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SYSTEMATIC REVIEW AND META-ANALYSIS

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Child–Pugh Versus MELD Score for the Assessment of Prognosis in Liver Cirrhosis

A Systematic Review and Meta-Analysis of Observational Studies

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Abstract: Child–Pugh and MELD scores have been widely used for the assessment of prognosis in liver cirrhosis. A systematic review and meta-analysis aimed to compare the discriminative ability of Child–Pugh versus MELD score to assess the prognosis of cirrhotic patients.

PubMed and EMBASE databases were searched. The statistical results were summarized from every individual study. The summary areas under receiver operating characteristic curves, sensitivities, specificities, positive and negative likelihood ratios, and diagnostic odds ratios were also calculated.

Of the 1095 papers initially identified, 119 were eligible for the systematic review. Study population was heterogeneous among studies. They included 269 comparisons, of which 44 favored MELD score, 16 favored Child–Pugh score, 99 did not find any significant difference between them, and 110 did not report the statistical significance. Forty-two papers were further included in the meta-analysis. In patients with acute-on-chronic liver failure, Child–Pugh score had a higher sensitivity and a lower specificity than MELD score. In patients admitted to ICU, MELD score had a smaller negative likelihood ratio and a higher sensitivity than Child–Pugh score. In patients undergoing surgery, Child–Pugh score had a higher specificity than MELD score. In other subgroup analyses, Child–Pugh and MELD scores had statistically similar discriminative abilities or could not be compared due to the presence of significant diagnostic threshold effects.

Although Child–Pugh and MELD scores had similar prognostic values in most of cases, their benefits might be heterogeneous in some specific conditions. The indications for Child–Pugh and MELD scores should be further identified.

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Abbreviations: ACLF = acute-on-chronic liver failure, AUSROC = summary areas under receiver operating characteristic curve, CI = confidence interval, DOR = diagnostic odds ratio, HCC = hepatocellular carcinoma, HE = hepatic encephalopathy, ICU = intensive care unit, INR = international normalized ratio, LT = liver transplantation, MELD = model for end-stage liver disease, NLR = negative likelihood ratio, PLR = positive likelihood ratio, QUADAS = Quality Assessment of Diagnostic Accuracy Studies, SE = standard error, TIPS = transjugular intrahepatic portosystemic shunts.

INTRODUCTION

Liver cirrhosis has a high morbidity and mortality, which is the 14th most common cause of death all over the world and the 4th in central Europe. It leads to 1.03 million deaths per year in the world,[1] and 170,000 deaths per year in Europe.[2] The prevalence of liver cirrhosis may be underestimated, because patients at the early phase of liver cirrhosis are often asymptomatic, and most of patients with liver cirrhosis are admitted due to its related complications. The 1-year mortality of liver cirrhosis varies greatly from 1% to 57% according to the complications.[3] It is necessary to use the prognostic models to identify high-risk patients.

Child–Pugh score was firstly proposed by Child and Turcotte to predict the operative risk in patients undergoing portosystemic shunt surgery for variceal bleeding. The primary version of Child–Pugh score included ascites, hepatic encephalopathy (HE), nutritional status, total bilirubin, and albumin. Pugh et al[4] modified the Child–Pugh classification by adding prothrombin time or international normalized ratio (INR) and removing nutritional status. Child–Pugh score has been widely used to assess the severity of liver dysfunction in clinical work.

Model for end-stage liver disease (MELD) score was initially created to predict the survival of patients undergoing transjugular intrahepatic portosystemic shunts (TIPS).[5] The primary version of MELD score included the etiology of liver cirrhosis, but this variable was unnecessary.[6] The present version of MELD score incorporated only 3 objective variables, including total bilirubin, creatinine, and INR. Currently, it has been used to rank the priority of liver transplantation (LT) candidates.

Child–Pugh and MELD scores have been widely used to predict the outcomes of cirrhotic patients. However, they have some drawbacks. First, 2 variables (i.e., ascites and HE) included in Child–Pugh score are subjective and may be variable according to the physicians' judgment and the use of diuretics and lactulose. Second, INR, which is one component of both Child-Pugh and MELD scores, does not sufficiently reflect coagulopathy and consequently liver function in

liver cirrhosis.[7] Third, there is an interlaboratory variation in INR value.[8]

Until now, a large number of studies compared their discriminative abilities. But the results remained controversial. Some studies favored the Child–Pugh score, but the others were on the opposite side. The aim of this systematic review and meta-analysis was to compare the discriminative ability of Child–Pugh versus MELD score for the assessment of prognosis in cirrhotic patients.

METHODS

This work is registered on PROSPERO database (registration number: CRD42015019700). Because this work is a systematic review of literatures, the ethical approval and patient consent are not necessary.

Study Search and Selection

We searched the PubMed and EMBASE databases. The search terms were as follows: (''Child score'' or ''Child–Pugh score'' or ''Child–Turcotte–Pugh score'') and (''MELD score'' or ''model for end stage liver disease score'') and (''liver cirrhosis''). The last search was performed on April 20, 2015.

The inclusion criteria were as follows: patients had been definitely diagnosed as liver cirrhosis; both Child–Pugh and MELD scores were calculated; areas under receiver operating characteristic curve of Child–Pugh versus MELD scores were compared; and sensitivity, specificity, and number of patients with endpoint events were reported. We excluded the following papers: duplicated papers; case reports; reviews; letters; commentaries; corrections; and papers unrelated to comparison of Child–Pugh and MELD scores. We did not restrict the publication years or study design.

Data Extraction

We extracted the following data: First author, study design, regions of study, the number of patients and the number of patients analyzed, age, sex, study population, etiology of cirrhosis, proportion of hepatocellular carcinoma (HCC), endpoints, cut-off value, true positive value, false positive value, false negative value, and true negative value.

Quality Assessment

Quality Assessment of Diagnostic Accuracy Studies (QUADAS) 2, a revised version of QUADAS, was used for the quality assessment.[9] We obtained the detailed information of the QUADAS 2 tool from the website (www.quadas.org). There are 4 key aspects incorporated: patient selection, index test, reference standard, and flow and timing. In the former 3 aspects, the risk of bias and applicability should be evaluated. In the last one, only the risk of bias should be evaluated. The risk of bias is judged as ''low,'' ''high,'' or ''unclear.'' If all the answers are ''yes,'' it should be judged as ''low'' risk. If any answer is ''unclear,'' it should be judged as ''unclear'' risk. If all answers are ''no,'' it should be judged as ''high'' risk. Similarly, the applicability is classified as ''low concern,'' ''high concern,'' or ''unclear concern.'' If the relevant information was not given, it would be classified as ''unclear concern.''

Meta-Analysis

The true positive, false positive, false negative, and true negative values were extracted and entered into the Meta-DiSc software version 1.4. If the diagnostic threshold effect was not statistically significant ($P > 0.05$ in the Spearman correlation test), the diagnostic accuracy would be further evaluated by a random-effects model. The summary areas under receiver operating characteristic curves (AUSROCs) with standard errors (SEs) and Q indexes with SEs, summary sensitivities and specificities with 95% confidence intervals (CIs), summary positive and negative likelihood ratios (PLRs and NLRs) with 95%CIs, and summary diagnostic odds ratios (DORs) with 95%CIs were reported. A statistically significant difference between the 2 scores was evaluated by analyzing the lower and upper limits of 95%CIs. If the diagnostic threshold effect was statistically significant ($P < 0.05$ in the Spearman correlation test), only AUSROCs with SEs and Q indexes with SEs were reported, but not sensitivities, specificities, PLRs, NLRs, or DORs. The heterogeneity among studies was evaluated by Chi-square test and inconsistency index. $P < 0.1$ and/or $I^2 > 50\%$ was suggestive of considerable heterogeneity.

RESULTS

Paper Selection

Overall, 1095 papers were identified via the 2 databases. According to the eligibility criteria, 119 papers were eligible for the systematic review (Figure 1).[10–128]

Description of Study Characteristics

The characteristics of the 119 papers were shown in Table 1. The countries included Austria (n = 1),[11] Belgium (n = 2),[38,96] China (n = 26),[20,21,27,30,31,53–55,59,60,74,84,102,109,112,113,117,119–121,123–128] Cuba (n = 1),[47] Czech Republic (n = 1),[44] Egypt (n = 1),[51] France (n = 6),[25,37,41,71,77,114] Germany (n = 7),[12,48–50,92,105,111] Greece (n = 1),[82] Hungary (n = 1),[61] India (n = 10),[19,29,39,40,67,75,76,86,98,115] Iran (n = 1),[87] Italy (n = 5),[22,24,43,46,91] Ivory Coast (n = 1),[13] Japan (n = 2),[57,106] Mexico (n = 1),[45] Nepal (n = 1),[28] Pakistan (n = 2),[62,97] Poland (n = 1),[88] Portugal (n = 3),[23,26,36] Serbia (n = 1),[18] Singapore (n = 2),[72,73] South Korea (n = 17),[10,15,16,32,33,56,63–66,68–70,83,99,100,103] Spain (n = 7),[14,58,89,90,94,95,116] Tunisia (n = 1),[78] Turkey (n = 3),[80,107,108] UK (n = 3),[34,42,110] and USA (n = 11).[17,35,52,79,81,85,93,101,104,118,122] The total number of patients analyzed in the included studies was 29,414. The number of patients varied from 17 to 2271.

The characteristics of study population were heterogeneous among studies. According to the clinical presentations, etiology of liver diseases, patients' conditions, and treatment options, they were mainly classified as follows: patients presenting with acute gastrointestinal bleeding (n = 12),[14,15,26,45,57,69,81,84,89,94,109,117] patients presenting with ascites (n = 2),[65,96] patients presenting with HE (n = 1),[10] patients presenting with acute-on-chronic liver failure (ACLF) (n = 5),[40,58,86,119,128] patients presenting with infection, sepsis, or spontaneous bacterial empyema (n = 5),[30,62,72,73,116] patients admitted to intensive care unit (ICU) (n = 10),[34,37,42,71,78,80,107,108,110,112] patients with trauma (n = 2),[35,93] patients with viral hepatitis-related liver cirrhosis alone (n = 3),[27,56,79] patients with alcohol-related liver cirrhosis alone (n = 5),[19,61,70,75,120] patients undergoing TIPS (n = 8),[11,31,44,91,92,101,113,123] patients undergoing LT (n = 10),[23,38,41,48,67,87,88,105,115,122] patients undergoing abdominal, cardiac, or other surgery/procedure (n = 13),[12,17,32,36,52,63,85,99,102,104,111,114,125] and unselected patients with liver cirrhosis (n = 43).[13,16,18,20–22,24,25,28,29,33,39,43,46,47,49,51,53–55,59,60,64,66,68,74,76,77,82,83,90,95,97,98,100,103,106,118,121,124,126,127] In 42 studies, no patient with HCC was included;[11,15,18,20–22,24–26,29,31,33,45–47,49,50,53–56,59,61,64,66,69,74,82,84,86,95,97,98,101–103,117,119,122–124,128] in 57 studies, the information regarding the number of

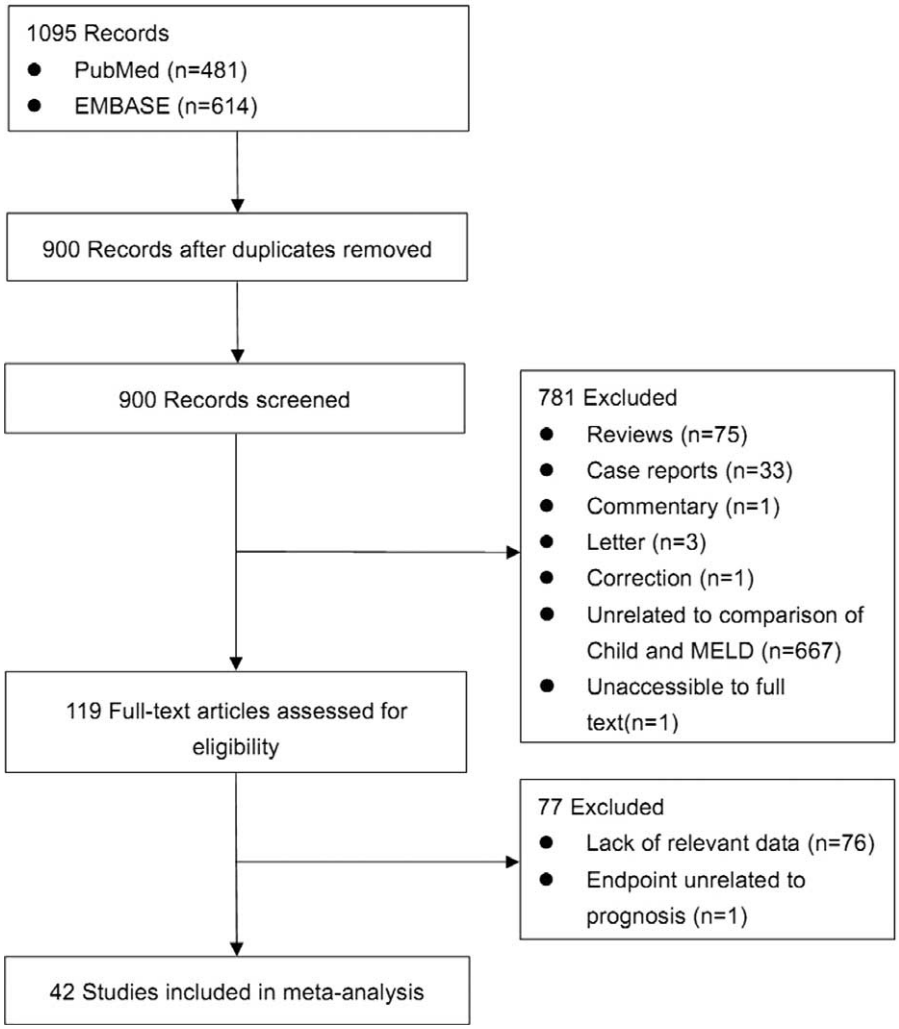

FIGURE 1. Flowchart of study inclusion.

patients with HCC was lacking;[12,13,17,19,23,28,30,32,34,35,37,39,40,42–44,48,52,57,58,60,62,63,65,67,70,71,73,75–77,79–81,83,85,87,88,91–93,99,100,104,105,110–116,118,120,121,125,126] and in 20 studies, 1.9% to 52.8% of included patients were diagnosed with HCC.[10,14,16,27,36,38,41,51,68,72,78,89,90,94,96,106–109,127]

Description of Statistical Results

Their statistical results were summarized in Table 2. There were 269 comparisons between MELD and Child–Pugh scores. Among 60 comparisons, a statistically significant difference ($P < 0.05$) was observed. In details, the superiority of MELD score over Child–Pugh score was observed in 44 comparisons; and the superiority of Child–Pugh score over MELD score was observed in 16 comparisons. Among 99 comparisons, no statistically significant difference ($P \geq 0.05$) was observed. Among 110 comparisons, the statistical significance was not reported.

