Comparative Study of MELD Score and Glasgow Coma Scale in Patients with Hepatic Encephalopathy

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Background and study aim: Hepatic encephalopathy occurs in approximately 30-45% of patients with cirrhosis and 10–50% of patients with transjugular intrahepatic Porto systemic shunt, while minimal hepatic encephalopathy affects approximately 20–60% of patients with liver disease**.** There are multiple prognostic scores that predict the mortality from chronic liver disease, of which the Child-Pugh score and the Model for End-stage Liver Disease (MELD) score are the most commonly used**.** The most widely used scale used to evaluate HE is the West-Haven (WH) scale, with scores ranging from 0 to 4. This study is designed to compare Glasgow coma scale to West-Haven scale in prediction of prognosis and survival of patients with hepatic encephalopathy.

Patients and Methods: This study was conducted on 100 patients with liver cirrhosis and overt Hepatic Encephalopathy admitted to The Department of Hepatology, Gastroenterology and Infectious Diseases of Mansoura Health Insurance Hospital, divided into four groups according to the grade of encephalopathy by West-Haven Criteria.

Results: There was no difference in prediction of survival among the studied patients assessed by GCS, MELD score, uMELD score and Child score (all had the same results).

Conclusion: Glasgow Coma Scale can be a prognostic tool for morbidity and mortality, as well as, follow-up in patients with HE and.

INTRODUCTION

Hepatic encephalopathy (HE) is a serious complication of decompensated cirrhosis that manifests as a wide range of neuropsychological clinical findings ranging from minimal HE to coma **[1]**. HE can be classified as either 'overt' or 'minimal'. Overt He (oHE) is a syndrome of neurological and neuronpsychiatric abnormalities that can be detected by bedside clinical tests. By contrast, patients with minimal He (mHE) present with normal mental and neurological status upon clinical examination but specific psychometric tests yield abnormal results **[2]**. Despite the important progresses of neuron imaging methods, clinical scales are commonly considered the best way to assess the degree of impairment and its impact on daily life activities for the majority of neurological diseases. Previous studies recommended using clinical scales for grading hepatic encephalopathy and to report efficacy in therapeutic trials such as the West-Haven criteria and Glasgow Coma Scale to assess the severity of HE **[3]**.

The model for end-stage liver disease (MELD) score was introduced to evaluate hepatic functions in cirrhotic patients. It has the advantage of using three objective and easily measured parameters: creatinine levels, international normalized ratio (INR) and total bilirubin **[4]**. The Model for End-Stage Liver Disease (MELD) score has been adopted as an objective indicator of liver disease severity **[1]**.

Aim of the work: this study aims at assessing the significance of Glasgow coma scale in evaluation of patients with hepatic encephalopathy in comparison

to the standard West-Haven criteria and its ability to predict morbidity and mortality in patients with hepatic encephalopathy in comparison with MELD score.

PATIENTS AND METHODS

This study was carried out on 100 patients with liver cirrhosis and overt Hepatic Encephalopathy. They were 85 males (85%) and15 females (15%), and their ages ranged between 18 and 60 years. All cases were selected from the Department of Hepatology, Gastroenterology and Infectious Diseases, Mansoura Health Insurance Hospital, within the period between January 2014 to June 2014.

The exclusion criteria were severe cardio-pulmonary disease, sepsis, renal disease, hepatocellular carcinoma, diabetes mellitus, patients listed to undergo transplantation.

Patients were subjected to the following:
Full history taking, thorough clinical examination. Routine laboratory investigations, that included: Complete blood picture. Liver profile tests: prothrombin time and concentration S. creatinine, viral markers, arterial blood ammonia.

Samples collection, preparation and handling:
A sample of arterial blood was sampled soon after admission under aseptic condition in preheparinized syringes from indwelling radial or femoral arterial catheters. Admission samples were taken within 24 hours of admission. Ammonia was measured with Ammonia Test Kit II for the PocketChem BA device (Arkay, Inc., Kyoto, Japan).

Abdominal Ultrasonography:
Liver was assessed for: size (span), echogenicity, surface, thickening of portal tracts, portal vein diameter, hepatic veins, inferior vena cava and presence or absence of focal lesions.

Spleen was assessed for: size, echogenicity, splenic vein diameter and presence or absence of collaterals. Other data concerning the gall bladder, both kidneys, pancreas, para aortic region as well as detection of ascites all were fulfilled.

The severity of liver cirrhosis in Hepatic Encephalopathy assessed using: Modified Child score:
Evaluation of the severity of liver cirrhosis was obtained in each cirrhotic patient with modified Child-Pugh score. This system relies on clinical and laboratory evaluation including ascites, grade of encephalopathy, serum albumin, bilirubin and prothrombin time **[5]**.

