

## ORIGINAL ARTICLE

**Diagnostic Validity of Leucocyte Esterase Dipstick Tests for Spontaneous Bacterial Peritonitis in Patients with Cirrhosis**MUHAMMAD KAMRAN HASSAN<sup>1</sup>, WIQAS AHMAD<sup>2</sup>, MUHAMMAD KASHIF<sup>3</sup><sup>1</sup>Assistant Professor, Department of Gastroenterology, Lady Reading Hospital, Peshawar<sup>2</sup>Specialist Registrar, Department of Gastroenterology, Hayatabad Medical Complex, Peshawar<sup>3</sup>Postgraduate Resident, Department of Gastroenterology, Lady Reading Hospital, PeshawarCorresponding author: Muhammad Kashif, Email: [mkashifkmc@gmail.com](mailto:mkashifkmc@gmail.com)**ABSTRACT****Background:** One of the worst sequelae of cirrhosis and ascites is spontaneous bacterial peritonitis (SBP). Early detection and treatment of SBP are therefore essential for survival because this complication is linked to a high death risk if antibiotics are not administered promptly. Leucocyte esterase dipstick testing can identify the SBP quickly.**Objective:** To evaluate the diagnostic accuracy of leucocyte esterase dipstick test for the detection of spontaneous bacterial peritonitis taking ascitic fluid neutrophil count as gold standard.**Study Design:** Cross Sectional Study**Settings:** Department of Gastroenterology, Lady Reading Hospital, Peshawar**Study Duration:** This study was conducted from 1<sup>st</sup> July 2021 till 30<sup>th</sup> June 2022**Materials and Methods:** Two samples (10cc each) of ascitic fluid aspirate were obtained from patients with cirrhosis on admission to the hospital, presenting with ascites, fever and abdominal pain. Bedside leucocyte esterase dipstick test was performed on one sample and the other was sent to hospital laboratory for ascitic fluid analysis for neutrophil count. The results of both modalities were compared diagnostic accuracy which was recorded in terms of sensitivity, specificity, positive predictive value and negative predictive.**Results:** Mean age of the patients was 46.68 ± 10.239 years. A total of 170 patients were enrolled. Age of the patients ranged from 18 to 75 years. Male patients were 113 (66.5%) while 57 patients (33.5%) were female. Hepatitis C was the leading cause of cirrhosis observed in 89 patients (52.4%). The sensitivity, specificity, positive and negative predictive value of leucocyte esterase dipstick test observed were 89.7%, 96.2%, 87.5% and 96.9% respectively.**Conclusion:** Leucocyte esterase dipstick test is a convenient, inexpensive and rapid diagnostic modality for SBP with better diagnostic accuracy.**Keywords:** Spontaneous Bacterial Peritonitis, Leucocyte Esterase Dipstick test, Diagnostic Accuracy.**INTRODUCTION**

Spontaneous bacterial peritonitis is a dreadful complication in patients with cirrhosis and ascites, ensuing in approximately 10 to 30% patients. Pathogenetically, the complication is suspected by the accumulation of infective abdominal fluid in the absence of a surgically correctable cause on abdominal imaging.<sup>1, 2</sup> If not addressed, death ensue within hours. Overall, mortality rate 30 to 50%. When timely diagnosed and promptly antibiotics are administered, favorable outcomes are observed within a short span of 2 days.<sup>3</sup> Hence, patients with suspicion of SBP should be evaluated and treated without time delay to avert death.<sup>4</sup>

Patients with SBP frequently presents with non-specific complaints like fever and abdominal pain. In certain and more severe instances, deterioration of consciousness may proceed, creating a diagnostic dilemma or hepatic encephalopathy overshadowing SBP.<sup>5</sup> For such considerations, a diagnostic ascitic tap is currently accepted procedure in every patient with ascites owing to cirrhosis who has just received a new diagnosis, as well as in any ascites patient who manifests with signs and symptoms of SBP. Ascitic fluid analysis revealing leucocyte count ≥250 cells per mm<sup>3</sup> is diagnostic for the presence SBP.<sup>6</sup>

