Review

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The ALBI score: From liver function in patients with HCC to a general measure of liver function

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Summary

The (albumin-bilirubin) 'ALBI' score is an index of 'liver function' that was recently developed to assess prognosis in patients with hepatocellular carcinoma, irrespective of the degree of underlying liver fibrosis. Other measures of liver function, such as model for end-stage liver disease (MELD) and Child-Pugh score, which were introduced for specific clinical scenarios, have seen their use extended to other areas of hepatology. In the case of ALBI, its application has been increasingly extended to chronic liver disease in general and in some instances to non-liver diseases where it has proven remarkably accurate in terms of prognosis. With respect to chronic liver disease, numerous publications have shown that ALBI is highly prognostic in patients with all types and stages of chronic liver disease. Outside of liver disease, ALBI has been reported as being of prognostic value in conditions ranging from chronic heart failure to brain tumours. Whilst in several of these reports, explanations for the relationship of liver function to a clinical condition have been proposed, it has to be acknowledged that the specificity of ALBI for liver function has not been clearly demonstrated. Nonetheless, and similar to the MELD and Child-Pugh scores, the lack of any mechanistic basis for ALBI's clinical utility does not preclude it from being clinically useful in certain situations. Why albumin and bilirubin levels, or a combination thereof, are prognostic in so many different diseases should be studied in the future.

Keywords: liver function; liver fibrosis; hepatocellular carcinoma; liver-related diseases; non-liver-related diseases; prognosis

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Introduction

The albumin-bilirubin (ALBI) score/grade was originally developed as a measure of liver function in patients with hepatocellular carcinoma (HCC).[1] It was developed by putting all 5 of the original components of the Child-Pugh score into a multivariable model. The clinical features (ascites, encephalopathy and international normalised ratio) were shown to be redundant in that the entire prognostic value of the Child-Pugh score could be explained by just the albumin and bilirubin levels in an appropriate formulation derived from the multivariable model, *i.e.* the 'Albumin-Bilirubin or ALBI score'. Furthermore, a review of the literature revealed more than 30 versions of the Child-Pugh score such that consistent scoring was difficult to achieve.[2] To this extent, the ALBI score is a simply 'refined' version of the Child-Pugh score that excludes redundant features thereby and avoids the inconsistencies inherent in the Child-Pugh grading.

The ALBI '*grade*', categorised on the basis of the 'ALBI '*score*' (from 1-3, 1 being best, 3 being the worst), was shown to be at least comparable with the conventional Child-Pugh score (Child-Pugh score) in terms of its prognostic ability both overall and for different disease stages and treatments. The fact that ALBI is calculated on the basis of just 2 objective laboratory values (albumin and bilirubin), without the requirement for subjective assessment of the extent of ascites or encephalopathy that is necessary for the Child-Pugh score, is also an important advantage. The granularity of the ALBI score permitted the detection of the small changes in liver function in patients with compensated cirrhosis that the Child-Pugh score was not sensitive enough to detect. This is particularly important in an era when the liver function of patients with HCC has been steadily improving,[2,3] so that most patients with HCC have no liver (dys)function according to Child-Pugh score.[2]

The prognostic value of ALBI for all HCC treatments, including hepatic resection,[4–20] locoregional ablative therapies,[21–26] transarterial,[27–37] and systemic therapies[38–59] has been extensively reported and summarised by Demirtas *et al.* in this *Journal*[60] and in systematic reviews and a meta-analysis.[61,62] As with the Child-Pugh and model for end-stage liver disease (MELD) scores, both of which were introduced for specific clinical situations and then extended to more general applications, the same has happened with ALBI. Increasingly, ALBI is being applied as a preferred measure of liver function due to its objectivity and sensitivity for minor liver function deterioration,

across several areas of medical practice and hepatology. In this review, we outline the use of ALBI score/grade across different specialties including general hepatology and beyond.

Key points

- ALBI score/grade is a liver function measure which was originally developed as a prognostic factor for patients with HCC, and has since become well established.
- ALBI score is objective and can detect smaller changes in liver dysfunction than the Child-Pugh or MELD scores.
- The ALBI score/grade has been successfully applied to the prediction of survival in patients with non-malignant liver diseases of various aetiologies.
- ALBI is often used as a standard measure of liver function when assessing other putative liver function indicators or assessing the changing degree of liver (dys)function.
- The ALBI score/grade can reportedly be a prognostic factor for several non-liver-related malignant and non-malignant diseases, the mechanism of which should be clarified in future studies.