Parameter	1	2	3
Ascites controlled	None	easily controlled	Poorly controlled
Encephalopathy	none	grades 1-2	grades 3-4
Bilirubin (mg/dl)	< 2.0	2-3	> 3.0
Albumin (g/dL)	> 3.5	2.8-3.5	< 2.8
Prothrombin time (seconds increased)	< 4	4-6	> 6

Points	Class	One year survival	Two year survival
5-6	A	100%	85%
7-9	B	81%	57%
10-15	C	45%	35%

MELD score:
(Model for end stage liver disease) for evaluation of the severity of liver cirrhosis in each cirrhotic patient, and this system relies on laboratory evaluation including serum bilirubin, serum creatinine and INR (international normalized ratio).

MELD score = {9.6 × log (creatinine mg/dL) + 3.8 × log (bilirubin mg/dL)+11.2 × log (INR)+6.4} **[6].**

West Haven Criteria for Grading of mental status in HE **[7]:**

Grade 1	Grade 2	Grade 3	Grade 4
• Trivial lack of awareness • Euphoria or anxiety • Shortened attention span • Impairment of addition or subtraction • Altered sleep rhythm	• Lethargy or apathy • Disorientation for time • Obvious personality change • Inappropriate behavior • Dyspraxia • Asterixis	• Somnolence to semi-stupor • Responsive to stimuli • Confused • Gross disorientation • Bizarre behavior •	Coma with or without painful stimuli response to

Glasgow Coma Scale: **[8]**

Eye Opening Response	Verbal Response	Motor ResponsE
• Spontaneous-open with blinking at base line 4 • To verbal stimuli, command, speech 3 • To pain only (not applied to face) 2 • No response 1 •	• Oriented 5 • Confused conversation, but able to answer questions 4 • Inappropriate words 3 • Incomprehensible speech 2 • No response 1	• Obeys commands for movement 6 • Purposeful movement to painful stimulus 5 • Withdraws in response to pain 4 • Flexion in response to pain (decorticate • posturing) 3 • Extension response in response to pain (decerebrate posturing) 2 • No response 1

Statistical Analysis

Data were tabulated, coded then analyzed using the computer program SPSS (Statistical package for social science) version 21 to obtain Descriptive statistics were calculated in the form of: A- Mean ± Standard deviation (SD) for quantitative parametric data. B- Median and range (Minimum – maximum) for quantitative non-parametric data. C- Frequency (Number-percent) for qualitative data.

In the statistical comparison between the different groups, the significance of difference was tested using one of the following tests :

A-Student's *t*-test:-Used to compare between mean of two groups of numerical (parametric) data. B- Mann Whitney U test: Used to compare between two groups of numerical (non-parametric) data. C- Kruskal Wallis test: Used to compare between more than two groups of numerical (non-parametric) data followed by Mann Whitney for multiple comparisons.

Significance level: For all above mentioned statistical tests done, the threshold of significance is fixed at 5% level (p-value). The results were considered: Non-significant when the probability of error is more than 5% ($p > 0.05$). Significant when the probability of error is less than 5% ($p \leq 0.05$). Highly significant when the probability of error is less than 0.1% ($p \leq 0.001$).

RESULTS

The study was conducted on 100 patients (cases group) 85 males (85%), 15 females (15%). the age ranged between 47 and 77 years old in group (1) cases with the mean age being 60.28±7.54 years in comparison with group (4), the age ranged between 50 and 66 years old with mean age 56.50±6.95 years. Table (1) All patients complained from disturbed consciousness.

The mean value of Serum Creatinine was significantly higher in group (3) group than in other groups. No statistical significant difference between the four groups as regards ALT, AST, alkaline phosphatase, total bilirubin, prothrombin concentration, INR and albumin (Table 2).

As shown in table (2) there was statistical significant difference between the four groups as regards the arterial blood ammonia. It was significantly more predominant in group (4) cases (356.50±47.93) than in group (1) cases (90.73±18.42).

As shown in table (3) The most cases of Child A were in group (2), most cases of Child B were in

group (1), and most cases of Child C were in group (3) with statistical significant difference between the four groups. The mean value of Child score was predominant in group (3) cases (10± 1.087) with highly statistical significant difference between the four groups. As regards the severity of liver disease, MELD score was predominantly high in group (3) cases (24.43± 6.45) in comparison with group (1) patients (18.52± 4.62). Also uMELD score was high in group (3) cases with statistically significant difference between the four groups. There was statistical significant difference between the four groups as regards the severity of neurological dysfunction assessed by Glasgow Coma Scale. The GCS was predominantly high in group (1) cases, and less in group (4) cases.

