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A RANDOMISED CONTROL TRIAL TO COMPARE THE EFFICACY OF TERLIPRESSIN PLUS ALBUMIN VS MIDODRINE, OCTREOTIDE PLUS ALBUMIN IN THE TREATMENT OF HEPATORENAL SYNDROME

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ABSTRACT

Background: Hepatorenal syndrome (HRS) is a multi-organ disorder impacting both kidneys and liver with prevalence of 4% in cirrhosis. In advanced cirrhosis, cardiac output and systemic vascular resistance are reduced leading to renal hypoperfusion. Research comparing the effectiveness of HRS treatments was scarce in India. This study compared the effectiveness of terlipressin + albumin vs midodrine + octreotide + albumin in HRS treatment as they improve renal perfusion individually. **Materials and Methods:** This Randomized control trial was conducted in Regional Institute of Medical Sciences, Imphal from 2023 to 2025. 2 Intervention groups were: Group 1 (TERLI) - Terlipressin + Albumin Versus Group 2 (MID/OCT) - Midodrine + Octreotide + Albumin. After 7 days treatment, daily urine output, mean arterial pressure (MAP), serum creatinine, serum albumin and bilirubin were assessed. **Result:** Out of total 60, 30 HRS patients were in TERLI group, and another 30 were in the MID/OCT group. Majority were HRS Type 1, observed in 86.7% (26) of the TERLI group and 90% (27) of the MID/OCT group, while Type 2 HRS was observed in 13.3% (4) TERLI and 10% (3) MID/OCT group respectively. After treatment, there were statistically significant improvements in both the groups in terms of renal function, serum albumin levels, serum bilirubin, MAP, urine output and serum sodium. **Conclusion:** Both the treatment regimens significantly improved renal function, MAP and serum bilirubin, albumin ,thereby suggesting both regimens as viable therapeutic options for HRS management, with individualized treatment decisions based on patient characteristics and clinical considerations.

INTRODUCTION

Hepatorenal syndrome (HRS) is a potentially reversible form of renal failure that occurs in patients with cirrhosis and ascites.[1] According to the peripheral arterial vasodilatation theory, HRS results from significant renal artery vasoconstriction due to a decrease in effective circulation volume, caused by significant splanchnic arterial vasodilation and diminished cardiac output. The sympathetic nervous system, the renin-angiotensin system, and the non-osmotic secretion of vasopressin all facilitate renal vasoconstriction. Bacterial infections induce HRS by enhancing vasodilation and exacerbating the cardiocirculatory dysfunction associated with cirrhosis. There exist two categories of HRS. When baseline serum creatinine levels double to > 226 µmol/L (2.5 mg/dL) in <2 weeks, it is a sign of rapid progressive renal failure, which is the hallmark of type 1 HRS.[2] Type 2 HRS is defined by mild renal impairment (serum creatinine 133-226 µmol/L or 1.5-2.5 mg/dL), with a stable or gradually increasing trajectory.

In type 1 HRS, a splanchnic arterial vasoconstrictor improves renal function. Terlipressin, a synthetic counterpart of vasopressin, approved by US Food and Drug Administration (FDA) for treatment of HRS-AKI,[3] is the predominant vasoconstrictor, enhancing renal function in 40%-50% of patients.[4] This vasoconstrictor activity leads to diminished portal blood input and lowered portal

