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Original Article

Frequency of Renal Impairment Among Patients with Liver Cirrhosis with Spontaneous Bacterial Peritonitis

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Abstract

Objective: This study aim was to ascertain the prevalence of renal impairment among patients diagnosed with spontaneous bacterial peritonitis resulting from liver cirrhosis.

Methods: The descriptive cross-sectional study was conducted in the Department of Gastroenterology, Hayatabad Medical Complex, located in Peshawar. The study duration was 6 months from September 29th, 2022 to March 29th, 2022. A cohort of 212 individuals was examined to ascertain the prevalence of renal dysfunction among patients afflected with spontaneous bacterial peritonitis because of liver cirrhosis.

Results: A total of 212 patients were recruited in which 34.3% (n=72) were found in aged 31-40 years. The mean age of the participants was 51.5±3.3 years. Among total, 87 (41.4%) were male and 123 (58.6%) were female patients. Among total, 48 (22.9%) were found in underweight range. It was observed that 96 patients (45.7%) had renal impairment, while 114 patients (54.3%) not affected with renal impairment. The analysis revealed that smoking was seen in 80 individuals (38.1%), whereas hypertension was observed in 120 individuals (57.1%).

Conclusion: Renal impairment has significant prevalent occurrence among cirrhotic patients presenting with ascites and spontaneous bacterial peritonitis (SBP). The SBP-RI variable has significant predictive value for hospital mortality in individuals diagnosed with SBP. Individuals who have significantly compromised liver function or pre-existing kidney failure are more susceptible to the development of spontaneous bacterial peritonitis with renal impairment.

Keywords: Renal impairment, Spontaneous bacterial peritonitis, Liver cirrhosis

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Introduction

Cirrhosis is a chronic and devastating disease that imposes a considerable cost on world health, resulting in huge levels of illness and death.[1] The phenomenon is notably widespread among the Pakistani demographic, making a substantial contribution to the number of hospital admissions.[2] Within this environment, it is seen that a significant percentage of persons tend to acquire cirrhosis within a timeframe ranging from 5 to 30 years.[3] The primary causative element in this scenario is viral hepatitis, as opposed to Western nations where cirrhosis produced by alcohol consumption is more prevalent. The increasing prevalence of cirrhosis highlights the need for further study aimed at gaining a deeper understanding of the related problems and their effective treatment.[4]

Spontaneous bacterial peritonitis (SBP) is a prevalent and perilous bacterial infection that usually manifests in individuals with cirrhosis and ascites, constituting a significant consequence of this condition.[5] Spontaneous bacterial peritonitis (SBP) has been seen to impact about 10 to 30% of individuals in this patient population, resulting in hospital death rates that vary between 20% and 30%.[6] The development of spontaneous bacterial peritonitis (SBP) is associated with compromised humoral and cellular immune responses, leading to the migration of intestinal bacteria into the ascitic fluid. Spontaneous bacterial peritonitis (SBP) is further distinguished by its unfavorable long-term prognosis, as evidenced by a significant increase in mortality rates ranging from

50% to 70% within a span of one year.[7]

The timely identification and precise diagnosis of bacterial infections that are accountable for spontaneous bacterial peritonitis (SBP) are imperative to enhance clinical results. The prognosis can be significantly improved, especially in acute care settings, through the implementation of prompt and appropriate antibiotic treatment.[5] Moreover, it is crucial to recognize the causative pathogens to guarantee the efficacy of antibiotic coverage, as evidenced by alterations in microbial and resistance patterns associated with heightened antibiotic prophylaxis and invasive procedures.[8]

