

From MELD to ALBI: Methods for Assessing Severity in Hepatic Disorders – A Narrative Review

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Abstract

Prognostic tools are essential in assessing disease severity and survival rates in advanced liver disease, guiding clinical decisions and treatment planning. These tools help assess suitability of patients of chronic liver disease (CLD) for undertaking advanced procedures as trans-jugular intrahepatic portosystemic shunt (TIPS). Nurses, as vital members of the care team, play a critical role in assisting in delivery of patient care. This review highlights key prognostic tools used in hepatology, their scoring, interpretations, and significance. The three common prognostic tools used in hepatology are: Child Pugh Turcotte (CTP) score, Model for End-Stage Liver Disease (MELD), and Albumin-Bilirubin (ALBI). On comparing the effectiveness there have been mixed results. All three have been used depending on the symptomatology, need of the patient, number of complications and extent of liver damage. The prognostic tools remain as the guide for planning and delivering quality care to the CLD patients.

Key words: Prognosis, Chronic liver disease, Prognostic tools

Liver cirrhosis is a global health issue with a rising incidence, particularly among individuals with alcohol-related liver disease, non-alcoholic fatty liver disease, autoimmune liver conditions, and drug-induced liver damage. Each year, over two million deaths are linked to liver diseases, with cirrhosis, viral hepatitis, and liver cancer responsible for 4 percent of all global fatalities, or 1 in every 25 deaths. Among these, women make up 1 out of 3 liver-related deaths. Though liver disease is currently the 11th leading cause of death, this number might be underreported. Cirrhosis ranks as the 10th leading cause of death in Africa, the 9th in Southeast Asia and Europe, and the 5th in the Eastern Mediterranean (Devarbhavi et al, 2023).

Cirrhosis poses a major global health challenge, contributing substantially to disability-adjusted life years (DALYs) and ranking as the 15th leading cause of DALYs worldwide. The impact is particularly pronounced in younger populations, where liver disease ranks as the 12th leading cause of DALYs for individuals aged 25 to 49 (Griffin et al, 2023). In India, the burden of liver disease is considerable, accounting for 18.3 percent of the two million global liver disease-related deaths in 2015 (Mokdad et al, 2014). In 2016, India recorded 199.5 deaths per million population due to cirrhosis (Mondal et al, 2022).

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Liver disease is responsible for two million deaths annually, accounting for 4 percent of all global deaths (1 in every 25 deaths), with men comprise about two-thirds of the liver disease-related fatalities. Most liver-related deaths are due to complications from cirrhosis and hepatocellular carcinoma, while acute hepatitis accounts for a smaller portion. Although liver disease is currently the 11th leading cause of death, the actual mortality rate may be underestimated (Devarbhavi et al, 2023). In India, liver disease has a significant impact, contributing to 18.3 percent of the two million global liver-related deaths in 2015 (Mokdad et al, 2014). In 2016, the country recorded 199.5 deaths per million people due to cirrhosis (Mondal et al, 2022).

Staging and prognostic tools are commonly used by the treating health team to determine the severity and prognosis of the advanced liver disease of the patient. These scores assist in making accurate and guided clinical decisions enhancing quality care. In India, numerous hospitals use the Child-Turcotte-Pugh (CTP) score, Model for End-Stage Liver Disease (MELD) score, and Albumin-Bilirubin (ALBI) score to assess the severity of advanced liver disease. Prominent institutions such as the Apollo Hospitals Group, Fortis Healthcare facilities, ILBS Delhi, extensively utilise both the CTP and MELD scores, especially in the context of liver transplantation. They are also increasingly integrating the ALBI score to streamline their assessment processes (Mehta et al, 2023).