Beyond HCC: Application of the ALBI score/grade in general hepatological practice

The ALBI score/grade has been successfully applied to the prediction of survival in patients with non-malignant liver diseases of various aetiologies, including chronic viral hepatitis B,[63–66] C,[67] primary biliary cholangitis[68–70] and autoimmune hepatitis[71] (Table 1). This is not surprising as liver function is an important indicator of the progression of liver disease, reflecting how near the patient is towards liver failure and liver-related mortality (Fig. 1).

In comparison to the MELD score which, by definition, relates to 'end-stage liver disease', ALBI is sufficiently sensitive to detect the early deterioration of liver function (Fig. 1). Thus, ALBI might be expected to predict longer-term mortality in patients with cirrhosis[72–74] better than the MELD score, which would be expected to predict shorter-term mortality in patients with decompensated cirrhosis or liver failure. However, several, but not all, studies reported that ALBI is comparable to MELD for predicting short-term mortality in patients with decompensated cirrhosis.[66,75–77] Perhaps surprisingly, it has been reported that ALBI predicts outcomes for patients undergoing liver transplantation.[78–80] The initial ALBI report showed no difference in survival according to pre-transplant ALBI, implying that prognosis was attributable to the function of the new liver. It is possible that, in those studies citing an association between ALBI and post-transplant survival, ALBI was acting as a measure of general peri-operative ill health. The ALBI score is strongly associated with the degree of hepatic fibrosis, as assessed by the FIB-4 (fibrosis-4) index[81,82] or aspartate aminotransferase-to-platelet ratio index (APRI).[83] This observation presumably explains several reports that the ALBI score is an important risk factor for HCC development,[67,74–88] particularly after sustained virologic response.[86–88] The best documented risk score for HCC in patients with chronic liver disease is the aMAP score[89,90] which combines ALBI with age, male sex and platelet count and may form the basis of a realistic risk stratification strategy.

In addition to HCC, ALBI has been reported to predict various complications associated with liver diseases, including portal hypertension,[73] oesophagogastric varices,[91,92] or portopulmonary hypertension.[93] These can be understood in the context that ALBI reflects liver function and liver disease progression.

ALBI is often used as a standard measure of liver function when assessing other putative liver function indicators or assessing the changing degree of liver (dys)function (Table 2). In the area of radiology, the enhancement effects of liver images

Table 1. Studies on ALBI as a prognostic factor in non-HCC patients with liver diseases.

Authors	Study design	Patients	Aetiology	Subject	Main findings
Prediction of mortality/survival					
Chen *et al.*[63]	Retrospective	806	HBV	Cirrhosis	ALBI score predicted long-term prognosis more accurately than MELD score or Child-Pugh class.
Wang *et al.*[64]	Retrospective	398	HBV	Cirrhosis	ALBI score predicted long-term prognosis superior to MELD and MELD-Na score.
Qi *et al.*[65]	Retrospective	81	HBV	Decompensated cirrhosis	ALBI and MELD scores predicted 1-month mortality.
Chen *et al.*[66]	Retrospective	84	HBV	ACLF	ALBI and MELD scores were independent predictors of 3-month mortality.
Peng *et al.*[77]	Retrospective	100	HBV	ACLF	Child-Pugh class, ALBI and MELD scores were ineffective in predicting the in-hospital mortality.
Fujita *et al.*[67]	Retrospective	382	HCV	All HCV	ALBI score predicted overall survival.
Chan *et al.*[68]	Retrospective	61	PBC	All PBC	ALBI score was the best for predicting liver-related events among Child-Pugh score, MELD score, Mayo risk score, Yale, European, and Newcastle model. ALBI grade stratified survivals.
Fujita *et al.*[69]	Retrospective	181	PBC	All PBC	ALBI score differentiated liver transplant-free survival better than APRI.
Ito *et al.*[70]	Retrospective	409	PBC	All PBC	ALBI score/grade and the Mayo score were superior prognostic tools among other prognostic tools.
Song *et al.*[71]	Retrospective	149	AIH	Cirrhosis	ALBI predicted 6, 12, 24, and 36-month mortality more accurately than Child-Pugh scores and MELD score. ALBI grade 3 showed lower survival than ALBI grade 1 or 2.
Fragaki *et al.*[72]	Retrospective	195	Various	Cirrhosis	ALBI score might be a better prognostic indicator of mortality than Child-Pugh score, MELD and MELD-Na scores.

