ORIGINAL ARTICLE

Incidence of Nephropathy After Spontaneous Bacterial Peritonitis in Decompensated Liver Cirrhosis at Muhammad Teaching Hospital, Peshawar: A Single Institution Descriptive Cross-Sectional Study

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ABSTRACT

Objective: To determine the incidence of nephropathy after spontaneous bacterial peritonitis in patients with decompensated liver cirrhosis.

Study Design: Descriptive cross-sectional study.

Place and Duration of Study: This study was conducted at the Department of Medicine, Muhammad Teaching Hospital (MTH), Peshawar, Pakistan from November 1st, 2024, to April 30th 2025.

Methods: A total of one hundred and ten (110) patients were part of the current study. This sample size was obtained by using the WHO sample size calculator, for which a reference study was considered having a frequency of renal impairment in about 83.3% of patients who had developed decompensated liver cirrhosis followed by spontaneous bacterial peritonitis. Consecutive, non-probability sampling technique was used. The confidence interval was equal to 95% while error margin was equal to 6% to calculate the size.

Results: Participants of the study were adults, and the minimum age was 18, whereas the oldest was 60 years, with a mean of 46.436 ± 6.81 years. As chronic liver disease patients were selected, they had a prolonged history of decompensated cirrhosis of the liver (mean duration was 8.845 ± 2.38 months). Gender classification of 110 participants was done, in which males were 91 (82.7%) and females were 19 (17.3%). Nephropathy (Renal impairment) was observed in 33 (30%) of patients after spontaneous bacterial peritonitis in decompensated liver cirrhosis.

Conclusion: In this study, the results showed that overall, there was 30% renal impairment in the observed cases. They were more prominent in Child's Pugh C cirrhosis liver compared to Class A or B cirrhosis liver because of the development of ascites.

Keywords: *Ascites, Cirrhosis, Nephropathy, Peritonitis.*

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Introduction

Spontaneous bacterial peritonitis (SBP) is a medical term used to explain acute infection of ascites. Ascites is defined as the collection of fluid in more than normal concentration in the abdominal cavity without a specific etiology.[1,2] SBP is usually more often present in those candidates of chronic liver cirrhosis who have developed ascites and is considered in the differential diagnosis when the patient presents with the symptoms of painful abdomen, fever, confusion, and/or abnormal mental status. There are no acceptable criteria for diagnosing a patient with SBP, and it has also been

reported that although in minority, but some patients also present to the clinicians without complaint of abdominal pain.[3]

It has been reported that SBP in the majority of cases is caused by gram-negative aerobic organisms (75%), in which 50% of the cases are caused by Klebsiella pneumoniae. Whereas, the rest are caused by Gram-positive aerobic microorganisms, in which the most frequently identified source of infections is S. pneumoniae or S. Viridans.[3,4]

SBP can be seen in any age, affecting both elderly and young children. In young children, it has been reported that neonates followed by children <5 years old are more frequently diagnosed with SBP. As already mentioned, liver cirrhosis is probably one of the most frequent causes for developing ascites. However, it is not confined to liver cirrhosis alone and can be seen as a complication in multiple other disease that leads to collection of ascitic fluid in the peritoneal cavity; to name a few includes congestive cardiac failure (CCF/CHF), Budd-Chiari syndrome, systemic lupus erythematosus (SLE), acute/chronic renal failure (ARF/CRF), or certain malignancies with poor prognosis.[5] Approximately 10-25% of such patients presenting with ascites lead to SBP complications, in which 20% of the cases ultimately lead to in-hospital mortality.[6]

Acute renal disease/impairment is a very frequent complication seen in cirrhotic patients with ascites and SBP, and is a leading cause of in-hospital deaths. Moreover, a systematic review reported after reviewing 18 articles, that compromised kidney function is the single most important independent predictor of mortality in patients who were diagnosed with liver cirrhosis and now present with SBP.[6] In another study by Bucsics T et al. it has been shown that the frequency of renal impairment was 83.3% in such patients having liver cirrhosis and SBP.[7]

To our knowledge, the renal complications after SBP in hepatic cirrhosis have not been studied in our general population. Therefore, I have planned to get local evidence regarding the burden of this morbidity in our population and to aid in the management of SBP in cirrhotic patients.

Methods

The study was conducted at the Department of Medicine, Muhammad Teaching Hospital (MTH), Peshawar, Pakistan from 1st November 2024 to 30th April 2025 after taking approval from the Ethical Review Board of the hospital vide letter no: MTH/EC/187/2024, dated: 25th October 2024. The total sample size for this descriptive cross-sectional work was 110 patients, with the aim of determining the incidence of renal impairment/complications after spontaneous SBP in liver cirrhosis. Sample size was calculated by using the official WHO software, in which a reference study was used during calculation, in which reported renal impairment frequency after SBP in cirrhosis was 83.3%[7] (confidence level was equal to 95%, and error margin was equal to 6%).

