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A Study of Association of Model of End Stage Liver Disease Score and Morbidity Outcomes in Patients with Ischemic Stroke

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KEYWORDS
Origanum majorana, paracetamol-induced liver injury, Hepatoprotective effect, hesperetin

ABSTRACT:
Background: The Model for End-Stage Liver Disease (MELD) is a scoring system that was initially developed to assess the severity of chronic liver disease. It incorporates three key laboratory values: serum bilirubin, serum creatinine, and the international normalized ratio (INR) for prothrombin time. This system provides a quantitative measurement of liver function and aids in prioritizing liver transplantation by predicting the short-term survival probability of patients with end-stage liver disease. Materials & Methods: This is hospital based cross sectional observational study which was conducted in the Department of general medicine of Meenakshi Medical college Hospital with study period of 1 year. The total sample size of the study was 100 patients. The collected data was entered in Microsoft Excel. Coding of the variables was done. Analysis was done using SPSS software (Version 27, IBM). Results: patients aged 51-60 years make up the largest group at 39%, followed by those aged 41-50 years at 27%. The 61-70 years group accounts for 17%, while individuals over 71 years represent 13%. The smallest group is individuals aged 31-40 years at 11%. The most common condition is Diabetic Mellitus affecting 31%, followed by Hypertension at 29%. 22% have both conditions, 18% have no co-morbidities. 39% of participants had a hospital stay of < 5 days, and 61% stayed for > 5 days. The highest severity group with MELD scores over 40 comprises 25%, while scores between 30-39, 20-29, 10-19, and 9 or less represent 17%, 19%, 21%, and 18% respectively. Among severity categories, "Severe" is the largest at 32%, followed by "Very Severe" at 29%, and "Mild to Moderately Severe" at 28%. The smallest group, "Mild," represents 11% of the population. Conclusion: The correlation found between MELD scores and hospital stay duration in ischemic stroke patients emphasizes the complex liver-brain interactions, indicating the necessity for individualized multidisciplinary care. Keywords: Model of End Stage Liver Disease Score, Morbidity, Ischemic Stroke, National Institute of Health Stroke Scale.

INTRODUCTION

The MELD Score was first introduced by Kamath, Malinchoc, Gordon et al. as a predictive model for patients with portal hypertension undergoing Trans jugular intrahepatic portosystemic shunts (TIPS) [1]. Later, UNOS adopted the MELD Score to streamline the allocation process for patients waiting for a liver transplant [2]. Consequently, the MELD Score gained recognition as a reliable tool for predicting the survival of patients with end-stage liver disease [3]. Moreover, the MELD Score has since been utilized to

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evaluate the risk associated with patients with liver cirrhosis undergoing heart surgery.

The Model for End-Stage Liver Disease (MELD) is a scoring system initially designed to evaluate the severity of chronic liver disease. It utilizes three key laboratory values: serum bilirubin, serum creatinine, and the international normalized ratio (INR) for prothrombin time. This model offers a quantitative measurement of liver function and aids in prioritizing liver transplantation by forecasting the short-term survival probability of patients with end-stage liver disease[4].

MELD scoring is a versatile tool that has found various applications in the medical field, including its initial intended use. For instance, cardiovascular thoracic surgeons have utilized the MELD score to evaluate the prognosis of patients with heart failure, thanks to its dependable and unbiased nature. This expansion of MELD's application is attributed to its ability to accurately predict patient outcomes across a range of medical conditions, including those beyond its original use[5].

Patients diagnosed with liver cirrhosis typically present with modified coagulation profiles, which elevates their risk for both hemorrhagic and ischemic strokes. The altered coagulation profile stems from the liver's reduced capacity to produce clotting factors, leading to an imbalance in blood clotting and bleeding, and consequently, affecting the overall health status of these patients[6].

Notably, ischemic stroke, a particular kind of stroke caused by the obstruction of blood flow to the brain, has been found to result in h eightened levels of serum bilirubin and serum creatinine. These biochemical shifts indicate the stress and harm that the stroke is causing within the body. Elevated serum bilirubin signifies the breakdown of red blood cells and liver dysfunction, while an increase in serum creatinine suggests impaired kidney function[7].

