NORADRENALINE VERSUS TERLIPRESSIN IN THE MANAGEMENT OF HEPATORENAL SYNDROME TYPE I

Iman Ismail Ramzy[1], Ahmed Fouad Soliman[2], Yosry Abd El-Rahman Mohammed[3], Mahmoud Abdo[4], Ali Abdel Rahim[5*], Muhammad A. Elzahaby[6], Khaled Mohammad Attallah[7], Mohamed El Sherbeni Hassaneen Hassaneen[8]

Article History: Received: 12.12.2022 **Revised:** 29.01.2023 **Accepted:** 15.03.2023

Abstract

Background: Hepatorenal syndrome (HRS) is characterized by functional renal failure in advanced liver disease. HRS can be treated using a variety of vasoconstrictors. The preferred medication for treating type 1 HRS (HRS-1) is terlipressin, it is costly and frequently difficult to obtain. the alpha-adrenergic medication noradrenaline may be beneficial in HRS.
Objectives: Evaluate the efficacy of noradrenaline versus terlipressin in the treatment of HRS-1 in order to minimize cost of treatment.
Patients and methods: Fifty cirrhotic individuals with HRS-1 were included in the study. The patients were divided randomly into two groups as follows: Group (A) Terlipressin (0.5-2 mg/6h) plus human albumin were used to treat 25 patients. Group (B): 25 patients were managed with noradrenaline (0.5-3 mg/h) plus human albumin.
Results: The initial traits of the two groups were comparable. The HRS reversed in 44% (11/25; p=0.571) of group B patients and 52% (13/25) of group A patients. Serum creatinine levels in both groups significantly decreased from baseline, with group A dropping from 2.88 ± 0.68 mg/dl to 2.16 ± 1.00 mg/dl and group B from 2.71± 0.67 mg/dl to 2.07 ± 1.21 mg/dl (p 0.023 and p 0.038, respectively). A reduced baseline creatinine level was a reliable indicator of treatment response**.**
In conclusion, noradrenaline, despite being less expensive, is equally efficient and secure in treating HRS type 1 as terlipressin.

Keywords: Noradrenaline, terlipressin, and hepatorenal syndrome

[1,2,4,]Endemic Medicine department, Faculty of Medicine, Cairo University, Egypt
[3,5*,6,8]Hepatology & Gastroenterology Department, Theodor Bilharz Research Institute, Cairo, Egypt
[7]Hepatology & Gastroenterology Department, National Liver Institute, Menoufia University, Egypt

Corresponding Email: [5*]ali_tbri_1982@yahoo.com

DOI: 10.31838/ecb/2023.12.s3.049

1. Introduction

Patients with cirrhosis may develop Hepatorenal Syndrome (HRS), a rare kind of severe functional kidney failure caused by severe renal vasoconstriction and occurring without obvious kidney histological abnormalities [(1).] The defining feature of type 1 HRS is rapid progressive renal failure, which manifests within two weeks and is indicated by a 50% reduction in creatinine clearance or a doubling of baseline blood creatinine [(2)]. In almost 70% of cases, a specific trigger for type 1 HRS can be determined. [(3)].
Terlipressin, a synthetic counterpart of vasopressin, is risk-free and has so far shown promising outcomes. According to a number of studies, terlipressin combined with albumin results in an adequate glomerular filtration rate (GFR) and almost normalises blood creatinine levels in 42% to 77% of individuals. But it's expensive and not easily accessible [(4).] On the other hand, noradrenaline, a catecholamine with mostly alpha-adrenergic activity, is easily available and moderately priced. Recent studies have demonstrated that noradrenaline can reverse HRS..**[(5)]**.Our aim was to evaluate the safety and efficacy of noradrenaline versus terlipressin in the treatment of HRS type I in order to minimize the cost of treatment.

2. Patients and Methods

In this prospective, randomised, comparative trial, patients with type 1 HRS received either terlipressin or norepinephrine intravenously. Between December 2014 and May 2018, 50 patients with hepatorenal syndrome were included in the study at hepatology and gastroenterology department Theodor Bilharz Research Institute (TBRI), Egypt and Arab Contractors Medical Center (ACMC-Egypt) (34 of them were males and 16 were females with age ranging from 29-90 years old) .Informed consents were obtained from all patients or their relatives if patients could not secure consent recruited in the study.