Leucocyte esterase dipstick test polymorphonuclear esterase activity based test reagent strip test. The principle of the test is based on an ester-based substrate which is hydrolyzed by esterase enzyme releasing a pyrrole. The pyrrole ring after chemical reaction with diazonium salt generates violet azo color. The gravity of the color corresponds to the number of leucocytes.<sup>7</sup> The utility of this reagent based rapid diagnostic modality is not limited to SBP but extends to infective conditions of meninges, urinary tract and peritoneal cavity especially patients undergoing peritoneal dialysis.<sup>8, 9</sup> The ascitic fluid total leucocyte and PMN count are not generally performed immediately in settings with limited resources, which prolongs the time to diagnosis. As a result, a rapid screening test is required for the early identification of SBP. Such a test may be leucocyte esterase activity reagent strip testing. This study is aimed to determine the diagnostic accuracy of leucocyte esterase dipstick test for the diagnosis of

spontaneous bacterial peritonitis in patients with cirrhosis taking ascitic fluid neutrophil count >250cells/mm<sup>3</sup> as gold standard.

**MATERIALS AND METHODS**

**Settings:** This cross sectional study was conducted at department of Gastroenterology, Lady Reading Hospital Peshawar from 1<sup>st</sup> July 2021 till 30<sup>th</sup> June 2022 after taking approval from the research review board of the hospital. Informed consent was taken from all study participants.

**Data collection:** Cirrhotic patients with suspicion of spontaneous bacterial peritonitis were included. Patients of either gender in the age range of 18 to 60 years were enrolled. Cirrhosis was determined based on 1) stigmata of chronic liver disease on physical examination including palmar erythema, jaundice, spider nevi, ascites, contractures and loss of axillary and pubic hair. 2) Laboratory tests like deranged liver function tests including serum albumin less than 3.5gm/dl and INR more than 1.2 or PT more than 15seconds. 3) Imaging modalities e.g., ultrasound showing shrunken liver, irregular margins and coarse echo-texture. Presence of all of the above were considered positive for liver cirrhosis. Patients with cirrhosis and presenting with complaint of ascites, pain abdomen and fever and absence of any identifiable surgically correctable intra-abdominal cause like perforation and pus collection on imaging (ultrasound) were labelled suspected spontaneous bacterial peritonitis. Two samples of 10cc ascitic fluid were collected under ultrasound guidance and local anesthesia by consultant interventional radiologist. One sample was used for bedside analysis and diagnosis of SBP using leucocyte esterase dipstick test. Reagent strip was placed in the sample for five minutes and observed for color changes. Color changes were compared with references standards mentioned on the packing. The second sample was sent hospital laboratory for evaluation under microscope for manual estimation of neutrophil count. Neutrophil count more than 250cells per mm<sup>3</sup> was considered confirmatory. Results of both test were compared to determine the diagnostic accuracy of reagent strip test.

**Analysis:** Mean and standard deviations were computed for quantitative variables like age, disease duration, hemoglobin and serum albumin. Frequencies and percentages were computed for qualitative variables like gender, Child Class and cause of CKD. Diagnostic accuracy was determined using 2x2 table in terms sensitivity, specificity, positive predictive value and negative predictive value. All analyses was performed with the statistical software package SPSS version 24.

**RESULTS**

A total of 170 participants were recruited. 113 (66.5%) were male while 57 (33.5%) were female. Mean age of the patients was 41.68 ± 5.239 years. Preponderance of participants (101 patients) was observed in the age group 41-60 years constituting 59.4% of the total. Hepatitis C was the most common cause of CLD, observed in 89 patients (52.4%) followed by hepatitis B in 57 patients (33.5%). Mean Child Pugh score was 11.891 ± 0.340. Child Class C cirrhosis was most prevalent, observed in 131 patients (77.1%). Mean serum sodium was 132.36 ± 2.511 mmol/L. Spontaneous bacterial peritonitis was diagnosed in 39 patients (22.9%) by ascitic fluid analysis. Reagent strip test reported SBP in 35 patients (21.2%). The observed sensitivity, specificity, positive predictive value and negative predictive value was 89.7%, 96.2%, 87.5% and 96.9% respectively.

