Comparison of Model for End Stage Liver Disease-Na score and Model for End Stage Liver Disease score in predicting in-hospital mortality in patients with end stage liver disease: an observational study

Tirthankar Mukherjee¹, Kamalesh Tagadur Nataraju²*, B. M. Rakesh³, Soumya Dattanagowda Dandothi³

¹Department of General Medicine, Kempegowda Institute of Medical Sciences, Bangalore, Karnataka, India
²Department of General Medicine, KVG Medical College, Sullia, Karnataka, India
³Department of General Medicine, Vydehi Institute of Medical Sciences and Research Centre, Bangalore, Karnataka, India

Received: 01 April 2019
Accepted: 02 May 2019

*Correspondence:
Dr. Kamalesh Tagadur Nataraju,
E-mail: tnkamalesh@gmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Model for End-stage Liver Disease (MELD) score was originally developed to predict mortality after trans jugular intrahepatic portosystemic shunt. Hyponatremia is the most common electrolyte abnormality in End Stage Liver Disease (ESLD). Incorporating serum sodium into MELD score increases its predictive accuracy.

Methods: This is an observational study conducted on 50 patients of ESLD admitted from October 2012 to September 2014. Study population was divided into survivor and non-survivor groups. MELD score and Model for End Stage Liver Disease-Na (MELD-Na) score was calculated and compared between the groups.

Results: Out of 50 participants, 20 (40%) died in the hospital due to cirrhosis related complications. The average age was 44.7±12.040 years in the survivor group and 54.1±9.910 years in the non-survivor group. The mean MELD score and MELD-Na score was found to be higher in non-survivors group (28.5 and 30.5) compared to survivors group (22.03 and 25.67) which was statistically very significant. Majority of the patients in survivor group had MELD score between 10-19 (43.3%) and 30-39 (36.7%). In the non-survivor group majority of patients had score of more than 20 (80%). MELD-Na score has better sensitivity (90%) compared to MELD score (80%) at a cut off value above 22. However, MELD score has better specificity (60%) compared to MELD-Na score (43.3%) at the same cut off value.

Conclusions: MELD-Na score was higher in non-survivor group with good predictability for in-hospital mortality and there was good correlation between both the scores in terms of degree of agreement and MELD-Na score was more sensitive compared to MELD score.

Keywords: Cirrhosis, MELD, MELD-Na

INTRODUCTION

Cirrhosis is the final common end point of all progressive liver diseases of various etiologies.¹ End stage liver disease (ESLD) is one of the leading causes of death in India and worldwide.² According to the latest WHO data published in 2017 liver disease deaths in India reached 259,749 or 2.95% of total deaths. The natural history of cirrhosis is variable depending on the etiology and interventions. Annual rate of decompensation is approximately 4% and 10% respectively for viral hepatitis C and hepatitis B. Decompensation in alcoholic...
liver disease is even more rapid with the continued alcohol usage. 5-year mortality is more than 85% once decompensation sets in, irrespective of the etiology. Various scoring systems have been developed to assess the severity and prognosticate the liver disease. Child-Turcott-Pugh (CTP) score, is a simple scoring system with a fairly good predictive value. (C) 1-year survival for patients with CTP class A, B and C are 100%, 80% and 45% respectively.4 The model for end-stage liver disease (MELD) score was developed to define medical urgency for transplantation. The MELD, originally developed to predict mortality after trans jugular intrahepatic portosystemic shunt.5 MELD score is calculated using serum total bilirubin, the international normalized ratio (INR), and serum creatinine and it correlates well with short-term mortality risk in ESLD.6-8 It has been observed in various studies that hyponatremia is the most common electrolyte abnormality due to various pathogenic mechanisms. Hyponatremia has been associated with hepatorenal syndrome ascites and cirrhosis related mortality.9-18 Hyponatremia which occurs due to free water retention correlates well with the mortality in cirrhosis especially, in those with low MELD score.19,20 For each millimole decrease in serum sodium between 125 and 140 mmol/L, the mortality increases by 5%.21 Incorporating serum sodium into the MELD score increases its predictive accuracy especially, for patients with ascites.22-24 As serum sodium is a readily available, cost-effective test, its incorporation into MELD score led to the development of MELD-Na score. This study was undertaken to evaluate the prognostic value of MELD-Na score in comparison with the conventional MELD score in patients with end stage liver disease.

