

## The donor liver allocation system: a model for end-stage liver disease

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The success of liver transplantation in China has resulted in a marked discrepancy between the number of patients waiting for a liver and the number of available organs. Therefore, questions have been raised about whom the valuable donor livers should be given to, and what guidelines should be followed for liver allocation.

In the past, donor livers were allocated to potential liver recipients mainly according to the Child-Turcotte-Pugh (CTP) score. The CTP classification, which had been applied to assess the severity of liver diseases in the United Network of Organ Sharing (UNOS) allocation algorithm, showed some limitations in determining medical urgency about liver transplantation. Its major shortcoming is that the UNOS allocation policy defines only 4 categories of disease severity for patients with end-stage liver disease: status 3 (CTP score  $\geq 7$ ), status 2B (CTP score  $\geq 10$ ), status 2A (CTP score  $\geq 10$ , in the intensive care unit and less than 7 days to live), and status 1 (acute liver failure, primary graft dysfunction or hepatic thrombosis occurring within the first week post-transplantation). In fact, too many patients are classified of status 2B, who form the largest group undergoing liver transplantation and who exhibit a broad range of disease severity. The patients of status 2B vary from those who are at home or working full time to those who require continuous hospitalization for complications relevant to their liver disease, but they do not meet the strict criteria for status 2A. In addition, there are several subjective parameters in the CTP criteria, such as liver encephalopathy and ascites on which doctors have their own different judgment of severity. Even in patients of status 2A, consensus is lacking on what constitute the criteria for a

patient who has less than 7 days to live. Although the CTP system is aimed to allocate donor liver to the greatest-needed patients, organs are often given according to the accumulated waiting time. Therefore, transplant doctors are looking forward to the more reasonable criteria for liver allocation.

The model for end-stage liver disease (MELD) as the recently-described criteria for allocation of donor liver has been widely accepted. MELD was originally developed to assess the short-term prognosis of patients with liver cirrhosis undergoing transjugular intrahepatic portosystemic shunt (TIPS) procedure. Calculation of MELD score is based on the results of three routine laboratory tests: (1) bilirubin, which determines how effectively the liver excretes bile; (2) international normalized ratio (INR, prothrombin time), which measures the liver's ability to make blood clotting factors; and (3) creatinine, which measures kidney function (Impaired kidney function is often associated with severe liver disease).<sup>[1]</sup> The MELD score is calculated using the following formula: MELD score =  $0.957 \times \text{Log}_e(\text{creatinine mg/dl}) + 0.378 \times \text{Log}_e(\text{bilirubin mg/dl}) + 1.120 \times \text{Log}_e(\text{INR}) + 0.643$ , then the score is multiplied by 10 and round to the nearest whole number. Laboratory levels less than 1.0 are set to 1.0 for calculation of the MELD score. The maximum serum creatinine considered with the MELD score equation is 4.0 mg/dl. If the level of creatinine is higher than 4.0 mg/dl or the patient is dialyzed twice within a week before the serum creatinine test, the MELD score will be calculated with a level of serum creatinine for 4.0 mg/dl. Therefore, the MELD score is a numerical scale, ranging from 6 scores (less ill) to 40 scores (gravely ill) and a yield of 34 scores for severity of illness. It gives each individual patient a "score" (number) based on how urgently he or she needs a liver transplant within the next three months.

Research showed that the MELD formula very accurately predicted in most liver patients short-term risk of death without a transplant.<sup>[2]</sup> The accuracy of the formula did not improve when other factors were added, such as the cause of liver failure or observed symptoms. The MELD score is relatively objective which ob-

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viate some subjective factors, including ascites, encephalopathy, and other complications of liver disease. The MELD formula is simple, objective and verifiable, and yields consistent results whenever the score is calculated and whoever the score is calculated.

The MELD score replaced the previous status 2A, 2B and 3 categories and was instituted by UNOS for liver allocation in February 2002. The status 1 category will keep the highest priority for receiving an organ and will not be affected by the MELD system. Because the MELD score can predict the 3-month mortality of the patients in waiting list and the patients with a higher score have a higher probability of death before getting a suitable donor liver, it is reasonable to give the available donor liver to the patient with the highest MELD score but prior to the development of the life-threatening disease. The use of the MELD model to allocate liver donor is of significance in reducing deaths of patients on the list.<sup>[3]</sup> The model also can predict the outcome of liver transplantation, since the patients with a higher score before transplantation may survive for a shorter time after transplantation.<sup>[4,5]</sup> Liver transplant doctors in China should adopt the MELD model to allocate the precious donor livers and to save more patients waiting for donor livers.

## Competing interest

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

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*Received June 8, 2004*

*Accepted after revision June 30, 2004*