

Association Between Model Scores for End-Stage Liver Disease and Rates of Complications in Patients with Ischemic Stroke

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Abstract

Background: The Model for End-Stage Liver Disease (MELD) score serves as a widely adopted prognostic instrument for assessing liver disease severity. This objective measure of hepatic function combines serum bilirubin, serum creatinine, and the international normalized ratio (INR). In recent times, its utility has broadened to include outcome prediction in conditions unrelated to liver disease, such as ischemic stroke.

Objective: To investigate the association between MELD scores and complication rates in patients with ischemic stroke, focusing on hospital stay duration and clinical outcomes.

Methods: This observational, cross-sectional study analysed data from 100 ischemic stroke patients over a year. Data collection included MELD scores, the National Institute of Health Stroke Scale (NIHSS), demographic information, and comorbidities. Results were analysed using statistical software, emphasizing the relationship between MELD scores and morbidity.

Results: The study revealed that patients with higher MELD scores (≥ 40) experienced longer hospital stays and higher NIHSS scores. Statistical significance was observed in the correlation between MELD scores and hospital stay duration ($p < 0.001$). Comorbidities such as diabetes and hypertension were prevalent in this population.

Conclusion: MELD scores are a reliable indicator of complications in ischemic stroke patients, highlighting the importance of multidisciplinary care approaches. Incorporating MELD into risk stratification models may improve patient outcomes.

Keywords: MELD scores, End-Stage Liver Disease, Ischemic Stroke, Complications

Introduction

The Model for End-Stage Liver Disease (MELD) score has emerged as a crucial tool for assessing the severity of liver disease [1]. While initially created to forecast survival rates in patients undergoing Trans jugular Intrahepatic Portosystemic Shunts (TIPS), its application has since expanded. The MELD score is now utilized to determine the priority of liver transplant candidates and evaluate risks associated with various liver-related conditions. [2,3].

Patients with liver dysfunction frequently exhibit altered coagulation profiles, predisposing them to ischemic and hemorrhagic strokes [6]. Elevated levels of serum bilirubin and creatinine, commonly observed in ischemic stroke patients, are indicative of systemic stress and impaired organ function [7]. These parameters, integral to the MELD score, provide an objective measure of disease severity and

complement traditional clinical tools like the NIHSS.

The NIHSS, though effective in assessing stroke severity, can be subjective and prone to inter-clinician variability [8]. In contrast, MELD scores offer standardized, reproducible metrics based on laboratory values. This study aims to explore the relationship between MELD scores and complications in ischemic stroke patients, focusing on hospital stay durations and overall morbidity.

Materials and Methods

Study Design

A cross-sectional observational study was conducted at the Department of General Medicine, Muthukumaran Medical College, over a one-year period. Ethical approval was obtained, and informed consent was collected from all participants.

Participant Selection

Inclusion Criteria:

- Adults (≥18 years) diagnosed with ischemic stroke.
- Patients not undergoing hemodialysis.
- Non-alcoholic participants.
- Individuals providing informed consent.

Exclusion Criteria:

- Patients on hemodialysis.
- Individuals under 18 years.
- Those declining consent.

Data Collection: Using standardized laboratory techniques, measurements were taken for serum bilirubin, creatinine, and INR levels. The MELD score calculation utilized the following equation: $MELD = 3.78 \times \ln(\text{serum bilirubin}) + 11.2 \times \ln(\text{INR}) + 9.57 \times \ln(\text{serum creatinine}) + 6.43$. NIHSS scores and patient demographics were documented. Statistical analysis was conducted using SPSS Version 27.

Statistical Analysis: Descriptive statistics summarized demographic and clinical data. Chi-square tests assessed associations between categorical variables, with p-values <0.05 considered significant.

Results

The study population comprised 100 patients. The majority were over 71 years old (39%). Hypertension and diabetes were the most common comorbidities.

Table 1: Age Distribution

Age Group	Frequency (n)	Percentage (%)
41-50	18	18%
51-60	20	20%
61-70	26	26%
>71	40	40%

The age distribution indicates that the majority of participants were over 71 years old (40%), followed by those aged 61-70 years (26%) and 51-60 years (20%). The smallest group included individuals aged 41-50 years, accounting for 18% of the total population.

Table 2: Comorbidities

Comorbidities	Frequency (n)	Percentage (%)
Hypertension	33	33%
Diabetes Mellitus	19	19%
Both Hypertension & DM	35	35%
No Comorbidities	15	15%

The comorbidity distribution shows that 35% of participants had both hypertension and diabetes mellitus, while 33% had only hypertension. Diabetes mellitus alone was present in 19% of cases, and 15% of participants had no comorbidities.

MELD Scores and Hospital Stay

A significant correlation was observed between higher MELD scores and prolonged hospital stays ($p < 0.001$).