**METHODS**

This is an observational study conducted on 50 patients of cirrhosis of liver admitted in the department of general Medicine, Kempegowda institute of medical sciences, from October 2012 to September 2014. Informed consent was obtained from all the participants or their care takers (of those who were not in a position to give consent due to their critical illness or due to encephalopathy). Cirrhosis of liver (End stage liver disease) was diagnosed based on clinical history and examination, biochemical tests, and ultrasonography of liver. Patients aged less than 18 years, who were on diuretic therapy and anti-coagulation therapy were excluded from the study. Demographic details, thorough clinical history and examination findings, complete blood count (CBC), liver function tests (LFT), prothrombin time (PT), activated partial thromboplastin time (APTT), International normalized ratio (INR), renal function tests, serum electrolytes, and abdominal ultrasonography findings were recorded. All patients were screened for subclinical hepatic encephalopathy using psychometric testing. Serum ammonia levels were tested in those with clinical/subclinical hepatic encephalopathy. All patients with ascites were subjected for ascitic fluid analysis to rule out spontaneous bacterial peritonitis (SBP). All previous health records of previous 6 months were screened for evidence of esophageal varices and those who had not undergone upper GI endoscopy within past 6 months were subjected for the same to look for esophageal varices. All patients were screened for hepatitis B virus (HBV), hepatitis C virus (HCV) and human immunodeficiency virus (HIV) infection. Those with evidence of possible hepatocellular carcinoma on ultrasonography were subjected for computerized tomography (CT) abdomen.

Child-turcott-pugh (CTP) score was calculated for all patients. Patients were grouped into class A, B and C according to total CTP score of 5-6,7-9 and 10-15 respectively. MELD score was calculated at admission. The participants were followed until discharge or death in the hospital and were observed for any cirrhosis related complications.

**MELD Score was calculated using the following formula**

\[0.957 \times \log (\text{serum creatinine in mg/dl}) + 0.378 \times \log (\text{Serum bilirubin in mg/dl}) + 1.12 \times \log (\text{INR}) + 0.643\]

The score is multiplied by 10 and rounded to the nearest whole number.

Serum sodium levels were obtained for all patients and the following formula was used to calculate MELD-Na score.

**MELD-Na:** MELD + 1.32 × (137-Na) - (0.033 × MELD × (137-Na))

**Statistical methods**

The following methods of statistical analysis have been used in this study. Data was entered in Microsoft excel and analyzed using SPSS (Statistical Package for social science, Ver.10.0.5) package. The results were averaged (mean± standard deviation) for continuous data and number and percentage for dichotomous data are presented in (Table and Figure). Normality of data was tested using Shapiro-Wilk test. Proportions were compared using chi-square (χ²) test of significance. Proportion of cases belonging to specific group of parameters or having a particular problem was expressed in absolute number and percentage. The student ‘t’ test was used to determine whether there was a statistical difference between groups in the parameters measured if the data is normal. A non-parametric test (distribution-free) used to compare two independent groups of sampled data. Unlike the parametric t-test, this non-parametric makes no assumptions about the distribution of the data (e.g., normality). A receiver operating characteristic (ROC) curve analysis was used to assess the accuracy of MELD and MELD-Na for identifying risk factor (death), or for identifying each factor separately. A comparison of the diagnostic abilities for each test was performed using

International Journal of Advances in Medicine | May-June 2019 | Vol 6 | Issue 3  Page 933
the area under the curves (AUC). The optimal cutoff points were obtained from the point on the ROC curve which was closest to (0,1). This point was calculated as the minimum value of the square root of \((1 - \text{sensitivity})^2 + (1 - \text{specificity})^2\). In all the above tests “p” value of less than 0.05 was accepted as indicating statistical significance.