Study Quality

The brief explanation of study quality was presented in Table 3. As for the risk of bias, 48 and 71 studies had low and unclear risks in the term of patient selection, respectively; 119 studies had low risks in the term of index tests; 117 and 2 studies had low and unclear risks in the term of reference standard, respectively; 91 and 28 studies had low and unclear risks in the term of flow and timing, respectively. As for the applicability concerns, 94 and 25 studies had low and high concerns in the term of patient selection, respectively; 2, 1, and 116 studies had low, unclear, and high concerns in the term of index test, respectively; 1 and 118 studies had low and high concerns in the term of reference standard, respectively.

Meta-Analysis

As for the meta-analysis, 77 papers were excluded,[12,14–16,20–23,26–31,33–39,41,43–47,49–51,53–55,57–60,63,64,66,68–73,75,78,79,81–83,85,86,88–90,92,93,95,96,99–101,103,105,106,113,114,118,120–124,126,128] because 76 studies were lacking of relevant data[12,14–16,20–23,26–31,33–39,41,43–47,49–51,53–55,57–59,63,64,66,68–73,75,78,79,81–83,85–86,88–90,92,93,95,96,99–101,103,105,106,113,114,118,120–124,126,128] and 1 study had the endpoint unrelated to the prognosis.[60] Finally, 42 papers were included (Figure 1).[10,11,13,17–19,24,25,32,40,42,48,52,56,61–63,67,74,76,77,80,84,87,91,94,97,98,102,104,107–112,115–117,119,125,127] Data extracted from these papers were summarized in Supplementary Table 1, http://links.lww.com/MD/A716.

TABLE 1. Study Characteristics: An Overview of Studies

First Author, year – Study Design	Regions	No. Total Pts/No. Pts Analyzed	Age, year	Male, %	Study Population	Etiology of Cirrhosis	HCC, %
An (2014) – R	South Korea	17/14	Median: 62 (56–65.5)	64.7%	Recurrent HE after embolization	HBV (52.9%) HCV (11.8%) Alcohol (29.4%) Others (5.9%)	17.6%
Angermayr (2003) – R	Austria	475/475	Mean ± SD: 56 ± 10.6	NA	Elective TIPS	Virus (14.3%) Alcohol (67.4%) Cholestatic (1.1%) Others (5.9%) Missing data (12%)	0.0%
Arif (2012) – R	Germany	109/109	Mean ± SD: women: 64.6 ± 10.8 men: 64.0 ± 10.6	75.2%	Patients who undergo heart surgery with cardiopulmonary bypass	Alcohol (55.0%) Cryptogenic (25.7%) Cardiac (6.4%) Viral (5.5%) PBC (2.8%) Other origin (4.6%)	NA
Attia (2008) – R	Ivory Coast	172/172	Mean ± SD: 47.5 ± 13	69.8%	Black African patients with cirrhosis	HBV (45.3%) HCV (10%) Alcohol + HBV/HCV (23.8%) Unknown (20.9%)	NA
Augustin (2009) – P	Spain	164/164	Median: 59 (48–70)	68.0%	AVB	Alcohol (33%) Virus (48%) Alcohol + Virus (19%)	13.0%
Bae (2007) – R	South Korea	71/71	Mean ± SD: 56 ± 10	85.9%	First episode of VB	HBV (40.8%) HCV (9.9%) Alcohol (43.7%) Cryptogenic (5.6%)	0.0%
Bang (2014) – P	South Korea	1002/1002	NA	NA	Patients with CLD who undergo HVPG measurement	Alcohol (40.5%) HBV (39.4%) HCV (8.8%) Others (11.3%)	6.2%
Befeler (2005) – R	USA	53/53	Mean: 52.6 (26–79)	62.0%	Patients who undergo abdominal surgery	HBV/HCV (47%) Cryptogenic (19%) Alcohol (19) NASH (7%) PSC/PBC (6%) BCS (2%)	NA
Benedeto-Stojanov (2009) – R	Serbia	100/100	Median: 57 (32–79)	76.0%	Patients with complications of liver disease	HBV (7%) HCV (4%) Alcohol (88%) AIH (1%)	0.0%
Bhise (2007) – R	India	79/79	Median: 42 (23–65)	100.0%	Alcoholic cirrhotic patients	Alcohol (100%)	NA
Bie (2007) – R	China	181/181	Median: 61 (23–76)	77.9%	Decompensated liver cirrhosis	HBV (81%) HCV (4%) Alcohol (10%) PBC + Others(5.5%)	0.0%
Bie (2009) – P	China	160/160	Mean ± SD: 52 ± 13	81.2%	Liver cirrhosis	HBV (80%) HCV (7%) Alcohol (7.5%) HBV + Alcohol (1.2%) HBV + HCV (1.2%) Cryptogenic (1.2%) Others (1.9%)	0.0%
Biselli (2015) – P	Italy	227/227	Median: 56 (19–69)	65.0%	MELD score <18 from Modena and Padua Centers (Training group)	HBV (8.3%) HCV (43%) Alcohol (24.9%) Viral + Alcohol (5.4%) Cryptogenic (5.4%) Others (6.9%)	0.0%
		292/292	Median: 54 (18–67)	66.1%	MELD score <18 from Bologna (Validation group)	HBV (4.8%) HCV (43.8%) Alcohol (21.9%) Viral + Alcohol (7.5%) Cryptogenic (5.5%) Others (7.2%)	0.0%
Boin Ide (2008) – R	Portugal	232/232	Mean ± SD: 46.4 ± 10.3	73.3%	Adult patients who undergo LT	HCV (51.1%)	NA
Botta (2003) – R	Italy	129/129	Median: 50 (22–75)	73.6%	Liver cirrhosis	HBV (11.6%) HCV (46.5%) HBV+ HCV (1.6%) HBV+ HDV (4.7%) HBV+ HCV + HDV (0.8%) Alcohol (21.7%) HCV + Alcohol (7.0%) AIH (6.2%)	0.0%
Boursier (2009) – P	France	308/308	Mean ± SD: 59.0 ± 10.9	64.0%	Liver cirrhosis	Alcohol (81.8%) Viral (11.4%) Others (6.8%)	0.0%
Cerqueira (2012) – R	Portugal	102/102	Mean ± SD: 55.4 ± 12.6	71.6%	First episode of oesophageal VB	DHCA (75.5%) Other (24.5%)	0.0%
Chan (2006) – R	China	506/480	Mean ± SD: 54 ± 15	82.0%	Chronic hepatitis B-related complications	HBV (100%)	28.0%
Chaurasia (2013) – P	Nepal	216/216	Mean ± SD: 51.31 ± 11.5	65.30%	Decompensated cirrhosis	Alcohol (96.3%) HBV (2.3%) HCV (1.4%)	NA

First Author, year – Study Design	Regions	No. Total Pts/No. Pts Analyzed	Age, year	Male, %	Study Population	Etiology of Cirrhosis	HCC, %
Chawla (2011) – P	India	102/102	Mean: 47.8 (45.5–50.1)	87.3%	Liver cirrhosis	Alcohol (44.1%) HBV (13.7%) HCV (17.6%) BCS (2.9%) Cryptogenic (21.6%)	0.0%
Chen (2011) – R	China Taiwan	81/81	Mean ± SD: 60 ± 12.8	67.9%	SBE	Alcohol (16.0%) HBV (42.0%) HCV (34.6%) Other + Unknown (7.4%)	NA
Chen (2013) – R	China	124/124	Median: 46 (21–88)	64.5%	Patients with SPH who treated with TIPS	Alcohol (4.8%) HBV (79.8%) Other (9.7%) Unknown (5.7%)	0.0%
Cho (2011) – R	South Korea	490/490	Median: 60 (18–86)	65.1%	Patients who undergo nonhepatic surgery under general anesthesia	HBV (65.7%) HCV (13.7%) Alcohol (5.9%) Cryptogenic (12.5%) Others (2.2%)	NA
Choi (2009) – R	South Korea	128/128	Mean ± SD: 54.2 ± 11.2	71.9%	Liver cirrhosis	HBV (65.7%) HCV (13.7%) Alcohol (5.9%) Cryptogenic (12.5%)	0.0%
Cholon gitas (2008) – R	UK	128/128	Mean ± SD: 49 ± 11	60.0%	Patients who were first admitted to ICU	Alcohol (63%) HBV/HCV (16.5%) Other (20.5%)	NA
Corneille (2011) – R	USA	163/163	Mean ± SD: 51 ± 11.9	80.0%	Trauma patients with liver dysfunction or cirrhosis	NA	NA
Costa (2009) – R	Portugal	190/190	Mean ± SD: 61.4 ± 12	81.0%	Surgery	Alcohol (87%) Viral (6%) Other (7%)	18.0%
Das (2010) – R	France	138/138	NA	68.0%	ICU patients	Alcohol (78%) HBV/HCV (16%) Other (6%)	NA
Degre (2004) – R	Belgium	131/131	NA	82.4%	Patients who undergo first LT	Alcohol (38.9%) Other (61.1%)	19.1%
Dhiman (2014) – P	India	50/50	Mean ± SD: 46 ± 13	86.0%	Cirrhosis with AD	Alcohol (58%) HCV + Alcohol (10%) AIH (6%) HBV (6%) Wilson (6%) Cryptogenic (14%)	NA
Duseja (2013) – P	India	100/100	Median: 49 (38–55.7)	87.0%	ACLF	Alcohol (72%) Alcohol + HBV/HCV (6%) HBV (5%) HCV (5%) AIH (4%) NASH/Cryptogenic (8%)	NA
Ecochard (2011) – R	France	560/560	Mean: 51.3 (20.2–70.9)	70.7%	LT	Alcohol (40.2%) HBV (3.2%) HCV (6.3%) HCC (25.9%) Other (24.5%)	25.9%
Emerson (2014) – P	UK	59/59	Mean ± SD: 51 ± 12	68.0%	ICU patients	Alcohol (80%) Nonalcoholic (20%)	NA
Fede (2011) – R	Italy	101/101	Mean ± SD: 59.0 ± 1.9	59.4%	Patients without infections or hemodynamic instability	Viral (46.5%) Alcohol (24.8%) Other (28.7%)	NA
Fejfar (2006) – R	Czech Republic	110/110	Mean: 55	NA	Patients who underwent TIPS for refractory ascites	Viral (15%) Alcohol (60%) PBC/PSC (2%) Cryptogenic (14%) BCS (7%) AIH (2%)	NA
Flores-Rendon (2008) – R	Mexico	212/212	Mean ± SD: 53 ± 12	68.0%	Acute EVB	Alcohol (73%) HBV/HCV (7%) AIH (3%) Other (17%)	0.0%
Giannini (2004) – P	Italy	145/145	Median: 60 (51–69)	73.0%	Liver cirrhosis	HBV (10.3%) HCV (47.6%) Alcohol (24.1%) Alcohol + HBV/HCV (7.6%) Cryptogenic (4.1%) PBC (2.8%) AIH (1.4%) Others (2.1%)	0.0%
Gomez (2009) – P	Cuba	172/170	Median: 56 (20–79)	62.0%	Liver cirrhosis	HBV (12%) HCV (53%) Alcohol (17%) Alcohol + Viral infection (9%) Viral co-infection (HBV/HCV) (1%) Unknown (7%) NAFL (1%)	0.0%
Gotthardt (2009) – R	Germany	268/168	Mean: 50.5 (16–68)	63.1%	Listed for single-organ LTx for nonfulminant liver disease	Alcohol (29.5%) Viral (28%) Other (20.2%) Malignancy (14.5%) Cholestatic (7.8%)	NA

First Author, year – Study Design	Regions	No. Total Pts/No. Pts Analyzed	Age, year	Male, %	Study Population	Etiology of Cirrhosis	HCC, %
Gotzberger (2012) – P	Germany	44/44	Mean ± SD: Alive: 57 ± 10 Death: 62 ± 9	68.2%	Liver cirrhosis	Alcohol abuse (65.9%) Chronic HBV/HCV (22.7%) Wilson's disease (2.3%) AIH (2.3%) PBC (2.3%) Cryptogenic (4.5%)	0.0%
Grunhage (2008) – P	Germany	92/92	Median: 55 (19–76)	66.0%	Liver cirrhosis	Alcohol (59.8%) HBV (6.5%) HCV (8.7%) Wilson's disease (2.2%) AIH (4.3%) Alpha1-antitrypsin deficiency (2.2%) PBC (1.1%) PSC (1.1%) Cryptogenic (13.0%) Hereditary hemochromatosis (1.1%)	0.0%
Hassan (2013) – R	Egypt	1000/1000	Mean ± SD: 54.8 ± 8	68.0%	Liver cirrhosis	NA	18.0%
Hoteit (2008) – R	USA	195/57	Mean ± SD: 57.1 ± 11.2	59.5%	Surgery	Alcohol (17.9%) HBV (3.6%) HCV (37.4%) AIH (2.6%) Alpha1-antitrypsin deficiency (1.5%) PBC (2.1%) PSC (2.6%) Cryptogenic (26.2%) Hemochromatosis (0.5%) Nonalcoholic steatohepatitis (1.0%) Amyloidosis (1.0%) Cardiac cirrhosis (0.5%) Cystic fibrosis (0.5%) Unknown (2.6%)	NA
Huo (2005) – P	China Taiwan	472/472	Mean ± SD: 65 ± 12	78.0%	Liver cirrhosis (CTP ≥ 7)	HBV (73%) Non-HBV (27%)	0.0%
Huo (2006) – P	China Taiwan	436/436	Mean ± SD: 66 ± 12	77.0%	Liver cirrhosis (CTP ≥ 7)	HBV (72%) Non-HBV (28%)	0.0%
Huo (2005) – P/R	China Taiwan	351 (58 P + 293 R)/351	Mean ± SD: 67 ± 11	76.0%	Liver cirrhosis (CTP ≥ 7)	HBV (69%) HCV (13%) Alcohol (6%) HBV + HCV (5%) Cryptogenic (4%) Others (3%)	0.0%
Hyun (2012) – R	South Korea	86/83	Mean ± SD: 54 ± 11	63.0%	HBV-related decompensated cirrhotic patients (CTP ≥ 7) who received antiviral therapy	HBV (100%)	0.0%
Ishizu (2014) – R	Japan	148/148	NA	NA	Patients with AVB who were treated by endoscopic variceal ligation	NA	NA
Jalan (2014) – P	Spain	275/275	Mean ± SD: 54.5 ± 12.1	64.0%	ACLF: Derivation set	Alcohol (54.7%) HCV (14.9%) Alcohol + HCV (10.8%)	NA
		225/225	Mean ± SD: 55.1 ± 11.1	76.0%	ACLF: External validation	Alcohol (70.2%) HCV (10.7%) Alcohol + HCV (6.2%)	NA
Jiang (2009) – R	China	188/188	Mean ± SD: Survival group: 61.56 ± 11.35 Death group: 62.68 ± 12.56	NA	Liver cirrhosis	Viral (88.39%) Alcohol (5.31%) PBC + Other (6.3%)	0.0%
Jiang (2013) – R	China	39/39	Mean ± SD: 45.6 ± 3.6	76.9%	Liver cirrhosis	HBV (66.7%) HCV (2.6%) Alcohol (2.6%) AIH (5.1%) Cryptogenic (2.6%) Nonviral (20.5%)	NA
Kalabay (2007) – P	Hungary	93/89	Mean ± SD: 54 ± 13	55.9%	Alcoholic liver disease	Alcohol (100%)	0.0%
Khan (2009) – R	Pakistan	530/530	Mean ± SD: 53 ± 13	59.0%	Infection (at admission or acquiring in hospital)	HBV (13%) HCV (64%) HBV+ HCV (5%) Non-HBV/HCV (15%) HBV + HDV (3%)	NA
Kim (2014) – R	South Korea	79/79	Median: 59 (20–84)	79.7%	Patients who undergo elective extrahepatic surgery under general anesthesia	HBV (45.6%) HCV (11.4%) Alcohol (34.2%) Non-HBV/HCV (8.9%)	NA
Kim (2007) – R	South Korea	355/355	Mean: 55.9 (21–92)	74.9%	Liver cirrhosis	HBV (40.0%) HCV (5.6%) Alcohol (49.9%) Unknown (4.5%)	0.0%