As shown in table (4) average cirrhotic liver was detected in 78.9% of group (1) cases in comparison with group (4) cases (25.0%). Enlarged cirrhotic liver was detected predominant in group (4) cases, while shrunken liver was present predominant in group (3) cases and was statistically significant. Splenomegaly was detected in 100% of group (1-3-4) cases compared to 97.1% of group (2) cases which was statistically not significant. Portal Vein Dilatation was detected predominant in group (4) cases (100%) in comparison with group (1) cases which was present in (63.1%) and was statistically significant. There was no statistically significant difference among the four groups as regards the portal vein dilatation, splenic vein dilatation, collaterals, and gall bladder. There was statistical significant difference between the four groups as regards ascites. Mild ascites was significantly more predominant in group (4) patients (50.0%) than in other groups. Moderate ascites was significantly more predominant in group (1) patients (63.2%) than in other groups. Severe ascites was significantly more predominant in group (3) patients (56.5%) than in other groups.

As shown in table (5) there was statistically significant difference as regards the mortality among the studied patients being more predominant in group (3) patients (87%) in comparison with group (1) cases (34.2%). West Haven Criteria had significant influence on overall survival of patients with hepatic encephalopathy .There was a longest survival time (mean 8.9 months) in the group (1), followed by a longer survival time (mean 4.13 months) in the group (2) and a shorter survival time (mean 2.8 months) in the group (4) and the shortest survival time (mean 2.11months) in the group (3) which was statistically significant. Table (6)

GCS had significant influence on overall survival of patients with hepatic encephalopathy. After one year, survival was predominant in score (11.76±1.93) and death in score (9.24±2.95). MELD score had significant influence on overall survival of patients with HE. After one year, survival was predominantly high when MELD score was early (17.64±4.29) and death occurred when the score was advanced (23.10±6.52). Also uMELD score affected on overall survival of patients with HE. After one year, survival was high when uMELD score was early (3.94±.489) and death occurred when the score (4.57±.737) was advanced with high significant statistically difference. Child score affected on overall survival of patients with HE. Survival was high when score was small (8.38±1.04) and death occurred when the score increased (9.18±1.27) with significant statistically difference between all groups. Table (7)

As shown in table (8) according to Cox regression, there was no difference in prediction of survival among the studied patients assessed by GCS, MELD score, uMELD score and Child score (all had the same results).

Table (1): Demographic features of the studied patients

Items	Group 1 (No=38)		Group 2 (No=35)		Group 3 (No23)		Group 4 (No=4)		Test of sig. p-value
Age									
Mean ± SD	60.28±7.54		59.22±8.24		58.69±9.74		56.50±6.95		F=.366 P=.777
Range	47-77		45-81		41-86		50-66		
Sex									
Male	31	81.6	28	80.0	22	95.7	4	100	X2=3.788 P=.285
Female	7	18.4	7	20.0	1	4.3	0	0	

Table (2): Liver and renal function of the studied patients

Items	Group 1 (n=38)	Group 2 (n=35)	Group 3 (n=23)	Group4 (n=4)	Test of sig. p-value
	Mean ± SD	**Mean ± SD**	**Mean ± SD**	**Mean ± SD**	
Creatinine mg/dL	1.17±.659	1.82±1.42	2.36±1.60	1.98±1.55	P1=.030 p2=.001 p3=.222 p4=.108 p5=.805 p6=.574
Albumin gm/dL	2.70±.402	2.69±.444	2.502±.407	2.58±.576	F=1.304 P=.278
Alkaline Phosphatase	178.26±48.41	177.31±79.18	185.61±43.02	196±24.06	F=.197 P=.898
ALT	45.60±21.41	39.91±20.55	56.47±48.45	48.50±23.17	F=1.455 p=.232
AST	47.02±20.37	51.25±21.69	72.17±64.68	41±18.07	F= 2.671 p=.052
Bilirubin mg/dl	4.87±3.51	5.11±3.82	5.81±3.22	3.42±.783	F= .674 p=.570
Prothrombin conc	16.26±3.06	16.42±3.31	17.64±4.09	15.17±.899	F=1.136 P=.338
INR	1.61±.45	1.59±.526	1.66±.494	1.53±.147	F=.131 P=.942
Arterial Blood Ammonia mg/dl	90.73±18.42	123.28±27.53	245.47±60.26	356.50±47.93	**P1=.000**** **p2=.000**** **p3=.000**** **p4=.000**** **p5=.000**** **p6= .000****

P1 comparison between groups 1 – 2. P2 comparison between groups 1 – 3. P3 comparison between groups 1 – 4. P4 comparison between groups 2 – 3. P5 comparison between groups 2 – 4. P6 comparison between groups 3 – 4. * significant, ** highly significant