**RESULTS**

Out of 50 study participants with end stage liver disease, 20 (40%) died in the hospital due to cirrhosis related complications. For the purpose of analysis, the study population was divided into survivor group and non-survivor group and the parameters were compared between each group.

| Table 1: Characteristics of study population. |
|-----------------------------------------------|
|                                            |
| **Survivors** (N=30) | **Non-survivors** (N=20) | **Total** (N=50) | ‘p’ value |
| Age (Mean± SD) | 44.7±12.040 | 54.1±9.910 | 48.5±12.056 | 0.006 |
| (Min-Max) | (26-80) | (35-73) | (26-80) |
| Gender | | | | |
| Male | 24 | 17 | 41 | 0.006 |
| Female | 6 | 3 | 9 | 0.652 |
| Jaundice | 18 | 16 | 34 | 0.181 |
| Abdominal distension | 21 | 16 | 37 | 0.430 |
| Pedal oedema | 20 | 12 | 32 | 0.630 |
| Alcohol consumption | 22 | 17 | 39 | 0.329 |
| Hypotension | 4 | 9 | 13 | 0.012 |
| Anemia | 23 | 17 | 40 | 0.470 |
| Thrombocytopenia | 25 | 15 | 40 | 0.470 |
| Presentation at admission | | | | |
| Dimorphic anaemia | 9 | 3 | 12 | 0.006 |
| Macrocytic anaemia | 2 | 1 | 3 | 0.600 |
| Microcytic hypochromic anaemia | 1 | 4 | 5 | 0.100 |
| Normocytic hypochromic anaemia | 2 | 1 | 3 | 0.438 |
| Normocytic normochromic anaemia | 13 | 11 | 24 | 0.006 |
| Pancytopenia | 1 | 0 | 1 | 2.00 |
| Raised ESR | 10 | 10 | 20 | 0.239 |
| Impaired glucose tolerance | 5 | 3 | 8 | 0.875 |
| USG/CT abdomen | | | | |
| Cirrhosis of liver | 30 | 20 | 50 | 1.000 |
| Splenomegaly | 20 | 12 | 32 | 0.630 |
| Ascitis | 20 | 12 | 32 | 0.630 |
| PV thrombosis | 2 | 0 | 2 | 0.239 |
| Complications | | | | |
| Hepatorenal syndrome | 7 | 6 | 13 | 0.599 |
| Hemodialysis | 1 | 5 | 6 | 0.021 |
| Esophageal varices | 27 | 15 | 42 | 0.156 |
| Spontaneous bacterial peritonitis (SBP) | 11 | 1 | 12 | 0.010 |
| Portal hypertension | 30 | 19 | 49 | 0.216 |
| Hepatic encephalopathy | 12 | 14 | 26 | 0.038 |
| Gastrointestinal tract bleed | 6 | 3 | 9 | 0.652 |
| Hepatocellular carcinoma | 0 | 1 | 1 | 2.00 |
| Etiology | | | | |
| Alcohol | 22 | 16 | 38 | 0.752 |
| Hepatitis B | 1 | 2 | 3 | 0.006 |
| Other non-alcoholic causes | 7 | 3 | 10 | 20.00 |

The average age was 44.7±12.040 years in the survivor group and 54.1±9.910 years in the non-survivor group. The age span was 26-80 years in survivor group and 35-73 years in non-survivor group.
There was male preponderance in both the study groups with male to female ratio of 4:1 in survivor group and 5.6:1 in non-survivor group. Gender difference with respect to in-hospital mortality was not statistically significant.