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Table 1 (*continued*)

Authors	Study design	Patients	Aetiology	Subject	Main findings
Hsieh *et al.*[73]	Retrospective	242	Various	Cirrhosis	ALBI score was associated with short-term outcome. ALBI was an independent predictor of survival as well as MELD, HVPG, and serum sodium.
Zou *et al.*[74]	Retrospective	631	Various	Cirrhosis	The prognostic performance of ALBI score was comparable with that of the Child-Pugh and MELD scores for predicting the in-hospital mortality of acute upper gastrointestinal bleeding in liver cirrhosis.
Oikonomou *et al.*[75]	Prospective	325	Various	Decompensated cirrhosis	ALBI was associated with survival or complications better than Child-Pugh class and MELD score.
Wan *et al.*[76]	Retrospective	456	Various	Decompensated cirrhosis	ALBI score provided a reliable prediction of mortality as well as Child-Pugh score, MELD score, MELD-Na score, and iMELD score.
Bernardi *et al.*[78]	Retrospective	301	Various	Transplantation	ALBI grade 3 was related to lower survival after liver transplantation.
Zhang *et al.*[79]	Retrospective	272	Various	Living-donor transplantation	ALBI score, Child-Pugh score, and MELD score predicted 30-day mortality with complications.
Ma *et al.*[80]	Retrospective	258	Various	Cadaveric transplantation	The ALBI score predicted overall survival and post-operative complications after liver transplantation.
Prediction of the development of HCC					
Fujita *et al.*[84]	Retrospective	91	HBV	All HBV	ALBI scores < -2.190 correlated with better HCC-free survival.
Fujita *et al.*[67]	Retrospective	382	HCV	All HCV	Smaller ALBI scores predict better HCC-free survival.
Casadei Gardini *et al.*[85]	Retrospective	514	HCV	All HCV, after DAAs	ALBI score, platelet count and aspartate aminotransferase-lymphocyte ratio identified patients with higher risk of HCC.
Abe *et al.*[86]	Retrospective	188	HCV	Cirrhosis, after SVR	ALBI score, platelet count, and diabetes were associated with HCC occurrence after SVR.
Tanaka *et al.*[87]	Retrospective	2,911	HCV	Cirrhosis, after SVR	ALBI grades 2 or 3 was associated with higher HCC risk as well as higher age and serum AFP levels.
Caviglia *et al.*[88]	Retrospective	575	HCV	Cirrhosis, after SVR	Only the ALBI score significantly associated with *de novo* HCC development among Forns index, APRI, FIB-4, and aMAP.
Prediction of liver-related complications other than HCC					
Hsieh *et al.*[73]	Retrospective	242	Various	Cirrhosis	ALBI score is best correlated with hepatic venous pressure gradient.
Miyamoto *et al.*[91]	Retrospective	141	Various	Cirrhosis	ALBI grade may be useful in predicting the presence of gastroesophageal varices and for stratifying bleeding risk.
Chen *et al.*[92]	Retrospective	1,102	Various	Cirrhosis and HCC	Combination of ALBI grade and platelet counts predicted a presence of high-risk oesophageal varices and variceal haemorrhage.
Kawaguchi *et al.*[93]	Retrospective	883	Various	Cirrhosis	ALBI score was the most impacted factor associated with severe portopulmonary hypertension.

ALBI, albumin-bilirubin; APRI, aspartate aminotransferase-to-platelet ratio index; DAA, direct-acting antiviral; FIB-4, fibrosis-4; HCC, hepatocellular carcinoma; MELD, model for end-stage liver disease; PBC, primary biliary cholangitis; SVR, sustained virological response.