Table (3): The severity of liver cirrhosis assessed by Child- Pugh classification, MELD and Glasgow Coma Scale

Items	Group 1		Group 2		Group 3		Group 4		Test of sig. p-value
	No=38	%100	No=35	%100	No=23	%100	No=4	%100	
Child grade									
Child A	1	2.6	1	2.9	0	0	0	0	**P1=.985 p2=.000** p3=.857 p4=.001** p5=.883 p6=.273**
Child B	31	81.6	28	80.0	8	34.8	3	75.0	
Child C	6	15.8	6	17.1	15	65.2	1	25.0	
Child score									
Mean ± SD	8.50± 1.059		8.48± 1.14		10± 1.087		9.25± .50		**P1=.955 p2=.000** p3=.192 p4=*.000*** *p5=.185* *p6=.205***
MELD score	18.52± 4.62		21.34± 6.92		24.43± 6.45		21± 6.37		**P1=.048 p2=.000** p3=.435 p4=.058 p5=.913 p6=.293**
uMELD score	4.08± .589		4.34± .785		4.73± .674		4.22± .618		**P1=.103 p2=.001** p3=.691 p4=.039* p5=.739 p6=.176**
GCS	12.84 ± 0.369		10.62 ±0 .91		6.43 ± 0.843		3.75± 1.50		**P1=.000** p2=.000** p3=.000** p4=.000** p5=.000** p6= .000****

P1 comparison between groups 1 – 2. P2 comparison between groups 1 – 3. P3 comparison between groups 1 – 4. P4 comparison between groups 2 – 3. P5 comparison between groups 2 – 4. P6 comparison between groups 3 – 4. * significant, ** highly significant

Table (4): Ultrasonographic features of the studied patients

Items	Group 1 (No=38)		Group 2 (No=35)		Group 3 (No=23)		Group 4 (No=4)		Sig. P
Liver size									
Average	30	78.9	27	77.1	7	30.4	1	25.0	**P1=.983 p2=.001** p3=.032 p4=.002* p5=.045* p6=.346**
Enlarged	1	2.6	1	2.9	1	4.3	1	25.0	
Shrunk	7	18.4	7	20.0	15	65.2	2	50.0	
Splenomegaly									
Remove	0	0	1	2.9	0	0	0	0	X^2=1.876 P=.599
Enlarged (>13cm)	38	100	34	97.1	23	100	4	100	
Collaterals									
No	11	28.9	6	17.1	6	26.1	1	25.0	X^2=1.469 P=.689
Yes	27	71.1	29	82.9	17	73.9	3	75.0	
Ascites									
Mild	2	5.3	3	8.6	1	4.3	2	50.0	**P1=.324 p2=.155 p3=.014 p4=.663 p5=.064 p6=.027***
Moderate	24	63.2	16	45.7	9	39.1	1	25.0	
Severe	12	31.6	16	45.7	13	56.5	1	25.0	
GB									
Thin wall	10	26.3	4	11.4	4	17.4	0	0	X^2=5.553 P=.475
Thick	27	71.1	31	88.6	19	82.6	4	100	
Removed	1	2.6	0	0	0	0	0	0	

P1 comparison between groups 1–2. P2 comparison between groups 1–3. P3 comparison between groups 1–4. P4 comparison between groups 2–3. P5 comparison between groups 2–4. P6 comparison between groups 3–4. * significant, **highly significant

Table (5): One year mortality among the studied patients

Survival	Group 1 (n=38)		Group 2 (n=35)		Group 3 (n=23)		Group 4 (n=4)		Test of sig. p-value
	No	%	No	%	No	%	No	%	
Survived	25	65.8	10	28.6	3	13.0	1	25.0	**P1=.001 p2=.000 p3=.146 p4=.165 p5=1 p6=.495**
Died	13	34.2	25	71.4	20	87.0	3	75.0	

Table (6): Means and Medians for Survival Time of patients with hepatic encephalopathy with reference to West Haven Criteria

West Haven criteria	Median Survival Time				Chi-Square	p-value
	Estimate	Std. Error	95% Confidence Interval			
			Lower Bound	Upper Bound		
1	8.940	0.764	7.444	10.437	32.497	**≤ 001****
2	4.130	0.874	2.418	5.843		
3	2.119	0.851	0.451	3.787		
4	2.808	2.365	0.000	7.443		
Overall	5.454	0.554	4.368	6.541		

** highly significant

Table (7): Overall survival of patients with hepatic encephalopathy with reference to GCS, MELD score, uMELD score and Child score.