| Table 2: Comparison of lab values between survivors and non-survivors group. |
|---------------------------------|-------|------|--------|------|---|-------|
| **Outcome** | **N** | **Mean** | **SD** | **Median** | **Min.** | **Max.** |  \( p \) value |
| Serum creatinine | | | | | | | |
| Survivors | 30 | 1.10 | 0.833 | 0.70 | .30 | 4.20 | 0.002 |
| Non -survivors | 20 | 3.18 | 3.387 | 1.65 | .30 | 11.60 | |
| Total | 50 | 1.93 | 2.432 | 1.00 | .30 | 11.60 | |
| Total bilirubin | | | | | | | |
| Survivors | 30 | 8.230 | 9.981 | 2.585 | .37 | 31.20 | 0.267 |
| Non-survivors | 20 | 11.719 | 11.850 | 7.500 | .60 | 41.80 | |
| Total | 50 | 9.626 | 10.788 | 4.270 | .37 | 41.80 | |
| Serum albumin | | | | | | | |
| Survivors | 30 | 2.293 | 0.652 | 2.300 | 1.00 | 3.90 | 0.472 |
| Non-survivors | 19 | 2.153 | 0.675 | 2.000 | 1.00 | 3.40 | |
| Total | 49 | 2.239 | 0.658 | 2.000 | 1.00 | 3.90 | |
| International normalized ratio | | | | | | | |
| Survivors | 30 | 2.441 | 1.19054 | 1.980 | 1.10 | 5.72 | 0.867 |
| Non-survivors | 20 | 2.3860 | 1.03482 | 2.2250 | 1.17 | 5.38 | |
| Total | 50 | 2.4190 | 1.12019 | 2.1450 | 1.10 | 5.72 | |
| Serum sodium | | | | | | | |
| Survivors | 30 | 131.23 | 6.377 | 132.50 | 119 | 144 | 0.505 |
| Non-survivors | 20 | 132.50 | 6.771 | 132.00 | 120 | 145 | |
| Total | 50 | 131.74 | 6.499 | 132.00 | 119 | 145 | |
| Serum potassium | | | | | | | |
| Survivors | 30 | 4.0400 | .76771 | 4.1000 | 2.90 | 5.90 | 0.901 |
| Non-survivors | 20 | 4.0050 | 1.21805 | 3.6500 | 1.80 | 7.00 | |
| Total | 50 | 4.0260 | .96146 | 4.1000 | 1.80 | 7.00 | |
| SGOT | | | | | | | |
| Survivors | 30 | 101.90 | 85.240 | 85.00 | 19 | 346 | 0.232 |
| Non-survivors | 20 | 135.50 | 110.563 | 123.50 | 28 | 459 | |
| Total | 50 | 115.34 | 96.523 | 92.00 | 19 | 459 | |
| SGPT | | | | | | | |
| Survivors | 30 | 58.63 | 105.558 | 31.50 | 10 | 605 | 0.721 |
| Non-survivors | 20 | 49.90 | 31.271 | 40.50 | 19 | 138 | |
| Total | 50 | 55.14 | 83.621 | 35.50 | 10 | 605 | |
| Serum ammonia | | | | | | | |
| Survivors | 13 | 123.75 | 77.7160 | 92.00 | 62.0 | 340.0 | 0.452 |
| Non-survivors | 14 | 107.24 | 21.6609 | 105.00 | 68.0 | 163.0 | |
| Total | 27 | 115.19 | 55.6135 | 102.00 | 62.0 | 340.0 | |

Among the various clinical presentations, the incidence of jaundice (80% vs 62.1%), ascites (80% vs 70%), anemia (85% vs 76.7%) and hypotension (45% vs 13.3%) was higher in the non-survivor group. A statistically significant difference was noted with respect to hypotension with a p-value of 0.012. The incidence of thrombocytopenia was found to be lower in non-survivor group (75%) compared to survivor group (83.3%). However, there was no significant statistical difference with respect to thrombocytopenia (Table 1).

Comparison of ultrasonology findings of abdomen is shown in the (Table 2).

Splenomegaly was noted in 32 (64%) patients of whom 20 (66.7%) patients belonged to survivor group and 12 (60%) patients belonged to non-survivor group. Ascites was found in 32 (64%) patients of whom 20 (66.7%) patients belonged to survivor group and 12 (66.7%) patients belonged to non-survivor group. 2 (4%) patients both of whom in the survivor group had evidence of portal vein thrombosis (Table 1).