Table 1: Baseline characteristics of patients

	Minimum	Maximum	Mean	Std. Deviation
Age (years)	18	59	41.68	5.239
Disease Duration (months)	6	60	31.43	8.572
Hb (gm/dl)	7.8	11.2	9.311	.573
Platelet Count(per ml)	51290	116400	79431.82	13784.541
Serum Albumin (gm/dl)	1.9	3.2	2.794	.211
Bilirubin (mg/dl)	1.7	2.8	2.219	.4269
ALT (IU/L)	73	97	84.16	6.508
INR	1.6	2,5	1.913	.1846

Table 2: Subgroup analysis of patients

Characteristics	Subgroups	%ages
Age	18-40 years	69 40.6%
	41-60 years	101 59.4%
Gender	male	113 66.5%
	female	57 33.5%
Disease duration	6-30 months	89 52.4%
	31-60 months	81 47.6%
Hb	≤9gm/dl	87 51.2%
	>9gm/dl	83 48.8%
Serum Albumin	less than 3.0 gm/dl	74 43.5%
	more than 3.0 gm/dl	96 56.5%
Platelet Count	Less than 100,000	106 62.4%
	more than 100,000	64 37.6%

Table 3: Diagnostic accuracy of leucocyte esterase dipstick tests

Diagnostic Accuracy	%Ages
Sensitivity	89.7%
Specificity	96.1%
Positive Predictive Value	87.5%
Negative Predictive Value	96.9%

**DISUCSSION**

Leucocyte esterase dipstick test is a convenient, inexpensive and rapid reagent strip test that could be utilized at bedside point of

care test for the rapid detection and diagnosis of infective ascites in patient with chronic liver disease. Early diagnosis of SBP is crucial for prompt initiation of antibiotics in such patients as any delay in antibiotic initiation would otherwise be potentially fatal.<sup>10</sup>

In this study we evaluated the diagnostic accuracy of leucocyte esterase dipstick tests for the diagnosis of SBP. Our observations included a major proportion of patients within the age group 41 to 60 years comprising 59.4% of all the study participants. This finding is similar to the result of the study conducted by Khatwani and colleagues who reported 61.1% patients within this age group.<sup>11</sup>

Male participants were more than female in this study. This may be because of the fact that chronic liver disease is more prevalent among males as compared females in our country.<sup>12</sup> Similar trend was reported by Khatawani and colleagues.<sup>11</sup> However, the proportion of female patients has increased in this study. This may be gradual acknowledgement of potential hazardous practices (shaving and sexual practices) and subsequent avoidance.

Hepatitis C was the most common cause of CLD recorded in this study. Hepatitis C is the most common cause CLD in our country.<sup>13</sup> This trend could be potentiated by the higher prevalence of HCV in our country. It was noteworthy to find a reduction in the proportion of patients with HBV related CLD in this study as compared to previous study. Improved vaccination drive against HCV and efforts to reduce vertical transmission in the last decade may have created this impact.

Majority of the participants had Child Class C cirrhosis. The development of ascites and subsequent spontaneous bacterial peritonitis on the background of cirrhotic liver is a direct manifestation of replacement of significant portion liver parenchyma with fibrotic tissue leading to decompensation and the sequelae.<sup>14</sup>

The sensitivity, specificity, positive predictive value and negative predictive value of leucocyte esterase dipstick test observed in this study were 89.7%, 96.2%, 87.5% and 96.9% respectively. This finding is in coherence with the result of the study conducted by Akram et al.<sup>15</sup> In another study by Honar N and colleagues, these values significantly lower than our observation.<sup>16</sup> This may be due to recruitment of pediatric population in their study while our study was limited to adult population. In contrast, Torun and colleagues reported better diagnostic accuracy than our findings.<sup>17</sup> We could not draw any conclusive evidence for this difference. The causative organism in different populations could be a reason. Taking ascitic fluid culture and sensitivity as gold standard could potentially address this speculation.

**CONCLUSION**

Enabling the physician to strengthen clinical findings and ensuring early diagnosis of SBP, leucocyte esterase dipstick test is a rapid and valuable point of care test, emanating prompt and timely administration of antibiotics to such patients. However, the test could not provide any information regarding the spectrum of underlying causative organism.

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