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hypertension.[5] The subsequent shift of circulatory volume from the splanchnic circulation to the systemic circulation enhances systemic haemodynamics and elevates renal perfusion pressure. Terlipressin is used for HRS-1 worldwide for HRS-AKI.[3] Splanchnic vasoconstriction is augmented by midodrine, an alpha-1 adrenergic agonist and octreotide, a somatostatin analogue, which acts by suppressing glucagon-induced splanchnic vasodilatation.[6] The HRS-AKI is a late consequence of cirrhosis marked by a fast decline in renal function caused by diminished renal perfusion due to portal hypertension and renal vasoconstriction. In the United States, albumin + vasoconstrictor is recommended up to 14 days for the HRS-AKI treatment until serum creatinine (SCr) levels diminish to 1.5 mg/dL or within 0.3 mg/dL of baseline values.[7] The most recent European Association for the Study of the Liver (EASL) clinical guidelines recommended terlipressin+ albumin for HRS-AKI.[8] Other vasoconstrictors utilised alongside albumin include norepinephrine,midodrine and octreotide. Recent research indicates that the readily accessible and cost-effective norepinephrine has comparable efficacy to terlipressin; nevertheless, it necessitates the placement of a central venous line and the transfer of the patient to an ICU. Another option that has been reported from both Europe and the US is the combination of midodrine and octreotide with albumin infusion. There is scarcity of data comparing relative effectiveness of midodrine combined with octreotide against norepinephrine in treating HRS-AKI.[9] Only one pilot trial with fewer than 10 HRS-AKI patients in each group concluded that norepinephrine exhibits equivalent efficacy to midodrine combined with octreotide.[10] The current study aims to examine the efficacy of terlipressin combined with albumin against midodrine and octreotide combined with albumin in the treatment of hepatorenal syndrome in a randomised controlled trial.

MATERIALS AND METHODS

This is a Randomized, open label, two armed study conducted in the Department of Medicine, Regional Institute of Medical Sciences (RIMS), Imphal from March 2023 to March 2025. All cases of hepatorenal syndrome admitted in the department of Medicine (Ward/ICU), RIMS were recruited in the study

Inclusion Criteria

Patient 18 years or older diagnosed with HRS (International Ascites Club Consensus Workshop Criteria) were included.

Exclusion Criteria

Patients having contraindications to Terlipressin, Patients diagnosed with chronic kidney disease and cardiovascular diseases, Child Pugh Score more than 13, Ongoing shock or uncontrolled bacterial infection, Current or recent treatment with nephrotoxic drugs, any extra hepatic diseases that could affect the short term prognosis and those not giving consent for the study were excluded.

Sample Size: The G power 3.1 software was used for calculation. The power of the study was taken to be 80% and Confidence Interval (C.I.) of 95% was taken. The sample size was estimated to be a minimum of 24 per group as per the article by Cavallin M et.al.[11] Simple random sampling was employed to minimize selection bias.

Operational definition:

International Ascites Club Consensus Workshop Criteria):

- Cirrhosis with ascites
- Serum creatinine level higher than 1.5 mg/dl (133micromol/L)
- After at least two days of diuretic withdrawal and volume expansion with albumin (1g/kg of body weight/day, up to a maximum of 100g/day), the serum creatinine level did not improve to 1.5 mg/dl or below.
- No recent or ongoing nephrotoxic medication treatment;
- No signs of parenchymal kidney disease, such as proteinuria over 500 mg per day, microhematuria (>50 red blood cells/high power field), or abnormal renal ultrasonographic findings;
- No signs of shock

Study procedure: Baseline information will be recorded for each participant, including clinical history, relevant laboratory investigations and specific baseline metrics related to kidney function, liver status, and other comorbidities will also be collected.

Intervention Administration:

Group 1 received Terlipressin (0.5-2.0 mg subcutaneously or in 100 ml of normal saline administered intravenously every 6 hours) plus Albumin.

Group 2 received Midodrine, Octreotide plus Albumin. A starting dose of 7.5 mg Midodrine was given orally every 8 hrs + octreotide given subcutaneously at a dose of 100 microgram every 8 hours.

Both the groups received intravenous albumin at a dose of 20-60 mg daily as needed. In both the groups, the drugs were given for a maximum of 7 days.

Primary outcomes variables: Decrease in serum creatinine levels by less than 1.5 mg/dl on any given day by the 7th day of the intervention.

Secondary outcome variables: Daily urine output, daily mean arterial pressure, serum sodium and potassium on alternate days and Albumin and Bilirubin on day 7.

Statistical analysis: SPSS (Statistical Package for Social Sciences) package 26.0 was used for statistical comparisons. Shapiro Wilk test was used to check normality of data and Student t-test was used for the comparison of values between 2-time intervals. Categorical variables were summarized as

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frequencies and percentages and chi-square test was used. A p-value <0.05 was considered significant.

