

# Diagnostic Accuracy of CRP for Evaluation of Spontaneous Bacterial Peritonitis

Rizwan Saeed Kiani<sup>1</sup>, Muhammad Nadeem<sup>2</sup> and Abdul Quddus<sup>1</sup>

## ABSTRACT

**Objective:** The objective of the present study was to determine the diagnostic accuracy of CRP for evaluation of spontaneous bacterial peritonitis in patients keeping ascetic fluid neutrophilic count more than  $250/\text{mm}^3$  as a gold standard.

**Study Design:** Cross Sectional Validation study.

**Place and Duration of Study:** This study was conducted at the Department of Gastroenterology and Medicine Poonch Medical College Rawalakot from October 2019 to January 2020.

**Materials and Methods:** All diagnosed cases of Chronic Liver Disease having ascites admitted in gastroenterology ward or presenting in the emergency department from 18 years and above, both male and female were included in the study by consecutive sampling were included in the study. A diagnosis of spontaneous bacterial peritonitis was made and documented if  $> 250/\text{mm}^3$  neutrophils were found in ascitic fluid. A serum sample was drawn for CRP and the results were reported in mg/L. Serum CRP level of  $\geq 29.5\text{mg/L}$  was considered as significant.

**Results:** Total 210 patients were included in the study. There were 60.95% (n=128) male and 39.04% (n=82) female patients with the mean age of  $43.36 \pm 13.68$  years (range 19-78 years). Spontaneous bacterial peritonitis was diagnosed in 28.09% (n=59) patients, CRP levels was greater than  $29.5\text{mg/L}$  in 29.52% (n=62) patients. Sensitivity was 83.05% and specificity was 91.39 %. Negative Predictive Value was 93.24% and Diagnostic Accuracy was 89.04%.

**Conclusion:** CRP is reliable serum marker for rapid diagnosis of spontaneous bacterial peritonitis in patients admitted due to complications of cirrhosis.

**Key Words:** Ascitic fluid, liver disease, peritonitis.

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## INTRODUCTION

Cirrhosis of liver is a common condition among patients presenting to the emergency and gastroenterology department. In 2017 globally there were about 10.6 million (10.3-10.9) cases of decompensated cirrhosis and 112 million (107-119) cases of compensated cirrhosis<sup>1</sup>. Cirrhosis is one of the leading cause of mortality amongst Pakistani population and frequent cause of admissions in our hospitals<sup>2</sup>. One of the most important complications of decompensated chronic liver disease is spontaneous bacterial peritonitis (SBP), which is common and associated with a high risk of morbidity and mortality. About 10-30% of patients having ascites develop SBP<sup>3</sup>, mortality is 20-25%.due to SBP in hospitalized patients<sup>4</sup>.

<sup>1</sup>. Department of Gastroenterology / Medicine<sup>2</sup>, Poonch Medical College Rawalakot.

Correspondence: Rizwan Saeed Kiani, Senior Registrar, Department of Gastroenterology, Poonch Medical College Rawalakot.

Contact No: 0334-5269263  
Email: dr.rizwankiani63@gmail.com

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Traditionally, ascitic fluid routine examination has been used for evaluating suspected intra-peritoneal bacterial infection in patients with decompensated chronic liver disease. A neutrophil count  $> 250 \text{ cells/mm}^3$  is considered diagnostic of SBP regardless of isolation of any infective agent from asitic fluid<sup>5,6</sup>. Different inflammatory markers are also raised significantly in the SBP and different studies have been conducted to determine the usefulness of these markers<sup>7</sup>. TNF- $\alpha$  and IL-6 were found significantly higher in patients of SBP as compared to sterile asites<sup>8,9</sup>. Similarly ascitic fluid lactoferrin, calprotectin and ascitic procalcitonin levels were found raised in SBP patients as compared to patients having ascites without SBP<sup>3,10,11</sup>. Leukocyte esterase reagent strips, based on detection of leukocyte esterase activity in fluids and serum C reactive proteins (CRP) were also found useful in the diagnosis of SBP<sup>12,13</sup>.

