JAMA Surgery

JAMA Surg. 2018; 153(1): e182001. doi:10.1001/jamasurg.2018.2001 PMID: 29710108

PRICE: $35.00USD

ISSN: 2168-6254 (print) ISSN: 2168-6262 (online) ISSN: 2168-6262 (online)

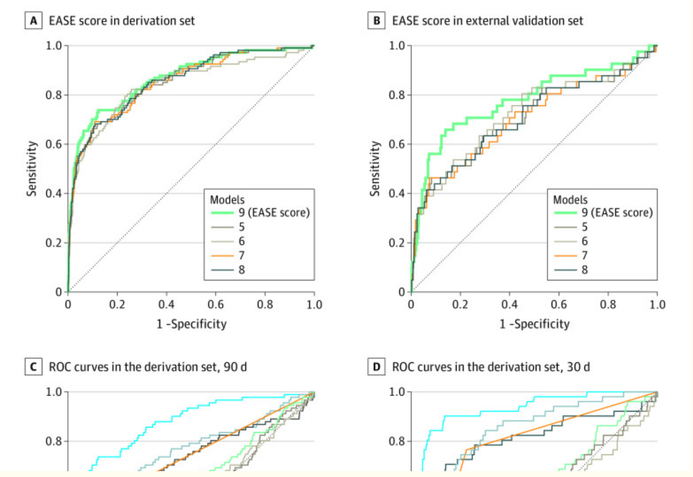
Development and Validation of a Comprehensive Model to Estimate Early Allograft Failure Among Patients Receiving Liver Transplant

Alireza Sharifian, MD[1] Fabrizio Cardoso, MD[1] Carlos Esquivel Villegas, MD[1] Gonzalo Sapisochin, MD[2] Ricardo Miyasaka, MD[3] Juan Pablo Arab, MD[4] Cristian Tejedo Rodríguez, MD[5] Ricardo Robles Campos, MD[6] Rafael Bruna Esteban, MD[7] Miguel Navasa, MD[8] Rafael Bruguera, MD[9] Miguel Rodríguez Sanjuan, MD[10] Rafael Duarte-Rojas, MD[11] Ricardo Rossi, MD[12] Ricardo Ramirez Arias, MD[13] Ricardo Vera, MD[14] Fernando Pardo, MD[15] Fernando Díaz Sanchez, MD[16] Ángel Rodríguez Luna, MD[17] Ángel Sánchez Bueno, MD[18] Pablo Ramírez, MD[19] Juan Sebastián Molina, MD[20] Miguel Ángel Gómez Bravo, MD[21] Miguel Ángel Suarez Artacho, MD[22] Miguel Ángel Bueno, MD[23] Juan Carlos Garcia-Valdecasas, MD[24] Rafael Matilla, MD[25] Ángel Rodríguez Laiz, MD[26] Ángel Rodríguez Romo, MD[27] Ángel Sánchez Hernández, MD[28] Ángel Sánchez Bueno, MD[29] Ángel Rodríguez Laiz, MD[30] Ángel Rodríguez Romo, MD[31] Ángel Sánchez Hernández, MD[32] Ángel Sánchez Bueno, MD[33] Ángel Rodríguez Laiz, MD[34] Ángel Rodríguez Romo, MD[35] Ángel Sánchez Hernández, MD[36] Ángel Sánchez Bueno,

unit; IQR, interquartile range; MELD, Model for End-stage Liver Disease; MP, perfusion machine; NA, not applicable; VVBP, venovenous bypass; WIT, warm ischemia time.

[a]Missing data and their percentages are also reported.
[b]Machine perfusion was used in 23 of 26 DCD grafts (88.5%) and in 57 of 1583 donations (3.6%) after brain death grafts.

Figure 2.