(*i.e.* uptake of contrast materials by the liver) on contrast-enhanced CT or MRI, are reportedly influenced by liver function as measured by ALBI.[94–96] Other studies have reported the effect of liver function, as assessed by ALBI, on serum levels of tumour markers, such as CA-125,[97] and the frequency of muscle cramps in patients with cirrhosis.[98] Several pharmacokinetic studies have assessed the role of liver dysfunction in relation to drug-induced adverse events.[99–101]

Although ALBI is widely used according to grade, the score on which 'grade' is based is, in fact, a continuous variable and, as such, is particularly appropriate for assessment of changes in liver function over time. Thus, changes in ALBI score have been reported during the progression of liver disease to cirrhosis and to decompensation,[99,100] during the course of systemic therapy for HCC, and in response to viral suppression by antiviral therapy or other therapies for liver diseases. In patients with HCC who had undergone systemic therapy, the adverse effect of molecular-targeted drugs or immune checkpoint inhibitors on liver function was often evaluated based on changes in ALBI score.[102–107] Conversely, the restoration of liver function in association with viral eradication or suppression – by nucleot(s)ide analogues for HBV or interferon- or direct-acting antiviral-based therapy for HCV – has been characterised by a decrease in ALBI score.[108–111] Further, the improvement of liver function associated with balloon-occluded retrograde transvenous obliteration for gastric varices or administration of rifaximin to control hyperammonaemia have been analysed with the ALBI score.[112,113]

Beyond liver diseases – ALBI in non-hepatic tumours

Since the original publication, there have been reports of a strong association between ALBI and mortality in many non-hepatological conditions (Table 3). For example, ALBI has been shown to be prognostic in cancers other than HCC, including pancreatic, colon and gastric cancer, intrahepatic cholangiocarcinoma, extrahepatic bile duct cancer, and even brain