Inclusion criteria:
Patients with cirrhosis who have ascites, a serum creatinine level under 1.5 mg/dl, no improvement in renal function after stopping diuretics, and no shock or fluid loss should receive IV human albumin over the course of 48 hours at a dose of 1 g/kg of body weight to a maximum of 100 g, absence of use of nephrotoxic medications, absence of ultrasound evidence of renal parenchymal diseases or obstructive uropathy,

Exclusion criteria:
patients with obstructive arterial disease of the limbs, cardiomyopathy, ventricular arrhythmia, or coronary artery disease, patients with nephropathy, patients were on nephrotoxic medications and patients (or a first degree relative) who refuse to sign a written informed consent

The patients were classified into two groups
Terlipressin group: 25 patients who received terlipressin with intravenous human albumin.

Noradrenaline group: 25 patients who received noradrenaline infusions with intravenous human albumin.

Methodology in details:
Full history taking: with special stress on the following. **Proper clinical examination:** with special stress.
Routine laboratory investigations, **abdominal Ultrasonography, echocardiogram and chest X ray**, c**hild Pugh classification** for cirrhosis was applied to obtain the severity of liver cell affection **(Pugh et al., 1973), after fulfilling criteria of HRS type I: patients were randomized into two groups: Group A**: 25 patients who received 0.5 mg of terlipressin intravenously every 6 hours. Response was assessed by keeping track of the patients' clinical health, daily urine output, daily serum creatinine, and vital signs. Terlipressin dosage was gradually raised every three days to a maximum of 2 mg every six hours if serum creatinine hadn't decreased by 25% of baseline value after three days. Patients were not given terlipressin if they exhibited symptoms or signs suggestive of ischemia problems. Terlipressin was restarted either with a lower dose or a different form of administration, such as a short-period infusion, after a cardiac condition evaluation. The 25 patients who made up Gathering B got constant noradrenaline mixtures at a beginning portion of 0.5 mg/h with an end goal to raise their mean blood vessel circulatory strain by no less than 10 mmHg or their 4-hour pee yield by in excess of 200 ml.When one of these objectives was not accomplished, the noradrenaline measurement was expanded like clockwork by 0.5 mg/h, up to a most extreme portion of 3 mg/h. Noradrenaline mixture was stopped in patients who had side effects or signs of ischemia issues. After the cardiovascular condition was evaluated and the treatment portion was brought down, the noradrenaline imbuement was continued. Patients in the two gatherings got 20 g of IV egg whites everyday until the preliminary's end.Albumin conveyance was briefly halted assuming focal venous tension expanded by in excess of 18 cm of saline.

Response to treatment was defined as: A decrease in serum creatinine to 1.5 mg/dL or less throughout treatment constitutes a full response. No reaction: after a decrease in serum creatinine of less than 50% from the baseline value or an increase in serum creatinine from the baseline value, a final serum creatinine level greater than 1.5 mg/dL.

Outcome measures:
Serum creatinine of less than 1.5 mg/dL was the study's main endpoint. Patients' deaths or a maximum of 15 days of treatment are examples of secondary end points.

Statistical analysis:
The outcome is presented as a mean with a standard deviation or as a percentage (%). When appropriate, categorical data expressed as percentages were compared using the Chi square test or Fisher exact test. The Kolmogorov-Smirnov test, a test for normality, was used to gauge the distribution of the data collected prior to treatment. So, to compare variables between the two groups, the unpaired t test or Mann-Whitney test was applied as necessary. The same group's pre- and post-treatment variables were compared using the Wilcoxon signed ranks test. To investigate how different parameters could predict how a patient would respond to treatment, a single-variable logistic regression test was performed. Data analysis was carried out using the statistical package for social sciences (SPSS) computer application (version 19 windows). P value less than 0.05 was regarded as significant.