The MELD score, which takes into account serum bilirubin, creatinine levels, and international normalized ratio can be utilized as a means of evaluating the severity of ischemic stroke. Unlike the traditional method, which is the National Institutes of Health Stroke Scale (NIHSS) and relies on clinical examination, the MELD score offers a more objective assessment. Although the NIHSS is effective, it can be subjective and prone to variations between clinicians, which can lead to inconsistencies in patient evaluation[8].

In contrast to other methods, the MELD score provides a reproducible and objective measurement based on laboratory values. This objective nature of the MELD score minimizes variability and enhances consistency in evaluating the severity of ischemic strokes. Due to this, the MELD score is considered a more reliable tool for assessing stroke risk and severity. It offers a standardized method that could improve patient management and outcomes in the context of ischemic stroke. The aim of the study is to highlight the positive correlation between Model of End Stage Liver Disease scoring and morbidity rate of ischemic stroke[9,10,11].

MATERIALS & METHODS

This is hospital based cross sectional observational study which was conducted in the Department of general medicine of Private medical college with study period of 1 year. The total sample size of the study was 100 patients.

Inclusion criteria –

- Patients admitted to the inpatient department of General Medicine Meenakshi Medical College Patients with Ischemic Stroke Patients not undergoing hemodialysis.
- Patients aged 18 years or older
- Patients who are not alcoholics
- Patients who provided consent

Exclusion criteria:

- Patients undergoing hemodialysis
- Patients under 18 years of age
- Patients who have not provided consent

Methodology

Serum creatinine levels will be measured by collecting a venous blood sample from participants and centrifuging it for 10 minutes at 2000 x g. A minimum of 0.1mL of the sample will be aliquoted using Roche

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Cat. No. 03263991190, CREP2 reagent kit, which requires no preparation. The reagents should be refrigerated until use and are stable for 8 weeks. The analysis will be done using Roche Cobas 6000 Chemistry Analyzer or Millipore Elix Gulfstream Clinical 35 System, both automated systems.

To measure total serum bilirubin, the Beckman Synchron LX20 method will be used, where bilirubin reacts with diazo reagent to form azobilirubin. For measuring international normalized ratio, blood will be drawn into a test tube with sodium citrate, centrifuged, and plasma taken for clotting time measurement. The INR value is calculated based on clotting time and ISI value. These measurements will be used in an equation to calculate the Model for End Stage Liver Disease score.

Morbidity will be assessed using the length of hospital stay, while the National Institute of Health Score will be based on various indices including level of consciousness, eye movements, facial palsy, motor skills, sensory abilities, language.

Ethical Clearence: The study was approved by Institutional Ethics Committee of the private medical college. A written informed consent was obtained from all the patients.

The collected data was entered in Microsoft Excel. Coding of the variables was done. Analysis was done using SPSS software (Version 27, IBM). Descriptive statistics was used. Association between categorical tests. The outcomes of the treatment groups were compared using a test to reach the hypothesis, a P value less than 0.5 was considered significant.

RESULT

This is hospital based cross sectional observational study which was conducted in the Department of general medicine of Private medical college with study period of 1 year. The total sample size of the study was 100 patients.

Table 1: Age distribution

Age	Frequency (n)	Percentage (%)
41 – 50 years	16	16%
51 – 60 years	21	21%
61 – 70 years	24	24%
>71 years	39	39%

The age distribution of a population, with the largest group being those aged 51-60 years, comprising 21% of the population . The next largest group is 41-50 years, making up 16%. The 61-70 years group accounts for 24%, while those over 71 years represent 39%.