Among the cirrhosis related complications, portal hypertension was the most common complication observed in 49 (98%) patients. Oesophageal varices was observed in 42 (84%) patients of whom 27 (90%) belonged to survivor group and 15 (75%) belonged to non-survivor group. Hepatic encephalopathy was observed in 26 (52%) patients the incidence of which was found to be higher in non-survivor group (70%) compared to survivor group (40%) and was statistically significant with a p value of 0.038. Hepatorenal syndrome was observed in 13 (26%) patients the incidence of which was found to be higher in non-survivor group (30%) compared to survivor group (23.3%). However, there was no statistical significance difference between the two
groups. Spontaneous bacterial peritonitis was observed in 11 (36.7%) patients compared to 1 (5%) patients in non-survivor group. This was found to be statistically significant with a p value of 0.010. GI bleed was noted in 9 (18%) of patients. Hepatocellular carcinoma was seen in 1 (2%) patient who died in the hospital (Table 1).

The mean MELD score and MELD-Na score was found to be higher in non-survivors group (28.5 and 30.5) compared to survivors group (22.03 and 25.67) which was statistically very significant (Table 3).

| Outcome | N    | Mean | SD     | Median | Min. | Max. | 'p' value |
|---------|------|------|--------|--------|------|------|-----------|
| MELD   | Survivors | 30  | 22.03  | 10.759 | 19.00 | 7    | 44        |
|         | Non-survivors | 20  | 28.50  | 8.488  | 28.00 | 15   | 44        |
|         | Total       | 50  | 24.62  | 10.329 | 25.00 | 7    | 44        |
| MELD Na | Survivors   | 30  | 25.67  | 9.466  | 28.00 | 10   | 43        |
|         | Non-survivors | 20  | 30.45  | 7.222  | 30.00 | 15   | 43        |
|         | Total       | 50  | 27.58  | 8.880  | 27.50 | 10   | 43        |

Majority of the patients in the survivor group had MELD score between 10-19 (43.3%) and 30-39 (36.7%). In the non-survivor group majority of the patients had score of more than 20 (80%). So, the MELD score was significantly higher in non-survivor group compared to survivor group (Table 4).

| Outcome | MELD | Total |
|---------|------|-------|
|         | <9  | 10-19 | 20-29 | 30-39 | ≥40 |
| Survivors | 3   | 13    | 2     | 11    | 1   |
|          | 10.0% | 43.3% | 6.7% | 36.7% | 3.3% |
|          | 100.0% |
| Non-survivors | 0   | 4     | 6     | 8     | 2   |
|          | 0.0% | 20.0% | 30.0% | 40.0% | 10.0% |
|          | 100.0% |
| Total    | 3   | 17    | 8     | 19    | 3   |
|          | 6.0% | 34.0% | 16.0% | 38.0% | 6.0% |
|          | 100.0% |

Majority of patients had MELD-Na score of more than 10 in survivor group and score of more than 20 in non-survivor group. MELD-Na score was significantly higher in non-survivor group compared to survivor group (Table 5). There was a statistically significant agreement between MELD score and MELD-Na score in 21 out of 30 (70%) patients in the survivor group and 17 out of 20 (85%) patients in non-survivor group. Hence there was relatively better agreement between the two score in the non-survivor group (85%) compared to the survivor group (70%) (Table 6).

The mean hospital stay was 5.8 days in non-survivor group compared to 9.6 days in survivor group (Table 7).
Table 6: Agreement between meld and model for end-stage liver disease-Na score between survivors and non-survivors.

| Outcome | MELD | MELD Na |
|---------|------|---------|
|         | <9   | 10-19   | 20-29 | 30-39 | ≥40   | Total |
| Survivors | <9 0 | 3       | 0     | 0     | 0     | 3     |
|           | 0.0% | 100.0%  | 0.0%  | 0.0%  | .0%   | 100.0%|
|          | 10-19 | 0       | 7     | 6     | 0     | 13    |
|           | 0.0% | 53.8%   | 46.2% | 0.0%  | .0%   | 100.0%|
|          | 20-29 | 0       | 0     | 2     | 0     | 2     |
|           | 0.0% | 0.0%    | 100.0%| 0.0%  | 0.0%  | 100.0%|
|          | 30-39 | 0       | 0     | 11    | 0     | 11    |
|           | 0.0% | 0.0%    | 100.0%| .0%   | 0.0%  | 100.0%|
|           | ≥40   | 0       | 0     | 0     | 1     | 1     |
|           | 0.0% | 0.0%    | 0.0%  | 100.0%| 100.0%|
| Total     | 0.0% | 33.3%   | 26.7% | 36.7% | 3.3%  | 100.0%|