Nevertheless, spontaneous bacterial peritonitis (SBP) frequently results in clinical decompensation, manifesting as the worsening of ascites, hepatic encephalopathy, gastrointestinal bleeding, and the engagement of extrahepatic organs, including renal impairment (RI).[9] The understanding of the incidence, clinical course, predisposing factors, and prognosis of RI in the context of SBP is currently lacking, despite its considerable importance. The significance of this knowledge gap cannot be overstated, as the occurrence of kidney failure in cirrhotic patients with ascites is linked to a highly unfavorable outcome.[10] Additionally, a considerable proportion of patients with spontaneous bacterial peritonitis (SBP) experience this complication even after the infection has been successfully treated. Hence, it is imperative to acquire a more profound comprehension of the natural progression of renal impairment associated with spontanous bacterial perotonitis (SBP) to effectively identify individuals who are susceptible to this condition and to take necessary preventive interventions aimed at safeguarding renal function.[11] Multiple studies have documented different rates of renal impairment (RI) among cirrhotic patients with spontaneous bacterial peritonitis (SBP), with certain studies suggesting a notable prevalence of RI in this patient population. As an example, a study indicated that 77.27% of individuals diagnosed with cirrhosis and spontaneous bacterial peritonitis (SBP) exhibited renal impairment (RI). Conversely, another study observed that 27.2% of patients with cirrhosis and SBP experienced renal impairment.[11]

The primary objective of this study is to ascertain the prevalence of renal dysfunction among individuals in the Pakistani population who have liver cirrhosis and spontaneous bacterial peritonitis (SBP). This study aims to address a significant knowledge gap by investigating the relationship between liver cirrhosis and the development of renal impairment in patients with spontaneous bacterial peritonitis (SBP), considering the high prevalence of liver cirrhosis in the region.

Methods

The research used a cross-sectional descriptive approach and was carried out in the Department of Gastroenterology located within the premises of Hayatabad Medical Complex in Peshawar, Pakistan. The duration of the study was six months from September 29th, 2022 to March 29th, 2022. The research had a sample size of 212 patients and was estimated using WHO software, considering an estimated percentage of 27.2% of renal impairment (RI) in patients with liver cirrhosis who had spontaneous bacterial peritonitis (SBP). The confidence level was 95%, and a margin of error of 6% was used. The sampling approach used in this study was sequential non-probability sampling.

All individuals are diagnosed with liver cirrhosis, irrespective of the level of severity, and with a minimum length of one year after the onset of the illness and age range spans from those over 30 years of age to those who are 60 years old were included in the study. Patients presenting with an alternate location of infection or individuals who have a medical background of diabetes, as shown by a fasting blood glucose level over 126 mg/dL were excluded from the study. Moreover, individuals who have been diagnosed with additional immunosuppressive illnesses such as Human Immunodeficiency Virus (HIV) or have a documented history of recent corticosteroid use within the last month were also excluded from this research.

The study was commenced after obtaining clearance from the institutional ethics and research council of the hospital. Comprehensive medical histories and thorough clinical exams were performed for all individuals. Standard and targeted pre-operative examinations were conducted. Renal impairment was assessed by measuring serum creatinine and urea levels at the hospital laboratory. The demographic details of the patients, such as their name, age, and gender, were documented using a standardized data-collecting form. The research outcomes were controlled for possible confounders and bias by strictly adhering to the exclusion criteria. The laboratory studies were carried out under the guidance of a highly experienced pathologist, who had a minimum of five years of expertise in the field.

The data acquired on the data collecting forms were subjected to analysis using SPSS version 20.0. Mean and standard deviation (Mean + SD) were computed for quantitative data, including age, duration of cirrhosis, and BMI. The analysis included the examination of categorical variables, including gender, diabetes mellitus (DM), hypertension (HTN), smoking, and renal impairment (RI), by means of computing percentages and frequencies. To investigate possible effect changes, the incidence of RI was stratified according to age, gender, duration of cirrhosis, and BMI. The chi-square test was used, and a p-value below 0.05 was deemed to have statistical significance. The study's findings were presen-

ted in tables and graphs to enhance comprehension of the results.