	Survived 1 year	Died 1 year	Test of sig. p-value
GCS	11.76±1.93	9.24±2.95	t=4.713 **p=.000****
MELD score	17.64±4.29	23.10±6.52	t= 4.621 **p=.000****
uMELD score	3.94±.489	4.57±.737	t= 4.691 **p=.000****
Child score	8.38±1.04	9.18±1.27	t=3.268 **p=.001****

Table (8): Cox regression for prediction of survival among the studied patients.

Covariates	p-value	Hazard ratio	95% CI for HR	
			Lower	Upper
GCS	.000**	.762	.697	.834
MELD score	.000**	1.106	1.061	1.153
uMELD score	.000**	2.412	1.666	3.491
Child score	.000**	1.513	1.219	1.878

**highly significant

DISCUSSION

Hepatic encephalopathy is a spectrum of neuropsychiatric manifestations ranging from psychomotor difficulties to altered consciousness and even coma **[9]**. Hepatic encephalopathy, a challenging complication of advanced liver disease, occurs in approximately 30–45% of patients with cirrhosis and10–50% of patients with transjugular intrahepatic Porto systemic shunt, while minimal hepatic encephalopathy affects approximately 20–60% of patients with liver disease **[10]**. Minimal hepatic encephalopathy, which is characterized by subtle motor and cognitive deficits, affects approximately 20–60% of patients with liver disease **[11,12]**. There are multiple prognostic scores that predict the mortality from chronic liver disease, of which the Child-Pugh score and the Model for End-stage Liver Disease (MELD) score are the most commonly used **[13]**. The MELD score had discriminative ability for 3-month survival of greater than 80%, regardless of the severity of liver disease, without any significant improvement by adding etiology or complications of cirrhosis **[6]**. MELD is a composite of the patient's laboratory values for serum bilirubin and serum creatinine, and the international normalized ratio (INR) for prothrombin time **[13]**. The most widely used scale used to evaluate HE is the West-Haven (WH) scale, with scores ranging from 0 to 4. This scale is easy to use but not suitable for patients with altered consciousness and is not well known by physicians other than hepatologists who manage these conditions. For deep coma, the validated Glasgow Coma Scale (GCS) has been proposed **[14]**. For all these considerations, the main aim of the present study was to assess comparison of MELD score and Glasgow coma scale in prediction of prognosis and survival of patients with hepatic encephalopathy.

In the current study hepatic encephalopathy commonly presented in males more than females. This was in agreement with Mouri et al. **[14]** and Lehner et al. **[15]** who reported that men are three times higher than women in most regions.

According to the liver biochemical profile in this study, serum creatinine was the only liver biochemical parameter significantly high in most of patients (group (3) patients. This result was in agreement with Gheorghe et al. **[16]** and Botta et al. **[17]** who documented the same results (that in a patient with HE, serum creatinine and INR were the variables significantly associated with six month mortality). In this study, conventional tests of hepatic function did not have statistical significant difference between the four groups, these results were comparable to Botta et al. **[17]** who documented that exactly. Ammonia has been regarded as one of the major pathogenetic factors of cerebral dysfunction in HE, and astrocyts has been the most commonly affected cell **[18,19]**. Ong et al. **[20]** showed that venous ammonia levels correlate with the severity of HE. In this study, arterial blood ammonia had a statistical significant difference between the four groups. It was significantly more predominant in group (4) cases (356.50±47.93) than in group (1) cases (90.73±18.42). This result was in agreement with Bernal et al. **[21]** who documented the same results that arterial ammonia on admission was significantly higher in group 4 patients [median: 113–mol/L (74-164 -mol/L)], and with Gheorghe et al. **[16]** who documented that mean plasma ammonia levels were increase with the severity of HE. Our findings support the final report of the working party at the 11th world congresses of gastroenterology ammonia testing was described as a potential diagnostic tool which, however, correlates poorly with symptoms of HE [9].

In this study, most cases of Child A (2.9%) were in Group (2), most cases of Child B (81.6%) were in Group (1), and most cases of Child C (65.2) were in Group (3) with statistical significant difference between the four groups. These results were in agreement with Stewart et al. **[1]** and Botta et al. **[17]** who documented nearly the same results (63%) of Group (1) cases were Child B. In contrast, these results disagree with Mouri et al. **[14]** who reported that most of the patients with Group (1- 4) cases were Child C (69%) as he collected patients with severe cirrhosis.

The mean value of Child score was predominantly high in most of patients (group (3) cases) (10± 1.087) with highly statistical significant difference between the four groups. These results were in agreement with Wehler et al. **[22]** and Botta et al. **[17]** who documented nearly the same results (10.9 ±1.8) in Group (2-4) cases, Child score was (9-10) in Group (3-4) cases **[1]**, and studies who stated that the mean value of Child score was (9-14) in Group (2-4) cases **[17]**. D'Amico et al. **[23]** found that the Child score, albumin, bilirubin, age, ascites, prothrombin time were the most common predictors of survival in patients with HE.