| Non-survivors | <9 0 | 0       | 0     | 0     | 0     | 0     |
|               | 0.0% | 0.0%    | 0.0%  | 0.0%  | .0%   | 0.0%  |
|               | 10-19 | 0       | 1     | 3     | 0     | 4     |
|               | 0.0% | 25.0%   | 75.0% | 0.0%  | 0.0%  | 100.0%|
|               | 20-29 | 0       | 6     | 0     | 0     | 6     |
|               | 0.0% | 0.0%    | 100.0%| 0.0%  | 0.0%  | 100.0%|
|               | 30-39 | 0       | 0     | 8     | 0     | 8     |
|               | 0.0% | 0.0%    | .0%   | 100.0%| 0.0%  | 100.0%|
|               | ≥40   | 0       | 0     | 0     | 2     | 2     |
|               | 0.0% | 0.0%    | 0.0%  | 100.0%| 100.0%|
| Total         | 0.0% | 5.0%    | 45.0% | 40.0% | 10.0% | 100.0%|

Table 7: Comparison of mean hospital days between survivor and non-survivor group.

| Outcome | N | Mean | SD   | Median | Min. | Max. | ‘p’ value |
|---------|---|------|------|--------|------|------|-----------|
| Survivors | 30 | 9.6  | 6.009| 8.5    | 2    | 27   | 0.000     |
| Non-survivors | 20 | 5.8  | 5.981| 4.0    | 1    | 25   | 0.030     |
| Total     | 50 | 8.1  | 6.240| 7.0    | 1    | 27   |           |

MELD-Na score has better sensitivity (90%) compared to MELD score (80%) at a cut off value above 22. However, MELD score has better specificity (60%) compared to MELD-Na score (43.3%) at the same cut off value (Figure 2).

**DISCUSSION**

In present study, out of 50 patients with end stage liver disease, 20 patients died within the hospital accounting for 40% in-hospital mortality. In a study conducted by Cholangitas E et al, mortality was seen up to 65%. High mortality in their study was probably due to higher incidence of life-threatening upper GI bleed (172 out of 312 patients). Of these 172 patients, 115 patients already had complications such as aspiration pneumonia, severe infection or organ failure. Authors also observed that higher age was associated with increased mortality. Most common presenting features in present study was...
abdominal distension (74%) followed by jaundice (69.4%), swelling of lower limbs (64%) and hypotension (26%). Authors observed that the mean serum creatinine was higher in death group and when serum creatinine was solely compared with the mortality, p value was found to be significant. The development of renal failure in cirrhotic patients indicates a catastrophic reduction in survival probability, such that it is the predominant factor in end stage cirrhosis. Mean serum sodium was 131.74mEq/dl as compared to 137mEq/dl in Cholangitas E et al, study. Even though mean bilirubin was relatively higher in non-survivor group compared to survivor group it was not statistically significant in predicting mortality.21 Similarly, serum sodium levels were not statistically significant.

MELD score and MELD-Na score was calculated for each patient and the mean value for survivor and non-survivor group was calculated. Authors observed that mean MELD score was found to higher in non-survivor group which was statistically significant with a p value of 0.002. MELD-Na score was also higher in non-survivor group but was not statistically significant. The best cut-off point for MELD score calculated using Youden index (sensitivity + specificity-1) was found to be 22 above which the mortality is higher. Similarly, authors calculated mean value for MELD-Na score and compared with the study done by Serste T et al, in France in 2012.25 The best cut-off value for MELD-Na came to be 22 similar to MELD score. To study the correlation between MELD score and MELD-Na score authors used the degree of agreement between the 2 scores. There was statistically significant agreement between the two scores in 21 out of 30 (70%) patients in the survivor group and 17 out of 20 (85%) patients in non-survivor group.