3. Results

This study was led on fifty cirrhotic patients with hepatorenal condition type1 that were owned up to Bedouin Workers for hire Clinical Center (ACMC-Egypt) and Ruler Abdullah Clinical Complex Jeddah (KAMCJ-KSA) from December 2014 till May 2018. These fifty patients were partitioned into two gatherings:As to progress in years conveyance of the concentrated on gatherings, the mean age ± SD (standard deviation) inside the terlipressin bunch was (58.88 ± 8.24) contrasted with (64.84 ± 10.66) inside noradrenaline bunch showing measurably huge distinction between the two gatherings. Concerning the sex dispersion of the concentrated on gatherings, the quantity of females inside the terlipressin gathering and noradrenaline bunch were 7 (28.0%) and 9 (36.0%) separately with no genuinely tremendous distinction in sex circulation between the two gatherings. Table (1)

Table (1): General characteristics of the two studied groups

	Terlipressin (n= 25)	**Noradrenaline (n= 25)**	**P value**
Age (yrs.)	58.88 ± 8.24	64.84 ± 10.66	0.032*
Gender Female	7 (28.0%)	9 (36.0%)	0.544
Male	18 (72.0%)	16 (64.0%)	

Data are expressed as mean ± SD or number (%). p> 0.05= not significant.*p≤ 0.05= significant.

Most of patients had low urine output which was 568.00 ± 261.76 ml/d in terlipressin group and 436.0 ± 141.07 ml/d in noradrenaline group. Most of the patients had low mean arterial blood pressure which was 57.88 ± 12.66 mm/Hg in terlipressin group and 49.84 ± 6.51 mm/Hg in noradrenaline group. The mean arterial blood pressure was statistically significantly different between the two study groups, being greater in the terlipressin group.
Regarding urine output, there was no statistically significant difference between the two study groups. **Table (2)**

Table (2): Baseline clinical parameters in the two studied groups

	Terlipressin (n= 25)	**Noradrenaline (n= 25)**	**P value**
UOP [#]	568.00 ± 261.76	436.0 ± 141.07	0.123
MAP [#]	57.88 ± 12.66	49.84 ± 6.51	0.015*

Data are expressed as mean ± SD p> 0.05= not significant.*p≤ 0.05= significant.
[#]= Mann Whitney test, MAP: mean arterial blood pressure, UOP: urine out put

Regarding dose of noradrenaline all patients started treatment with 0.5 mg /hr, maximum dose of noradrenaline used was 0.7 mg /hr in 6 (24%) patients, 1.3 mg /hr in 9 (36 2%) patients, 1.5 mg/ hr in 7 (28%) patients, and 2.3 mg /hr in 3(12%) patients, patients with mean dose of treatment **1.2± 0.45 mg/hr.** Regarding duration of treatment, 2 (8%) patients were given treatment for 4 days [one patient responded, the other one died], 5 (20%) patients for 5 days [3 patients died, 2 patients responded],3(12%) patients for 6 days[3patients responded], 4 (16%) patients for 7 days [2 patients

responded,2 patients died], 4 (16%) patients for 8 days[3 patients died and one patient responded], one (4%) patient for 9 days [responded], one (4%) patient for 10 days [patient died], 2(8%) patients for 11 days[2 patients died] , 3 (12%) patients for 14 days [one patient did not achieve response, one patient died and one patient responded], with mean duration of treatment **7.52 ± 2.67** days, with cost of treatment **14,448** Egyptian pounds. Regarding the cost of treatment, there was a statistically significant difference between the two study groups.Regarding the length of therapy, there was no statistically significant difference between the two study groups. **Table (3)**

Table (16) Duration and cost of treatment of the two studied groups

	Terlipressin (n= 25)	**Noradrenaline (n= 25)**	**P value**
Duration of treatment	7.1± 3.00	7.52 ± 2.67	0.559
Cost of treatment	138880 L.E (7802$)	14448 L.E (820 $)	0.001*

Data are expressed as mean ± SD. p> 0.05= not significant. *p≤ 0.05= significant

In terlipressin group: there was response to treatment in 13 patients (52%). **In noradrenaline group:** there was response to treatment in 11 patients (44%). There was no statistically significant difference between the two studied groups regarding outcome. **Table (4)**

Table (4): Outcome in the two studied groups

	Terlipressin (n= 25)	**Noradrenaline (n= 25)**	**P value**
Non responders	12 (48.0%)	14 (56.0%)	0.571
Responders	13 (52.0%)	11 (44.0%)	

Data are expressed as number (%). p> 0.05= not significant.