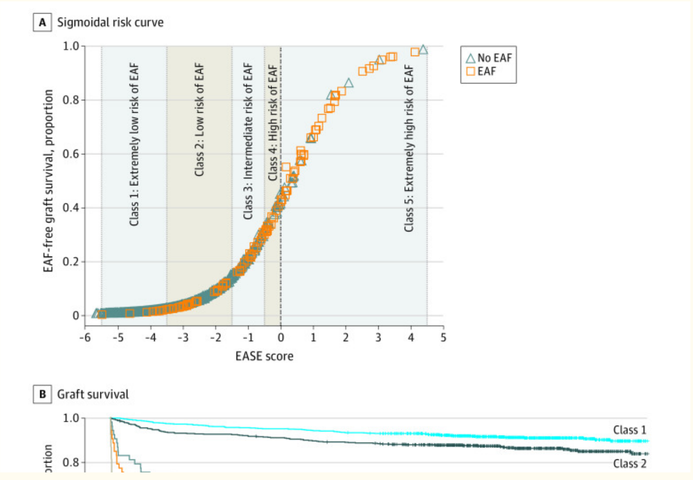


Open in a separate window

Receiver Operating Characteristic (ROC) Curves

A, B. The ROC curves for the Early Allograft Failure Simplified Estimation (EASE) score (final model 9) and other models (5, 6, 7, and 8) at 90 days in the derivation set and in the external validation set. C, The ROC curves in the derivation set. D, The ROC curves for the EASE score developed at 90 days and applied at 30 days and for other estimated scores in the derivation. D-MELD indicates donor age × Model for End-stage Liver Disease; DRI, Donor Risk Index; EAD, Early Allograft Dysfunction; L-GrAFT, Liver Graft Assessment Following Transplantation; MEAF, Model for Early Allograft Function; and New ET-DRI, New Eurotransplant Donor Risk Index.

Figure 3.



Open in a separate window

Early Allograft Failure Simplified Estimation (EASE) Score and Kaplan-Meier Survival Curves

A, Sigmoidal day 90 early allograft failure (EAF) distribution according to the EASE score in 1609 evaluated patients. Five different risk classes are identified, with the dashed central line denoting the threshold for an unsustainable EAF risk. The constant obtained by logistic regression analysis was increased by 0.3060 to calibrate the unsustainable risk cutoff at the 0 threshold. B and C, Early allograft failure–free graft survival and patient survival according to the 5 EASE score risk classes are shown. The dashed line between classes 4 and 5 in panel C representing the extremely high-risk threshold (unsustainable risk cutoff) indicates the poor survival of patients in extremely high-risk class 5. The extremely high-risk class and the unsustainable risk cutoff indicate the threshold that mandates prompt retransplant.

Table 2.

Characteristics of EASE Score and Other Published Scores[a]

Characteristic	DRI,[6] 2006	EAD,[16] 2010	D-MELD,[29] 2011	New ET-DRI,[30] 2012	MEAF,[17] 2015	L-GrAFT,[20] 2018	EASE 2020
Object of score	Donor quality	Graft quality	Donor-recipient match	Donor quality	Graft recovery	Graft recovery	Graft recovery
End point	Graft failure	Graft dysfunction	Graft failure/patient death	Graft failure	Graft failure	Graft failure	Comprehensive graft failure
Cutoff	≥2	4	>1628/>1628	>2	≥8	>1.3	>0
% Of estimated cases	80% at 90 d	75% at 180 d	84%/86% at 90 d	79% at 90 d	70% at 90 d	16% at 90 d	28% at 90 d
Day of evaluation in relation to LT	Intraoperative	7	−1	Intraoperative	3	10	10
Donor							
Age	X		X	X			
g-GT				X			
Race (White vs African American)	X						
Height	X						
Cause of death (vascular vs other)	X			X			
DCD	X			X			

Open in a separate window

Abbreviations: ALT, alanine aminotransferase; AST, aspartate aminotransferase; DCD, donation after cardiac death; D-MELD, donor age × Model for End-stage Liver Disease; DRI, Donor Risk Index; EAD, Early Allograft Dysfunction; EASE, Early Allograft Failure Simplified Estimation; g-GT, gamma-glutamyl transpeptidase; L-GrAFT, Liver Graft Assessment Following Transplantation; INR, international normalized ratio; LT, liver transplant; MEAF, Model for Early Allograft Function; MELD, Model for End-stage Liver Disease; New ET-DRI, New Eurotransplant Donor Risk Index.

SI conversion factors: To convert bilirubin to μmol/L, multiply by 17.104; ALT and AST to μkat/L, by 0.0167

[a]Scores are different in terms of object, end point, cutoff, number of factors used and total number of entries as well as the discrimination ability at 90 days. The L-GraFT and EASE scores presented the highest C statistic (0.85 and 0.87, respectively). However, the number of data entries necessary to calculate is 17 for EASE and 40 for L-GrAFT. X indicates the characteristics included in the score, multiple X's indicate data collected at multiple days, and number of X's indicates the number of days.
[b]The number of variables is 7; however, the number of factors included in the model is 8 because the platelet count is included as the area under the curve and as slope.
[c]At 180 days.
[d]External data set.
[e]In Figure 2C and eTable 5 of the Supplement.