According to MELD score most of patients (Group (3) patients) (24.43± 6.45) were presented at advanced score comparing to the Group (2) patients (21.34± 6.92) and the Group (4) patients (21± 6.37) which presented at intermediate score, and the early score (18.52± 4.62) were presented in Group (1) patients with statistical significant difference between the four groups. These results in agreement with Stewart et al. **[1]** who stated that the mean value of MELD score in Group (3) patients were (15-25), in Group (2) patients were (13-22), and in Group (1) patients were (7-17), and Laferrière et al. **[24]** who documented nearly the same results with a median of 22 (17-28) in Group (3) patients, and with that who reported that most of the patients with Group (2-4)cases were presented at advanced score (22 ± 9) and Group (1) cases were presented at early score (19± 8) [14].After clinical examination of patients with HE, it was found that as the grades of HE increased, MELD score and Child score were also high **[1]**. The MELD score reflects liver disease severity, with higher values indicating worse disease **[6,25]**. Sanyal et al. **[26]** demonstrated a strong association between MELD score and developing HE as well as HE and mortality. It has recently been suggested that changes in MELD score may be as important as the absolute MELD score in predicting short-term survival **[27]**. Baseline MELD score has been shown also to be an accurate predictor of 3-month mortality on the wait list in patients with end-stage liver disease, and it was suggested that the accuracy may extend to up to 1 year **[28]**. According to uMELD score most of patients (Group 3 patients) (4.73 ± 0.674) were presented at advanced score comparing to the Group (2) patients (4.34± .785) which presented at intermediate score, and the early score (4.08± .589) were presented in Group 1patients with statistical significant difference between the four. These results were in agreement with Craig et al. **[29]** which documented nearly the same results. In this study, the mean value of Glasgow Coma Scale was predominantly high in group 1 cases (12.84 ± 0.369), and less in group 4 cases (3.75± 1.50) with statistical significant difference between the four groups. This result was in agreement with Mouri et al. **[14]** who documented that the mean value of Glasgow Coma Scale was (14.9 ± 0.3) in Group 1 cases.

Abdominal ultrasonography was done to evaluate the liver status in the studied patients and all of the patients (100%) with HE had sonographic evidence of liver cirrhosis. This goes in agreement with Poordad **[30]** who stated that, all cases of HE frequently coexists with cirrhosis and studies who documented nearly the same results **[31]**. This was supported also by Said et al. **[28]** which reported that cirrhosis is present in the vast majority of patients with HE, and Biselli et al. **[32]** which documented that cirrhosis of the liver was present in 100% of patients with HE. Average cirrhotic liver was detected in78.9% of group 1 cases in comparison with group 4 cases (25.0%). Enlarged cirrhotic liver was detected predominant in group 4 cases, while shrunken liver was present predominant in group 3 cases and was statistically significant. This goes in agreement with Stewart et al. **[1]** who documented nearly the same results, and Mouri et al. **[14]** who reported that most of the patients (86%) had average cirrhotic liver. The Homogenous liver was present in 100% in the four groups, compared to heterogeneous liver which is present in 0% in the four groups (as HCC was excluded in this study). This goes in agreement with Stewart et al. **[1]** who documented nearly the same results, and Laferrière et al. **[33]** who reported that 100% in the all groups had homogenous liver. In contrast, these results disagree with Mouri et al. **[14]** who reported that 14% of cases had heterogeneous liver, and Lehner et al. **[15]** who reported that 14.5% of cases had heterogeneous liver. Splenomegaly was detected in 100% of group (1-3-4) cases compared to 97.1% of group (2) cases. These results was in agreement with Stewart et al. **[1]** who reported nearly the same results, and Lehner et al. **[15]** who stated that 100% in the all groups had splenomegaly. Portal Vein Dilatation was detected more in group 4 cases in comparison with group (1) cases which was present in (63.1%) and was statistically significant. These results were in agreement with Stewart et al. **[1]** who documented nearly the same results. There was no statistically significant difference among the four groups as regards the portal vein dilatation, splenic vein dilatation, collaterals, and gall bladder. These results are in agreement with Stewart et al. **[1]** who reported nearly the same results.

After one-year follow up of patients with HE, it was founded that (61%) of patients died. These results in agreement with Fichet et al. **[34]** who reported nearly the same results (54%) [34], and Gildea et al. **[35]** who reported nearly that (69%) of patients died with a median survival of 1 month. Mortality from studies regarding patients with HE ranged from 33% to 91%, depending of severity of the underlying disease **[36,37]**. West

Haven Criteria had significant influence on overall survival of patients with hepatic encephalopathy. The longest survival time (mean 8.9 months) was in the group 1, followed by a longer survival time (mean 4.13 months) in the group 2and a shorter survival time (mean 2.80 months) in the group (4) and the shortest survival time (mean 2.11months) in the group 3category group .These results in agreement with Mouri et al. **[14]** which reported nearly the same results.