Consecutive, non-probability sampling techniques were used. Patients would be randomly and consecutively selected (double blind).

Inclusion Criteria: Patients aged 18 to 60 years old, both genders (male/female) with decompensated liver cirrhosis and spontaneous bacterial peritonitis.

Exclusion Criteria: Patients having already diagnosed chronic kidney disease, Hepatocellular carcinoma, other malignancies, obstructive uropathy, acute/chronic cardiac or cerebral vascular events, and pregnant females were excluded from the study.

Those patients who presented with one or more of the above-mentioned conditions were excluded from this study to minimize the effects of modifiers and reduce bias.

Prior to the conduction of this research, ethical approval was obtained from the ethics and research committees of the Muhammad Teaching Hospital, Peshawar. Only those patients who were fulfilling the inclusion criteria were selected from the Department of Medicine and Gastroenterology, Muhammad Teaching Hospital, Peshawar. The details of the research procedure and its objectives were discussed with participants, and they were made aware of the whole procedure beforehand in a counseling meeting with them. In this meeting, those who were willing were recruited after their informed consent. Basic demographic data, including age, gender, and duration of cirrhosis, were recorded.

For routine biochemistry test, both blood and urine samples were obtained, in which routine biochemical test, renal function test, coagulation profiles, and arterial blood gas (ABGs) were

performed, while chest X-Ray and ultrasound examination were also carried out. The urine output/hour was also recorded. Renal impairment in these patients was carefully assessed, and the details were recorded on an approved Performa.

Data obtained during this research were statistically analyzed using SPSS version 25. Quantitative variables such as age and duration of hepatic cirrhosis were represented in terms of Mean ±SD. Qualitative variables, such as gender and renal impairment, were described in terms of frequencies and percentages. Renal impairment was further stratified to other variables like age, gender, and duration of hepatic cirrhosis. Using the post-stratification chi-square test, the significant results were considered to have a *P*-value <0.05. The results obtained in this study were depicted in the form of tables and graphs.

Results

Gender distribution among 110 patients was analyzed as follows: N=110 Gender Wise Distribution Male 91 (82.7%) Female 19 (17.3%). (Figure 1).

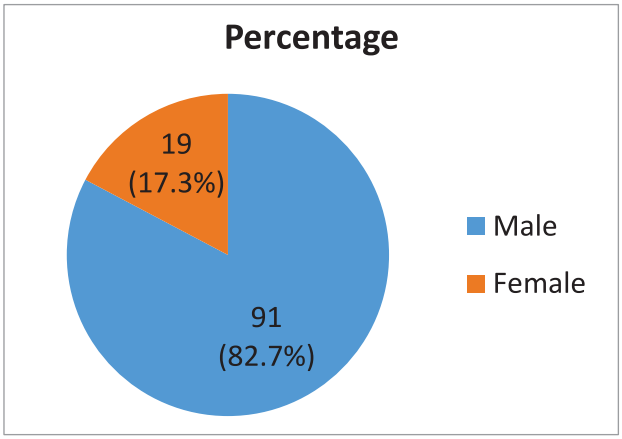

Fig.1: Gender Distribution (N=110)

All the participants belonged to the adult group and their ages were between 18 and 60 years, whereas the mean age was 46.436 ± 6.81 years, and the mean time since cirrhosis developed was 8.845 ± 2.38 months, as shown in Table 1. Renal impairment was noted in 30% of patients after SBP in cirrhosis, as shown in Table 2. Stratification of renal impairment concerning age, gender, and duration of cirrhosis is shown in Table 4 and 5, respectively.

Table 1: age and duration of cirrhosis (N=110)

Demographics	Mean ± SD
Age (years)	46.436 ± 6.81
Duration of cirrhosis (months)	8.845 ± 2.38

Table 2: Renal impairment (N=110)

Renal Impairment	Frequency	Percentage %
Yes	33	30%
No	77	70%
Total	110	100%

Table 3: Stratification of renal impairment for age N (%)

Age (years)	Renal Impairment	
	Yes	No
18-40	2 (9.5%)	19 (90.5%)
41-60	31 (34.8%)	58 (65.2%)
Total	33 (30%)	77 (70%)

Table 4: Stratification of renal impairment for gender N (%)

Gender	Renal Impairment	
	Yes	No
Male	26 (28.6%)	65 (71.4%)
Female	7 (36.8%)	12 (63.2%)
Total	33 (30%)	77 (70%)

Table 5: Stratification of renal impairment for duration of cirrhosis N (%)

Duration of cirrhosis (months)	Renal Impairment	
	Yes	No
≤6	1 (8.3%)	11 (91.7%)
>6	32 (32.7%)	66 (67.3%)
Total	33 (30%)	77 (70%)