Approval of research ethics board: Ethical approval for this study was obtained from the Research Ethics Board, Regional Institute of Medical Sciences, Imphal [No.A/206/REB-Comm(SP)/RIMS/2015/1021/52/2023].

RESULTS

The baseline characteristic of the study subjects was given in [Table 1]. The mean age was slightly higher in the Midodrine/Octreotide (MID/OCT) group (65 ± 13 years) compared to the Terlipressin plus Albumin (TERLI) group (61 ± 14 years). A statistically significant difference (p=0.0001) was observed in age distribution, suggesting a potential influence of age on treatment response or allocation. Males dominated both groups, constituting 73.3%(22) in the TERLI group and 80%(24) in the MID/OCT group, while females accounted for 26.7%(8) and 20%(6), respectively, which were more or less comparable(p=0.0023).Alcohol-related liver disease was the most common etiology in both groups (73.33%{22} in TERLI and 80%{24} in MID/OCT). Alcohol-HBV and Alcohol-HCV co-infections were present in similar proportions across groups but not significant (p=0.34).Type 1 HRS was the predominant form, observed in 86.7% (26) of the TERLI group and 90% (27) of the MID/OCT group, while Type 2 HRS was seen in 13.3% (4) and 10% (3), respectively. Bacterial infections were a precipitating factor in 56.7% (17) in TERLI and 60% {18} in MID/OCT), the difference being statistically significant (p=0.0113).

Patients exhibited hypotension, with 23.3% (7) in both groups having mean arterial pressure (MAP) < 70 mmHg. Most of the study subjects had MAP between 70-100 mmHg (43.3% {13} in TERLI, 40% {12} in MID/OCT). Laboratory parameters of the patients were given in table 2. Coagulation profiles were comparable, with 23.3% (7) of patients in both groups having an INR of 1.2, while 46.7% (14) (TERLI) and 50% (15) (MID/OCT) had INR values between 1.2 and 2.Majority of the participants presented with serum bilirubin levels between 1.5-5 mg/dL (53.3% {16} in TERLI and 46.7% {14} in MID/OCT). Hyperbilirubinemia (>5 mg/dL) was noted in 33.3% (10) of the TERLI group and 36.7% (11) of the MID/OCT group. Severe renal dysfunction was evident, with 63.3% (19) of TERLI and 60% (18) of MID/OCT patients having creatinine >3 mg/dL. Elevated urea levels >100 mg/dL was seen in 40% (12) of TERLI and 60% (18) of MID/OCT patients. Moderate elevation (60-100 mg/dL) of urea was seen in 46.6% {14}(TERLI) and 33.3% {10} (MID/OCT). Normal potassium levels (3.6-5.2 mEq/L) was present in majority patients (73.3% {22} in TERLI and 60% {18} in MID/OCT). Hypokalemia (<3.6 mEq/L) was seen in 13.3% {4} (TERLI) and 20% {6} (MID/OCT), while hyperkalemia (>5.2 mEq/L) was 13.3% (4) and 20% (6), respectively. Hypoalbuminemia was prevalent, with 56.6% (17) of TERLI and 40% (12) of MID/OCT patients having albumin <2.8 g/dL. Most patients had severe liver disease (MELD 30-39), with 76.7% (23) in TERLI and 66.7% (20) in MID/OCT. A smaller proportion had a score >40 (16.7% {5} in TERLI and 20% {6) in MID/OCT).

Most patients had moderate AST elevations (50-250 U/L), with 73.3% (22) in TERLI and 86.6% (26) in MID/OCT. AST >250 U/L was observed in 20% {6} (TERLI) and 13.3% {4} (MID/OCT). Moderate ALT elevations (50-250 U/L) were seen in 63.3% {19} TERLI) and 73.3% {22} (MID/OCT). ALT >250 U/L was present in 16.6% {5} (TERLI) and 20% {6} (MID/OCT). Most patients had elevated GGT (>40 U/L), with 83.3% (25) in TERLI and 90% (27) in MID/OCT. Most patients had no comorbid conditions (63.3% {19} in TERLI, 53.3% {16} in MID/OCT). Diabetes was observed in 20% {6} (TERLI) and 26.6% {8} (MID/OCT), while hypertension was present in 16.6% {5} (TERLI) and 20% {6} (MID/OCT). Most patients belonged to Class C (80% {40} in TERLI, 70% {21} in MID/OCT), reflecting severe liver dysfunction.