First Author, year – Study Design	Regions	No. Total Pts/No. Pts Analyzed	Age, year	Male, %	Study Population	Etiology of Cirrhosis	HCC, %
Kim (2014) – P	South Korea	65/65	Mean ± SD: 55 ± 9.2	63.1%	Cirrhotic patients with ascites	Viral hepatitis (26.1%) Alcohol (56.9%) Virus + Alcohol (9.3%) Others (7.7%)	NA
Koo (2013) – R	South Korea	882/882	Mean ± SD: 57.5 ± 10.9	75.5%	Liver cirrhosis	HBV (34.2%) HCV (7.3%) Alcohol (45.4%) AIH (1.5%) PBC (0.7%) PSC (0.3%) NAFLD (0.2%) Wilson's disease (0.3%) Unknown (2.2%)	0.0%
Krishnan (2013) – R	India	216/216	NA	NA	Single-organ LT for nonfulminant liver disease	NA	NA
Kwon (2014) – P	South Korea	295/295	NA	NA	Advanced liver cirrhosis (CTP > 6)	NA	37.3%
Lee (2002) – R	South Korea	93/93	Mean ± SD: 53.8 ± 10.7	82.8%	First episode of AVB	HBV (24.7%) HCV (8.6%) Alcohol (51.6%) Alcohol + HBV (11.8%) Unknown (3.3%)	0.0%
Lee (2015) – R	South Korea	345/345	NA	85.5%	Acutely decompensated alcoholic cirrhosis	Alcohol (100%)	NA
Levesque (2012) – P	France	377/377	Mean ± SD: 55.5 ± 11.4	73.5%	ICU patients	Alcohol (68%) HBV (4%) HCV (14%) Alcohol + Hepatitis (6%) Others (8%)	NA
Lim (2011) – R	Singapore	205/205	Mean ± SD: 64.0 ± 13.0	51.7%	Patients admitted for sepsis	Cryptogenic (43.9%) Alcohol (16.6%) HBV (25.9%) HCV (7.8%) AIH (2.9%) PBC (2.4%) BCS (0.5%)	18.5%
Lim (2009) – R	Singapore	208/208	NA	NA	Patients admitted for sepsis	NA	NA
Lv (2009) – R	China	256/256	Mean ± SD: 54.3 ± 11.5	78.5%	Liver cirrhosis	Alcohol (9.3%) HBV (61.3%) HCV (15.2%) Others (14.1%)	0.0%
Mallaiyappan (2013) – R/P	India	110 R/110	Mean ± SD: 44.2 ± 9.8	99.1%	Alcoholic liver disease	Alcohol (100%)	NA
		96 P/96	Mean ± SD: 43.8 ± 9.4	95.8%	Alcoholic liver disease	Alcohol (100%)	NA
Mishra (2007) – P	India	76/76	Mean ± SD: 46.97 ± 12.96	75.0%	Liver cirrhosis	Alcohol (50.0%) HBV (27.6%) HCV (6.6%) Metabolic (1.3%) Cryptogenic (14.5%)	NA
Moreno (2013) – P	France	125/125	Mean ± SD: 57.9 ± 9.8	68.8%	Liver cirrhosis	Alcohol (84.2%)	NA
Mouelhi (2010) – R	Tunisia	286/286	Mean ± SD: 59 ± 13	56.3%	ICU patients	NA	17.1%
Nunes (2010) – P	USA	303/303	Mean: 44	64.0%	HCV-related liver disease	HCV (100%)	NA
Olmez (2012) – P	Turkey	201/201	Mean ± SD: 56.8 ± 14.1	64.7%	ICU patients	Alcohol (11.1%) HBV (35.8%) HCV (18.2%) Cryptogenic (22.2%)	NA
Orloff (2012) – RCT	USA	211 (106EST/ 105EPCS)/211	NA	NA	EVB	NA	NA
Papatheodoridis (2005) – R	Greece	102/102	Median: 61 (27–89)	68.0%	Decompensated cirrhosis	HBV (23%) HCV (17%) Alcohol (38%) PBC/PSC (7%) Unknown (15%)	0.0%
Park (2014) – P	South Korea	867/867	NA	NA	Patients with CLD who underwent HVPG measurement	HBV (40.2%) HCV (9.2%) Alcohol (39.7%) NASH (2.3%) Others (8.5%)	NA
Peng (2015) – R	China	145/145	Mean ± SD: 56.77 ± 11.33	64.8%	Acute UGIB	HBV (31.7%) HCV (7.6%) HBV + HCV (0.7%) Alcohol (24.1%) HBV + Alcohol (2.1%) Unknown (24.1%) Others (9.7%)	0.0%
Perkins (2004) – R	USA	33/33	Mean: 58	36.4%	Patients who undergo cholecystectomy	NA	NA

First Author, year – Study Design	Regions	No. Total Pts/No. Pts Analyzed	Age, year	Male, %	Study Population	Etiology of Cirrhosis	HCC, %
Radha Krishna (2009) – R	India	121/121	Mean ± SD: 36.3 ± 18.0	70.2%	ACLF with acute viral hepatitis due to HAV or HEV	HBV (30%) HCV (4.1%) Alcohol (11%) HBV + Alcohol (2.5%) HCV + Alcohol (1%) Cryptogenic (36%) AIH (5%) Wilson's (5.8%) HBV + Wilson's (1%) Hemochromatosis (1.7%) BCS (1.7%)	0.0%
Rahimi- Dehkordi (2014) – P	Iran	257/257	Mean ± SD: 40.77 ± 13.45	54.1%	Waiting for LT	HBV (18.7%) HCV (14.8%) Alcohol (0.4%) Cryptogenic (34.2%) AIH (19.5%) PSC (8.9%) PBC (1.2%) Wilson's disease (2.3%)	NA
Raszeja-Wyszomirska (2009) – R	Poland	48/48	Mean ± SD: Survivors: 53 ± 11 Nonsurvivors: 45 ± 9	62.5%	OLT	Viral + Alcohol (37.5%) AIH (22.9%) Other (39.6%)	NA
Reverter (2014) – P	Spain	178/178	Mean ± SD: 58.3 ± 12.4	73.0%	Esophageal AVB	Alcohol (39%) HCV (32%) Virus + Alcohol (11%) Others (18%)	10.0%
Ripoll (2007) – RCT	Spain	213/213	Median: 54 (46–63)	59.0%	Compensated cirrhosis with portal hypertension but without varices	Alcohol (24%) Nonalcoholic (76%) HBV (4%) HCV (62%) Cryptogenic (5%) Other (5%)	9.0%
Salerno (2002) – R	Italy	140/138	Median: 60.5 (14–76)	64.3%	Elective TIPS	Viral (67%) Alcohol (20%) Cholestatic (2%) Other (11%)	NA
Schepke (2003) – P	Germany	162/162	Mean ± SD: 57.0 ± 10.4	64.2%	TIPS	Viral (16.7%) Alcohol (69.1%) Cholestatic (4.3%) Other (9.9%)	NA
Seamon (2010) – R	USA	68/68	Mean ± SD: 53.2 ± 8.9	83.8%	Trauma patients with CLD	HBV (7.4%) HCV (39.7%) Alcohol (Intoxication: 47.1%; Dependence: 42.6%) HBV + HCV (4.4%)	NA
Sempere (2009) – R	Spain	201/201	Mean ± SD: 59.48 ± 11.78	70.6%	AVB	Alcohol (45.3%) Virus (31.3%) Alcohol + Virus (13.4%) Other (10%)	11.4%
Serra (2004) – R	Spain	212/212	Mean ± SD: Death group: 68.8 ± 10 Alive group: 67.3 ± 12.5	NA	Decompensated cirrhosis	HBV (2.8%) HCV (28.3%) Alcohol (15.6%) Cryptogenetic (9.9%)	0.0%
Serste (2012) – P	Belgium	174/174	Mean ± SD: 60.3 ± 11.6	79.9%	Cirrhosis and refractory ascites	HBV (9.8%) HCV (21.3%) Alcohol (55.2%)	29.9%
Shaikh (2010) – Descriptive	Pakistan	110/110	Mean ± SD: 46.76 ± 12.93	65.0%	Decompensated cirrhosis	HBV (35%) HCV (54%) HBV + HCV (11%)	0.0%
Sharma (2010) – P	India	200/200	Mean ± SD: 41.6 ± 11.7	79.5%	Patients without recent UGIB or HE	NA	0.0%
Song (2011) – R	South Korea	98/98	Mean ± SD: 57.8 ± 10.5	81.6%	Patients who undergo intraabdominal surgery under generalized anesthesia	HBV (57.2%) HCV (10.2%) Alcohol (22.4%) Other (10.2%)	NA
Song (2014) – R	South Korea	946/946	Median: 54 (47–63)	74.3%	Cirrhosis with AD	NA	NA
Stewart (2007) – R	USA	223/223	Mean: 56 (45.4–64.6)	NA	TIPS	Viral (11%) Alcohol (62%) Cholestatic (9%) Other (19%)	0.0%
		271/271	Mean: 60.4 (49.5–69.2)	NA	Decompensated cirrhosis	Viral (20%) Alcohol (31%) Cholestatic (16%) Other (33%)	0.0%
Su (2009) – R	China Taiwan	46/46	Mean ± SD: 53.3 ± 12.7	26.1%	Patients with PBC who undergo biopsy	Cholestatic (100%)	0.0%
Suk (2014) – P	South Korea	1002/1002	NA	NA	Patients with CLD who undergo HVPG measurement	NA	0.0%

First Author, year – Study Design	Regions	No. Total Pts/No. Pts Analyzed	Age, year	Male, %	Study Population	Etiology of Cirrhosis	HCC, %
Suman (2004) – R	USA	44/44	Mean ± SD: Death: 58.3 ± 11.7 No death: 64.6 ± 12.5	61.0%	Patients with undergo cardiac surgery using CPB	HBV (6.8%) HCV (6.8%) AIH (6.8%) Alcohol (25%) PBC/PSC (4.5%) Cardiac cirrhosis (4.5%) Cryptogenic (45.5%)	NA
Tacke (2007) – R	Germany	111/111	Median: 46 (18–70)	59.5%	CLD evaluated for potential LT	Viral (28.8%) Biliary/AIH (24.3%) Alcohol/Cryptogenic (26.1%) Other origin (20.7%)	NA
Takaya (2012) – R	Japan	108/108	Mean ± SD: Child A: 66.4 ± 7.8 Child B: 63.6 ± 8.3 Child C: 64.7 ± 15.1	59.3%	Liver disease	HBV (14.8%) HCV (62.0%) Alcohol (9.3%) PBC (3.7%) Cryptogenic (10.2%)	52.8%
Tas (2012) – R	Turkey	90/90	Mean ± SD: 69 ± 5.919	57.8%	ICU patients	HBV (32.2%) HCV (33.3%) Alcohol (10%) Cryptogenic (30%)	7.8%
Tas (2012) – R	Turkey	106/106	Mean: Discharged: 56 (40–80) Deceased: 55.5 (17–80)	30.2%	ICU patients	HBV (33%) HCV (20%) HBV + HDV (0.9%) Alcohol (16%) AIH (6.6%) Cryptogenic (6.6%) Wilson disease (0.9%) PBC (0.9%)	1.9%
Teng (2014) – R	China Taiwan	132/132	Mean: 51.3 (46.3–64.2)	83.3%	Acute GVB after emergent endoscopic NBC injection	Alcohol (36.4%) Alcohol + HBV/HCV (18.2%) HBV/HCV (45.4%)	25.8%
Theocharidou (2014) – R	UK	635/635	Mean ± SD: 50.5 ± 11.7	62.4%	ICU patients	Alcohol (63.3%) HBV (7.1%) HCV (9.1%) AIH/PSC/PBC/Wilson's disease (7.2%) Cryptogenic (3.3%) Alcohol + Viral hepatitis (3.1%) Other (6.6%)	NA
Thielmann (2010) – R	Germany	57/57	Mean ± SD: 62 ± 10	67.0%	Noncardiac liver cirrhosis, undergo open-heart surgery using CPB	NA	NA
Tu (2011) – P	China Taiwan	202/202	Mean ± SD: 58 ± 14	75.7%	ICU patients	HBV (29%) HCV (22%) Alcohol (20%) HBV + Alcohol (9%) HCV + Alcohol (2%) HBV + HCV (3%) HBV + HCV + Alcohol (1%) Other causes (14%)	NA
Tzeng (2009) – R	China Taiwan	107/107	Mean ± SD: 55.50 ± 12.33	69.0%	Emergent TIPS for uncontrolled VB	Alcohol (24%) Viral hepatitis (B and/or C) (68%) Other (7%)	NA
Vanhuyse (2012) – R	France	34/34	Mean ± SD: 64.8 ± 12.8	76.5%	Patients who underwent cardiac surgery	Alcohol (58%) Viral hepatitis (21%) Alcohol + Viral hepatitis (12%) PBC (6%) Hemochromatosis (3%)	NA
Velayutham (2012) – R	India	210/210	Mean: 45.9	76.2%	Patients listed for single-organ LT for nonfulminant liver disease	NA	NA
Viasus (2011) – P	Spain	90/90	Mean ± SD: 61.8 ± 13	80.0%	Nonseverely immunosuppressed cirrhotic patients with pneumonia	Alcohol (38.9%) HCV (27.8%) Viral hepatitis + Alcohol (12.2%) Cryptogenic (5.5%) HBV (3.3%) Unknown (11.1%)	NA
Wang (2014) – P	China	429/429	Mean ± SD: 48.9 ± 13.8	79.3%	After cessation of AVB by endoscopic therapy within 48 hours of admission	HBV (75.8%) HCV (3.3%) Alcohol (6.8%) Biliary (1.4%) Others (11.0%)	0.0%