Nurses play a critical role in the implementation and management of CTP, MELD, and ALBI scores in liver disease care. While providing care to the liver disease patients the nurses need to keep a close monitoring on bilirubin levels, serum albumin, creatinine, INR, and clinical symptoms such as ascites and hepatic encephalopathy. These values are vital for calculating these prognostic scores, which are crucial for assessing disease severity, guiding treatment decisions, and determining eligibility for advanced procedures like TIPS. Nurses also educate patients and their families about the significance of these scores and what they imply for the patient's prognosis and treatment options. In addition, nurses often monitor patients' responses to treatment and report any changes in clinical status that might impact their scores, ensuring timely interventions. By collaborating closely with physicians, nurses contribute to the multidisciplinary approach required for managing complex liver conditions, thereby playing a vital role in optimising patient outcomes through the accurate application of CTP, MELD, and ALBI scores (Khatua et al, 2023; Liu et al, 2017).

Need for the review: Gastroenterology focuses on treating gastrointestinal disorders. Gastroenterology nurses play a crucial role in managing advanced liver disease, yet many lack knowledge in staging and prognostic tools. Dr Amal Bakr's study (2021) revealed that 78.65 percent of nurses had insufficient knowledge, and 63 percent demonstrated unsatisfactory practices in liver cirrhosis care. Similarly, Fabrellas et al (2023) highlighted the need for improved global liver disease education for nurses, advocating for increased awareness of hepatology nursing practices to enhance patient care and interdisciplinary collaboration.

Search Strategy and Outcome

A literature search was conducted across multiple databases, including PubMed, Scopus, Medline, and Google Scholar, focusing on studies from 2010 to 2024 (Fig 1). The search used keywords and MeSH terms related to hepatology, prognostic tools (CTP, MELD, ALBI scores), and nursing care. Boolean operators refined the search, resulting in 594 articles. Sixty articles were shortlisted based on relevance to the review. From these 15 were fully reviewed.

Child-Pugh-Turcotte score: This score was originally developed in 1964 by Charles G. Child and Turcotte score helps determine whether patients will benefit from elective surgical management of oesophageal varices, a common complication of

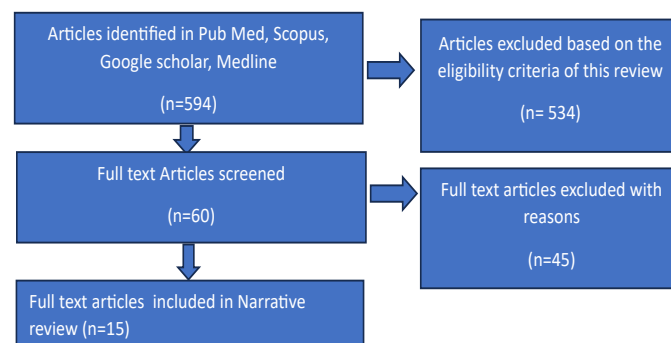


Fig 1: Schematic diagram of literature search and selection of articles included in narrative review.

advanced liver disease where the oesophageal veins enlarge and bleed easily. The Child-Turcotte-Pugh (CTP) score assesses liver disease severity using five parameters: ascites, encephalopathy, bilirubin, INR, and albumin levels. Each parameter is rated from 1 to 3, with a maximum total score of 15. Patients are classified into Child-Pugh classes based on the total score: Class A (5-6) indicates good hepatic function, Class B (7-9) reflects moderate impairment, and Class C (10-15) indicates severe dysfunction. The CTP score can be calculated manually or using online tools, helping to determine the severity of hepatic dysfunction (Yang & Xiong, 2022; Hasan et al, 2023).

Limitations of CTP: The CTP score was once used to decide liver transplant allocation, but it had some drawbacks. These included the subjective assessment of ascites and encephalopathy, not taking kidney function into account, and offering only 10 distinct scores based on the assigned points (Acharya et al, 2019).

Clinical significance of CTP score: The CTP score helps determine a patient's suitability for elective surgery. Class A patients are generally considered safe for surgery while Class B patients face higher risks and need further medical evaluation. Elective surgery is not recommended for Class C patients (Acharya et al, 2019). The score also predicts the mortality risk for major surgeries, particularly abdominal procedures. Mortality rates are 10 percent for Class A, 30 percent for Class B, and 70-80 percent for Class C patients (Nicoll, 2012). It also assesses the risk of complications, such as variceal bleeding, regardless of the cause of liver damage (Jadaun & Saigal, 2022).