There were statistical significant differences observed across the two groups for MAP, hyperbilirubinemia, increased creatinine,potassium, MELD score while not significant for PT INR, hypoalbuminemia, increased urea, elevated liver enzymes (AST,ALT,GGT) and Child Pugh score (P value < 0.05).

Effect of Treatment on Clinical Parameters: After seven days of treatment , both groups showed statistically significant improvements in renal function (p=0.030 for TERLI and p=0.041 for MID/OCT), serum albumin levels (p=0.047 for TERLI and p=0.052 for MID/OCT), MAP (p=0.021 for TERLI and p=0.029 for MID/OCT), urine output (p=0.001 for TERLI and p=0.003 for MID/OCT), and serum sodium levels (p=0.017 for TERLI and p=0.024 for MID/OCT). Serum bilirubin also showed a significant decline (p=0.015 for TERLI and p=0.020 for MID/OCT), indicating liver function improvement. No significant changes in serum potassium levels were observed, as shown in [Table 3].

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Table 1: Baseline characteristics of the study subjects (N = 60).

Characteristics	TERLI GROUP (n, %) (n = 30)	MID/OCT Group (n, %) (n = 30)	p - value
Age (in years)			
18-30	1 (3.3)	2 (6.7)	
31-40	4 (13.3)	4 (13.3)	0.0001
41-50	10(33.3)	9(30)	
51-60	10 (33.3)	9(30)	
>61	5 (16.6)	6 (20)	
Gender			
Male	22 (73.3)	24 (80)	0.0023
Female	8 (26.7)	6 (20)	
Etiology			
Alcohol	22 (73.33)	24 (80.0)	
Alcohol+HBV	3 (10.0)	3 (10.0)	0.34
Alcohol +HCV	4 (13.33)	3 (10.0)	
HCV	1 (3.33)	0 (0.0)	
HRS			
TYPE 1	26 (86.7)	27 (90)	0.01
TYPE 2	4 (13.3)	3 (10)	
Bacterial infections			
Yes	17 (56.7)	18 (60)	0.0113
No	13 (43.3)	12 (40)	
Mean Arterial Pressure			
Below 70 mmHg	7 (23.3)	7 (23.3)	0.0004
70-100 mmHg	13 (43.3)	12 (40)	
Above 100 mmHg	10 (33.3)	11 (26.7)	
Child–Pugh category			
Class A	0(0)	0(0)	
Class B	6 (20)	9 (30)	0.055
Class C	24 (80)	21 (70)	
MELD Score			
20 to 29	2 (6.7)	4 (13.3)	0.004
30 to 39	23 (76.7)	20 (66.7)	
Over 40	5 (16.7)	6 (20)	
Co- morbidities			
Diabetes mellitus	6 (20)	8 (26.6)	0.0001
Hypertension	5 (16.6)	6 (20)	
No comorbidities	19 (63.3)	16 (53.3)	

*HBV- Hepatitis B virus, HCV- hepatitis C virus, HRS- hepatorenal syndrome, MELD- Model End stage liver disease

Table 2: Laboratory parameters of the study subjects (N = 60).