First Author, year – Study Design	Regions	No. Total Pts/No. Pts Analyzed	Age, year	Male, %	Study Population	Etiology of Cirrhosis	HCC, %
Wiesner (2003) – P	USA	2271/2271	Mean: 50.7 (18–79)	67.8%	Patients with CLD added to OPTN liver waiting list	HBV (5.8%) HCV (36.4%) Alcohol (27.6%) Cryptogenic (11.0%) AIH (4.9%) Nonalcoholic steatosis (2.4%) α-1 Antitrypsin (2.1%) Wilson's (0.2%) Sarcold (0.2%) PSC (1.8%) PBC (1.1%) Drug induced (0.6%) Amyloid (0.3%) Other (5.6%)	NA
Wu (2015) – P	China	121/121	Mean ± SD: 43.3 ± 12.0	79.3%	ACHBLF: Training cohort	HBV (100%)	0.0%
		93/93	Mean ± SD: 47.8 ± 13.5	68.8%	ACHBLF: Validation cohort	HBV (100%)	0.0%
Xie (2013) – R	China	205/205	Mean ± SD: 50.48 ± 11.15	99.5%	Alcoholic liver disease	Alcohol (100%)	NA
Xiong (2004) – R	China	199/199	Mean ± SD: 3-month: Survival: 61.1 ± 13.3 Death: 64.3 ± 14.5	62.3%	Liver cirrhosis	HBV (86.9%) HCV (0.5%) Alcohol (3.5%) Schistosome (5.0%) Cryptogenic (2.0%) AIH (2.0%)	NA
Zapata (2004) – R	USA	26/26	Mean ± SD: 46.9 ± 10.9	57.7%	LT	Alcohol (22%) HCV (12%) Cryptogenic (17%) PBC (17%) AIH (12%) Miscellaneous (20%)	0.0%
Zhang (2014) – R	China	159/159	Mean ± SD: 52 ± 12	71.1%	TIPS	Alcohol (10.1%) Viral (66.0%) Cholestatic (13.8%) Other (10.1%)	0.0%
Zhang (2012) – R	China	160/160	Mean ± SD: Survival group: 52.5 ± 9.0 Death group: 52.4 ± 11.5	NA	Liver cirrhosis	NA	0.0%
Zhang (2015) – R	China	77/77	Mean: 62.6 (34–89)	53.2%	Patients with choledocholithiasis who undergo ERCP for the first time	HBV (54.5%) HCV (1.3%) Alcohol (3.9%) Cryptogenic (1.3%) Schistosome (2.6%) Secondary biliary (33.8%) Mixed (2.6%)	NA
Zhang (2005) – R	China	315/315	Mean: Male: 52.9 Female: 60.9	67.3%	Liver cirrhosis	HBV (67.0%) HCV (7.6%) Alcohol (8.3%) Alcohol + HBV (1.0%) HBV + HCV (1.0%) PBC (6.3%) Unknown (5.4%) Others (3.4%)	NA
Zhang (2012) – R	China	435/435	Median: 56 (20–87)	77.5%	Liver cirrhosis	Viral (79.1%) Alcohol abuse (8.0%) Biliary cirrhosis (5.1%) Other (7.8%)	38.9%
Zheng (2011) – R	China	242/242	Mean ± SD: 46.0 ± 12.9	81.0%	Suspected ACHBLF: Internal cohort	HBV (100%)	0.0%
		210/210	Mean ± SD: 45.3 ± 9.7	78.6%	Suspected ACHBLF: External cohort	HBV (100%)	0.0%

ACHBLF = acute-on-chronic hepatitis B liver failure, ACLF = acute-on-chronic liver failure, AD = acute decompensation, AIH = autoimmune hepatitis, AVB = acute variceal bleeding, BCS = Budd-Chiari syndrome, CLD = chronic liver disease, CPB = cardiopulmonary bypass, CTP = Child–Turcotte–Pugh, EPCS = emergency direct portacaval shunt, ERCP = endoscopic retrograde cholangiopancreatography, EST = endoscopic sclerotherapy, EVB = esophageal variceal bleeding, GVB = gastric variceal bleeding, HAV = hepatitis A virus, HBV = hepatitis B virus, HCC = hepatocellular carcinoma, HCV = hepatitis C virus, HDV = hepatitis D virus, HE = hepatic encephalopathy, HEV = hepatitis E virus, HVPG = hepatic venous pressure gradient, ICU = intensive care unit, LT = liver transplantation, MELD = model for end-stage liver disease, NA = not available, NAFL = nonalcoholic fatty liver, NASH = nonalcoholic steatohepatitis, NBC = N-butyl cyanoacrylate, OLT = orthotopic liver transplantation, P = prospective, PBC = primary biliary cirrhosis, PSC = primary sclerosing cholangitis, Pts = patients, R = retrospective, RCT = randomized controlled trials, SBE = spontaneous bacterial empyema, SD = standard deviation, SPH = symptomatic portal hypertension, TIPS = transjugular intrahepatic portosystemic shunt, UGIB = upper gastrointestinal bleeding, VB = variceal bleeding.

TABLE 2. Results of Comparison Between MELD and Child–Pugh Score: An Overview of Studies

First Author, year – Study Design	Study Population	Endpoint	Diagnostic Accuracy of Child–Pugh Score (95% CI)	Diagnostic Accuracy of MELD Score (95% CI)	*P* Value
An (2014) – R	Recurrent HE after embolization	2-year mortality	AUC = 0.99 (NA)	AUC = 1.0 (NA)	>0.05
		2-year recurrence of HE	AUC = 0.66 (NA)	AUC = 0.60 (NA)	>0.05
Angermayr (2003) – R	Elective TIPS	1-month mortality	AUC = 0.78 (NA)	AUC = 0.73 (NA)	>0.05
		3-month mortality	AUC = 0.70 (NA)	AUC = 0.72 (NA)	>0.05
		1-year mortality	AUC = 0.66 (NA)	AUC = 0.66 (NA)	>0.05
Arif (2012) – R	Patients who undergo heart surgery with cardiopulmonary bypass	30-day mortality	AUC = 0.60 ± 0.064 (NA)	AUC = 0.71 ± 0.06 (NA)	<0.05
Attia (2008) – R	Black African patients with cirrhosis	3-month mortality	AUC = 0.72 (0.64–0.80)	AUC = 0.75 (0.62–0.88)	0.68
		6-month mortality	AUC = 0.64 (0.54–0.74)	AUC = 0.62 (0.49–0.74)	0.67
		12-month mortality	AUC = 0.69 (0.60–0.78)	AUC = 0.64 (0.53–0.75)	0.38
Augustin (2009) – P	AVB	6-week mortality	AUC = 0.75 (0.67–0.83)	AUC = 0.74 (0.65–0.83)	NA
Bae (2007) – R	First episode of VB	6-month mortality	AUC = 0.81 (0.663–0.958)	AUC = 0.75 (0.603–0.901)	NA
		1-year mortality	AUC = 0.71 (0.549–0.872)	AUC = 0.66 (NS) (0.490–0.831)	NA
		2-year mortality	AUC = 0.62 (NS) (0.472–0.759)	AUC = 0.63 (NS) (0.491–0.772)	NA
Bang (2014) – P	Patients with CLD who undergo HVPG measurement	Prediction of HCC	AUC = 0.681 (NA)	AUC = 0.659 (NA)	NA
Befeler (2005) – R	Patients who undergo abdominal surgery	Poor outcome	AUC = 0.814 (NA)	AUC = 0.826 (NA)	NA
Benedeto-Stojanov (2009) – R	Patients with complications of liver disease	15-month mortality	AUC = 0.89 (NA)	AUC = 0.84 (NA)	NA
Bhise (2007) – R	Alcoholic cirrhotic patients	3-month mortality	AUC = 0.8343 (NA)	AUC = 0.873 (NA)	NA
		6-month mortality	AUC = 0.77 (NA)	AUC = 0.885 (NA)	NA
Bie (2007) – R	Decompensated cirrhosis	6-month mortality	AUC = 0.626 (0.580–0.688)	AUC = 0.729 (0.673–0.796)	<0.001
Bie (2009) – P	Liver cirrhosis	3-month mortality	AUC = 0.605 (0.543–0.658)	AUC = 0.828 (0.763–0.855)	<0.01
Biselli (2015) – P	MELD score <18 from Modena and Padua Centers (Training group)	3-month dropout	AUC = 0.888 (0.882–0.893)	AUC = 0.592 (0.586–0.598)	NA
		6-month dropout	AUC = 0.809 (0.805–0.814)	AUC = 0.648 (0.643–0.653)	NA
		12-month dropout	AUC = 0.775 (0.772–0.778)	AUC = 0.651 (0.647–0.655)	NA
	MELD score <18 from Bologna (Validation group)	3-month dropout	AUC = 0.659 (0.653–0.666)	AUC = 0.548 (0.541–0.554)	NA
		6-month dropout	AUC = 0.687 (0.681–0.692)	AUC = 0.518 (0.512–0.524)	NA
		12-month dropout	AUC = 0.687 (0.681–0.693)	AUC = 0.582 (0.575–0.588)	NA

First Author, year – Study Design	Study Population	Endpoint	Diagnostic Accuracy of Child–Pugh Score (95% CI)	Diagnostic Accuracy of MELD Score (95% CI)	*P* Value
Boin Ide (2008) – R	Adult patients who undergo LT	10-year mortality	NA (NA)	NA (NA)	NA
Botta (2003) – R	Liver cirrhosis	6-month mortality	AUC = 0.824 (NA)	AUC = 0.796 (NA)	NA
		1-year mortality	AUC = 0.691 (NA)	AUC = 0.675 (NA)	NA
Boursier (2009) – P	Whole liver cirrhosis	6-month mortality	AUC = 0.882 ± 0.03 (NA)	AUC = 0.866 ± 0.03 (NA)	0.305
	Decompensated cirrhosis	6-month mortality	AUC = 0.796 ± 0.04 (NA)	AUC = 0.800 ± 0.04 (NA)	0.902
Cerqueira (2012) – R	First episode of EVB	In-hospital mortality	AUC = 0.719 (0.585–0.853)	AUC = 0.760 (0.644–0.876)	NA
Chan (2006) – R	Chronic HBV	3-month mortality	AUC = 0.75 (0.70–0.80)	AUC = 0.65 (0.59–0.71)	<0.0001
		1-year mortality	AUC = 0.77 (0.72–0.81)	AUC = 0.63 (0.58–0.68)	<0.0001
	Non-HCC, Cirrhotic	3-month mortality	AUC = 0.81 (0.75–0.87)	AUC = 0.75 (0.66–0.84)	0.03
		1-year mortality	AUC = 0.82 (0.76–0.87)	AUC = 0.73 (0.67–0.80)	0.0014
	Non-HCC without lamivudine treatment	3-month mortality	AUC = 0.80 (0.73–0.87)	AUC = 0.77 (0.68–0.87)	0.32
		1-year mortality	AUC = 0.80 (0.75–0.86)	AUC = 0.77 (0.71–0.84)	0.16
	HCC	1-year mortality	AUC = 0.71 (0.59–0.83)	AUC = 0.61 (0.49–0.73)	0.037
	Non-HCC, noncirrhotic	1-year mortality	AUC = 0.68 (0.36–1.00)	AUC = 0.67 (0.35–0.99)	0.43
Chaurasia (2013) – P	Decompensated cirrhosis	In-hospital mortality	AUC = 0.738 (NA)	AUC = 0.864 (NA)	<0.05
Chawla (2011) – P	Liver cirrhosis	1-month mortality	AUC = 0.875 (0.794–0.932)	AUC = 0.920 (0.849–0.964)	0.44
		3-month mortality	AUC = 0.884 (0.806–0.939)	AUC = 0.967 (0.911–0.992)	0.05
		6-month mortality	AUC = 0.908 (0.835–0.956)	AUC = 0.977 (0.925–0.996)	0.05
	Alcohol-related	1-month mortality	AUC = 0.875 (0.742–0.954)	AUC = 0.944 (0.832–0.990)	0.29
		3-month mortality	AUC = 0.874 (0.741–0.954)	AUC = 0.955 (0.847–0.993)	0.18
		6-month mortality	AUC = 0.904 (0.779–0.971)	AUC = 0.993 (0.908–1.000)	0.08
	Nonalcoholic	1-month mortality	AUC = 0.851 (0.732–0.932)	AUC = 0.910 (0.804–0.969)	0.62
		3-month mortality	AUC = 0.896 (0.786–0.961)	AUC = 0.980 (0.901–0.997)	0.15
		6-month mortality	AUC = 0.911 (0.805–0.970)	AUC = 0.972 (0.890–0.996)	0.22
Chen (2011) – R	SBE	In-hospital mortality	AUC = 0.744 (NA)	AUC = 0.720 (NA)	NA
Chen (2013) – R	Patients with SPH who treated with TIPS	1-year mortality – Overall	AUC = 0.764 (NA)	AUC = 0.654 (NA)	NA
		1-year mortality – Na < 138	AUC = 0.663 (NS) (NA)	AUC = 0.564 (NS) (NA)	NA
		1-year mortality – Na ≥ 138	AUC = 0.806 (NA)	AUC = 0.685 (NA)	NA
Cho (2011) – R	Patients who undergo nonhepatic surgery under general anesthesia	1-month mortality	AUC = 0.866 (NA)	AUC = 0.738 (NA)	0.089
		3-month mortality	AUC = 0.859 (NA)	AUC = 0.761 (NA)	0.027
Choi (2009) – R	Liver cirrhosis	3-month cirrhotic complications of VB and HE	AUC = 0.654 (0.56–0.75)	AUC = 0.707 (0.62–0.80)	NA
Cholongitas (2008) – R	Patients who were first admitted to ICU	ICU or 6-weeks mortality – Scores calculated at 24 h	AUC = 0.75 (NA)	AUC = 0.78 (NA)	NA