MELD Score: The MELD score is widely used to assess the severity of liver disease (Calculating and Interpreting MELD Scores, 2024) and has evolved over time. Originally, it was based on a patient's lab values - serum bilirubin, serum creatinine, and the international normalised ratio (INR), to predict three-month survival after a transjugular

intrahepatic portosystemic shunt (TIPS) procedure. MELD scores range from 6 to 40, with higher scores indicating more severe disease and a greater risk of mortality (Acharya et al, 2019; Panezai et al, 2023; Hasan et al, 2023).

Revision in the MELD score: The MELD score was revised to include sodium levels, leading to the MELD-Na score. Hyponatremia, a common complication in cirrhosis, is strongly associated with disease severity and is an independent predictor of mortality for liver transplant candidates. Adding sodium levels to the original MELD score improves its predictive accuracy, especially for hyponatraemic patients with lower MELD scores awaiting transplantation. This adjustment has increased the transplant priority for these patients by about 12 percent (Leise et al, 2011).

The formula for calculating the original MELD score is:

$$\text{MELD} = 3.8 * \log_e (\text{serum bilirubin [mg/dL]}) + 11.2 * \log_e (\text{INR}) + 9.6 * \log_e (\text{serum creatinine [mg/dL]}) + 6.4.$$
 With the addition of sodium, the formula becomes:

$$\text{MELD-Na} = \text{MELD} + 1.32 * (137 - \text{Na}) - [0.033 * \text{MELD} * (137 - \text{Na})]$$

In this formula, sodium levels below 125 mmol/L are capped at 125, and those above 137 mmol/L are capped at 137. The MELD score was later refined into MELD 3.0 for improved precision.

MELD 3.0: The MELD score was further updated to MELD 3.0, which retains the original variables (serum bilirubin, serum creatinine, and INR) while adding new factors such as patient sex, serum sodium, and serum albumin. The upper limit for serum creatinine was also reduced from 4.0 mg/dL to 3.0 mg/dL. Additionally, MELD 3.0 incorporates interaction terms between sodium and bilirubin, as well as creatinine and albumin, to improve accuracy in predicting patient outcomes (Calculating and Interpreting MELD Scores, 2024).

Scoring of MELD: The MELD score ranges from 6 to 40, with higher scores indicating greater disease severity and a more urgent need for a liver transplant from a deceased donor. The frequency of score monitoring depends on the score value; for scores of 25 or higher, check every week; for scores between 19 and 24, check every 30 days; for scores between 11 and 18, check every three months, and for scores of 10 or less check once a year.

Use in transplantation: The MELD score is used to prioritise patients for deceased donor liver transplants, with those having higher MELD scores receiving higher priority on the transplant list (Trivedi, 2022).

ALBI score: The Albumin-Bilirubin (ALBI) score is a widely used prognostic tool for patients with chronic liver disease (CLD) and hepatocellular carcinoma (Qi, 2018). It is calculated using serum albumin and bilirubin levels, which reflect the liver's synthetic and metabolic functions, with serum albumin also indicating nutritional status (Toyoda., 2022). The formula for the ALBI score is:

$$(\log_{10} \text{bilirubin} \times 0.66) + (\text{albumin} \times -0.0852)$$

The ALBI score uses bilirubin levels measured in $\mu\text{mol/L}$ and albumin levels in g/L, categorising results into three grades: Grade 1 (≤ -2.60), Grade 2 (between -2.60 and -1.39), and Grade 3 (≥ -1.39). Unlike the CTP score, which includes subjective parameters such as ascites and hepatic encephalopathy, the ALBI score is more reproducible. Additionally, studies have shown its effectiveness in assessing non-malignant liver diseases, including chronic viral hepatitis B, primary biliary cholangitis, and autoimmune hepatitis.

