strict aseptic milieu. 05 cc ascitic fluid sample was sent to hospital laboratory for analysis under microscope for neutrophil count. Presence of ≥ 250 cells per mm³ was considered confirmatory for the presence of SBP. Leucocyte esterase dipstick was placed in the remaining 05 cc for 05 minute and change in the color was noted and compared with reference standards. Results of the leucocyte esterase dipstick were compared with the results of microscopic analysis to determine the diagnostic accuracy of leucocyte esterase dipstick test. The sensitivity and specificity were calculated in the study

evaluating the diagnostic accuracy of the Leucocyte Esterase Dipstick Test. The accuracy was determined by the number of positive results found among the total. All data was collected on pre-designed proforma. The statistical analysis program IBM SPSS version 24.0 was used to enter and analyze data. Mean and standard deviations were calculated for quantitative variables. The qualitative variables were presented in the form of frequencies and percentages.

RESULTS

A total of 107 patients were enrolled during study period. Age of the patients ranged from 4 to 14 years. Mean age of the patients was 6.68 ± 1.239 years. Majority of the patients were in the age group 4 – 8 years (68 patients, 63.5%) while the remaining 39 patients (36.5%) belonged to the age group 9 – 14 years. The ratio of male to female participants among the enrolled patients was 1.4: 1. Mean serum albumin was 2.35 ± 0.472 gm/dl while mean duration of illness was 14.39 ± 5.273 months (table 1).

Parameters	Minimum	Maximum	Mean \pm SD
Age (years)	4	14	6.68 \pm 1.239
Disease Duration (months)	6	30	14.39 \pm 5.273
Serum albumin (gm/dl)	1.3	2.9	2.35 \pm 0.472
Gender of Patient's			
Male	76 (71.02%)		
Female	31 (28.97%)		

Table 1: Baseline characteristics of patients

The number of patients diagnosed with SBP on ascitic fluid R/E based on absolute neutrophil count ≥ 250 cells/mm³ as well as correctly diagnosed by leucocyte esterase test were 19 (17.7%). Seven patients (6.5%) had neutrophil count ≥ 250 cells/mm³ but labelled negative for SBP on leucocyte esterase dipstick test. Three patients (2.8%) were labelled positive for SBP on leucocyte dipstick test however their ascitic fluid analysis revealed neutrophil count less than 250 cells/mm³. Rest of the 78 patients (72.9%) were labelled negative for SBP both on dipstick stick test and ascitic fluid analysis (table 2).

PMN Count ≥ 250 cells/mm ³	Leucocyte Esterase Dipstick		Total
	Positive	Negative	
Positive	19	03	22
Negative	07	78	85
Total	26	81	107

Table 2: 2x2 table (Leucocyte esterase dipstick versus PMN count)

The sensitivity, specificity, positive predictive value, negative predictive value and overall accuracy of leucocyte esterase dipstick for the diagnosis of spontaneous bacterial peritonitis were 86.4%, 92.0%, 73.1%, 96.4% and 90.9% respectively (table 3).

Accuracy	%
Sensitivity	86.4
Specificity	92.0
Positive predictive value	73.1
Negative predictive value	96.4
Overall accuracy	90.9

Table 3: Accuracy of leucocyte esterase dipstick

DISCUSSION

A major consequence of paediatric nephrotic syndrome is spontaneous bacterial peritonitis. Peritonitis happens in 2% to 6% of individuals with nephrotic syndrome, while incidence as extreme as 17% have been reported in studies [10, 11]. While majority of episodes have been reported during the first couple of years after diagnosis, peritonitis is a rare primary presentation [12]. In our study, peritonitis was confirmed in 19 patients (17.7%). Our study results are similar to the results of study conducted by Rashid J and colleagues [13]. In patients with nephrotic syndrome, spontaneous bacterial peritonitis has a complex and varied etiology. The most frequent causes of SBP are Gram negative organisms, particularly *Escherichia coli* and *S. pneumoniae* [14]. Numerous studies have suggested that the majority of paediatric peritonitis may now be caused by Gram-negative microorganisms as a result of the widespread immunization against pneumococcal bacteria in many countries [15]. *S. pneumoniae*, however, continues to be a significant contributor to spontaneous bacterial peritonitis in children with nephrotic syndrome [16]. Gorensek MJ et al, reported abdominal pain and fever as the most prevalent symptoms of SBP in their in study [10]. In our study, all patients enrolled had abdominal pain and fever as their presenting complaint. Diarrhea was reported in 50% patients with nephrotic syndrome and ascites complicated by SBP [17]. None of the study participants in our study had diarrhea as their presenting complaint. The mean duration of illness in our study was 14.39±5.273 months. This is in agreement with the results as reported by other studies [12, 18]. Leukocyte esterase, which was first utilized for urine analysis, is now extensively employed for diagnosing bodily fluid infective conditions, and several studies have verified its accuracy and validity for PMN cell identification [19, 20]. To our knowledge, this study is the first of its kind evaluating the diagnostic validity of leucocyte esterase for SBP in children with nephrotic syndrome in our setup. Very little knowledge is available on this subject even internationally. The sensitivity, specificity, positive predictive value, negative predictive value and accuracy of leucocyte esterase dipstick taking PMN count as gold standard were 86.4%, 92.0%, 73.1%, 96.4% and 90.9% % respectively. Our study results are lower than the results of the study conducted by Farahmand and colleagues [19]. These discrepancies in

test validity may be attributed to the use of different commercial dipsticks with varying colorimetric scales.

CONCLUSIONS

It is concluded that reagent strips are quick, practical, and low-cost diagnostics with good sensitivity and specificity for identifying SBP in children with nephrotic syndrome.

Conflicts of Interest

The authors declare no conflict of interest

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