Parameters	TERLI GROUP (n,%)	MID/OCT Group (n, %)	P value
INR			
1.2	7 (23.3)	7 (23.3)	0.423
1.2 to 2	14 (46.7)	15 (50)	
>2	9 (30)	8 (26.7)	
Serum bilirubin, mg/dl			
<1.5 mg/dL	4 (13.3)	5 (16.7)	0.02
1.5 to 5 mg/dL	16 (53.3)	14 (46.7)	
>5 mg/dL	10 (33.3)	11 (36.7)	
Serum Creatinine, mg/dl			
<2 mg/dL	3 (10)	2 (6.7)	0.007
2 to 3 mg/dL	8 (26.6)	10 (33.3)	
>3 mg/dL	19(63.3)	18 (60)	
Serum albumin, g/dL			
>3.5 g/dL	1 (3.3)	0 (0)	0.065
2.8 to 3.5 g/dL	12 (40)	18 (60)	
< 2.8 g/dL	17 (56.6)	12 (40)	
Serum urea, mg/dl			
<60 mg/dl	4 (13.3)	2 (6.6)	0.091
60 to 100 mg/dl	14 (46.6)	10 (33.3)	
>100 mg/dl	12 (40)	18 (60)	
Serum potassium, mEq/L			
<3.6 mEq/L	4 (13.3)	6 (20)	0.008
3.6 to 5.2 mEq/L	22 (73.3)	18 (60)	
>5.2 mEq/L	4 (13.3)	6 (20)	
Aspartate aminotransferase, U/L			
8 to 50 U/L	2 (6.6)	0 (0)	0.10
50 to 250 U/L	22 (73.3)	26 (86.6)	
>250	6 (20)	4 (13.3)	
Alanine aminotransferase, U/L			
4 to 50 U/L	6 (20)	2 (6.6)	0.12

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50 to 250 U/L >250	19 (63.3) 5 (16.6)	22 (73.3) 6 (20)	
Gamma-glutamyl transferase, U/L 5 to 40 U/L >40 U/L	 5 (16.6) 25 (83.3)	 3 (10) 27 (90)	 0.09

*INR- international normalized ratio

Table 3: Effect of Terlipressin (Group 1) Compared to Midodrine/Octreotide (Group 2) on Various Parameters (N = 60).

Parameters	Baseline (Day 0) Mean ± SD	Day 7 Mean ± SD	p-value (Baseline vs. Day 7)
Serum Creatinine (mg/dL)	4.20 ± 1.35 (G1) / 4.15 ± 1.42 (G2)	3.10 ± 1.75 (G1) / 3.25 ± 1.68 (G2)	0.030 (G1) / 0.041 (G2)
Serum Albumin (g/dL)	2.40 ± 0.38 (G1) / 2.35 ± 0.42 (G2)	2.65 ± 0.50 (G1) / 2.60 ± 0.48 (G2)	0.047 (G1) / 0.052 (G2)
Mean Arterial Pressure (mmHg)	74.5 ± 7.8 (G1) / 73.8 ± 7.4 (G2)	81.2 ± 9.6 (G1) / 79.5 ± 9.2 (G2)	0.021 (G1) / 0.029 (G2)
Urine Output/24 hours (mL)	215.0 ± 74.5 (G1) / 225.0 ± 80.3 (G2)	610.0 ± 405.5 (G1) / 580.0 ± 390.2 (G2)	0.001 (G1) / 0.003 (G2)
Serum Sodium (mEq/L)	128.5 ± 5.4 (G1) / 126.8 ± 4.9 (G2)	133.4 ± 6.3 (G1) / 131.2 ± 5.8 (G2)	0.017 (G1) / 0.024 (G2)
Serum Potassium (mEq/L)	3.85 ± 1.20 (G1) / 3.78 ± 1.15 (G2)	3.92 ± 1.05 (G1) / 3.81 ± 1.08 (G2)	0.542 (G1) / 0.618 (G2)
Serum Bilirubin (mg/dL)	10.40 ± 9.12 (G1) / 10.25 ± 8.85 (G2)	7.25 ± 6.98 (G1) / 7.10 ± 7.02 (G2)	0.015 (G1) / 0.020 (G2)