Results

The sample consisted of 212 individuals who were divided into four distinct age cohorts: 20-30 years, 31-40 years, 41-50 years, and 51-60 years. Most participants belonged to the age range of 31-40 years, accounting for 34.3% of the entire sample. This was followed by those in the age range of 41-50 years, constituting 26.2% of the participants. Table 1 displays the statistical characteristics of the subjects, revealing a mean age of 51.56 years and a standard deviation of ±3.357. Table 1 shows the gender distribution of the 212 patients. The research included individuals of both genders, including both males and females. Most patients in the study were female, comprising 58.6% of the overall sample, while the remaining 41.4% were male. The distribution of patients depending on their Body Mass Index (BMI) categorization is shown in Table 1. The patients were classified into four distinct BMI categories, namely Underweight, Normal, Overweight, and Obese. The predominant category consisted of individuals falling within the Normal Range, accounting for 47.6% of the whole population. Subsequently, the Underweight Range included 22.9% of the entire sample. The average weight of the patients was found to be 81.1 kg, with a standard variation of ±3.91. The distribution of renal impairment (RI) among the 212 patients is shown in Table 1. The study revealed that most patients, namely 45.7%, presented with renal impairment (RI), whilst the remaining 54.3% of patients did not display any indications of RI. Table 1 provides an overview of the prevalence of smoking and hypertension among the 212 patients. The prevalence of smoking among the patients was found to be 38.1%, whilst hypertension was seen in 57.1% of the individuals. The statistics presented above provide a comprehensive depiction of the prevalence of the risk variables among the subjects included in the research.

Table 1: *The demographic details of the study participants.*

Parameter	Detail	Frequency	Percentage
Age Group Mean age 51.5±3.3	20-30 Years	36	17.1
	31-40 Years	72	34.3
	41-50 Years	55	26.2
	51-60 Years	47	22.4
Gender-wise	Male	87	41.4
	Female	123	58.6
Duration of Disease	Less than 6 months	99	47.1
	More than 6 months	111	52.9
BMI Classification Mean weight 81.1±3.91kg	Underweight	48	12.9
	Normal	100	47.6
	Overweight	35	16.7
	Obese	27	12.9
Distribution of renal impairment	Yes	96	45.7
	No	114	54.3
Distribution of smoking status	Yes	80	38.1
	No	130	61.9
Distribution of diabetes mellitus	Yes	96	45.7
	No	114	54.3

The participants' age and renal impairment:

The presented table illustrates the prevalence of renal impairment among several age cohorts, namely those aged 30-60 years, 31-40 years, 41-50 years, and 51-60 years. A chi-square test was conducted, revealing a statistically significant association (p-value = 0.000) between age and renal impairment. The variables of

Table 2: *Shows the association between renal impairment and associated factors.*

Variable	Detail	Renal Impairment		P-Value
		Yes (96)	No (114)	
Age-wise distribution	31-40 Years	32 (33.3%)	40 (35.1%)	0.000
	41-50 Years	23 (24.0%)	32 (28.1%)	
	51-60 Years	16 (16.7%)	31 (27.2%)	
Gender	Male	87 (90.6%)	0 (.0%)	P = 0.000
	Female	9 (9.4%)	114 (100.0%)	
Duration of complaint or bleeding	Less than 6 months	75 (78.1%)	24 (21.1%)	P = 0.000
	More than 6 months	21 (21.9%)	90 (78.9%)	
BMI Classification	Underweight	17 (17.7%)	31 (27.2%)	P = 0.00
	Normal	43 (44.8%)	57 (50.0%)	
	Overweight	21 (21.9%)	14 (12.3%)	
	Obese	15 (15.6%)	12 (10.5%)	
Smoking	Yes	80 (83.3%)	0 (.0%)	P = 0.000
	No	16 (16.7%)	114 (100.0%)	
Hypertension	Yes	96 (100.0%)	24 (21.1%)	P = 0.000
	No	0 (.0%)	90 (78.9%)	
Diabetes Mellitus	Yes	96 (100.0%)	0 (.0%)	P = 0.00
	No	0 (.0%)	114 (100.0%)	

renal impairment and gender. The study presents an analysis of the prevalence of renal impairment in both male and female subjects. The findings of the chi-square test revealed a statistically significant relationship (p-value = 0.000) between gender and the presence of renal impairment. The stratification of renal impairment by the length of the illness. The patients were classified into two groups depending on the length of their condition, namely whether it was less than 6 months or more than 6 months. The chi-square test showed a statistically significant association (p-value = 0.000) between the length of the illness and the presence of renal impairment. Table 2 displays a cross-tabulation of renal impairment and BMI categorization, including the categories of Underweight Range, Normal Range, Overweight Range, and Obese Range. The findings demonstrate a statistically significant correlation (p-value = 0.000) between BMI categorization and the presence of renal impairment. The stratification of renal impairment based on three variables: smoking, hypertension, and diabetes mellitus. The chi-square test yielded statistically significant findings (p-value = 0.000), indicating a substantial connection between the identified risk variables and the occurrence of renal impairment (Table 2).