This table compares how noradrenaline and terlipressin affected several measures at the beginning and end of treatment.At the end of the treatment, the serum creatinine in the terlipressin group significantly decreased from 2.88 0.68 mg/dl at baseline to 2.16 1.00 mg/dl, P value 0.023. At the end of the treatment, serum urea had significantly decreased from 124.44 50.33 mg/dl at baseline to 90.48 39.00 mg/dl, P value 0.04. There was significant increase of urine output from 568.00 ± 261.76 ml/day at base line to 877.20 ± 724.54 ml/day, P value 0.03 at end of treatment. There was significant increase of mean arterial blood pressure from 57.88 ± 12.66 mm/Hg at base line to 63.25 ± 22.75 mm/Hg, P value 0.025 at end of treatment. **In noradrenaline group:** There was significant decrease of serum creatinine from 2.71 ± 0.67 mg/dl at base line to 2.07 ± 1.21 mg/dl, P value 0.038 at end of treatment. There was significant decrease of serum urea from 85.08 ± 38.92 mg/dl at base line to 61.68 ± 38.47 mg/dl, P value 0.037 at end of treatment. There was significant increase of urine output from 436.0 ± 141.07 ml/day at base line to 644.00 ± 538.00 ml/day, P value 0.038 at end of treatment. There was significant increase of mean arterial blood pressure from 49.84 ± 6.51 mm/Hg at base line to 55.92 ± 20.11 mm/Hg, P value 0.042 at end of treatment. **Table (5)**

Table (5): Changes in parameters with therapy in the two study groups

	Terlipressin (n= 25)			**Noradrenaline (n= 25)**		
	Baseline	**End of treatment**	**P value**	**Baseline**	**End of treatment**	**P value**
Creatinine (mg/dl)	2.88 ± 0.68	2.16 ± 1.00	0.023*	2.71 ± 0.67	2.07 ± 1.21	0.038*
Urea (mg/dl)	124.44 ± 50.33	90.48 ± 39.00	0.040*	85.08 ± 38.92	61.68 ± 38.47	0.037*
UOP (ml/day)	568.00 ± 261.76	877.20 ± 724.54	0.030*	436.0 ± 141.07	644.00 ± 538.00	0.038*
MAP (mm/Hg)	57.88 ± 12.66	63.44 ± 22.75	0.025*	49.84 ± 6.51	55.92 ± 20.11	0.042*
Number of responders (%)	0 (0.0%)	13 (52.00%)		0 (0.0%)	11 (44%)	

Data are expressed as mean ± SD. number (%). p> 0.05= not significant. *p< 0.05= significant.

There was significant decrease of serum creatinine from 3.14 ± 0.73 mg/dl at base line to 1.27 ± 0.15 mg/dl at end of treatment. There was significant decrease of serum urea from 155.92 ± 39.95 mg/dl at base line to 68.46 ± 25.59 mg/dl at end of treatment. There was significant increase of urine

output from 584.62 ± 253.63 ml /day at base line to 1457.69 ± 418.25 ml/day at end of treatment. There was significant increase of mean arterial blood pressure from 59.77 ± 12.77 mm/Hg at base line to 75.62 ± 8.65 mm/Hg at end of treatment. **Regarding noradrenaline group (n=11):** There was significant decrease of serum creatinine from 3.01 ± 0.65 mg/dl at base line to 1.03 ± 0.30 mg/dl at end of treatment. There was significant decrease of serum urea from 87.36 ± 37.01 mg/dl at base line to 29.00 ± 16.21 mg/dl at end of treatment. There was significant increase of urine output from 386.36 ± 139.81 ml/day at base line to 1172.73 ± 143.81 ml/day at end of treatment. There was significant increase of mean arterial blood pressure from 46.36 ± 6.74 mm/Hg at base line to 71.73 ± 4.78 mm/Hg at end of treatment. **Table (6)**

Table (6): Changes in parameters in responders of the two studied groups:

	Terlipressin (n= 13)			**Noradrenaline (n= 11)**		
	Baseline	**End of treatment**	**P value**	**Baseline**	**End of treatment**	**P value**
Creatinine (mg/dl)	3.14 ± 0.73	1.27 ± 0.15	0.001*	3.01 ± 0.65	1.03 ± 0.30	0.003*
Urea (mg/dl)	155.92 ± 39.95	68.46 ± 25.59	0.001*	87.36 ± 37.01	29.00 ± 16.21	0.003*
UOP (ml/day)	584.62 ± 253.63	1,457.69 ± 418.25	0.001*	386.36 ± 139.81	1,172.73 ± 143.81	0.003*
MAP (mm/ Hg)	59.77 ± 12.77	75.62 ± 8.65	0.001*	46.36 ± 6.74	71.73 ± 4.78	0.003*