Immediate diagnosis of SBP is important for prompt empiric antibiotic therapy. Ascitic fluid analysis to count neutrophils is not always readily available in all hospitals. Simple and reliable laboratory parameters are necessary for immediate diagnosis of infections in decompensated chronic liver disease patients. Most of the biomarkers studied also need diagnostic ascitic fluid tap to confirm the diagnosis of SBP. Serum CRP is only non-invasive, easily available and cost effective

alternative as shown by different studies. It is also helpful in predicting the response of treatment<sup>13</sup>. Few studies have been conducted to find the usefulness of CRP in the early diagnosis of SBP internationally. Some of these studies used ascitic fluid CRP levels rather than serum CRP levels<sup>15</sup>. No study has been conducted in Pakistan. This study was conducted to determine the diagnostic accuracy of serum CRP levels for the rapid diagnosis of spontaneous bacterial peritonitis in patients having ascites secondary to decompensated chronic liver disease in our population. Simple and reliable laboratory parameters are necessary for immediate diagnosis of infections in decompensated chronic liver disease patients. Recently, serum inflammatory biomarkers such as CRP and procalcitonin (PCT) have been shown to improve clinician accuracy for the diagnosis of spontaneous bacterial peritonitis with important prognostic and therapeutic implications.

## MATERIALS AND METHODS

This cross sectional validation study was conducted at Department of Gastroenterology and Medicine poonch medical college rawalakot from 16-10-2019 to 15-01-2020. All diagnosed cases of Chronic Liver Disease having ascites admitted in gastroenterology ward or presenting in the emergency department from 18 years and above, both male and female were included in the study by consecutive sampling were included in the study. Patients with any of the following conditions were excluded: having ascites due to other causes, evidence of infection from other sources as evident by urine and stool routine examination, chest x-ray or obvious source of skin infection. Informed consent was taken from each patient; Ethical approval was obtained from Hospital Ethical committee.

Patient's age and gender was recorded upon admission. Baseline investigations including complete blood count, urine RE and chest X ray were done. An abdominal ultrasound was done to confirm the presence of ascites. Diagnostic abdominal paracentesis was done with 24 gauge needle. Initially 10 cc ascitic fluid was sent to laboratory for routine examination including total cell count ( $\text{mm}^3$ ), differential count (percentages), protein concentration (gm/dl) and gram stain. A diagnosis of spontaneous bacterial peritonitis was made and documented if  $> 250 \text{ mm}^3$  neutrophils were found in ascitic fluid. A serum sample was drawn for CRP and the results were reported in mg/L. Serum CRP level of  $\geq 29.5 \text{ mg/L}$  was considered as significant. All the data was recorded in the Performa.

SPSS (version 17) was used to enter and analyze the data. Mean  $\pm$  standard deviation (SD) was calculated for quantitative variable like age and CRP levels. Frequencies and percentages were calculated for qualitative variables like gender, presence or absence of spontaneous bacterial peritonitis. Sensitivity,

specificity, Positive predictive value (PPV) and Negative prediction value (NPV) were calculated to validate the findings.

## RESULTS

Total 210 patients were included in the study. There were 60.95 (n=128) male and 39.04% (n=82) female patients with the mean age of  $43.36 \pm 13.68$  years (range 19-78 years).

Spontaneous bacterial peritonitis was diagnosed in 28.09% (n=59) patients, CRP levels was greater than  $29.5 \text{ mg/L}$  in 29.52% (n=62) patients. CRP level was high in 83.05% (n=49) patients with SBP whereas it was raised only in 8.6% (n=13) patients without SBP. Sensitivity was 83.05% and specificity was 91.39 % (shown in table 1). Positive Predictive Value was 79.03 %, Negative Predictive Value was 93.24% and Diagnostic Accuracy was 89.04%.

**Table No.1: 2x2 table of CRP Levels  $> 29.5 \text{ mg/L}$  and SBP**

		Spontaneous Bacterial Peritonitis		Total
		Present	Absent	
CRP Level $> 29.5 \text{ mg/L}$	Yes	a=49	b=13	62
	No	c=10	d=138	148
Total		59	151	210
Sensitivity		83.05%		
Specificity		91.39%		

$$\text{Positive Predictive Value: } \frac{a}{a+b} \times 100 = 79.03\%$$

$$\text{Negative Predictive Value: } \frac{d}{d+c} \times 100 = 93.2\%$$

$$\text{Diagnostic Accuracy: } \frac{a+d}{a+b+c+d} \times 100 = 89.04\%$$

## DISCUSSION

Decompensated chronic liver disease is a common complaint among patients presenting to the emergency department. One of the most important complications of decompensated chronic liver disease is spontaneous bacterial peritonitis, which is common and associated with a high risk of morbidity and mortality.