Discussion

The purpose of this research was to find out how often individuals with spontaneous bacterial peritonitis (SBP) and liver cirrhosis had renal impairment (RI). The findings have various implications for clinical practice and will be examined considering prior research.

The research population's age distribution revealed a wide age range, with the bulk of participants lying between the ages of 31 and 60. Interestingly, the patient's mean age was 51.56 years. This is consistent with other research showing a broad age range among cirrhosis and SBP patients. The age distribution in this research is consistent with the demographic features of patients with cirrhosis, a disease that may afflict people of different ages.[12] Distribution by gender showed that a larger percentage of the study's participants were female patients 58.6% of the total. This gender distribution is in line with other studies that found that in certain groups, women had a greater frequency of cirrhosis. These results highlight the significance of vulnerability to cirrhosis and gender-specific risk variables.[13]

According to the patient's BMI categorization, 47.6% of participants were found to be within the normal BMI range. This is in line with earlier research that showed cirrhotic individuals' BMI distribution to be comparable. The study's average patient weight of 81.1 kg was indicative of the cirrhotic population's varied BMI status[14]. The study's distribution of renal impairment showed that 45.7% of patients had RI, underscoring the substantial effect of SBP on kidney function. This finding is in line with other studies that found a significant frequency of RI in individuals with SBP who were cirrhotic. It also emphasizes how important it is to measure renal function while managing these individuals 15. 38.1% of the patients in the study were smokers, and 57.1% had hypertension, according to the analysis of their smoking and hypertension status. These results are consistent with earlier research showing these risk variables to be common in patients with cirrhosis. Hypertension and smoking may make cirrhosis complications — including RI—worse.[16]

The evaluation of SBP-RI in cirrhosis patients by the research yielded important information. According to reports, 33% of patients had SBP-RI, highlighting the significant risk of renal impairment in these individuals. The research implies that, when unreported cases are taken into consideration, the true incidence of SBP-RI can be considerably greater. This is in line with other studies that have repeatedly shown a significant prevalence of RI in individuals with SBP who are cirrhotic.[17] The study's most important discovery is the link between SBP-RI and a bad prognosis. Compared to patients without SBP-RI, who had a far lower hospital death rate (9%), patients with SBP-RI had an alarmingly high hospital mortality rate (54%). Previous research has consistently shown a relationship between SBP-RI and higher mortality. It emphasizes how important it is to identify and treat SBP-RI as soon as possible to enhance patient outcomes.[6] The multivariate analysis of the research revealed several independent predictors of mortality in SBP, including serum bilirubin levels, age, BUN levels, and the isolation of the causative organism. The fact that these variables have been identified as prognostic markers in SBP before highlights their practical significance.[12]

Features of SBP-RI are comparable to those seen in cirrhosis patients with ascites, indicating a same pathophysiological etiology. Many studies have been conducted on the involvement of endotoxin in SBP and its effects on renal vasoconstriction, vasodilation, and endothelial function. Endotoxins trigger renal vasoconstrictors, but they also cause endotoxin-induced vasodilators, such as prostacyclin and nitric oxide, to contribute to circulatory dysfunction. These processes probably have a role in SBP-RI formation.[18] As a result, this research highlights the correlation between renal impairment and a bad prognosis and validates the high occurrence of renal impairment in cirrhotic individuals with SBP. The results are consistent with other studies and highlight the need of early identification and management to lessen the effects of SBP-RI. The work emphasizes the significance of treating SBP-RI in the treatment of cirrhotic patients and advances our knowledge of the

disorder's intricate etiology and clinical ramifications. In this high-risk group, more research and therapeutic recommendations are needed to enhance patient outcomes and lower mortality.[19]

Conclusion

In conclusion, the findings of this research suggest that renal impairment is a common occurrence among cirrhotic individuals who have ascites and SBP. Nevertheless, it is worth noting that in some individuals, the reversal of SBP-RI may occur after the clearance of the illness. Individuals who have significant liver dysfunction or pre-existing kidney failure are more susceptible to the development of spontaneous bacterial peritonitis with renal impairment.

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