Chart 1: Gender distribution among the study participants

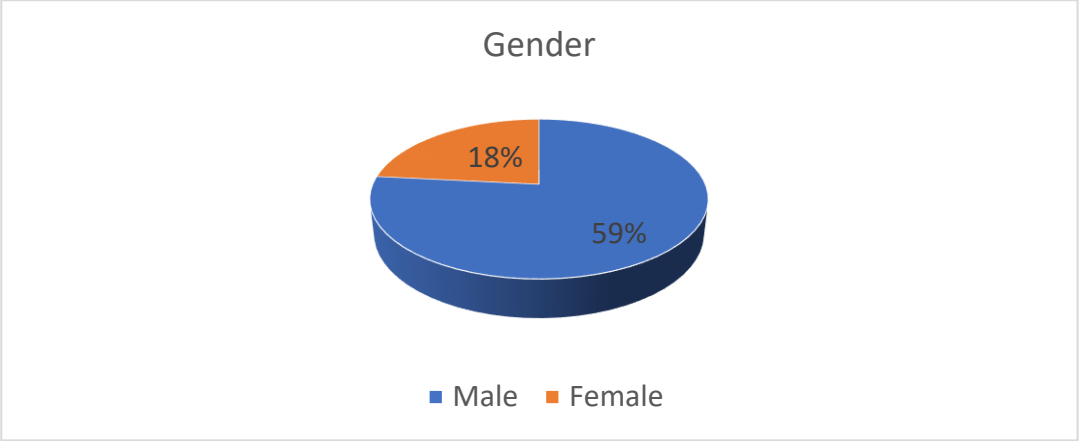

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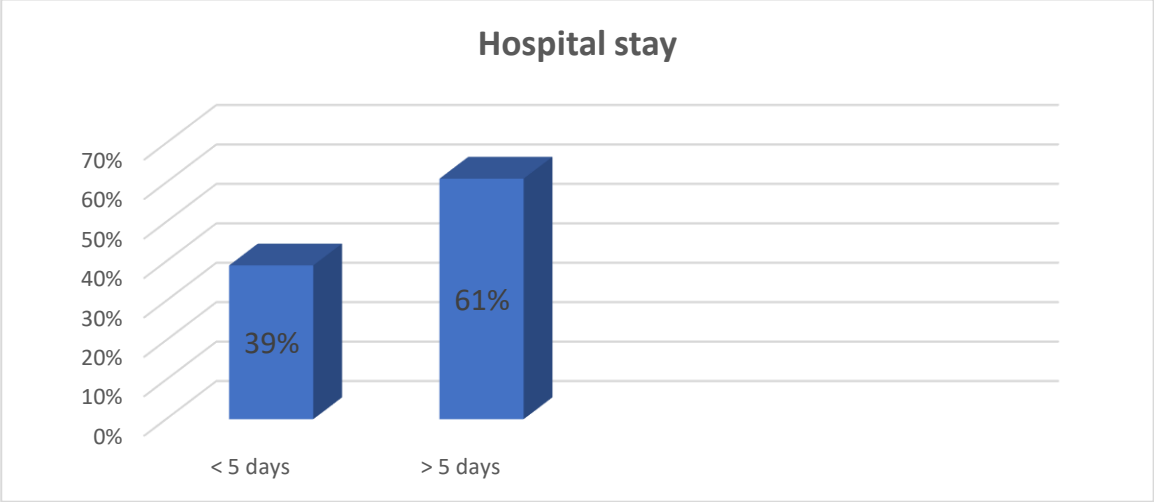
Table 2: Details of co-morbidities

Co-Morbidities	Frequency	Percentage (%)
Hypertensive	29	29%
Diabetic Mellitus	22	22%
Both (Hypertensive & Diabetic Mellitus)	31	31%
No morbidity	18	18%
Total	100	100%

Diabetic Mellitus is the most common condition, affecting 22%. Hypertension follows closely, with 29% (29 individuals) being hypertensive. A notable 31% have both hypertension and diabetes mellitus and 18% (18 individuals) have no co-morbidities.

Chart 2: Details on hospital stay



Among the study participants, hospital stay for < 5 days was 39% and 61% for > 5 days.

Table 3: Details on Model End Stage Live Disease score

MELD score	Frequency	Percentage (%)
>40	25	25%
30-39	17	17%
20-29	19	19%
10-19	21	21%
9 or less	18	18%
Total	100	100%

The highest severity group, with MELD scores over 40, comprises 25% of the population (25 individuals). Those with scores between 30-39 make up 17% (17 individuals), and scores between 20-29 account for 19% (19 individuals). The group with scores from 10-19 includes 21% (21 individuals), while those with scores of 9 or less represent 18% (18 individuals).