First Author, year – Study Design	Study Population	Endpoint	Diagnostic Accuracy of Child–Pugh Score (95% CI)	Diagnostic Accuracy of MELD Score (95% CI)	*P* Value
		ICU or 6-weeks mortality – Scores calculated at 48 h	AUC = 0.78 (NA)	AUC = 0.86 (NA)	NA
Corneille (2011) – R	Trauma patients with liver dysfunction or cirrhosis	In-hospital mortality	AUC = 0.639 (NA)	AUC = 0.725 (NA)	0.38
Costa (2009) – R	Surgery	Peri-operative mortality – Overall	AUC = 0.72 (0.61–0.83)	AUC = 0.76 (0.64–0.89)	>0.05
		Peri-operative mortality – Elective surgery	AUC = 0.54 (NS) (0.24–0.84)	AUC = 0.61(NS) (0.27–0.94)	NA
Das (2010) – R	ICU patients	In-hospital mortality – Scores calculated on day 1	AUC = 0.76 (NA)	AUC = 0.77 (NA)	NA
		In-hospital mortality – Scores calculated after 3 days	AUC = 0.69 (NA)	AUC = 0.67 (NA)	NA
Degre (2004) – R	Patients who undergo first LT	3-month mortality	AUC = 0.726 ± 0.084 (NA)	AUC = 0.704 ± 0.084 (NA)	>0.05
Dhiman (2014) – P	Cirrhosis with AD	28-day mortality	AUC = 0.739 (NA)	AUC = 0.710 (NA)	NA
Duseja (2013) – P	ACLF	Short-term mortality	AUC = 0.61 (0.49–0.73)	AUC = 0.67 (0.56–0.78)	>0.05
Ecochard (2011) – R	LT	Mortality before LT	AUC = 0.70 (0.64–0.77)	AUC = 0.66 (0.59–0.72)	NA
		Mortality after LT	AUC = 0.45 (0.37–0.52)	AUC = 0.42 (0.35–0.49)	NA
		Short-term mortality after LT	AUC = 0.78 (0.72–0.84)	AUC = 0.73 (0.66–0.80)	NA
Emerson (2014) – P	ICU patients	ICU mortality	AUC = 0.70 (0.55–0.85)	AUC = 0.74 (0.61–0.88)	NA
Fede (2011) – R	Patients without infections or hemodynamic instability	Adrenal insufficiency	AUC = 0.78 (NA)	AUC = 0.75 (NA)	NA
Fejfar (2006) – R	Patients who underwent TIPS for refractory ascites	1-month mortality	AUC = 0.62* (NA)	AUC = 0.73 (NA)	NA
		3-month mortality	AUC = 0.67 (NA)	AUC = 0.73 (NA)	NA
		1-year mortality	AUC = 0.61 (NA)	AUC = 0.66 (NA)	>0.05
Flores- Rendon (2008) – R	Acute EVB	5-day failure to control bleeding	AUC = 0.693 (NS) (0.561–0.825)	AUC = 0.679 (NS) (0.495–0.863)	>0.05
		In-hospital mortality	AUC = 0.809 (0.710–0.907)	AUC = 0.88 (0.77–0.99)	<0.05
		Mortality related to EVB	AUC = 0.794 (0.676–0.913)	AUC = 0.905 (0.801–1.00)	>0.05†
Giannini (2004) – P	Liver cirrhosis	3-month mortality	AUC = 0.757 (0.679–0.825)	AUC = 0.947 (0.897–0.977)	0.012
		3-month mortality – Excluding serum creatinine levels ≥1.2 mg/dL	AUC = 0.787 (0.697–0.861)	AUC = 0.933 (0.867–0.972)	>0.05
Gomez (2009) – P	Liver cirrhosis	12-week mortality	AUC = 0.82 (0.71–0.89)	AUC = 0.82 (0.71–0.89)	>0.05
		52-week mortality	AUC = 0.84 (0.76–0.91)	AUC = 0.82 (0.73–0.89)	>0.05
		104-week mortality	AUC = 0.86 (0.78–0.91)	AUC = 0.82 (0.74–0.90)	>0.05
Gotthardt (2009) – R	Listed for single-organ LTx for nonfulminant liver disease	Mortality or removed for poor condition	AUC = 0.73 (NA)	AUC = 0.68 (NA)	0.091
Gotzberger (2012) – P	Liver cirrhosis	Death or 6-month survival	AUC = 0.677 (0.518–0.837)	AUC = 0.724 (0.575–0.873)	NA
Grunhage (2008) – P	Liver cirrhosis	6-month mortality	AUC = 0.72 (NA)	AUC = 0.78 (NA)	>0.05
		15-month mortality	AUC = 0.68 (NA)	AUC = 0.78 (NA)	>0.05
		24-month mortality	AUC = 0.70 (NA)	AUC = 0.79 (NA)	>0.05
Hassan (2013) – R	Liver cirrhosis	1-year mortality	AUC = 0.658 (NA)	AUC = 0.725 (NA)	<0.05
Hoteit (2008) – R	Surgery	Death or hepatic decompensation (30 postprocedure days)	AUC = 0.696 ± 0.070 (NA)	AUC = 0.755 ± 0.066 (NA)	0.2

First Author, year – Study Design	Study Population	Endpoint	Diagnostic Accuracy of Child–Pugh Score (95% CI)	Diagnostic Accuracy of MELD Score (95% CI)	*P* Value
Huo (2005) – P	Liver cirrhosis (CTP ≥ 7)	3-month mortality	AUC = 0.635 (NA)	AUC = 0.785 (NA)	>0.1
		6-month mortality	AUC = 0.607 (NA)	AUC = 0.714 (NA)	>0.1
		9-month mortality	AUC = 0.594 (NA)	AUC = 0.689 (NA)	>0.1
		12-month mortality	AUC = 0.592 (NA)	AUC = 0.681 (NA)	>0.1
	Subgroup: MELD score >14	3-month mortality	AUC = 0.543 (NA)	AUC = 0.715 (NA)	0.02
		6-month mortality	AUC = 0.536 (NA)	AUC = 0.705 (NA)	0.003
		9-month mortality	AUC = 0.507 (NA)	AUC = 0.737 (NA)	<0.001
		12-month mortality	AUC = 0.526 (NA)	AUC = 0.716 (NA)	<0.001
Huo (2006) – P	Liver cirrhosis (CTP ≥ 7)	3-month mortality	AUC = 0.809[‡] (0.769–0.845)	AUC = 0.872 (0.836–0.901)	0.069
		6-month mortality	AUC = 0.756 (0.713–0.796)	AUC = 0.837 (0.799–0.871)	0.008
Huo (2005) – P/R	Liver cirrhosis (CTP ≥ 7)	6-month mortality	AUC = 0.528 (0.475–0.581)	AUC = 0.718 (0.668–0.765)	0.004
		12-month mortality	AUC = 0.528 (0.472–0.583)	AUC = 0.744 (0.693–0.791)	<0.001
Hyun (2012) – R	HBV-related decompensated cirrhotic patients (CTP ≥ 7) who received antiviral therapy	6-month mortality	AUC = 0.913 (Score calculated at admission) (0.838–0.988)	AUC = 0.977 (Score calculated at 3-month) (0.940–1.014)	NA
Ishizu (2014) – R	Patients with AVB who were treated by endoscopic variceal ligation	30-day mortality	NA (NA)	NA (NA)	NA
Jalan (2014) – P	ACLF: Derivation set	1-month mortality	AUC = 0.668 (0.610–0.726)	AUC = 0.687 (0.635–0.738)	NA
		3-month mortality	AUC = 0.655 (0.605–0.705)	AUC = 0.659 (0.615–0.710)	NA
		6-month mortality	AUC = 0.642 (0.593–0.691)	AUC = 0.652 (0.607–0.697)	NA
		1-year mortality	AUC = 0.636 (0.588–0.683)	AUC = 0.638 (0.595–0.682)	NA
	ACLF: External validation	1-month mortality	AUC = 0.653 (0.603–0.704)	AUC = 0.645 (0.593–0.697)	NA
		3-month mortality	AUC = 0.647 (0.599–0.695)	AUC = 0.635 (0.585–0.684)	NA
Jiang (2009) – R	Liver cirrhosis	3-month mortality	AUC = 0.818 (0.747–0.889)	AUC = 0.804 (0.730–0.878)	>0.05
Jiang (2013) – R	Liver cirrhosis	Nonsufficient visualization of the biliary tree 20 min after Gd-EOB-DT-PA	AUC = 0.78 (NA)	AUC = 0.86 (NA)	NA
Kalabay (2007) – P	Alcoholic liver disease	1-year mortality	AUC = 0.865 ± 0.040 (0.787–0.943)	AUC = 0.739 ± 0.052 (0.637–0.871)	NA
		1–12-month mortality	AUC = 0.855 ± 0.050 (0.757–0.953)	AUC = 0.740 ± 0.058 (0.626–0.854)	NA
Khan (2009) – R	Infection (at admission or acquiring in hospital)	In-hospital mortality	AUC = 0.67 (NA)	AUC = 0.68 (NA)	NA

First Author, year – Study Design	Study Population	Endpoint	Diagnostic Accuracy of Child–Pugh Score (95% CI)	Diagnostic Accuracy of MELD Score (95% CI)	*P* Value
Kim (2014) – R	Patients who undergo elective extrahepatic surgery under general anesthesia	Operative mortality	NA (NA)	NA (NA)	NA
		Overall mortality	NA (NA)	NA (NA)	NA
Kim (2007) – R	Liver cirrhosis	3-month mortality	AUC = 0.828 (NA)	AUC = 0.845 (NA)	>0.05
		1-year mortality	AUC = 0.792 (NA)	AUC = 0.800 (NA)	>0.05
Kim (2014) – P	Cirrhotic patients with ascites	1-year mortality	AUC = 0.777 (0.635–0.883)	AUC = 0.769 (0.627–0.877)	NA
Koo (2013) – R	Liver cirrhosis	3-month mortality	AUC = 0.831 (NA)	AUC = 0.844 (NA)	>0.05
	Excluding CTP class A	3-month mortality	AUC = 0.765 (NA)	AUC = 0.795 (NA)	NA
	HBV-related	3-month mortality	AUC = 0.896 (NA)	AUC = 0.953 (NA)	NA
	HCV-related	3-month mortality	AUC = 0.943 (NA)	AUC = 0.947 (NA)	NA
	Alcohol-related	3-month mortality	AUC = 0.755 (NA)	AUC = 0.752 (NA)	NA
Krishnan (2013) – R	Single-organ LT for nonfulminant liver disease	3-month mortality	NA (NA)	NA (NA)	<0.001 MELD was better
		6-month mortality	NA (NA)	NA (NA)	>0.05
Kwon (2014) – P	Advanced liver cirrhosis (CTP > 6)	4-month mortality	AUC = 0.648 (0.569–0.727)	AUC = 0.691 (0.619–0.764)	NA
Lee (2002) – R	First episode of AVB	6-week mortality	AUC = 0.809 (0.720–0.898)	AUC = 0.804 (0.696–0.911)	>0.05
		1-year mortality	AUC = 0.765 (0.665–0.865)	AUC = 0.780 (0.676–0.883)	NA
Lee (2015) – R	Acutely decompensated alcoholic cirrhosis	4-week mortality	AUC = 0.705 (0.638–0.773)	AUC = 0.804 (0.747–0.861)	NA
	Supportive care group	1-week mortality	AUC = 0.668 (0.550–0.785)	AUC = 0.762 (0.664–0.860)	NA
		4-week mortality	AUC = 0.775 (0.712–0.838)	AUC = 0.852 (0.798–0.905)	NA
	LT group	12-week mortality	AUC = 0.891 (0.803–0.979)	AUC = 0.839 (0.668–1.000)	NA
Levesque (2012) – P	ICU patients	ICU mortality	AUC = 0.79 (0.74–0.84).	AUC = 0.82 (NA)	NA
Lim (2011) – R	Patients admitted for sepsis	In-hospital mortality	AUC = 0.934 (0.902–0.966)	AUC = 0.751 (0.671–0.831)	NA
Lim (2009) – R	Patients admitted for sepsis	In-hospital mortality	AUC = 0.933 (NA)	AUC = 0.757 (NA)	NA
Lv (2009) – R	Liver cirrhosis	1-month mortality	AUC = 0.722 (0.692–0.752)	AUC = 0.819 (0.753–0.885)	<0.01
		3-month mortality	AUC = 0.721 (0.689–0.753)	AUC = 0.820 (0.756–0.884)	<0.01
	Low MELD group (≤17)	1-month mortality	AUC = 0.754 (NA)	AUC = 0.608 (NA)	<0.01
		3-month mortality	AUC = 0.732 (NA)	AUC = 0.611 (NA)	<0.01
	High MELD group (>17)	1-month mortality	AUC = 0.710 (NA)	AUC = 0.737 (NA)	>0.05
		3-month mortality	AUC = 0.752 (NA)	AUC = 0.773 (NA)	>0.05
Mallaiyappan (2013) – R/P	Alcoholic liver disease[R]	1-month mortality	AUC = 0.67 (0.57–0.77)	AUC = 0.72 (0.62–0.81)	>0.05
		3-month mortality	AUC = 0.70 (0.60–0.80)	AUC = 0.73 (0.64–0.83)	>0.05
		6-month mortality	AUC = 0.75 (0.65–0.86)	AUC = 0.83 (0.74–0.93)	>0.05
	Alcoholic liver disease[P]	1-month mortality	AUC = 0.56 (0.44–0.67)	AUC = 0.86 (0.78–0.94)	<0.0001
		3-month mortality	AUC = 0.57 (0.45–0.67)	AUC = 0.80 (0.72–0.89)	<0.0058