Discussion

Liver diseases leading to cirrhosis is associated with a multitude of complications. It has been observed that the prevalence of renal disease in patients is directly proportional to severe liver pathology, irrespective of the causes of cirrhosis. Likewise, it has been reported that renal functions were significantly improved in those patients who had shown improvement in liver functions, especially after successful treatment and/or liver transplantation.[8] In the current study male dominated the female representation in a ratio of 4.8 to 1. A somewhat similar pattern was documented in age distribution as well as gender-based comparison in another cohort study of cirrhosis. In a previous study by Biggins SW et al, which shows that the variation in renal function from the normal ranges occurred irrespective of the cause of hepatic cirrhosis in patients, is in perfect agreement with our study.[9]

In this research, serum creatinine levels were determined along with blood urea nitrogen (BUN) levels for the assessment of renal function; however, other factors that can determine a multitude of other aspects of renal function could not be evaluated, which is indeed one of the limitations of this research work. In patients who were diagnosed with liver cirrhosis and later developed ascites and SBP, complications like renal impairment also occurred, for which different theories were proposed to explain the probable cause such complications lead to hospital admissions, prolonged hospital stay, and costly treatments. to overcome these burdens, we therefore propose that such patients be treated with albumin administration.[10] In the current medical research study, renal impairment was documented in 33 (30%) patients, whereas 77 (70%) had absolutely normal renal functions. Research also shows that SBP causing renal impairment were markedly high in those patient who died in the hospital. A research study conducted by Arroyo V et al. reported that eight patients out of a total of 23 led to renal failure, where six of them died.[11] On the contrary, all those patients who didn't develop renal failure were sent home without any mortality. Other studies have also reported similar findings, and in conclusion, it was stated that renal impairment in such patients who were already cirrhotic and had ascites as well as SBP leads to mortality in admitted patients.[12,13] Our study reported that the mean BUN was 22.15 ± 11.65 and creatinine concentration in the serum was 1.22 ± 0.93. Based on these results, it was evident that the mean creatinine level in our research was lower in contrast to another study in such patients, which reported the mean creatinine level 1.95 ± 1.00.[9] A study conducted by Juncu S et al. has shown in their research that BUN was 75.2 ± 67.9, while the serum creatinine level was 1.6 ± 1.3 in such patients who were diagnosed with liver cirrhosis and had developed SBP.[14] These readings are also comparatively higher than those documented in our study. Such variations in the results can be attributed to the patient's selection and exclusion criteria, especially in those with a previous history of renal impairment before developing SBP. Whereas, multiple other conditions in such cohort studies, which are known causes of renal insufficiency in other patients, also affect the results.[15]

In this study, according to the Child's Class, we studied the frequency of renal impairment, and it was found that its frequency is directly related to the severity of the liver disease. This finding was never documented in earlier research. Instead, these studies focused on the Model for End-Stage Liver Disease (MELD) score for the development of kidney damage. However, as is evident during the analysis of these sub-groups, the sample size was not estimated for each one; therefore, a more reliable inference in this regard could not be established. Previous research showed that cirrhotic patients with SBP had higher BUN and serum creatinine levels.[16,17] This derangement was not associated with the cause of

cirrhosis. However, their frequency was dependent on other factors such as prothrombin time (PT), albumin concentration in the serum, and sodium level in blood, BUN, and serum creatinine levels at the time of diagnosis of SBP.[18,19] Although it is noteworthy that Child- Pugh classification has five parameters in which PT values and serum albumin concentration are also the two important ones.[20] Research shows that the mortality rate was much higher in patients with kidney diseases who also had liver cirrhosis, but the fact is that the death may have been caused mostly by the complications of liver disease rather than renal disease. Previous studies have also shown such pattern in which there is link and strong association between acute kidney injury and spontaneous bacterial peritonitis.[21] Also limitations or short comes to the study were variability in the impact of different bacteria types on the severity of spontaneous bacterial peritonitis and renal dysfunction.[22] Future suggestions in the context of this study will include the role of photo-responsive nanomaterials and vaptans in the diagnosis, classification, and treatment of renal injury, followed by spontaneous bacterial peritonitis.[23] Confounders of the study were also noted, which could cause renal impairment. Given the small number of patients who reported additional diseases in this study, we were unable to analyze them separately and determine whether these diseases increase the risk of renal impairment in patients with cirrhotic liver disease and SBP. The exact cause of renal impairment in liver disease is yet to be established. Still, it has been proposed to be multifactorial.

Conclusion

In this study, results showed that overall, there was 30% renal impairment in the observed cases. They were more prominent in Child's Pugh C cirrhosis liver compared to Class A & B cirrhosis liver, respectively, because of the development of ascites.

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Conflict of Interest: The authors declare no conflict of interest

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Author Contributions

SA: Conception and design of the work
MA: Writing the original draft, proofreading, and approval for final submission
SAZK: Manuscript writing for methodology design and investigation
RU: Validation of data, interpretation, and write-up of results
AI: Data acquisition, curation, and statistical analysis
MSK: Revising, editing, and supervising for intellectual content