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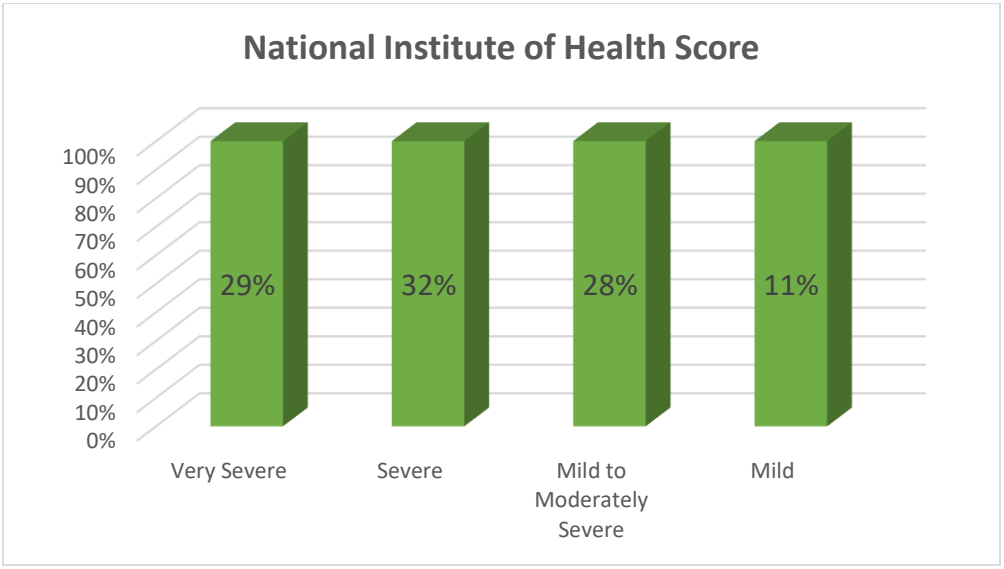
Chart 3: Details on National Institute of Health Score



The largest group, labeled "Severe," comprises 32% (32 individuals). Those categorized as "Very Severe" account for 29% (29 individuals), while "Mild to Moderately Severe" includes 28% (28 individuals). The smallest group, "Mild," represents 11% (11 individuals).

Table 4: Association of hospital stay with Morbidity

Morbidity	**Hospital stay**		**P value**
	< 5 days	**>5 days**	
Hypertensive	5	24	**0.000***
Diabetic Mellitus	6	25	
Both (Hypertensive & Diabetic Mellitus)	4	18	
No morbidity	17	1	

The table compares hospital stay durations (< 5 days and > 5 days) for patients with different morbidities. Among hypertensive patients, 24 had stays longer than 5 days, while 5 stayed less than 5 days. Diabetic Mellitus patients showed a similar trend, with 25 having extended stays and 6 staying shorter. Patients with both hypertension and diabetes were evenly split, with 18 in each stay duration category. Conversely, most patients with no comorbidity had shorter stays, with 17 staying less than 5 days and only 1 staying longer. This indicates that patients with comorbidities tend to have longer hospital stays compared to those without, which is statistically significant.

Table 5: Association of hospital stay with Model End Stage Live Disease score

MELD score	**Hospital stay**		**P value**
	< 5 days	**>5 days**	
>40	11	20	**0.000***

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30-39	9	16	
20-29	8	11	
10-19	6	8	
9 or less	5	6	

The table illustrates the relationship between MELD scores and the length of hospital stays, along with a P value indicating statistical significance. Patients with MELD scores over 40 had the longest hospital stays, with 20 staying more than 5 days and 11 staying less than 5 days. For those with MELD scores between 30-39, 16 had extended stays while 9 stayed shorter. Similarly, patients scores of 20-29 had 11 long stays and 8 short stays, and those with scores of 10-19 had 8 long stays and 6 short stays. The group with MELD scores of 9 or less had the least difference, with 6 long stays and 5 short stays. The P value of 0.000* indicates a statistically significant correlation between higher MELD scores and longer hospital stays, suggesting that more severe liver disease is associated with prolonged hospitalization.