In a retrospective study, Wang et al (2019) demonstrated that the ALBI score outperforms the MELD and MELD-Na scores in predicting 2-year mortality. Receiver operating characteristic (ROC) curve analysis showed that the ALBI score had an area under the curve (AUC) of 0.756, significantly higher than the MELD score (AUC 0.655, $p < 0.05$) and MELD-Na (AUC 0.662, $p < 0.05$).

Fujita et al (2019) evaluated the diagnostic accuracy of the ALBI score in assessing hepatic fibrosis stages and transplant-free survival in patients with primary biliary cholangitis (PBC). They identified an ALBI score cutoff of -1.679 , which effectively distinguished stage 4 fibrosis from stages 1-3, achieving 100 percent sensitivity and 91.1 percent specificity, with a likelihood ratio of 12.3. Additionally, Ito et al (2020) found that the ALBI score had a stronger predictive ability for overall mortality and the need for liver transplantation compared to the Child-Pugh score at 10 years, with areas under the curve (AUC) of 0.896 for the ALBI score and 0.82 for the Child-Pugh score.

Similarly, Song et al (2019) demonstrated that the ALBI score (AUC 0.826) was superior to both the Child-Pugh score (AUC 0.672, $p < 0.001$) and the MELD score (AUC 0.731, $p = 0.007$) in predicting 12-month mortality. Patients with an ALBI grade 3 had significantly lower survival rates compared to those with ALBI grades 1 and 2. Other studies by Fragaki et al (2019) and Wan et al (2020) also confirmed the superior efficacy of the ALBI score compared to other prognostic tools.

Discussion

This review highlights CTP, MELD and ALBI are some of the common prognostic tools used in the hepatology settings. Many studies have been done to assess the ability of CTP and MELD in predicting mortality.

In a 2020, India-based study by Acharya et al (2020) involving 171 patients with end-stage liver disease at a tertiary healthcare centre, it was found that the CTP, MELD, and MELD-Na scores on day 1 were significantly higher among non-survivors compared to survivors ($p < 0.0001$ for each). The C-statistic for predicting 3-month mortality was 0.93 for the CTP score ($p < 0.0001$), 0.86 for the MELD score ($p < 0.0001$), and 0.83 for the MELD-Na score ($p < 0.0001$). The CTP score was significantly better than the MELD and MELD-Na scores for predicting 3-month mortality ($p < 0.0001$ for both comparisons). These findings align with those of Gotthardt et al (2009); Heuman et al (2003); and Rahimi-Dehkordi et al (2014).

According to Acharya et al (2020), when assessing the suitability of prognostic tools, the CTP score may be more appropriate for patients with hepatic encephalopathy and ascites, as it accounts for these specific factors. In contrast, for patients with renal impairment, with or without hyponatremia, the MELD score is more applicable. The inclusion of sodium in the MELD score has improved its accuracy in predicting mortality over a three-month period.

Implications in Nursing

Nurses in specialised hepatology and medical-surgical settings need to stay updated on prognostic tools to assess liver disease severity, enabling them to provide effective, need-based care. This knowledge empowers patients and families to participate in care planning and adhere to treatments. Prognostic tools guide treatment plans, transplant decisions, and end-of-life care, ensuring the patient's quality of life is prioritised. Regular assessments help identify complications early, leading to timely interventions. Collaboration with healthcare professionals is enhanced through a shared understanding of disease severity, improving communication and unified patient care.

Conclusion

The CTP, MELD, and ALBI prognostic tools are essential in hepatology for assessing illness severity, mortality risk, and eligibility for advanced procedures like TIPS in managing chronic liver disease complications. Higher scores from these tools help prioritise patients for deceased donor transplants. Hepatology nurses play a crucial role

in patient care and must be knowledgeable about these tools to provide high-quality support to patients with chronic liver disease.

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