DISCUSSION

In the present study, the age distribution was relatively comparable across both treatment groups. The majority of participants were aged between 41 to 60 years, with the mean age slightly higher in the Midodrine/Octreotide (MID/OCT) group at 65 ± 13 years, compared to 61 ± 14 years in the Terlipressin (TERLI) group, similar to those reported by Aleksander Krag et al,[12] and Yoshiyuki Narahara et al,[13] HRS predominantly affects patients in their fifth to seventh decades of life, where the risk of decompensated cirrhosis is highest. In our study, male patients predominated in both treatment groups. Males constituted 73.3% (22) of the TERLI group and 80% (24) of the MID/OCT group, whereas females accounted for only 26.7% (8) and 20% (6), respectively.Similar gender distribution was reported by Aleksander Krag et al,[12] (72% males) and Yoshiyuki Narahara et al,[13] (70% males).These consistent findings across multiple studies support the notion that gender-based biological, behavioral, and socio-cultural factors contribute to the higher burden of liver-related complications, including HRS, among men.

In the present study, alcohol-related liver disease was the most frequent underlying cause of HRS, observed in 73.33% (22) of patients in the TERLI group and 80% (24) in the MID/OCT group. Co-infections with hepatitis viruses were also noted, including Alcohol-HBV and Alcohol-HCV, present in 10–13.33% of patients across both groups. These findings reinforce the well-established association between chronic alcohol consumption and advanced liver disease leading to HRS with comparable trends noted by Stevan A. Gonzalez et al,[14] Nguyen-Tat et al,[15] and Zafar Ahmad Khan et al.[16] In our study, bacterial infections were identified as a precipitating factor, 56.7% (17) in the TERLI group and 60% (18) in the MID/OCT group. This finding reflects the well-established role of systemic infections as a major trigger for HRS in patients with advanced cirrhosis, particularly in those who develop acute kidney injury (AKI) secondary to circulatory dysfunction. Our results are strongly supported by the findings of Reskan Altun et al,[17] and SilvanoFasolato et al,[11] Rakhi Maiwall and Shiv Kumar Sarin,[18] also emphasized that infection control is a cornerstone of managing HRS, as inflammatory mediators exacerbate vasodilation and renal hypoperfusion.

In our study, Type 1 HRS was the predominant presentation, observed in 86.7% (26) of patients in the TERLI group and 90% (27) in the MID/OCT group. Type 2 HRS was less common, seen in only 13.3% (4) and 10% (3) of the TERLI and MID/OCT groups, respectively. These findings highlight the severity and acute nature of kidney injury in most patients enrolled, consistent with the clinical urgency typically associated with HRS Type 1 which were in agreement with the study done by Yoshiyuki Naraharaet al.[13]Further supporting our findings, Rakhi Maiwall and Shiv Kumar Sarin,[18] emphasized that Type 1 HRS, being more acute and life-threatening, accounts for the majority of hospitalizations and treatment interventions in decompensated cirrhotics. George Kalambokis et al,[19] also noted that Type 1 HRS patients showed more rapid clinical deterioration and required urgent vasoconstrictor-based therapy.

In our study, the coagulation profiles of patients were comparable across the two treatment groups. An INR of 1.2 was recorded in 23.3% (7) of patients in both the groups, while 46.7%(14) of patients in the TERLI group and 50% (15) in the MID/OCT group had INR values between 1.2 and 2. These findings reflect a moderate degree of coagulopathy, commonly associated with decompensated cirrhosis and HRS, which was consistent with the findings by Nguyen-Tat et al,[15] and Zafar Ahmad Khan et al,[16]

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M. Cavallin et al,[11] also highlighted that elevated INR is often a surrogate for hepatic synthetic failure, which correlates with poor prognosis but does not necessarily affect response to treatment. In our study, the majority of patients presented with moderate hyperbilirubinemia, with serum bilirubin levels between 1.5–5 mg/dL in 53.3% (16) of the TERLI group and 46.7% (14) of the MID/OCT group. Higher bilirubin levels (>5 mg/dL) were observed in 33.3% (10) and 36.7% (11) of the TERLI and MID/OCT groups, respectively, indicating significant hepatic dysfunction. Nguyen-Tat et al,[15] and Allegretti et al,[20] observed similar findings and noted that bilirubin levels often correlate with the severity of liver failure in HRS-AKI. Hypoalbuminemia was prevalent among our patients, with 56.6% (17) in the TERLI group and 40% (12) in the MID/OCT group having serum albumin <2.8 g/dL. These findings reflect impaired hepatic synthetic function and were consistent with reports by Cavallin et al,[11] and Tyler Pitre et al,[21] who described low albumin as a common feature in decompensated cirrhosis and HRS, often requiring concurrent albumin infusion as part of therapeutic strategy.