Table 6: Association of hospital stay with National Institute of Health Score

NIH score	**Hospital stay**		**P value**
	< 5 days	**>5 days**	
(Very Severe) >25	13	23	**0.001***
(Severe) 15-24	10	17	
(Mild to Moderately Severe) 5-14	9	12	
(Mild) 1-5	7	9	

The table examines the correlation between NIH stroke scores and the length of hospital stays, along with a P value indicating statistical significance. For patients categorized as "Very Severe," 23 had hospital stays longer than 5 days, while 13 stayed less than 5 days. In the "Severe" category, 17 had extended stays, and 10 had shorter stays. Those classified as "Mild to Moderately Severe" had 12 long stays and 9 short stays. In the "Mild" category, 9 had extended stays, and 7 had shorter stays. The P value of 0.001* indicates a statistically significant relationship between higher NIH stroke scores and longer hospital stays, suggesting that patients with more severe stroke symptoms tend to have prolonged hospitalization.

DISCUSSION:

Re-evaluating the MELD score can have a considerable influence as an instrument for predicting the postoperative outcome. Notably, higher MELD scores are related to the presence of more comorbidities. In contrast, the MELD score utilizes three simple measures to characterize the severity of liver disease, directly measuring it through INR and bilirubin, as well as any accompanying renal impairment.

The observed positive correlation between the Model for End-Stage Liver Disease (MELD) score and the duration of hospital stay in patients with ischemic stroke suggests that liver dysfunction, as assessed by the MELD score, may be a significant factor influencing the post-stroke recovery trajectory. Let's delve into an elaboration of this correlation:

1. Increased Complexity of Care: Patients with higher MELD scores likely have more advanced liver disease and may present with a constellation of comorbidities, including hepatic encephalopathy, ascites, and coagulopathy, which can complicate their clinical management. These patients may require more intensive monitoring, specialized interventions, and

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multidisciplinary care coordination during their hospitalization, leading to prolonged hospital stays.

2. Impact on Rehabilitation and Functional Recovery: Liver dysfunction can have systemic effects on various organ systems, including the central nervous system, which may impair the patient's ability to participate in rehabilitation programs and hinder functional recovery after ischemic stroke. Cognitive deficits, motor impairments, and fatigue associated with liver disease can prolong the time required for stroke survivors to regain independence in activities of daily living, thereby extending their hospitalization.

3. Complications and Clinical Deterioration: Patients with higher MELD scores are at increased risk of developing post-stroke complications such as infections, venous thromboembolism, and gastrointestinal bleeding, which can lead to clinical deterioration and necessitate prolonged hospitalization for management. Additionally, the presence of liver dysfunction may exacerbate pre-existing comorbidities and increase susceptibility to adverse events during the acute phase of stroke recovery.

4. Delayed Discharge Planning: Patients with liver dysfunction may have complex social and logistical needs that require careful coordination of discharge planning, including arrangements for post-acute care services, rehabilitation facilities, and home healthcare support. Delays in discharge planning due to logistical challenges or limited availability of resources can contribute to prolonged hospital stays in this patient population.

5. Underlying Pathophysiological Mechanisms: The association between MELD scores and duration of hospital stay may also reflect shared underlying pathophysiological mechanisms linking liver dysfunction and ischemic stroke outcomes. Chronic inflammation, endothelial dysfunction, and alterations in the coagulation cascade associated with liver disease may contribute to a prothrombotic state, exacerbating ischemic brain injury and delaying recovery.

Clinical Implications and Future Directions: Understanding the positive correlation between MELD scores and duration of hospital stay in patients with ischemic stroke has important clinical implications. Clinicians should be aware of the impact of liver dysfunction on post-stroke outcomes and consider incorporating MELD scores into risk stratification algorithms to identify patients at higher risk of prolonged hospitalization. Future research should focus on elucidating the underlying mechanisms driving this association and exploring targeted interventions to optimize outcomes in ischemic stroke patients with liver dysfunction.

CONCLUSION:

The positive correlation between MELD scores and duration of hospital stay in patients with ischemic stroke underscores the multifaceted nature of liver-brain interactions and highlights the need for comprehensive, multidisciplinary care approaches tailored to the unique needs of this patient population. Treatment can be adjusted due to MELD score which can be used to predict outcomes in patient with ischemic stroke. The MELD score is an objective measurement and can be reproducible among different clinicians who treat the same patient.

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