Table 8: Agreement between meld and Meld-Na score between survivors and non-survivors groups.

| Outcome MELD | MELD NA | Total |
|--------------|---------|-------|
|              | 0<9     | 10-19 | 20-29 | 30-39 | ≥40 |
| <9           | 0       | 3      | 0      | 0      | Z0  |
|              | 0.0%    | 100.0%| 0.0%   | 0.0%   | 0.0% | 100.0% |
| 10-19        | 0       | 7      | 6      | 0      | 0   |
|              | 0.0%    | 53.8% | 46.2%  | 0.0%   | 0.0% | 100.0% |
| 20-29        | 0       | 0      | 2      | 0      | 0   |
|              | 0.0%    | 0.0%  | 100.0% | 0.0%   | 0.0% | 100.0% |
| 30-39        | 0       | 0      | 0      | 11     | 0   |
|              | 0.0%    | 0.0%  | 0.0%   | 100.0% | 0.0% | 100.0% |
| ≥40          | 0       | 0      | 0      | 0      | 1   |
|              | 0.0%    | 0.0%  | 0.0%   | 0.0%   | 100.0% |
| Total        | 0       | 10     | 8      | 11     | 1   |
|              | 0.0%    | 33.3% | 26.7%  | 36.7%  | 3.3% | 100.0% |

| Outcome MELD | MELD NA | Total |
|--------------|---------|-------|
|              | 0<9     | 10-19 | 20-29 | 30-39 | ≥40 |
| <9           | 0       | 0      | 0      | 0      | 0   |
|              | 0.0%    | 0.0%  | 0.0%   | 0.0%   | 0.0% |
| 10-19        | 0       | 1      | 3      | 0      | 0   |
|              | 0.0%    | 25.0% | 75.0%  | 0.0%   | 0.0% | 100.0% |
| 20-29        | 0       | 0      | 6      | 0      | 0   |
|              | 0.0%    | 0.0%  | 100.0% | 0.0%   | 0.0% | 100.0% |
| 30-39        | 0       | 0      | 0      | 8      | 0   |
|              | 0.0%    | 0.0%  | 0.0%   | 100.0% | 0.0% | 100.0% |
| ≥40          | 0       | 0      | 0      | 0      | 2   |
|              | 0.0%    | 0.0%  | 0.0%   | 0.0%   | 100.0% |
| Total        | 0       | 1      | 9      | 8      | 2   |
|              | 0.0%    | 5.0%  | 45.0%  | 40.0%  | 10.0% | 100.0% |

At cut off value more than 22, MELD-Na score has better sensitivity (90%) compared to MELD score (80%). However, in terms of specificity, MELD score is better than MELD-Na score (60% vs 43.3%) (Table 8).

CONCLUSION

MELD-Na score was higher in non-survivor group with good predictability for in-hospital mortality and there was good correlation between both the scores in terms of degree of agreement and MELD-Na score was more sensitive compared to MELD score.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee
REFERENCES