Traditionally, ascitic fluid evaluation has been used for evaluating suspected intra-peritoneal bacterial infection in patients with decompensated chronic liver disease. By considering a neutrophils count  $> 250 \text{ cells/mm}^3$  determined by the manual method as the "gold standard" for the SBP diagnosis, the automated blood cell counter had a sensitivity of 100% and a specificity of 97.7%, whereas positive and negative predictive values were 94.1% and 100%, respectively.<sup>16</sup>

Simple and reliable laboratory parameters are necessary for immediate diagnosis of infections in decompensated chronic liver disease patients. Recently, serum inflammatory biomarkers such as CRP and procalcitonin (PCT) have been shown to improve clinician

accuracy for the diagnosis of spontaneous bacterial peritonitis with important prognostic and therapeutic implications.<sup>4</sup>

In our study we found that serum CRP level was raised significantly in patients of cirrhosis having spontaneous bacterial peritonitis. Its sensitivity in diagnosing the SBP was found 83.05% and specificity 91.39 % as compared to gold standard ascitic neutrophils count. It can be used as non-invasive serum marker for the diagnosis of SBP. Negative predictive value was 93.24 %, so a normal CRP is more important to rule out the SBP in suspected patients.

Our 60.95% patients were male and 39.04% patients were female. Cirrhosis is more common in males because females have slower progression of fibrosis and decreased incidence of cirrhosis pre transplantation as shown by studies done earlier<sup>17</sup>. A study conducted in Taiwan shows male predominance of 71% in patients having cirrhosis<sup>18</sup>. These findings are consistent with our findings of male predominance. Another study also supports our findings by showing that men had higher incidence of cirrhosis in all age groups as compared to women<sup>19</sup>. A local study also showed that 64 % patients of cirrhosis were male in their study<sup>20</sup>.

Mean age in our study was  $43.36 \pm 13.68$  years. Although cirrhosis of liver is found in young age as well but usually it is common in old age having higher mean age<sup>18</sup>. Mean age was found 40.5 years in patients of cirrhosis in a study conducted by Devrajani BR et al<sup>20</sup>. This mean age is comparable with our study. A study conducted in china shows mean age of  $50.29 \pm 7.03$  in SBP group of cirrhotic patients, almost same as found in our study<sup>21</sup>.

CRP level was high in 83.05% patients of SBP in our study with sensitivity of 83.05% and specificity of 91.39% for the diagnosis of SBP in patients of cirrhosis. Positive predictive value was 79.03% and negative predictive value was 93.04%. Our findings are suggestive that CRP level can be used as a marker to help in the diagnosis of SBP. These results are comparable with the results of Rizk E et al, they concluded that CRP may be used as a reliable marker for the diagnosis of SBP; CRP was shown to have 96% specificity and 90% sensitivity for detecting SBP in their study<sup>22</sup>. Kadam et al also have same results, showing that CRP level was significantly higher in patients with SBP as compared to patients having sterile ascites<sup>15</sup>. The sensitivity of CRP in diagnosing the SBP was found 93.3% in another study conducted in Egypt also supporting our findings<sup>23</sup>.

It was single center study considering Neutrophils count  $> 250 \text{ mm}^3$  as diagnostic of SBP; ascitic fluid culture was not done. In future multicenter studies are recommended comparing CRP levels with ascitic fluid culture along with neutrophil count.

## CONCLUSION

CRP is reliable serum marker for rapid diagnosis of spontaneous bacterial peritonitis in patients admitted due to complications of cirrhosis.

### Author's Contribution:

Concept & Design of Study: Rizwan Saeed Kiani  
 Drafting: Muhammad Nadeem  
 Data Analysis: Abdul Quddus  
 Revisiting Critically: Rizwan Saeed Kiani, Muhammad Nadeem  
 Final Approval of version: Rizwan Saeed Kiani

**Conflict of Interest:** The study has no conflict of interest to declare by any author.

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