First Author, year – Study Design	Study Population	Endpoint	Diagnostic Accuracy of Child–Pugh Score (95% CI)	Diagnostic Accuracy of MELD Score (95% CI)	*P* Value
		6-month mortality	AUC = 0.51 (0.39 – 0.63)	AUC = 0.89[††] (0.82–0.95)	<0.0001
Mishra (2007) – P	Liver cirrhosis	6-month mortality	AUC = 0.804 (NA)	AUC = 0.764 (NA)	>0.05
Moreno (2013) – P	Liver cirrhosis	1-year mortality or received LT	AUC = 0.80 (0.71–0.86)	AUC = 0.80 (0.70–0.86)	NA
Mouelhi (2010) – R	ICU patients	In-hospital mortality	AUC = 0.80 (NA)	AUC = 0.94 (NA)	<0.05
Nunes (2010) – P	HCV-related liver disease	1-year mortality	AUC = 0.93 (0.77–0.98)	AUC = 0.84 (0.67–0.93)	NA
		3-year mortality	AUC = 0.91 (0.79–0.96)	AUC = 0.84 (0.71–0.91)	NA
		5-year mortality	AUC = 0.84 (0.72–0.94)	AUC = 0.84 (0.74–0.90)	NA
Olmez (2012) – P	ICU patients	3-year mortality	AUC = 0.72[‖] (0.704–0.810)	AUC = 0.78[¶] (0.714–0.843)	NA
Orloff (2012) – RCT	EVB	Recurrent PSE – Overall	AUC = 0.62 (NA)	AUC = 0.53 (NA)	0.089
		Recurrent PSE – EST arm	AUC = 0.58 (NA)	AUC = 0.50 (NA)	0.490
		Recurrent PSE – EPCS arm	AUC = 0.66 (NA)	AUC = 0.55 (NA)	0.092
		Hospital readmission – Overall	AUC = 0.61 (NA)	AUC = 0.47 (NA)	0.009
		Hospital readmission – EST arm	AUC = 0.59 (NA)	AUC = 0.46 (NA)	0.012
		Hospital readmission – EPCS arm	AUC = 0.63 (NA)	AUC = 0.48 (NA)	0.240
		Rebleeding – EST arm	AUC = 0.61 (NA)	AUC = 0.56 (NA)	0.390
		6-month mortality – EPCS arm	AUC = 0.77 (NA)	AUC = 0.70 (NA)	>0.05
Papatheodoridis (2005) – R	Decompensated cirrhosis	3-month mortality	AUC = 0.73 (NA)	AUC = 0.79 (NA)	0.19
		6-month mortality	AUC = 0.71 (NA)	AUC = 0.77 (NA)	0.18
		12-month mortality	AUC = 0.68 (NA)	AUC = 0.78 (NA)	0.09
		24-month mortality – Overall	AUC = 0.70 (NA)	AUC = 0.79 (NA)	0.27
		24-month mortality – Unadjusted for GGT	AUC = 0.65 (NA)	AUC = 0.73 (NA)	>0.05
		24-month mortality – Adjusted for GGT	AUC = 0.77 (NA)	AUC = 0.81 (NA)	>0.05
Park (2014) – P	Patients with CLD who underwent HVPG measurement	Mortality	AUC = 0.766 (NA)	AUC = 0.733 (NA)	NA
Peng (2015) – R	Acute UGIB	In-hospital mortality	AUC = 0.796 (0.721–0.858)	AUC = 0.810 (0.736–0.870)	0.7241
Perkins (2004) – R	Patients who undergo cholecystectomy	Postoperative morbidity (90-day)	AUC = 0.839 (NA)	AUC = 0.938 (NA)	>0.05
Radha Krishna (2009) – R	ACLF with acute viral hepatitis due to HAV or HEV	3-month mortality	AUC = 0.631 (0.538–0.734)	AUC = 0.941 (0.897–0.985)	<0.05
Rahimi- Dehkordi (2014) – P	Waiting for LT	9-month mortality or removal from the waiting list due to poor condition	AUC = 0.75 (NA)	AUC = 0.69 (NA)	0.065
Raszeja-Wyszomirska (2009) – R	OLT	Early mortality	AUC = 0.758	AUC = 0.655 (NS)	NA
Reverter (2014) – P	Esophageal AVB	6-week mortality	AUC = 0.740 (0.639–0.841)	AUC = 0.795 (0.689–0.901)	0.2179
Ripoll (2007) – RCT	Compensated cirrhosis with portal hypertension but without varices	Developed decompensation	AUC = 0.61 (0.52–0.71)	AUC = 0.64 (0.55–0.72)	NA
Salerno (2002) – R	Elective TIPS	3-month mortality	AUC = 0.70 (0.52–0.89)	AUC = 0.84 (0.74–0.94)	0.038

First Author, year – Study Design	Study Population	Endpoint	Diagnostic Accuracy of Child–Pugh Score (95% CI)	Diagnostic Accuracy of MELD Score (95% CI)	*P* Value
		3-month mortality – Child B	NA (NA)	AUC = 0.75 (0.60–0.90)	NA
		3-month mortality – Child C	NA (NA)	AUC = 0.82 (0.60–1.00)	NA
		3-month mortality – Refractory ascites	NA (NA)	AUC = 0.77 (0.58–0.95)	NA
		3-month mortality – VB	NA (NA)	AUC = 0.84 (0.71–0.98)	NA
		6-month mortality	AUC = 0.69 (0.56–0.83)	AUC = 0.81 (0.70–0.91)	0.07
		12-month mortality	AUC = 0.66 (0.54–0.78)	AUC = 0.71 (0.58–0.84)	0.41
Schepke (2003) – P	TIPS	3-month mortality	AUC = 0.72 (0.60–0.84)	AUC = 0.71 (0.56–0.86)	>0.05
		1-year mortality	AUC = 0.67 (0.57–0.76)	AUC = 0.73 (0.64–0.82)	>0.05
		3-year mortality	AUC = 0.73 (0.63–0.84)	AUC = 0.74 (0.64–0.84)	>0.05
	TIPS for the treatment of intestinal bleeding	3-month mortality	AUC = 0.77 (0.63–0.91)	AUC = 0.77 (0.61–0.94)	>0.05
		1-year mortality	AUC = 0.67 (0.55–0.80)	AUC = 0.78 (0.67–0.89)	0.059
		3-year mortality	AUC = 0.70 (0.57–0.81)	AUC = 0.79 (0.68–0.90)	0.124
Seamon (2010) – R	Trauma patients with CLD	In-hospital mortality – CTP score	AUC = 0.75 (0.60–0.91)	AUC = 0.61 (NS) (0.44–0.79)	<0.05
		In-hospital mortality – CTP class	AUC = 0.76 (0.64–0.89)	AUC = 0.61 (NS) (0.44–0.79)	<0.05
		Hepatic complication – CTP score	AUC = 0.80 (0.61–0.98)	AUC = 0.74 (NS) (0.49–0.99)	<0.05
		Hepatic complication – CTP class	AUC = 0.79 (0.63–0.95)	AUC = 0.61 (NS) (0.49–0.99)	<0.05
Sempere (2009) – R	AVB	6-week mortality	AUC = 0.762 (0.682–0.842)	AUC = 0.804 (0.728–0.881)	<0.05
		3-month mortality	AUC = 0.760 (0.684–0.836)	AUC = 0.794 (0.720–0.868)	<0.05
		1-year mortality	AUC = 0.741 (0.668–0.814)	AUC = 0.766 (0.697–0.835)	<0.05
		36-week mortality[#]	AUC = 0.717 (0.645–0.788)	AUC = 0.737 (0.667–0.808)	<0.05
Serra (2004) – R	Decompensated cirrhosis	In-hospital mortality	AUC = 0.628 (0.527–0.729)	AUC = 0.757 (0.655–0.858)	>0.05
		3-month mortality	AUC = 0.613 (0.531–0.695)	AUC = 0.706 (0.629–0.783)	>0.05
Serste (2012) – P	Cirrhosis and refractory ascites	2-year mortality	AUC = 0.89 (0.85–0.94)	AUC = 0.58 (0.49–0.67)	<0.0001
Shaikh (2010) – Descriptive	Decompensated cirrhosis	Prolong hospitalization for more or less than 14 days or in-hospital mortality	AUC = 0.726 (0.633–0.82)	AUC = 0.642 (0.53–0.745)	NA
Sharma (2010) – P	Patients without recent UGIB or HE	Minimal HE	AUC = 0.585 (0.503–0.667)	AUC = 0.743 (0.670–0.816)	<0.05
Song (2011) – R	Patients who undergo intraabdominal surgery under generalized anesthesia	Mortality	AUC = 0.71 (0.62–0.83)	AUC = 0.82 (0.69–0.93)	<0.05
Song (2014) – R	AD	1-month mortality	AUC = 0.769 (NA)	AUC = 0.837 (NA)	0.016
		3-month mortality	AUC = 0.784 (NA)	AUC = 0.813 (NA)	NA
Stewart (2007) – R	TIPS	3-month mortality	AUC = 0.68 (NA)	AUC = 0.75 (NA)	NA
		1-year mortality	AUC = 0.67 (NA)	AUC = 0.75 (NA)	NA
	Decompensated cirrhosis	3-month mortality	AUC = 0.79 (NA)	AUC = 0.80 (NA)	NA

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		1-year mortality	AUC = 0.79 (NA)	AUC = 0.80 (NA)	NA
Su (2009) – R	Patients with PBC who undergo biopsy	Advanced fibrosis	AUC = 0.608 (NS) (0.393–0.823)	AUC = 0.617 (NS) (0.392–0.842)	NA
Suk (2014) – P	Patients with CLD who undergo HVPG measurement	Develop HCC	AUC = 0.681 (NA)	AUC = 0.659 (NA)	NA
Suman (2004) – R	Patients with undergo cardiac surgery using CPB	Mortality	AUC = 0.84 ± 0.09 (NA)	AUC = 0.87 ± 0.09 (NA)	0.72
		Hepatic decompensation	NA (NA)	NA (NA)	NA
Tacke (2007) – R	CLD evaluated for potential LT	Development of UGIB	AUC = 0.584 (NA)	AUC = 0.577 (NA)	NA
Takaya (2012) – R	Liver disease	1-year mortality	AUC = 0.769 (0.658–0.881)	AUC = 0.805 (0.695–0.915)	>0.05
		2-year mortality	AUC = 0.752 (0.645–0.859)	AUC = 0.805 (0.702–0.907)	>0.05
Tas (2012) – R	ICU patients	ICU mortality	AUC = 0.687 (0.573–0.801)	AUC = 0.766 (0.659–0.872)	NA
Tas (2012) – R	ICU patients	ICU mortality	NA (NA)	NA (NA)	NA
Teng (2014) – R	Acute GVB after emergent endoscopic NBC injection	6-week mortality	AUC = 0.848 (0.755–0.942)	AUC = 0.794 (0.690–0.897)	0.437
Theocharidou (2014) – R	ICU patients	In-hospital mortality – Overall	NA (NA)	NA (NA)	NA
		In-hospital mortality – Training group	AUC = 0.668 (NA)	AUC = 0.787 (NA)	NA
		In-hospital mortality – Validation group	AUC = 0.707 (NA)	AUC = 0.749 (NA)	NA
		In-hospital mortality – 2005–2012 year group	AUC = 0.68 (NA)	AUC = 0.73 (NA)	NA
Thielmann (2010) – R	Noncardiac LC, undergo open-heart surgery with the use of CPB	In-hospital mortality	AUC = 0.757 ± 0.070 (0.623–0.890)	AUC = 0.851 ± 0.050 (0.745–0.956)	0.17
Tu (2011) – P	ICU patients	In-hospital mortality	AUC = 0.714 ± 0.053 (0.611–0.817)	AUC = 0.865 ± 0.037 (0.792–0.938)	NA
Tzeng (2009) – R	Emergent TIPS for uncontrolled VB	1-month mortality	AUC = 0.74 (0.65–0.82)	AUC = 0.78 (0.69–0.85)	>0.05
		2-month mortality	AUC = 0.71 (0.62–0.80)	AUC = 0.78 (0.69–0.86)	>0.05
		1-year mortality	AUC = 0.73 (0.64–0.81)	AUC = 0.74 (0.65–0.82)	>0.05
Vanhuyse (2012) – R	Patients who underwent cardiac surgery	Operative mortality	AUC = 0.658 ± 0.10 (NA)	AUC = 0.691 ± 0.11 (NA)	0.8
Velayutham (2012) – R	Patients listed for single-organ LT for nonfulminant liver disease	Mortality or severe deterioration	NA (NA)	NA (NA)	>0.05
Viasus (2011) – P	Nonseverely immunosuppressed cirrhotic patients with pneumonia	30-day mortality or ICU admission	AUC = 0.761 (0.655–0.848)	AUC = 0.832 (0.736–0.904)	NA
Wang (2014) – P	After cessation of AVB by endoscopic therapy within 48 hours of admission	3-month rebleeding	AUC = 0.69 (0.64–0.73)	AUC = 0.77 (0.73–0.81)	<0.0001
		1-year rebleeding	AUC = 0.65 (0.60–0.70)	AUC = 0.80 (0.76–0.84)	<0.0001
		3-month rebleeding – associated mortality	AUC = 0.66 (0.61–0.70)	AUC = 0.75 (0.70–0.79)	0.0003

First Author, year – Study Design	Study Population	Endpoint	Diagnostic Accuracy of Child–Pugh Score (95% CI)	Diagnostic Accuracy of MELD Score (95% CI)	*P* Value
		1-year rebleeding – associated mortality	AUC = 0.68 (0.63–0.72)	AUC = 0.78 (0.74–0.82)	<0.0001
	HBV-associated	3-month rebleeding	AUC = 0.70 (0.65–0.75)	AUC = 0.77 (0.72–0.82)	0.002
		1-year rebleeding	AUC = 0.65 (0.59–0.70)	AUC = 0.77 (0.72–0.82)	<0.0001
		3-month rebleeding – associated mortality	AUC = 0.67 (0.62–0.72)	AUC = 0.76 (0.71–0.80)	0.003
		1-year rebleeding – associated mortality	AUC = 0.67 (0.61–0.72)	AUC = 0.76 (0.71–0.81)	0.0001
Wiesner (2003) – P	Patients with CLD added to OPTN liver waiting list	3-month mortality	AUC = 0.76 (0.74–0.79)	AUC = 0.83 (0.81–0.84)	<0.001
Wu (2015) – P	ACHBLF: Training cohort	3-month mortality	AUC = 0.738 (0.650–0.814)	AUC = 0.712 (0.623–0.791)	NA
	ACHBLF: Validation cohort	3-month mortality	AUC = 0.585 (0.478–0.686)	AUC = 0.689 (0.585–0.781)	NA
Xie (2013) – R	Alcoholic liver disease	In-hospital mortality	NA	NA	NA
		3-month mortality	NA	NA	NA
Xiong (2004) – R	Liver cirrhosis	3-month mortality	AUC = 0.745 (0.656–0.835)	AUC = 0.826 (0.752–0.900)	<0.05
		1-year mortality	AUC = 0.724 (0.646–0.802)	AUC = 0.758 (0.687–0.830)	>0.05
Zapata (2004) – R	LT	NA (NA)	NA (NA)	NA (NA)	NA
Zhang (2014) – R	TIPS	3-month mortality	NA (NA)	NA (NA)	>0.05
		1-year mortality	AUC = 0.74 (0.58–0.90)	AUC = 0.75 (0.61–0.88)	0.474
		2-year mortality	AUC = 0.70 (0.55–0.86)	AUC = 0.76 (0.64–0.89)	0.285
Zhang (2012) – R	Liver cirrhosis	3-month mortality	AUC = 0.770 (0.648–0.891)	AUC = 0.736 (0.609–0.863)	>0.05
		3-month mortality – Nonhemorrhage death group	AUC = 0.889 (0.794–0.983)	AUC = 0.869 (0.763–0.976)	<0.05
Zhang (2015) – R	Patients with choledocholithiasis who undergo ERCP for the first time	Incidence of complications – Overall	NA (NA)	AUC = 0.75 (0.63–0.87)	NA
		Incidence of complications – Male	AUC = 0.69 (NS) (0.53–0.85)	AUC = 0.77 (0.63–0.92)	NA
		Incidence of complications – Female	AUC = 0.71 (0.53–0.89)	AUC = 0.68 (NS) (0.48–0.89)	NA
		Incidence of complications – Jaundice	AUC = 0.53 (NS) (0.28–0.79)	AUC = 0.57 (NS) (0.31–0.83)	NA
		Incidence of complications – No-jaundice	AUC = 0.72 (0.58–0.86)	AUC = 0.79 (0.64–0.94)	NA
Zhang (2005) – R	Liver cirrhosis	3-month mortality	AUC = 0.82 (0.60–1.05)	AUC = 0.95 (0.87–1.03)	>0.05
		6-month mortality	AUC = 0.74** (0.63–0.85)	AUC = 0.85 (0.78–0.93)	<0.05
		1-year mortality	AUC = 0.78§ (0.69–0.86)	AUC = 0.83 (0.76–0.90)	<0.05
		2-year mortality	AUC = 0.79 (0.73–0.84)	AUC = 0.80 (0.74–0.85)	>0.05
		3-year mortality	AUC = 0.78 (0.73–0.83)	AUC = 0.82 (0.77–0.87)	<0.05
		4-year mortality	AUC = 0.79 (0.74–0.84)	AUC = 0.82 (0.76–0.87)	<0.05
Zhang (2012) – R	Liver cirrhosis	6-month mortality	AUC = 0.718 (NA)	AUC = 0.708 (NA)	NA
		1-year mortality	AUC = 0.679 (NA)	AUC = 0.657 (NA)	NA