Data are expressed as mean ± SD. *p≤0.05= significant

Regarding creatinine: There was statistically non-significant difference between the terlipressin and noradrenaline group at base line (3.14 ± 0.73 mg/dl vs. 3.01 ± 0.65 mg/dl respectively) with significant difference at end of treatment (1.27 ± 0.15 mg/dl vs. 1.03 ± 0.30 mg/dl respectively) in more decrease of creatinine with noradrenaline group. **Regarding UOP:** There was statistically non-significant difference between the terlipressin and noradrenaline group at base line (584.62 ± 253.63 ml/day vs. 386.36 ± 139.81 ml/day respectively) with significant difference at end of treatment (1457.69 ± 418.25 ml/day vs. 1172.73 ± 143.81 ml/day respectively) with more increase of UOP in terlipressin group. **Regarding MAP:** There was statistically significant difference between the terlipressin and noradrenaline group at base line (59.77 ± 12.77 mm /Hg vs. 46.36 ± 6.74 mm/Hg respectively) with lower MAP in noradrenaline group with non-significant difference at end of treatment (75.62 ± 8.65 mm/Hg vs. 71.73 ± 4.78 mm/Hg respectively). **Regarding serum urea:** There was statistically significant difference between the terlipressin and noradrenaline group at base line (155.92 ± 39.95 mg/dl vs. 87.36 ± 37.01 mg/dl respectively) with lower urea in noradrenaline group with also significant difference at end of treatment (68.46 ± 25.59 mg/dl vs. 29.00 ± 16.21 mg/dl respectively) with lower urea in noradrenaline group. **Table (7)**

Table (7): Comparison between base line and end of treatment parameters in responders in both groups

	Baseline			**End of treatment**		
	Terlipressin (n= 13)	**Noradrenaline (n= 11)**	**P value**	**Terlipressin (n= 13)**	**Noradrenaline (n= 11)**	**P value**
Creatinine (mg/dl)	3.14 ± 0.73	3.01 ± 0.65	0.728	1.27 ± 0.15	1.03 ± 0.30	0.030*
Urea (mg/dl)	155.92 ± 39.95	87.36 ± 37.01	0.001*	68.46 ± 25.59	29.00 ± 16.21	0.001*
UOP (ml/day)	584.62 ± 253.63	386.36 ± 139.81	0.058	1457.69 ± 418.25	1172.73 ± 143.81	0.033*
MAP (mm/Hg)	59.77 ± 12.77	46.36 ± 6.74	0.007*	75.62 ± 8.65	71.73 ± 4.78	0.083

Data are expressed as mean ± SD. *p< 0.05= significant

Several variables obtained at baseline were analyzed for the predictive value of response to treatment. Multivariate analysis showed base line serum creatinine as predictor for response. **Table (8)**

Table (8): Multivariate analysis of baseline variables according to response to treatment

	B	Sig.	Exp(B)	95.0% CI for EXP(B)	
				Lower	Upper
Age	-0.127	0.068	0.881	0.768	1.010
Sex (male)	-1.598	0.131	0.202	0.025	1.607
Child	0.842	0.227	2.320	0.592	9.084
MELD	-0.302	0.152	0.739	0.489	1.118
T. bilirubin	-0.126	0.317	0.881	0.688	1.129
Albumin	-0.439	0.701	0.645	0.069	6.036
Na	0.018	0.798	1.018	0.889	1.166
PLT	0.017	0.156	1.017	0.994	1.041
INR	1.486	0.323	4.421	0.232	84.241
Baseline creat	2.795	0.010*	16.363	1.949	137.358
Baseline urea	0.019	0.198	1.019	0.990	1.049
Baseline UOP	-0.004	0.084	0.996	0.991	1.001
Baseline MAP	0.031	0.556	1.032	0.929	1.146

p> 0.05= not significant. *p< 0.05= significant.