1. Perri GA. Complications of end-stage liver disease. Can Fam Physic. 2016;62(1):44-50.
2. Kung HC, Hoyert DL, Xu J, Murphy SL. Deaths: final data for 2005. Natl Vital Stat Rep. 2008;56(10):1-20.
3. Schuppan, D, Afshar NH. Liver cirrhosis. Lancet. 2008;371(9615):838-51.
4. Infante-Rivard C, Snosal A, Villeneuve JP. Clinical and statistical validity of conventional prognostic factors in predicting short-term survival among cirrhotics. Hepatol. 1987;7:660-4.
5. Malinchoc, M, Kamath PS, Gordon FD, Peine CJ, Rank J, Borg PC. A model to predict poor survival in patients undergoing transjugular intrahepatic portosystemic shunts. Hepatol. 2000;31:864-71.
6. Kamath P, Wiesner R, Malinchoc M, Kremers W, Therneau T, Kosberg C, et al. A model to predict survival in patients with end-stage liver disease. Hepatol. 2001;33:464-70.
7. 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. Gastroenterol. 2003;124:91-6.
8. Freeman RB Jr, Wiesner RH, Harper A, McDiarmid SV, Lake J, Edwards E, et al. The new liver allocation system (moving toward evidence-based transplantation policy). Liver Transpl. 2002;8:851-8.
9. Porcel A, Diaz F, Rendon P, Macias M, Martin-Herrera L, Giron-Gonzalez JA. Dilutional hyponatremia in patients with cirrhosis and ascites. Arch Intern Med. 2002;162:323-8.
10. Arroyo V, Colmenero J. Ascites and hepatorenal syndrome in cirrhosis (pathophysiological basis of therapy and current management). J Hepatol. 2003;38:669-89.
11. Gines, A, Escorsell A, Gines P, Salo J, Jimenez W, Ingla da L, Navasa M, et al. Incidence, predictive factors, and prognosis of the hepatorenal syndrome in cirrhosis with ascites. Gastroenterol. 1993;105:229-36.
12. Cosby RL, Yee B, Schrier RW. New classification with prognostic value in cirrhotic patients. Miner Electrolyte Metab. 1989;15:261.
13. Borroni G, Maggi A, Sangiovanni A, Cazzaniga M, Salerno F. Clinical relevance of hyponatraemia for the hospital outcome of cirrhotic patients. Dig Liver Dis. 2000;32:605-10.
14. Fernandez-Esparrach G, Sanchez-Fueyo A, Gines P, Uriz J, Quinto L, Ventura PJ, et al. A prognostic model for predicting survival in cirrhosis with ascites. J Hepatol. 2001;34:46-52.
15. Shear L, Kleinerman J, Gabuzda GJ. Renal failure in patients with cirrhosis of the liver. I. Clinical and pathologic characteristics. Am J Med. 1965;39:184-98.
16. Llach J, Gines P, Arroyo V, Rimola A, Tito L, Badalamenti S, et al. Prognostic value of arterial pressure, endogenous vasoactive systems, and renal function in cirrhotic patients admitted to the hospital for the treatment of ascites. Gastroenterol. 1988;94:482-7.
17. Earley L, Sanders C. The effect of changing serum osmolality on the release of antidiuretic hormone in certain patients with compensated cirrhosis of the liver and low osmolality. J Clin Invest. 1959;38:545-0.
18. Arroyo V, Rodes J, Gutierrez-Lizarraga MA, Revert L. Prognostic value of spontaneous hyponatremia in cirrhosis with ascites. Am J Dig Dis. 1976;21:249-56.
19. Huo T, Wang YW, Yang YY, Lin HC, Lee PC, Hou MC, et al. Model for end-stage liver disease score to serum sodium ratio index as a prognostic predictor and its correlation with portal pressure in patients with liver cirrhosis. Liver Int. 2007;27(4):498-506.
20. Heuman DM, Abou-Assi SG, Habib A, Williams LM, Stravitz RT, Sanyal AJ, et al. Persistent ascites and low serum sodium identify patients with cirrhosis and low MELD scores who are at high risk for early death. Hepatol. 2004;40(4):802-10.
21. Cholongitas E, Marelli L, Kerry A, Senzolo M, Goodfellow DW, Nair D, et al. Different methods of creatinine measurement significantly affect MELD scores. Liver Trans. 2007;13:523-9.
22. Biggins SW, Kim WR, Terrault NA, Saab S, Balan V, Schiano T, et al. Evidence-based incorporation of serum sodium concentration into MELD. Gastroenterol. 2006;130:1652-0.
23. Heuman DM, Mihas AA, Habib A, Gilles HS, Stravitz RT, Sanyal AJ, et al. MELD-XI: a rational approach to “sickest first” liver transplantation in cirrhotic patients requiring anticoagulant therapy. Liver Transp. 2007;13:30-7.
24. Martin EF, O’Brien C. Update on MELD and organ allocation. Clin Liver Dis. 2014;8(4):105-7.
25. Serste T, Gustot T, Rautou PE. Severe hyponatremia is a better predictor of mortality than MELD-Na in patients with cirrhosis and refractory ascites. J Hepatol. 2012;57(2):274-80.

Cite this article as: Mukherjee T, Nataraju KT, Rakesh BM, Dandothi SD. Comparison of Model for End Stage Liver Disease-Na score and Model for End Stage Liver Disease score in predicting in-hospital mortality in patients with end stage liver disease: an observational study. Int J Adv Med 2019;6:932-9.