First Author, year – Study Design	Study Population	Endpoint	Diagnostic Accuracy of Child–Pugh Score (95% CI)	Diagnostic Accuracy of MELD Score (95% CI)	*P* Value
Zheng (2011) – R	Suspected ACHBLF	3-month mortality – Internal cohort	AUC = 0.718 (0.657–0.774)	AUC = 0.694 (0.632–0.752)	NA
		3-month mortality – External cohort	AUC = 0.601 (0.532–0.668)	AUC = 0.775 (0.712–0.830)	NA

ACHBLF = acute-on-chronic hepatitis B liver failure, ACLF = acute-on-chronic liver failure, AD = acute decompensation, AUC = area under the curve, AVB = acute variceal bleeding, CI = confidence interval, CLD = chronic liver disease, CPB = cardiopulmonary bypass, CTP = Child–Turcotte–Pugh, EPCS = emergency direct portacaval shunt, ERCP = endoscopic retrograde cholangiopancreatography, EST = endoscopic sclerotherapy, EVB = esophageal variceal bleeding, GGT = gamma-glutamyl-transpeptidase, GVB = gastric variceal bleeding, HAV = hepatitis A virus, HBV = hepatitis B virus, HCC = hepatocellular carcinoma, HCV = hepatitis C virus, HE = hepatic encephalopathy, HEV = hepatitis E virus, HVPG = hepatic venous pressure gradient, ICU = intensive care unit, LC = liver cirrhosis, LT = liver transplantation, MELD = model for end-stage liver disease, NA = not available, NBC = N-butyl cyanoacrylate, NS = not significant, OLT = orthotopic liver transplantation, P = prospective, PBC = primary biliary cirrhosis, PSE = portal-systemic encephalopathy, R = retrospective, RCT = randomized controlled trials, SBE = spontaneous bacterial empyema, SD = standard deviation, SPH = symptomatic portal hypertension, TIPS = transjugular intrahepatic portosystemic shunt, UGIB = upper gastrointestinal bleeding, VB = variceal bleeding.

[*] 0.62 was recorded in the table, but 0.63 was recorded in the abstract.

[†] >0.05 was recorded in the figure, but <0.05 was recorded in the article.

[‡] 0.809 was recorded in the article, 0.808 was recorded in the table.

[§] 0.78 was recorded in the table, but 0.74 was recorded in the abstract.

[‖] 0.72 was recorded in the table, but 0.724 was recorded in the discussion.

[¶] 0.78 was recorded in the table, but 0.790 was recorded in the discussion.

[#] 36-week mortality was recorded in the original paper, but it should be revised as 36-month mortality.

[**] 0.74 was recorded in the table, but 0.78 was recorded in the abstract.

[††] 0.89 was recorded in the table, but 0.88 was recorded in the article.

TABLE 3. Quality Assessment

	Risk of Bias (LR/UR/HR)				Applicability Concerns (LC/UC/HC)		
First Author, year – Study Design	**Patient Selection**	**Index Test**	**Reference Standard**	**Flow and Timing**	**Patient Selection**	**Index Test**	**Reference Standard**
An (2014) – R	LR	LR	LR	UR	LC	HC	HC
Angermayr (2003) – R	UR	LR	LR	UR	LC	HC	HC
Arif (2012) – R	UR	LR	LR	LR	LC	HC	HC
Attia (2008) – R	UR	LR	LR	LR	HC	HC	HC
Augustin (2009) – P	LR	LR	LR	LR	LC	HC	HC
Bae (2007) – R	UR	LR	LR	LR	LC	HC	HC
Bang (2014) – P	UR	LR	LR	UR	LC	UC	HC
Befeler (2005) – R	UR	LR	LR	UR	LC	HC	HC
Benedeto-Stojanov (2009) – R	UR	LR	LR	LR	HC	HC	HC
Bhise (2007) – R	UR	LR	LR	LR	LC	HC	HC
Bie (2007) – R	UR	LR	LR	LR	LC	HC	HC
Bie (2009) – P	UR	LR	LR	LR	HC	HC	HC
Biselli (2015) – P	LR	LR	LR	UR	LC	HC	HC
Boin Ide (2008) – R	UR	LR	LR	UR	LC	HC	HC
Botta (2003) – R	LR	LR	LR	LR	HC	HC	HC
Boursier (2009) – P	LR	LR	LR	LR	HC	HC	HC
Cerqueira (2012) – R	UR	LR	LR	LR	LC	HC	HC
Chan (2006) – R	LR	LR	LR	UR	LC	HC	HC
Chaurasia (2013) – P	LR	LR	LR	LR	LC	HC	HC
Chawla (2011) – P	LR	LR	LR	LR	HC	HC	HC
Chen (2011) – R	UR	LR	LR	LR	LC	HC	HC
Chen (2013) – R	UR	LR	LR	LR	LC	HC	HC
Cho (2011) – R	UR	LR	LR	LR	LC	HC	HC
Choi (2009) – R	LR	LR	LR	UR	HC	HC	HC
Cholongitas (2008) – R	LR	LR	LR	LR	LC	HC	HC
Corneille (2011) – R	UR	LR	LR	UR	LC	HC	HC
Costa (2009) – R	UR	LR	LR	LR	LC	HC	HC
Das (2010) – R	UR	LR	LR	LR	LC	HC	HC
Degre (2004) – R	LR	LR	LR	UR	LC	HC	HC
Dhiman (2014) – P	UR	LR	LR	LR	LC	HC	HC
Duseja (2013) – P	LR	LR	LR	LR	LC	HC	HC
Ecochard (2011) – R	LR	LR	LR	LR	LC	HC	HC
Emerson (2014) – P	UR	LR	LR	LR	LC	HC	HC
Fede (2011) – R	LR	LR	LR	UR	LC	LC	HC
Fejfar (2006) – R	UR	LR	LR	LR	LC	HC	HC
Flores-Rendon (2008) – R	UR	LR	LR	LR	LC	HC	HC
Giannini (2004) – P	UR	LR	LR	LR	HC	HC	HC
Gomez (2009) – P	LR	LR	LR	UR	HC	HC	HC
Gotthardt (2009) – R	LR	LR	LR	UR	LC	HC	HC
Gotzberger (2012) – P	LR	LR	LR	LR	HC	HC	HC
Grunhage (2008) – P	UR	LR	LR	LR	HC	HC	HC
Hassan (2013) – R	LR	LR	LR	LR	HC	HC	HC
Hoteit (2008) – R	UR	LR	LR	UR	LC	HC	HC
Huo (2005) – P	UR	LR	LR	LR	LC	HC	HC
Huo (2006) – P	UR	LR	LR	LR	LC	HC	HC
Huo (2005) – P/R	UR	LR	LR	LR	LC	HC	HC
Hyun (2012) – R	LR	LR	LR	UR	LC	HC	HC
Ishizu (2014) – R	UR	LR	LR	LR	LC	HC	HC
Jalan (2014) – P	UR	LR	LR	LR	LC	HC	HC
Jiang (2009) – R	UR	LR	LR	LR	HC	HC	HC
Jiang (2013) – R	UR	LR	UR	LR	HC	LC	LC
Kalabay (2007) – P	UR	LR	LR	UR	LC	HC	HC
Khan (2009) – R	UR	LR	LR	LR	LC	HC	HC
Kim (2014) – R	UR	LR	LR	UR	LC	HC	HC
Kim (2007) – R	UR	LR	LR	LR	HC	HC	HC

First Author, year – Study Design	Risk of Bias (LR/UR/HR)				Applicability Concerns (LC/UC/HC)		
	Patient Selection	Index Test	Reference Standard	Flow and Timing	Patient Selection	Index Test	Reference Standard
Kim (2014) – P	LR	LR	LR	LR	LC	HC	HC
Koo (2013) – R	UR	LR	LR	LR	HC	HC	HC
Krishnan (2013) – R	LR	LR	LR	UR	LC	HC	HC
Kwon (2014) – P	UR	LR	LR	LR	LC	HC	HC
Lee (2002) – R	UR	LR	LR	LR	LC	HC	HC
Lee (2015) – R	UR	LR	LR	LR	LC	HC	HC
Levesque (2012) – P	LR	LR	LR	LR	LC	HC	HC
Lim (2011) – R	UR	LR	LR	LR	LC	HC	HC
Lim (2009) – R	UR	LR	LR	LR	LC	HC	HC
Lv (2009) – R	UR	LR	LR	LR	HC	HC	HC
Mallaiyappan (2013) – R/P	UR	LR	LR	LR	LC	HC	HC
Mishra (2007) – P	UR	LR	LR	LR	HC	HC	HC
Moreno (2013) – P	LR	LR	LR	LR	LC	HC	HC
Mouelhi (2010) – R	UR	LR	LR	LR	LC	HC	HC
Nunes (2010) – P	UR	LR	LR	UR	LC	HC	HC
Olmez (2012) – P	UR	LR	LR	LR	LC	HC	HC
Orloff (2012) – RCT	LR	LR	UR	UR	LC	HC	HC
Papatheodoridis (2005) – R	UR	LR	LR	LR	LC	HC	HC
Park (2014) – P	UR	LR	LR	UR	HC	HC	HC
Peng (2015) – R	UR	LR	LR	LR	LC	HC	HC
Perkins (2004) – R	UR	LR	LR	LR	LC	HC	HC
Radha Krishna (2009) – R	UR	LR	LR	LR	LC	HC	HC
Rahimi-Dehkordi (2014) – P	UR	LR	LR	LR	LC	HC	HC
Raszeja-Wyszomirska (2009) – R	LR	LR	LR	LR	LC	HC	HC
Reverter (2014) – P	UR	LR	LR	LR	LC	HC	HC
Ripoll (2007) – RCT	LR	LR	LR	LR	LC	HC	HC
Salerno (2002) – R	LR	LR	LR	UR	LC	HC	HC
Schepke (2003) – P	LR	LR	LR	LR	LC	HC	HC
Seamon (2010) – R	LR	LR	LR	LR	LC	HC	HC
Sempere (2009) – R	UR	LR	LR	LR	LC	HC	HC
Serra (2004) – R	LR	LR	LR	LR	LC	HC	HC
Serste (2012) – P	LR	LR	LR	LR	LC	HC	HC
Shaikh (2010) – Descriptive	LR	LR	LR	LR	LC	HC	HC
Sharma (2010) – P	LR	LR	LR	LR	LC	HC	HC
Song (2011) – R	UR	LR	LR	LR	LC	HC	HC
Song (2014) – R	LR	LR	LR	LR	LC	HC	HC
Stewart (2007) – R	UR	LR	LR	LR	HC	HC	HC
Su (2009) – R	LR	LR	LR	LR	LC	HC	HC
Suk (2014) – P	UR	LR	LR	UR	LC	HC	HC
Suman (2004) – R	UR	LR	LR	LR	LC	HC	HC
Tacke (2007) – R	LR	LR	LR	UR	LC	HC	HC
Takaya (2012) – R	UR	LR	LR	UR	HC	HC	HC
Tas (2012) – R	UR	LR	LR	LR	LC	HC	HC
Tas (2012) – R	UR	LR	LR	LR	LC	HC	HC
Teng (2014) – R	UR	LR	LR	LR	LC	HC	HC
Theocharidou (2014) – R	LR	LR	LR	LR	LC	HC	HC
Thielmann (2010) – R	LR	LR	LR	LR	LC	HC	HC
Tu (2011) – P	LR	LR	LR	LR	LC	HC	HC
Tzeng (2009) – R	LR	LR	LR	LR	LC	HC	HC
Vanhuyse (2012) – R	UR	LR	LR	LR	LC	HC	HC
Velayutham (2012) – R	LR	LR	LR	LR	LC	HC	HC
Viasus (2011) – P	LR	LR	LR	LR	LC	HC	HC
Wang (2014) – P	LR	LR	LR	LR	LC	HC	HC
Wiesner (2003) – P	UR	LR	LR	LR	LC	HC	HC
Wu (2015) – P	UR	LR	LR	LR	LC	HC	HC
Xie (2013) – R	LR	LR	LR	UR	LC	HC	HC
Xiong (2004) – R	UR	LR	LR	LR	HC	HC	HC
Zapata (2004) – R	LR	LR	LR	LR	LC	HC	HC

First Author, year – Study Design	Risk of Bias (LR/UR/HR)				Applicability Concerns (LC/UC/HC)		
	Patient Selection	Index Test	Reference Standard	Flow and Timing	Patient Selection	Index Test	Reference Standard
Zhang (2014) – R	LR	LR	LR	UR	LC	HC	HC
Zhang (2012) – R	UR	LR	LR	LR	HC	HC	HC
Zhang (2015) – R	LR	LR	LR	LR	LC	HC	HC
Zhang (2005) – R	UR	LR	LR	UR	HC	HC	HC
Zhang (2012) – R	UR	LR	LR	LR	HC	HC	HC
Zheng (2011) – R	LR	LR	LR	LR	LC	HC	HC

Patient selection – Question 1: Could the selection of patients have introduced bias? Question 2: Was a case–control design avoided? Question 3: Did the study avoid inappropriate exclusions? Applicability concerns: Are there concerns that the included patients and setting do not match the review question? Index test – Question 1: Were the index test results interpreted without knowledge of the results of the reference standard? Question 2: If a threshold was used, was it prespecified? Applicability concerns: Are there concerns that the index test, its conduct, or its interpretation differ from the review question? Reference standard – Question 1: Is the reference standard likely to correctly classify the target condition? Question 2: Were the reference standard results interpreted without knowledge of the results of the index test? Applicability concerns: Are there concerns that the target condition as defined by the reference standard does not match the question? Flow and timing – Question 1: Was there an appropriate interval between the index test and reference standard and did all patients receive the same reference standard? Question 2: Were all patients included in the analysis? HC = high concern, LC = low concern, LR = low risk, P = prospective, R = retrospective, RCT = randomized controlled trials, UC = unknown concern, UR = unclear risk.

Meta-analyses were performed according to the clinical presentations, etiology of liver diseases, patients' conditions, treatment options, and endpoints (Table 4).

Subgroup Analysis According to the Clinical Presentations

Two studies were eligible for the subgroup meta-analysis to compare the diagnostic accuracy of Child–Pugh versus MELD score in patients with ACLF.[40,119] The mean AUSROC of MELD score was larger than that of Child–Pugh score. There was no statistically significant diagnostic threshold effect in the meta-analysis of Child–Pugh or MELD score. The 95%CIs of DORs, NLRs, and PLRs were overlapped between them. But the 95%CIs of sensitivities and specificities were not overlapped. Child–Pugh score had a higher summary sensitivity than MELD score, but MELD score had a higher summary specificity than Child–Pugh score.