There was no significant difference between to terlipressin and noradrenaline group regarding adverse effects, with no serious adverse effects in both groups. **Table (9)**

Table (9): Adverse effects of terlipressin and noradrenaline

	Terlipressin (n= 25)	Noradrenaline (n= 25)	P value
Adverse effect	5 (20.0%)	4 (16.0%)	0.362
Chest pain	1 (4.0%)	4 (16.0%)	
Diarrhea	2 (8.0%)	0 (0.0%)	
Abdominal cramp	2 (8.0%)	0 (0.0%)	

There was no significant difference between to terlipressin and noradrenaline group regarding incidence of mortality. **Table (10)**

Table (10): Mortality in both groups

	Terlipressin (n= 11)	Noradrenaline (n= 13)	P value
Mortality	11(44.0%)	13 (52.0%)	0.571
Metabolic disturbance	9(36%)	8 (32.0%)	
Chest infection	2 (8.0%)	3 (12.0%)	
Ruptured HFL	0 (0.0%)	1 (4.0%)	
Sepsis with DIC	0 (0.0%)	1 (4.0%)	

4. Discussion

Hepatorenal condition is one of the likely reasons for intense kidney injury in patients with intense or persistent liver illness. However, fulminant hepatic failure can result from any cause. The most prevalent causes of portal hypertension are affected individuals' cirrhosis, severe alcoholic hepatitis, or (less frequently) metastatic tumours [(6).] An estimated 35–40% of individuals with ascites and end-stage liver disease (ESLD) experience HRS [(7).]

In the present investigation, we investigated the treatment of type 1 HRS in cirrhotic patients using albumin, terlipressin, and noradrenaline. Regarding the proportion of patients whose hepatorenal syndrome was successfully reversed, there was no discernible difference between the two groups: 52% (13 out of 25) in the terlipressin group and 44% (11 out of 25) in the noradrenaline group. Hepatorenal syndrome reversal was achieved in 39.1% (9 out of 23) of the terlipressin group and in 43.4% (10 out of 23) of the noradrenaline group,

according to Singh et al. (8), with no discernible difference between the two groups., whereas Sharma et al. (9) reported that the reversal was accomplished in 50% (10 out of 20) patients in the terlipressin group and in 50% (10 out of (10), with no discernible difference between the two groups, the reversal was achieved in 45% (9 out of 20) of the terlipressin group patients and in 47.6% (10 out of 21) of the noradrenaline group patients.

The above mentioned data from our study and previous studies showed effectiveness of both noradrenaline and terlipressin in reversal of HRS without significant difference between the two drugs. This can be accounted for by the vasoconstrictive effects of vasoconstrictors on systemic circulation, which can enhance systemic hemodynamics and ameliorate the hyperdynamic circulation that develops in decompensated liver cirrhosis. Terlipressin was administered to the trial participants at a mean dose of 4.00 1.76 mg daily. There are several different daily terlipressin dosages that have been described in previous studies. In a study by Singh et al., the average daily dose of terlipressin was 3.13 0.73 mg, while in a study by Omesh et al. (10) it was 3 mg.. The average treatment period for the terlipressin group in our study lasted 7.1 3.00 days. There has been a wide range of treatment durations reported in earlier research., the mean duration in the study done by **Singh *et al.*** **(8)** was 7.82 ± 3.12 days, while in **Omesh *et al.*** **(10)** it was 8.3 ± 2.4 days and in **Martín *et al.*** **(11)** it was 7 ± 5 days.

In our review symptom of treatment happened in both concentrated on gatherings. In terlipressin bunch, 2 patients (8%) had the runs, 2 patients (8%) had stomach issues and 1 patient (4%) had chest torment, which worked on either in the wake of diminishing the portion of terlipressin or adjusting pace of organization and which were normal aftereffects with no impedance with consummation of treatment.

Singh et al. (8) revealed that 6 out of 23 patients created difficulties inside terlipressin bunch, four patients had stomach squeezes and expanded recurrence of stools, one created cyanosis of the toe and another created transient ventricular additional systole, while Omesh et al. (10) announced that 5 out of 20 patients created confusions, two patients had diarrheas, two patients had gentle chest agony and one had stomach torment and Solanki et al. (4) detailed that 5 out of 12 patients created inconveniences, two patients had crampy stomach torment and three patients had self-restricting cardiovascular arrhythmias.