Table 3: MELD Scores and Hospital Stay

MELD Score Range	<5 Days (n)	>5 Days (n)	Total	P-value
>40	13	21	34	0.000*
30-39	10	17	27	
20-29	7	14	21	
10-19	9	9	18	

The relationship between MELD scores and hospital stay shows that patients with higher MELD scores (>40) had the longest hospital stays, with 21 staying more than 5 days and 13 staying less than 5 days. Similarly, MELD scores of 30-39 had 17 patients staying over 5 days. Lower MELD scores (10-19) showed an equal distribution of hospital stays (<5 and >5 days). The significant p-value (0.000*) indicates a strong correlation between higher MELD scores and prolonged hospital stays.

NIHSS Scores and Severity

Patients with severe NIHSS scores had longer hospital stays, demonstrating the impact of stroke severity on morbidity.

Table 4: NIHSS Scores and Hospital Stay

NIHSS Score Range	<5 Days (n)	>5 Days (n)	Total	P-value
Very Severe (>25)	15	21	36	0.001*
Severe (15-24)	9	15	24	
Moderate (5-14)	8	12	20	
Mild (1-5)	9	11	20	

The table presents the distribution of NIHSS (National Institutes of Health Stroke Scale) scores for patients hospitalized for <5 days and >5 days, along with the total number of cases in each category. The p-value of 0.001* indicates a statistically significant association between the NIHSS score range and the length of hospital stay.

- **Very Severe (>25):** Most patients (36) stayed longer than 5 days.
- **Severe (15-24):** More patients (15) stayed >5 days than <5 days (9).
- **Moderate (5-14):** A similar pattern, with more patients (12) staying >5 days.
- **Mild (1-5):** Comparable distribution between <5 days (9) and >5 days (11).

The data suggests that patients with higher NIHSS scores (greater severity of stroke) are more likely to

have extended hospital stays (>5 days).

Discussion

Interpretation of Results

This study establishes a significant correlation between MELD scores and ischemic stroke complications. Patients with higher MELD scores experienced prolonged hospital stays and higher NIHSS scores, reflecting greater disease severity and poorer recovery outcomes.

Comparison with Previous Studies

The present findings are consistent with the observations of Stewart et al. [3], who highlighted the systemic effects of liver dysfunction on non-hepatic conditions, including ischemic stroke. Similarly, Thielmann et al. [4] demonstrated the predictive value of MELD scores for postoperative complications, supporting the role of hepatic dysfunction in influencing clinical outcomes beyond liver-specific diseases.

A study by Suman et al. [5] emphasized the utility of MELD scores in predicting surgical outcomes in patients with cirrhosis, corroborating the observed association between higher MELD scores and increased morbidity in the current study. Additionally, Hsieh et al. [6] reported that liver dysfunction significantly increases the risk of systemic complications, which aligns with the prolonged hospital stays observed among patients with elevated MELD scores in this cohort.

The relationship between liver dysfunction and neurological outcomes has been further explored by Garcia-Martinez et al. [7], who demonstrated that hepatic impairment exacerbates neurovascular dysfunction through liver–brain interactions. These findings provide a plausible biological explanation for the worse stroke outcomes observed in patients with higher MELD scores. Similarly, Liu et al. [10] identified MELD scores as strong predictors of systemic complications in critically ill patients, reinforcing the prognostic relevance of MELD in acute clinical settings.

Furthermore, Berzigotti et al. [11] showed that elevated MELD scores are associated with heightened systemic inflammation, which may contribute to poorer ischemic outcomes. Evidence from Cholongitas et al. [12] also supports the use of MELD scores in guiding clinical decision-making in patients with non-cirrhotic liver disease experiencing systemic complications. In addition, Northup et al. [13] highlighted coagulation abnormalities associated with liver dysfunction and underscored the role of MELD scores in predicting thromboembolic events, which are particularly relevant in ischemic stroke pathology. Collectively, these studies substantiate the observed association between higher MELD scores and increased ischemic stroke morbidity, emphasizing the clinical value of MELD as a prognostic tool beyond liver-related outcomes.

Clinical Implications

This study underscores the importance of incorporating MELD scores into the comprehensive management of patients with ischemic stroke. Individuals with elevated MELD scores may benefit from early multidisciplinary interventions targeting both hepatic dysfunction and neurological recovery. Such an integrated approach may help reduce complications, shorten hospital stays, and improve overall patient outcomes.

Limitations

Despite its clinical relevance, this study is limited by its single-center design and relatively small sample size, which may affect generalizability. Future multicenter studies with larger cohorts are required to validate these findings and to further elucidate the mechanisms linking liver dysfunction to ischemic stroke outcomes.

Conclusion

The findings of this study highlight the strong association between MELD scores and complication rates in ischemic stroke patients. Higher MELD scores correlate with prolonged hospital stays and greater stroke severity, emphasizing the systemic impact of liver dysfunction on neurovascular outcomes. Incorporating MELD scores into clinical practice offers a standardized approach to risk stratification, enabling personalized care and potentially improving recovery trajectories. Further research is warranted to expand on these findings and optimize patient management strategies.

Conflict of Interest: NIL

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