Four studies were eligible for the subgroup meta-analysis to compare the diagnostic accuracy of Child–Pugh versus MELD score in patients with UGIB.[84,94,109,117] The mean AUSROC of MELD score was larger than that of Child–Pugh score. There was a statistically significant diagnostic threshold effect in the meta-analysis of MELD score. Thus, DOR, NLR, PLR, sensitivity, or specificity of MELD score was not calculated.

Subgroup Analysis According to the Etiology of Liver Diseases

Two studies were eligible for the subgroup meta-analysis to compare the diagnostic accuracy of Child–Pugh versus MELD score in patients with alcohol alone related liver cirrhosis.[19,61] The mean AUSROC of Child–Pugh score was larger than that of MELD score. There was no statistically significant diagnostic threshold effect in the meta-analysis of Child–Pugh or MELD score. The 95%CIs of DORs, NLRs, PLRs, sensitivities, and specificities were overlapped between them.

Two studies were eligible for the subgroup meta-analysis to compare the diagnostic accuracy of Child–Pugh versus MELD score in patients with hepatitis B virus alone related liver cirrhosis.[56,119] The mean AUSROC of MELD score was larger than that of Child–Pugh score. There was a statistically significant diagnostic threshold effect in the meta-analysis of MELD score. Thus, DOR, NLR, PLR, sensitivity, or specificity of MELD score was not calculated.

Subgroup Analysis According to the Patients' Conditions

Six studies were eligible for the subgroup meta-analysis to compare the diagnostic accuracy of Child–Pugh versus MELD score in patients admitted to ICU.[42,80,107,108,110,112] The mean AUSROC of MELD score was larger than that of Child–Pugh score. There was no statistically significant diagnostic threshold effect in the meta-analysis of Child–Pugh or MELD score. The 95%CIs of DORs, PLRs, and specificities were overlapped between them. But the 95%CIs of NLRs and sensitivities were not overlapped. MELD score had a smaller summary NLR and a higher summary sensitivity than Child–Pugh score.

Four studies were eligible for the subgroup meta-analysis to compare the diagnostic accuracy of Child–Pugh versus MELD score in LT candidates.[48,67,87,115] The mean AUSROC of MELD score was larger than that of Child–Pugh score. There was no statistically significant diagnostic threshold effect in the meta-analysis of Child–Pugh or MELD score. The 95%CIs of DORs, NLRs, PLRs, sensitivities, and specificities were overlapped between them.

Subgroup Analysis According to the Treatment Options

Five studies were eligible for the subgroup meta-analysis to compare the diagnostic accuracy of Child–Pugh versus MELD score in patients who underwent surgery.[17,32,52,104,111] The mean AUSROC of Child–Pugh score was larger than that of MELD score. There was no statistically significant diagnostic threshold effect in the meta-analysis of Child–Pugh or MELD score. The 95%CIs of DORs, NLRs, PLRs, and sensitivities were overlapped between them. But the 95%CIs of specificities were not overlapped. Child–Pugh score had a higher summary specificity than MELD score.

TABLE 4. Results of Meta-Analyses

Subgroups	No. Total Studies	No. Groups Analyzed	Prognostic Index	AUC ± SE	Threshold Analysis (*P* Value)	Diagnostic OR (95% CI)	Negative LR (95% CI)	Positive LR (95% CI)	Sensitivity (95% CI)	Specificity (95% CI)
Subgroup according to clinical presentations										
ACLF	2	3	Child	0.5278 ± 0.0954	0.667	4.68 (1.63–13.45)	0.36 (0.16–0.83)	1.66 (1.37–2.01)	0.81 (0.73–0.87)	0.51 (0.43–0.58)
			MELD	0.7247 ± 0.0418	0.667	5.20 (3.13–8.64)	0.51 (0.41–0.64)	2.59 (1.51–4.43)	0.63 (0.54–0.71)	0.77 (0.70–0.83)
VB	4	8	Child	0.7445 ± 0.0203	0.058	4.76 (3.56–6.37)	0.50 (0.42–0.60)	2.26 (1.79–2.86)	0.67 (0.62–0.71)	0.63 (0.60–0.65)
			MELD	0.7875 ± 0.0200	0.000	NA	NA	NA	NA	NA
Subgroup according to etiology of liver diseases										
Alcohol	2	4	Child	0.8317 ± 0.0406	0.600	9.81 (5.25–18.30)	0.34 (0.24–0.50)	3.21 (2.44–4.22)	0.74 (0.63–0.83)	0.76 (0.71–0.82)
			MELD	0.8182 ± 0.0393	0.400	7.91 (2.64–23.69)	0.43 (0.23–0.79)	3.11 (1.96–4.95)	0.68 (0.56–0.78)	0.77 (0.71–0.82)
HBV	2	3	Child	0.4994 ± 0.1781	0.667	8.96 (2.00–40.03)	0.22 (0.06–0.79)	2.12 (1.35–3.34)	0.88 (0.80–0.94)	0.59 (0.52–0.66)
			MELD	0.9524 ± 0.0470	0.000	NA	NA	NA	NA	NA
Subgroup according to patient conditions										
ICU	6	6	Child	0.7531 ± 0.0313	0.872	4.97 (3.04–8.14)	0.48 (0.36–0.65)	2.26 (1.81–2.83)	0.66 (0.61–0.71)	0.70 (0.66–0.75)
			MELD	0.8454 ± 0.0384	0.784	9.61 (6.66–13.86)	0.29 (0.23–0.35)	2.67 (2.19–3.26)	0.80 (0.76–0.84)	0.70 (0.66–0.75)
LT candidates	4	4	Child	0.8062 ± 0.0466	0.600	10.89 (4.36–27.21)	0.32 (0.22–0.47)	3.42 (2.01–5.80)	0.76 (0.69–0.83)	0.76 (0.72–0.79)
			MELD	0.8547 ± 0.0764	0.200	12.47 (3.28–47.38)	0.29 (0.14–0.57)	3.45 (1.71–6.95)	0.80 (0.73–0.86)	0.73 (0.70–0.77)
Subgroup according to treatment options										
Surgery	5	6	Child	0.8342 ± 0.0322	0.468	11.10 (6.01–20.49)	0.38 (0.19–0.75)	3.71 (2.29–6.03)	0.70 (0.61–0.79)	0.82 (0.79–0.84)
			MELD	0.7824 ± 0.0435	0.125	6.52 (3.79–11.20)	0.43 (0.33–0.58)	2.70 (2.02–3.62)	0.70 (0.61–0.79)	0.71 (0.68–0.73)
TIPS	2	2	Child	NA	NA	7.77 (4.37–13.84)	0.71 (0.61–0.82)	5.47 (3.49–8.57)	0.34 (0.24–0.45)	0.94 (0.91–0.96)
			MELD	NA	NA	11.59 (4.22–31.83)	0.68 (0.58–0.80)	7.82 (3.35–18.25)	0.35 (0.26–0.47)	0.95 (0.92–0.96)
Subgroup according to endpoints										
In-hospital mortality	5	5	Child	0.7051 ± 0.0345	0.037	NA	NA	NA	NA	NA
			MELD	0.7437 ± 0.1144	0.505	8.17 (3.68–18.14)	0.32 (0.20–0.51)	2.59 (1.84–3.66)	0.75 (0.71–0.79)	0.66 (0.62–0.69)
3-month mortality	8	9	Child	0.7903 ± 0.0255	0.025	NA	NA	NA	NA	NA
			MELD	0.7936 ± 0.0254	0.010	NA	NA	NA	NA	NA
6-month mortality	7	7	Child	0.8867 ± 0.0228	0.008	NA	NA	NA	NA	NA
			MELD	0.8896 ± 0.0343	0.760	21.67 (7.45–63.03)	0.23 (0.11–0.46)	4.47 (3.00–6.66)	0.73 (0.67–0.79)	0.81 (0.79–0.84)
12-month mortality	8	8	Child	0.7421 ± 0.0270	0.233	5.25 (3.52–7.82)	0.50 (0.39–0.64)	2.54 (1.86–3.46)	0.58 (0.54–0.63)	0.72 (0.69–0.75)
			MELD	0.7420 ± 0.0375	0.139	5.01 (3.23–7.77)	0.56 (0.46–0.67)	2.51 (1.86–3.39)	0.56 (0.52–0.61)	0.75 (0.72–0.78)

ACLF = acute-on-chronic liver failure, AUC = area under the curve, CI = confidence interval, HBV = hepatitis B virus, ICU = intensive care unit, LR = likelihood ratio, LT = liver transplantation, MELD = model for end-stage liver disease, NA = not available, OR = odds ratio, SE = standard error, TIPS = transjugular intrahepatic portosystemic shunt, VB = variceal bleeding.

Two studies were eligible for the subgroup meta-analysis to compare the diagnostic accuracy of Child–Pugh versus MELD score in patients who underwent TIPS.[11,91] Because only 2 comparisons were eligible for the subgroup meta-analysis, the mean AUSROCs of Child–Pugh and MELD scores could not be calculated. The 95%CIs of DORs, NLRs, PLRs, sensitivities, and specificities were overlapped between them.

Subgroup Analysis According to the Endpoints

Five studies were eligible for the subgroup meta-analysis to compare the diagnostic accuracy of Child–Pugh versus MELD score for predicting the in-hospital mortality.[62,84,110–112] The mean AUSROC of MELD score was larger than that of Child–Pugh score. There was a statistically significant diagnostic threshold effect in the meta-analysis of Child–Pugh score. DOR, NLR, PLR, sensitivity, or specificity of Child–Pugh score was not calculated.

Eight studies were eligible for the subgroup meta-analysis to compare the diagnostic accuracy of Child–Pugh versus MELD score for predicting the 3-month mortality.[11,19,32,74,91,94,117,119] The mean AUSROC of MELD score was larger than that of Child–Pugh score. There were statistically significant diagnostic threshold effects in the meta-analyses of Child–Pugh and MELD scores. DORs, NLRs, PLRs, sensitivities, or specificities of Child–Pugh and MELD scores were not calculated.

Seven studies were eligible for the subgroup meta-analysis to compare the diagnostic accuracy of Child–Pugh versus MELD score for predicting the 6-month mortality.[19,24,25,56,67,76,127] The mean AUSROC of MELD score was larger than that of Child–Pugh score. There was a statistically significant diagnostic threshold effect in the meta-analysis of Child–Pugh score. DOR, NLR, PLR, sensitivity, or specificity of Child–Pugh score was not calculated.

Eight studies were eligible for the subgroup meta-analysis to compare the diagnostic accuracy of Child–Pugh versus MELD score for predicting the 12-month mortality.[13,24,61,65,77,94,117,127] The mean AUSROC of Child–Pugh score was larger than that of MELD score. There was no statistically significant diagnostic threshold effect in the meta-analysis of Child–Pugh or MELD score. The 95%CIs of DORs, NLRs, PLRs, sensitivities, and specificities were overlapped between them.

DISCUSSION

To our knowledge, this is the most comprehensive review to evaluate the diagnostic accuracy of Child–Pugh and MELD scores in patients with liver cirrhosis. Indeed, several previous narrative reviews regarding their prognostic values had been published by top experts.[129–131] By comparison, our study employed a systematic search strategy to maximize the number of relevant papers. Several additional strengths included: the study and patient characteristics were systematically analyzed; the study quality was carefully evaluated; the clinical significance of Child–Pugh and MELD scores was further subdivided according to the different study population; and the meta-analysis was employed to synthesize the statistical results. Some remarkable findings should be summarized as follows.

First, in patients with ACLF, Child–Pugh score had a significantly higher sensitivity than MELD score, because the 95%CIs were not overlapped among them and the lower limit of 95%CI of Child–Pugh score was higher than the upper limit of 95%CI of MELD score ($0.73 > 0.71$); by contrast, MELD score had a significantly higher specificity than Child–Pugh score, because the 95%CIs were not overlapped among them and the lower limit of 95%CI of MELD score was higher than the upper limit of 95%CI of Child–Pugh score ($0.70 > 0.58$). These findings suggested that Child–Pugh score might have a better discriminative ability to predict the probability of developing some endpoint events in patients with ACLF, and that MELD score might have a better discriminative ability to predict the probability of free of developing some endpoint events in such patients.

Second, in patients admitted to ICU, MELD score had a significantly smaller NLR than Child–Pugh score, because the 95%CIs were not overlapped among them and the upper limit of 95%CI of MELD score was smaller than the lower limit of 95%CI of Child–Pugh score ($0.35 < 0.36$). MELD score also had a significantly higher sensitivity than Child–Pugh score, because the 95%CIs were not overlapped among them and the lower limit of 95%CI of MELD score was higher than the upper limit of 95%CI of Child–Pugh score ($0.76 > 0.71$). These findings suggested that MELD score might have a better discriminative ability to predict the probability of developing some endpoint events in such patients.

Third, in patients undergoing surgery, Child–Pugh score had a significantly higher specificity than MELD score, because the 95%CIs were not overlapped among them and the lower limit of 95%CI of Child–Pugh score was higher than the upper limit of 95%CI of MELD score ($0.79 > 0.73$). These findings suggested that Child–Pugh score might have a better discriminative ability to predict the probability of free of developing some endpoint events in such patients.

Fourth, Child–Pugh and MELD scores had statistically similar discriminative abilities in some subgroups (i.e., patients with alcohol alone related liver cirrhosis, LT candidates, patients undergoing TIPS, and 12-month mortality as the endpoint).

Fifth, because of statistically significant diagnostic threshold effects, DORs, NLRs, PLRs, sensitivities, or specificities could not be compared in some subgroups (i.e., patients with acute gastrointestinal bleeding, patients with hepatitis B virus alone related liver cirrhosis, in-hospital mortality as the endpoint, 3-month mortality as the endpoint, and 6-month mortality as the endpoint).

Our study had 2 major limitations. First, although a great number of papers were included in the systematic review, not all included studies were eligible for our meta-analysis. Additionally, in some subgroup analyses, DORs, NLRs, PLRs, sensitivities, or specificities were not available. Thus, the combination of data from some selected papers could result in the potential bias. Second, the cut-off values of Child–Pugh and MELD scores for the assessment of prognosis were different among included studies. Therefore, we could not obtain any accurate thresholds for identifying the high-risk or low-risk patients.

In conclusion, we provided an overview regarding the comparison of Child–Pugh and MELD scores for the assessment of prognosis in liver cirrhosis. Both of them had similar prognostic significance in most of cases. However, given their distinctive benefits for some specific conditions, further studies might be necessary to clarify the candidates who should use Child–Pugh or MELD score for the assessment of prognosis and the timing when we should use Child–Pugh or MELD score for the assessment of prognosis. New scores should also be proposed to more accurately assess the prognosis of patients with liver disease based on prospective studies.

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