In the present study, MELD score had significant influence on overall survival of patients with HE. The score was advanced in the most of patients group 3 category group with a shortest survival time, intermediate in the group (2-4) category group with a longer survival time, early in the group 1 with a longest survival time. These results in agreement with Stewart et al. **[1]** and Laferrière et al. **[24]** who documented nearly the same results.

In the present study, Glasgow Coma Scale had a significant influence on overall survival of patients with HE, overall survival was shorter in patients with lower score and longer with higher score. This result was in agreement with Mouri et al. **[14]** who documented the same results.

CONCLUSION

Glasgow coma scale can help assess patients with hepatic encephalopathy and can with great accuracy assess risk of one year mortality.

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REFERENCES

1. Stewart CI, Malinchoc M, Kim WR, Kamath PS. Hepatic encephalopathy as a predictor of survival in patients with end stage liver disease. *Liver transplantation* 2007; 13:1366-1371.
2. Prakash R , Mullen KD. Mechanisms, diagnosis and management of HE. *Nat Rev Gastroenterol Hepatol* 2010;7 (9): 515-25.
3. Ortiz M, Jacas C, Cordoba J: Minimal hepatic encephalopathy. diagnosis, clinical significance and recommendations. *J Hepatol* 2005;42: S45–S53.
4. Ham J, Gish RG , Mullen K, Model for End-Stage Liver Disease (MELD). Liver transplantation, 2006;S102-S104.
5. Pugh RN, Murray-Lyon IM, Dawson JL, Pietroni MC, Williams R.Transection of the oesophagus for bleeding oesophageal varices. *Br J Surg* 1973; 60: 646 – 649.
6. Kamath PS, Wiesner RH, Malinchoc M. A model to predict survival in patients with end-stage liver disease. *Hepatology* 2001;33: 464-470.
7. Mullen KD, Ong JP, Aggarwal A, Krieger D, Easley KA, Karafa MT, Van Lente F, Arroliga AC.Correlation between ammonia levels and the Severity of HE. *The American journal of medicine* 2003;114: 188 –193.
8. Teasdale G , Jennett B.Assessment of coma and impaired consciousness. *Lancet* 2003; 81-84.
9. Ferenci P, Lockwood A, Mullen K, Tarter R, Weissenborn K, Blei AT.Hepatic encephalopathy-definition, nomenclature, diagnosis, and quantification: final report of the working party at the 11h World Congresses of Gastroenterology, Vienna. *Hepatology* 2002;35: 716–721.
10. Poordad FF. Review article: the burden of hepatic encephalopathy. *Aliment Pharmacol Ther*. 2007; 25 Suppl 1: 3-9.
11. Romero-Gomez M, Cordoba J, Jover R, Olmo JA, Ramirez M, Rey R, et al.Value of the critical flicker frequency in patients with minimal hepatic encephalopathy. *Hepatology* 2007;45:879–885.
12. Das A, Dhiman RK, Saraswat VA, Verma M, Naik SR. Prevalence and natural history of subclinical hepatic encephalopathy in cirrhosis. *J Gastroenterol Hepatol* 2001; 16(5):531-5.
13. Freeman R.B, Wiesner RH, Edwards E, Harper A, Merion R, Wolfe R.Results of the first year of the new liver allocation plan. *Liver Transpl* 2004; 10: 7–15.
14. Mouri S, Tripon S, Rudler M, Mallet M, Mayaux J, Thabut D, Weiss N.FOUR Score, a reliable score for assessing overt hepatic encephalopathy in cirrhotic patients. *Neurocritical Care* 2014; 1541- 6933.
15. Lehner S, Stemmler H, Mück A, Braess J, Parhofer KG. Prognostic parameters and risk stratification in intensive care patients with severe liver diseases. *J Gastrointestinal Liver Dis* 2014;19(4): 399 -404.
16. Gheorghel L, Iacob S, Iacob R, Gheorghe1C, Popescu I.Variation of the MELD Score as a predictor of death on the waiting list for liver transplantation. *J Gastrointestinal Liver Dis* 2007; 16 (3) 267-272.
17. Botta F, Giannini E, Romagnoli P, Fasoli A, Malfatti F, Chiarbonello B, et al. MELD scoring system is useful for predicting prognosis in patients with liver cirrhosis and is correlated with residual liver function: a European study. *Gut* 2003;52:134–139.
18. Bajaj JS. The modern management of hepatic encephalopathy. *Aliment Pharmacol Ther* 2009; 31:537 – 47.