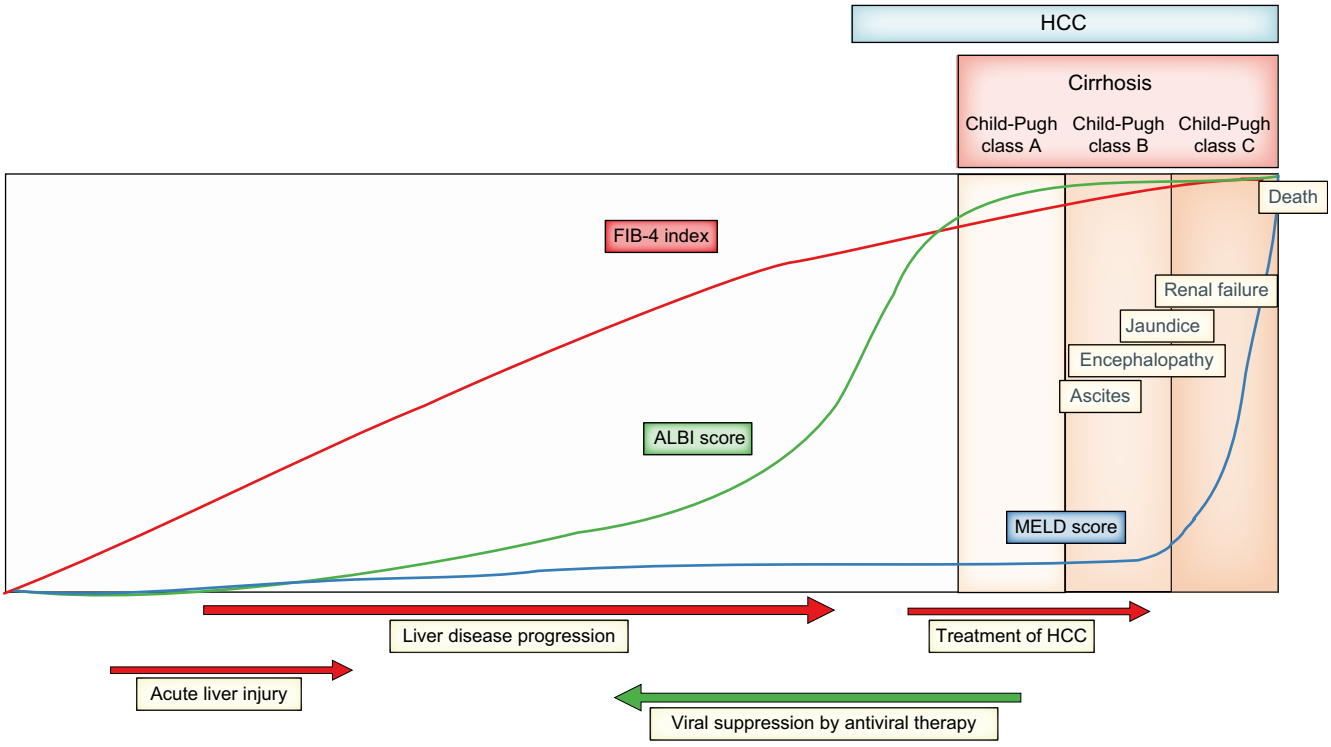

Fig. 1. Schematic representation of the changes of ALBI score in comparison to FIB-4 index and MELD score, in association with the progression of liver diseases to end-stage liver disease. ALBI score increases earlier than MELD score and before the development of cirrhosis, revealing slight deterioration in liver function. Liver function deteriorates with the treatment of HCC and may be restored by the eradication or suppression of viral hepatitis. ALBI, albumin-bilirubin; FIB-4, fibrosis-4; HCC, hepatocellular carcinoma; MELD, model for end-stage liver disease.

cancer (glioma and medulloblastoma).[114–136] ALBI is likely to be reflective of liver dysfunction in patients undergoing hepatic resection for intrahepatic tumours, such as intrahepatic cholangiocarcinoma or metastatic liver tumours, and tolerance for those undergoing systemic therapy, including chemotherapies, molecular-targeted drugs and immune checkpoint inhibitors.[118,123,126–128,131,133,134] Although most authors have attempted to link the association of ALBI with a particular cancer to liver function, we should consider whether its association with mortality is actually through some aspect of liver dysfunction or whether it simply reflects the prognostic power of serum albumin and bilirubin levels, independent of liver function. The mechanism underlying the prognostic impact of albumin and bilirubin remains unknown, but authors of the aforementioned studies have discussed the role of albumin as an indicator of malnutrition, and the immunomodulatory roles of both albumin and bilirubin. Further supporting the relative non-specificity of ALBI is its role in predicting very short-term mortality of patients with all malignancies in terminal care.[137]

Beyond liver diseases – ALBI in benign non-liver disease

There have been several reports that the ALBI score is prognostic in certain non-hepatological conditions including acute or chronic heart failure (short-term and long-term prognosis),[138–143] acute pancreatitis[144] and aortic dissection. In some conditions the prognostic value is remarkably high. For example, in acute pancreatitis[145] ALBI proved superior to well-established scores such as SOFA (sequential organ failure assessment), SAPS (simplified acute physiology score)-II, APACHE (acute physiology and chronic health evaluation)-II, Ranson and Glasgow. In each of these instances authors have attempted to explain their results in terms of liver dysfunction associated with the particular condition described. For example, in the case of cardiac failure, several authors have noted that elevated bilirubin, hypoalbuminaemia, and hepatic fibrosis often accompany advanced heart failure due to severe passive congestion.[138] Whilst such explanations may be valid, it is important to acknowledge, as in the case of non-hepatological cancer, that these observations may cast doubt on the specificity of ALBI for liver function. However, such an observation does not decrease the value of ALBI in routine hepatological practice. The Child-Pugh score, of which ALBI is just a 'refinement', has never been shown to be specific for liver disease and yet it has been widely used, with benefit, for more than 40 years. However, there is considerable literature on the association of disturbances in both albumin and bilirubin metabolism with many chronic conditions. Such issues are worthy of further research and it is likely that, in different clinical conditions, different combinations of albumin and bilirubin, and perhaps other parameters, might prove to be optimal.

Conclusion and future perspectives

Severe deterioration of liver function causes serious morbidity irrespective of its origin. It is therefore not surprising that ALBI, a

Table 2. ALBI used as a measure of liver function.

