Does Model for End-stage Liver Disease (MELD) Require Modification?

HG Desai

Abstract

Model for End-stage Liver Disease (MELD) measures serum bilirubin (mg/dL), serum albumin (g/dL), International Normalised Ratio (INR) for prothrombin time. MELD score accurately predicts survival in 3 months for cirrhotic patients on the waiting list of liver transplantation. In about 15% of patients, it does not accurately predict survival and hence MELD-Na is recommended.

MELD score is a poor predictor of survival after liver transplantation. Downgrading of MELD score for age of recipient and chance of recurrence of the disease is recommended to accurately predict survival after liver transplantation.

In chronic liver diseases (CLD), accurate prognosis is essential, for prioritization of a patient for organ allocation for liver transplant (LT). Prognosis in CLD, is judged by measuring serum bilirubin (mg/dL), serum albumin (g/dL), ascites, encephalopathy, nutritional status (Child-Turcotte : CT;1964). Pugh (1973) modified this classification by excluding nutritional status and adding prothrombin time (CTP). CTP score is classified as: A (5-6), B (7-9), C (10-15), by allotting 1-3 score for each of the five parameters; the higher the score (3-15), the greater the severity of CLD.

CTP score has some limitations: (i) assessment of degree of ascites and/or depth of encephalopathy is subjective; (ii) measurement of prothrombin time in different laboratories is variable, depending on the sensitivity of the thromboplastin reagent used; (iii) serum bilirubin of 3 or 13 mg/dL or prothrombin time increased by 6 or 16 seconds will not alter CTP score; (iv) for patients on the waiting list for LT, CTP score is within a narrow range of 7-15 (Child B or C), and some patients may have identical CTP score; the time on the waiting list is then taken as a tie-breaker, which is unreliable.

Upto 1996, allocation of organ for deceased donor liver transplant (DDLT), was based on CTP score, time on the waiting list and whether the patient is at home, in hospital or intensive care unit (ICU). However, the minimal criteria for registering in the waiting list and for admission in an ICU, are not well defined and hence these parameters – longest on the waiting list or in an ICU, are not useful. Furthermore, these parameters do not accurately identify, the most sick patient on the waiting list for LT.

The model for end-stage liver disease (MELD) score (2000) is calculated from serum bilirubin (mg/dL), serum creatinine (mg/dL), International Normalised Ratio (INR) for prothrombin time and also included the aetiology of liver disease: (zero for cholestatic or alcoholic, one score for other aetiology). Aetiology of liver was later excluded, as it did not significantly affect the MELD score. MELD is calculated from:

\[
\text{MELD} = \text{log}_e (\text{bilirubin} (\text{mg/dL}) + 11.2 \times \text{INR} + 9.6 \times \text{creatinine} (\text{mg/dL}) + 6.4 \times \text{creatinine value is assumed 4 for patients on dialysis})
\]

If the MELD score is >25, 19-24, 11-18, ≤ 10, it is recalculated every 7 days, 1.3, 12 months respectively.

MELD score - sickest first policy, was validated for predicting survival in 3 months in cirrhotic patients, initially for 231 patients undergoing Transjugular Intrahepatic Portosystemic Shunt (TIPS) (2000) and later for those on the waiting list for LT (United Network for Organ Sharing (UNOS: Feb. 27, 2002).

In patients of cirrhosis of liver, MELD score is more accurate than CTP score, (MELD score ≥40: 71% mortality, <10: 2%), in predicting mortality in next 3 months.

Upgrading of MELD score for Hepatocellular Carcinoma (HCC):

Patients with HCC, have lower 1 year survival is 60% (Europe), 45% (US) and 10 year survival is 47% (Europe). In a waiting list for LT, should HCC patients (average age 55 years), with higher chance of recurrence and a shorter expected survival, have a priority over younger patients (25 years) with low or no chance of recurrence and identical MELD score (prior to upgrading)? Is this fair prioritization?

Integrated MELD (iMELD) model including serum sodium (Na) and age:

MELD Na: Hyponatraemia, (low serum Na:120-135 mEq/L) is known to indicate poor prognosis in patients with cirrhosis. Decrease of serum sodium by 1 mEq/L results in 12% decrease in 3 month survival. Hyponatremia (if present), usually precedes rise in serum creatinine. Serum sodium is included in iMELD score because with decrease in serum sodium, the risk of death to patients on the waiting list for LT increases.

MELD Na = MELD-Na-[0.025 x MELD x (140-Na)] + 140.

(As in MELD score, MELD-Na score is rounded to the nearest integer).

Independent of MELD score, low serum sodium and age are indicators of poor prognosis. Patients on the waiting list, with low MELD score and low serum sodium (iMELD), should justifiably acquire a higher priority, in view of a higher mortality expected in them. In a patient with low MELD score of 10 and a low serum sodium of 125 mEq/L, MELD Na score will be 21. In contrast, MELD and MELD Na will be nearly identical in patients with high (≥ 21) MELD score, or in those with normal sodium (>135 mEq/L).

Age of recipient: After a successful LT, greater the age of the
Patients of cholangiocarcinoma are usually not on the waiting list for DDLT, as their expected survival even after a successful LT, is limited.

Reurrence of disease: Patients of cholangiocarcinoma are usually not on the waiting list for DDLT, as recurrence rate is early and high (86%); if LT is performed, 3 year survival is < 20%. Hence, the necessity of downgrading the MELD score, with the chance of recurrence of the disease after LT, was emphasised.

Total serum bilirubin: MELD score includes total bilirubin which is a sum of direct (hepatic) and indirect (non-hepatic) bilirubin. In cirrhosis, increased indirect bilirubin may result from glucose-6 phosphate deficiency (G6PD), thalassaemia trait, spur cell anaemia, ribavirin, antiretroviral drugs. Whether inclusion of direct bilirubin instead of total bilirubin for measuring the MELD score, improves its accuracy or not, is not known.

Serum creatinine: Raised serum creatinine (a late event), is a known predictor of poor prognosis in cirrhosis of liver. Problems with serum creatinine are: serum creatinine values are low due to reduced muscle mass, selection of one creatinine value amongst the few fluctuating values in a decompensated cirrhotic on diuretic therapy, the arbitrarily selected value of 4 for dialysis patients, estimation of creatinine,26 and an increase of combined liver – kidney transplants, following the allocation of liver for LT, on the basis of MELD score (February 27, 2002). Limitations of MELD have been emphasized by a few authors.27-29 MELD score is a good predictor of survival prior to LT but in 15% of patients MELD score does not accurately predict survival.28 IMELD-Na will correct this deficiency to a large extent. In contrast, MELD score is a poor predictor of survival after LT.29 This will perhaps be corrected to some extent by down grading the MELD score, for the chance of recurrence of the disease and the age of the recipient.29 This downgrading, (if approved by RRB) in all probability, will reduce death of young patients on the waiting list. In large volume LT units, where significant number of HCC patients are operated with MELD up grading, the number of young patients (if any), dying on the waiting list, needs to be calculated.

References

13. ELTR data analysis booklet. 05/1968 – 06-2008.

© JAPL • JUNE 2011 • VOL. 59