19. Bhatia V, Singh R, Acharya SK. Predictive value of arterial ammonia for complications and outcome in acute liver failure. *Gut* 2006; 55:98-104.
20. Ong JP, Aggarwal A, Krieger D, Easley KA, Karafa MT, Van Lente F, et al.Correlation between ammonia levels and the severity of hepatic encephalopathy. *Am J Med* 2003; 114: 188-193.
21. Bernal W, Hall C, Karvellas C J, Auzinger G, Sizer E, and Wendon J. Arterial Ammonia and Clinical Risk Factors for Encephalopathy and Intracranial Hypertension in Acute Liver Failure. *Hepatology* 2007;46:1844-1852.
22. Wehler M, Kokoska J, Reulbach U, Hahn EJ and Strauss R: Short-Term Prognosis in Critically Ill Patients with Cirrhosis Assessed by Prognostic Scoring Systems. *Hepatology* 2001; 34:255-261.
23. D'Amico G, Garcýa-Tsao G, Pagliaro L. Natural history and prognostic indicators of survival in cirrhosis: a systematic review of 118 studies. *J Hepatol* 2006; 44: 217-231.
24. Laferrière VM, Homberger C, Bichoupan K, Dieterich DT. MELD score and antibiotics use are predictors of length of stay in patients hospitalized with hepatic encephalopathy. *BMC Gastroenterology* 2014; 14:185.
25. Wiesner R, Edwards E, Freeman R, Harper A, Kim R, Kamath P, et al. Model for end-stage liver disease (MELD) and allocation of donor livers. *Gastroenterology* 2003; 124: 91–96.
26. Sanyal AJ, Banas C, Sargeant C, Luketic VA, Sterling RK, Stravitz RT, et al. Similarities and differences in outcomes of cirrhosis due to nonalcoholic steatohepatitis and hepatitis C. *Hepatology* 2006;43:682-689.
27. Saab S, Landaverde C, Ibrahim A, Durazo F, Han S, Yersiz H, Farmer D, Ghobrial R, Goldstein L, Tong M, et al.The MELD Score in Advanced Liver Disease: Association with Clinical Portal Hypertension and Mortality. *Experimental and clinical transplantation* 2004; 4(1): 395-399.
28. Said A, Williams J, Holden J, Remington P, Gangnon R, Musat A, et al. Model for end stage liver diseases core predicts mortality across abroad spectrum of liver disease. *J Hepatol* 2004; 40: 897–903.
29. Craig DG, Reid TW, Wright EC, Martin KG, Davidson JS, Hayes PC, Simpson KJ: The sequential organ failure assessment (SOFA) score is prognostically superior to the model for end-stage liver disease (MELD) and MELD variants following paracetamol (acetaminophen) overdose. *Aliment Pharmacol Ther* 2012; 35: 705–713.
30. Poordad FF. Review article: the burden of hepatic encephalopathy. *Aliment Pharmacol Ther*.2007; 25 Suppl 1: 3-9.
31. Biggins SW, Rodriguez HJ, Bacchetti P, Bass NM, Roberts JP, Terrault NA. Serum sodium predicts mortality in patients listed for liver transplantation. *Hepatology* 2005,41: 32-39.
32. Biselli M, Gitto S., Gramenzi A. Six score systems to evaluate candidates with advanced cirrhosis for orthotopic liver transplant: which is the winner? .*Liver Transpl* 2010;16: 964-973.
33. Laferrière VM, Homberger C, Bichoupan K, Dieterich DT. MELD score and antibiotics use are predictors of length of stay in patients hospitalized with hepatic encephalopathy. *BMC Gastroenterology* 2014; 14:185.
34. Fichet J, Mercier E, Genée O, Garot D, Legras A, Dequin F, Perrotin D. Prognosis and 1-year mortality of intensive care unit patients with severe hepatic encephalopathy. *Journal of Critical Care* 2009; 24, 364–370.
35. Gildea TR, Cook WC, Nelson DR. Predictors of long-term mortality in patients with cirrhosis of the liver admitted to a medical ICU. *Chest* 2004; 126: 598-603.
36. Aggarwal A, Ong JP, Younossi ZM. Predictors of mortality and resource utilization in cirrhotic patients admitted to the medical ICU. *Chest* 2001; 119:1489-97.
37. Benhaddouch Z, Abidi K, Naoufel M. Mortality and prognostic factors of the cirrhotic patients with hepatic encephalopathy admitted to medical intensive care unit. *Ann Fr Anesth Reanim* 2007; 26: 490-5.

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