Authors	Study design	Patients	Subject	Main findings
Used as a standard measure of liver function				
Ozaki *et al.*[94]	Retrospective	303	Dual-energy CT images	Comparison of hepatic extracellular volume fractions between liver segments based on ALBI grade.
Takatsu *et al.*[95]	Retrospective	220	Hepatobiliary phase enhancement by EOB-MRI	Quantitative liver-spleen contrast ratio was correlated better by ALBI grade than by Child-Pugh score.
Takatsu *et al.*[96]	Retrospective	212	Hepatobiliary phase enhancement by EOB-MRI	Quantitative liver-spleen contrast ratio and ALBI grade could predict the liver contrast enhancement effect in hepatobiliary phase images of EOB-MRI.
Edula *et al.*[97]	Retrospective	172	Tumour marker	CA-125 concentration in cirrhotic patients based on liver function assessed by ALBI score, MELD score, and Child-Pugh class.
Shimada *et al.*[98]	Retrospective	70	Muscle cramp	Muscle cramp was observed more frequently in association of the deterioration of liver function assessed by ALBI score or Child-Pugh class.
Liver function by ALBI and pharmacokinetics				
Shimizu *et al.*[99]	Retrospective	183	Serum drug concentrations	ALBI score could be used to assess variations in the serum concentration of methadone.
Kokubun *et al.*[100]	Retrospective	25	Drug-induced adverse event	ALBI score was significantly correlated with the incidence of ifosfamide-related neuropsychiatric symptoms.
Asai *et al.*[101]	Retrospective	109	Drug-induced liver injury	Low liver function assessed by ALBI was predictor for micafungin-induced liver injury.
Serial changes in liver function assessed by ALBI				
Guha *et al.*[102]	Retrospective	379	Liver disease progression	A scoring system, based on a combination of ALBI score and FIB-4 index, that identifies patients at risk for liver decompensation.
Sakamaki *et al.*[103]	Retrospective and prospective	159	Liver disease progression	A longitudinal increase in the ALBI score is closely associated with non-malignancy-related mortality and quality of life.
Johnson *et al.*[108]	Retrospective	2,394	Liver function after SVR in HCV	ALBI score decreased in SVR and increased in non-SVR in both IFN- and DAAs-treated patients.
Nakajima *et al.*[109]	Retrospective	403	Liver function after SVR in HCV	ALBI grade decreased by SVR by DAA even in elderly patients.
Ogawa *et al.*[110]	Retrospective	392	Liver function after SVR in HCV cirrhosis	FIB-4 index and ALBI score significantly decreased after SVR.
Tada *et al.*[111]	Prospective	65	Liver function after SVR in HCV decompensated cirrhosis	ALBI scores decreased during and after treatment in patients who achieved SVR.
Waguri *et al.*[112]	Retrospective	57	Liver function after B-RTO	ALBI scores and Child-Pugh class significantly decreased 3 years after B-RTO.
Ishikawa *et al.*[113]	Retrospective	21	Liver function after treatment for encephalopathy	ALBI scores and CONUT score significantly decreased after rifaximin administration.
Kudo *et al.*[104]	Retrospective	534	Liver function by ramucirumab for HCC	Ramucirumab for HCC did not negatively impact liver function assessed by ALBI grade.
Vogel *et al.*[105]	Retrospective	413	Liver function by pembrolizumab for HCC	Pembrolizumab did not adversely impact liver function assessed by ALBI grade.
Muto *et al.*[106]	Retrospective	237	Liver function by molecular-targeted therapy for HCC	Transient deterioration of liver function assessed by ALBI associated with sorafenib or lenvatinib.
Hiraoka *et al.*[107]	Retrospective	123	Liver function by lenvatinib for HCC	Decline in hepatic function assessed by ALBI was common in the early stage after introducing lenvatinib.

ALBI, albumin-bilirubin; B-RTO, balloon-occluded retrograde transvenous obliteration; DAA, direct-acting antiviral; EOB-MRI, ethoxybenzyl-MRI; FIB-4, fibrosis-4; HCC, hepatocellular carcinoma; IFN, interferon; SVR, sustained virological response.

measure of liver function, can be a prognostic factor for diseases other than those of the liver. The Child-Pugh score has been used for a long time as a measure of liver (dys)function in patients with cirrhosis, predominantly by hepatologists to assess the severity of cirrhosis. In contrast, shortly after its original description, ALBI has been being widely used by healthcare specialists, this is perhaps due to its objectivity and simplicity. The severe liver dysfunction in patients with cirrhosis (*i.e.*, right part of Fig. 1) is the area mainly dealt with by hepatologists. It is likely therefore that the Child-Pugh or MELD scores will continue to be used by hepatologists. In contrast, in many patients who do not have primary liver disease but may have modest liver dysfunction (*i.e.*, middle or left parts of Fig. 1), the ALBI score can be used by non-hepatologists. Studies on the specificity of ALBI for liver function will be an interesting research area in the future.

Table 3. Studies on ALBI as a prognostic factor in patients with non-liver-related diseases.

