

King's Criteria, APACHE II, and SOFA Scores in Acute Liver Failure

To the Editor:

We read with great interest the article by Larson A et al.¹ regarding the characteristics and the outcome of acetaminophen-induced acute liver failure (ALF) in a large cohort of patients in the USA. Interestingly, they found that the APACHE II score performed better in terms of predicting outcome with a much higher sensitivity and slightly lower specificity, compared with the King's Hospital criteria. The accompanying editorial had a word of caution suggesting the King's criteria had not been used in the clinical context in which they had been originally derived. As prophylactic use of fresh frozen plasma in the United States was common place this would have altered the prothrombin time assessment.²

Recently, we have evaluated 100 consecutive patients with acetaminophen-induced ALF (41 men, mean age 38 ± 13 years). At admission, demographic, clinical and laboratory variables were recorded, including baseline serum phosphate and arterial blood lactate concentrations at 0, 4, 8 and 12 hours post admission. Fresh frozen plasma was not used.

Multivariable logistic regression analysis, and 3 prognostic scores (King's criteria, Apache II and SOFA)³⁻⁵ were evaluated and compared by receiver operating characteristic (ROC) curves. The Youden index (sensitivity + specificity - 1) was used to select the best cut off points, at which sensitivity, specificity, positive (PPV) and negative (NPV) predictive values were calculated.

In our cohort, 54 patients (54%) (group 1) survived with conservative medical management, and 46 (46%, group 2) either died without liver transplantation (LT) (27%) or underwent LT (19%). King's criteria were met less frequently in group 1 (9 patients), compared with group 2 (21 patients, 17 died without LT and 4 underwent LT) ($P = .001$). Group 1 patients, compared with group 2, had significantly lower median APACHE II (10 vs. 13) and SOFA scores (9 vs. 12) ($P < .001$). The independent factors associated with outcome (survival vs. death or LT) were prothrombin time ($P = .007$), FiO_2 ($P = .047$) and lactate at 12 hours ($P < .0001$).

Table 1 shows the comparison of the 3 prognostic models and solely lactate at 12 hours. The King's criteria had the lowest discrimination ability (area under the ROC curve) and sensitivity, but the highest specificity, followed by the SOFA score. Although in our centre the use of fresh frozen plasma is not a standard practice, our data is similar to that of Larson et al.¹ and with a previous King's study.⁶ Our ALF cohort is the first, in which the SOFA score, previously used in acute on chronic liver disease,^{7,8} is compared with APACHE II and King's criteria. The predictive accuracy of SOFA score is likely to reflect multi-organ dysfunction, predominant in ALF⁹ and is much simpler than APACHE II.

The prognostic impact of lactate in ALF has been recognized for several years. In our cohort, serum lactate at 12 hours post admission, similar to 83 ALF patients in Birmingham,¹⁰ was independently associated with outcome, and had better discrimination than King's criteria.

Serum lactate is clearly a useful prognostic marker and further work on clinically useful cut off values, and their validation will improve management of ALF.⁹

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Potential conflict of interest: Nothing to report.

Table 1. Prediction of Outcome in Consecutive 100 Patients With Acetaminophen-Induced Acute Liver Failure

	ROC Curve	Cutoff Point	Youden Index	Sensitivity (%)	Specificity (%)	PPV	NPV
King's criteria	0.65	≥1	0.30	47	83	0.70	0.65
Lactate (mmol/L)*	0.76	3.3	0.40	68	73	0.68	0.73
APACHE II	0.77	12	0.43	67	76	0.69	0.75
SOFA	0.79	12	0.47	67	80	0.74	0.74

Abbreviations: ROC, receiver operating characteristic; PPV, positive predictive value; NPV, negative predictive value.

*Lactate as measured at 12 hours post admission.