Singh et al. (8) revealed that 2 out of 23 patients had abnormal chest torment with ordinary echocardiogram and troponin levels, while Duvoux et al. (12) and Omesh et al. (10) both revealed that 2 out of 12 patients had an episode of chest torment with typical echocardiogram and troponin levels and that the aggravation improved with alteration of the treatment's portion. Our review's multivariate investigation uncovered that the gauge serum creatinine level can be utilized as an indicator for reaction, with serum creatinine (2.795 mg/dl) being fundamentally connected with reaction (p =0.01). This relationship might be made sense of by the movement of intense kidney injury, which is known to be joined by an expansion in serum creatinine, which is related with a critical decrease in mid-term endurance (13).

Our discoveries agree with those of Altun et al. (14) who found a critical connection between gauge serum creatinine level (2.5 mg/dl) and reaction (p 0.05). As indicated by Martn et al. (11), gauge pee volume and serum creatinine were prognostic determinants of reaction to medicine. Sharma et al. (9) correspondingly found that standard creatinine freedom, Guide, and plasma renin action were autonomous indicators of reaction. Then again, concentrates by Singh et al. (8) and Omesh et al. (10) found that the Merge score was a free indicator of reaction to treatment and that the CTP score on day 1 was an indicator of reaction.

5. Conclusion

When treating type I hepatorenal syndrome, there is no appreciable difference in the effects of noradrenaline infusion and terlipressin. Since noradrenaline is less expensive to treat than terlipressin, it might be preferred, especially in low-income settings. There was no distinction between the unfavourable side effects of terlipressin and noradrenaline. Through a central venous catheter, noradrenaline is continuously infused intravenously, whereas terlipressin is administered intravenously as a bolus in a peripheral vein.

Fund: Self funded

Confect of Interest: None

6. References

Fagundes C and Ginès P. (2012): Hepatorenal syndrome: a severe, but treatable, cause of kidney failure in cirrhosis. American Journal of Kidney Diseases, 59: 874–885.

Simonson MS. (1993): Endothelins: multifunctional renal peptides. Physiological Reviews, 73: 375-411.

Péron JM, Bureau C, Gonzalez L *et al*. (2005): Treatment of hepatorenal syndrome as defined by the international ascites club by albumin and furosemide infusion according

to the central venous pressure: a prospective pilot study. American Journal of Gastroenterology, 100: 702-707.

Solanki P, Chawla A, Garg R *et al*., (2003): Beneficial effects of terlipressin in hepatorenal syndrome: a prospective, randomized placebo-controlled clinical trial. J Gastroenterol Hepatol; 18: 152-156.

Ghosh S, Choudhary N, Sharma K *et al*. (2013): Noradrenaline vs. terlipressin in the treatment of type 2 hepatorenal syndrome: a randomized pilot study. Liver International, 33:1187-1193.

Ginès P, Schrier RW. (2009): Renal failure in cirrhosis. New England Journal of Medicine, 361:1279.

Al-Khafaji A, Nadim MK, Kellum JA (2015): Hepatorenal Disorders. Chest, 148 (2):550-8.

Singh V, Ghosh S, Singh B et al. (2012): Noradrenaline vs. terlipressin in the treatment of hepatorenal syndrome: A randomized study. Journal of Hepatology, 56: 1293–1298.

Sharma P, Kumar A, Sharma BC *et al*., (2008): An open label, pilot, randomized controlled trial of noradrenaline versus terlipressin in the treatment of type 1 hepatorenal syndrome and predictors of response. American Journal of Gastroenterology, 103:1689–1697.

Omesh G, Sandeep S, Natasha S *et al*. (2016): Noradrenaline is as Effective as Terlipressin in Hepatorenal Syndrome Type 1: A Prospective, Randomized Trial: Journal of The Association of Physicians of India, 64: 30-35.

Martín-llahí M, Pépin MN, Guevara M *et al*. (2008): Terlipressin and albumin vs albumin in patients with cirrhosis and hepatorenal syndrome: a randomized study. Gastroenterology, 134:1352–1359.

Duvoux C, Zanditenas D, Hezodec C (2002): Effects of noradrenalin and albumin in patients with type I hepatorenal syndrome: a pilot study. Hepatology, 36:374–380.

Tsien C, Rabie R, Wong F (2013): Acute kidney injury in decompensated cirrhosis. Gut; 62:131–137.

Altun R, Korkmaz M, Yıldırım E *et al*. (2015): Terlipressin and albumin for type 1 hepatorenal syndrome: does bacterial infection affect the response. Springerplus, 4:806.