Severe renal dysfunction was evident in our cohort, with serum creatinine levels exceeding 3 mg/dL in 63.3% (19) of the TERLI group and 60% (18) of the MID/OCT group. These findings aligned with Stevan A. Gonzalez et al,[14] and Rakhi Maiwall and Shiv Kumar Sarin,[18] indicating a poor prognosis in HRS. Elevated serum urea levels (>100 mg/dL) were seen in 40% (12) of the TERLI group and 60% (18) of the MID/OCT group, while moderate elevations (60–100 mg/dL) were observed in 46.6% (14) and 33.3% (10) respectively. This pattern of uremia aligns with the renal hypoperfusion hallmark of HRS, as documented by Zafar Ahmad Khan et al,[16] and Catherine Skagen et al,[22] both of whom noted elevated urea in over 50% of HRS cases. Regarding serum potassium, most patients had values within the normal range (3.6–5.2 mEq/L), with 73.3% (22) in the TERLI group and 60% (18) in the MID/OCT group. Hypokalemia (<3.6 mEq/L) was seen in 13.3% (4) and 20% (6), while hyperkalemia (>5.2 mEq/L) was noted in 13.3% (4) and 20% (6), respectively. These electrolyte imbalances, though less marked, are typical in HRS and were similarly reported by George Kalambokis et al,[19] and AbdulSatharShanid,[23] who emphasized careful monitoring of potassium due to the risk of cardiac arrhythmias and its potential influence on response to vasoconstrictor therapy.

In our study, the majority of patients exhibited moderate elevations AST levels with 73.3% (22) in the TERLI group and 86.6% (26) in the MID/OCT group. AST levels >250 U/L were observed in 20% (6) and 13.3% (4) of the TERLI and MID/OCT groups, respectively. Alanine aminotransferase (ALT) was also moderately elevated in most patients, with 63.3% (19) in the TERLI group and 73.3% (22) in the MID/OCT group falling within the 50–250 U/L range. Severe ALT elevation (>250 U/L) was present in 16.6% (5) and 20% (6) of the TERLI and MID/OCT groups, respectively, indicating ongoing hepatocellular injury among the HRS study population. Our findings were consistent with the study by Michael Curry et al,[24] and Diane S. Aschenbrenner.[25] Gamma-glutamyl transferase (GGT) levels were elevated (>40 U/L) in 83.3% (25) in the TERLI group and 90% (27%) in the MID/OCT group, which was similar to the findings by Aleksander Krag et al,[12] and Silvano Fasolato et al.[11] These findings reflect biliary epithelial cell damage or cholestatic features often present in alcohol-induced or viral cirrhosis.

In our study, the majority of patients were classified as Child–Pugh Class C, accounting for 80% (24) in the TERLI group and 70% (21) in the MID/OCT group, indicating advanced hepatic dysfunction. In this study ,Class B is represented by 20% (6) in the TERLI group and 30% (9) in the MID/OCT group and none in class A, which were comparable to studies done by Yoshiyuki Narahara et al,[13] and Catherine Skagen et al.[22] Rakhi Maiwall and Shiv Kumar Sarin,[18] underscored that Child–Pugh Class C patients have reduced hepatic reserve, poorer response to therapy, and higher short-term mortality, necessitating early intervention and close monitoring.

CONCLUSION

This study showed significant improvements in both the groups after 7 days of treatment, particularly in serum creatinine, urine output, and serum sodium levels, indicating effective management of renal dysfunction. Although both the groups exhibited differences in some parameters, these variations did not translate into significant differences in overall clinical outcomes. These findings highlight the overall efficacy of both treatment regimens in improving renal, circulatory, and hepatic parameters in HRS patients with no significant differences in outcomes between the two groups.

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