Authors	Study design	Patients	Subject	Main findings
Cancer other than HCC				
Li *et al.*[114]	Retrospective	535	Intrahepatic cholangiocarcinoma	ALBI grade with prognostic nutritional index is a predictor for overall survival and progression-free survival after radical resection.
Tsilimigras *et al.*[115]	Retrospective	706	Intrahepatic cholangiocarcinoma	ALBI score was associated with both short- and long-term mortalities following resection.
Yang *et al.*[116]	Retrospective	52	Intrahepatic cholangiocarcinoma	ALBI grade was a significant biomarker for predicting survival in patients within the Milan criteria who underwent microwave ablation.
Ni *et al.*[117]	Retrospective	78	Intrahepatic cholangiocarcinoma	ALBI grade was effective to predict long-term survivals of patients treated with CT-guided microwave ablation.
Deng *et al.*[118]	Retrospective	42	Intrahepatic cholangiocarcinoma	The median overall survival of patients with ALBI grade 1 was longer than that of patients with ALBI grade 2 treated with PD-1-targeted immunotherapy.
Wang *et al.*[119]	Retrospective	109	Extrahepatic cholangiocarcinoma	ALBI grade could be used as a predictor of survival in patients who underwent biliary stenting combined with iodine-125 seed implantation.
Fernandez-Placencia *et al.*[120]	Retrospective	101	Ampullary of Vater cancer	ALBI grade and eGFR were predictors of mortality after pancreaticoduodenectomy.
Imamura *et al.*[121]	Retrospective	877	Pancreatic cancer	ALBI grade was a predictor for overall survival in patients who underwent pancreatectomy.
Yagyu *et al.*[122]	Retrospective	100	Pancreatic cancer	The combination of ALBI grade and CA19-9 concentration predicted overall survival.
Sakin *et al.*[123]	Retrospective	273	Pancreatic cancer with liver metastasis	ALBI grade was related to overall survival and progression-free survival in patients with liver metastasis treated with a first-line chemotherapy.
Zhang *et al.*[124]	Retrospective	269	Advanced pancreatic cancer	ALBI score was correlated with overall survival in patients with liver metastasis but not in patients without liver metastasis.
Koh *et al.*[125]	Retrospective	1,015	Colorectal cancer	ALBI score was an independent factor associated with overall survival and further discriminated survival in combination with myosteatosis.
Watanabe *et al.*[126]	Retrospective	60	Colorectal cancer with metastasis	ALBI score was significantly correlated with overall survival in patients receiving later-line chemotherapy with regorafenib.
Pereyra *et al.*[127]	Retrospective	339	Colorectal cancer with liver metastasis	ALBI with APRI predicted liver dysfunction associated with neoadjuvant chemotherapy and postoperative mortality.
Abdel-Rahman *et al.*[128]	Retrospective	1,434	Colorectal cancer with liver metastasis	Higher baseline ALBI score is associated with worse overall and progression-free survival in patients treated with first-line systemic therapy (panitumumab).
Zhu *et al.*[129]	Retrospective	243	Gastric cancer	ALBI grade could predict postoperative complications and overall survival, especially those with TNM stages II-III.
Kanda *et al.*[130]	Retrospective	283	Gastric cancer	ALBI grade was a predictive factor for disease-free and disease-specific survival in patients with pT2-4 cancer after radical gastrectomy.
Miwa *et al.*[131]	Retrospective	98	Gastric cancer	ALBI was associated with the tolerability of postoperative adjuvant S-1 monotherapy in patients with pStage II/III cancer.
Kinoshita *et al.*[132]	Retrospective	947	Non-small cell lung cancer	ALBI grade 2/3 was an independent predictor of worse cancer-specific survival in patients who underwent resection.
Matsukane *et al.*[133]	Retrospective	140	Non-small cell lung cancer	ALBI grade was an independent prognostic factor for both progression-free survival and overall survival who received immune checkpoint inhibitors.
Takada *et al.*[134]	Retrospective	452	Non-small cell lung cancer	The ALBI grade was an independent prognostic factor for survival in patients with advanced or recurrent cancer who receive anti-PD-1-based therapy.
Zhang *et al.*[135]	Retrospective	324	High-grade glioma	ALBI score was independent predictor for both progression-free survival and overall survival in patients who received resection.
Zhu *et al.*[136]	Retrospective	111	Medulloblastoma	ALBI score was a prognostic biomarker for overall survival in patients undergoing surgical resection as well as systemic immune-inflammation index and prognostic nutritional index.

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Table 3 (*continued*)

Authors	Study design	Patients	Subject	Main findings
Ieda *et al.*[137]	Retrospective	483	Terminal cancer	ALBI as well as CRP/albumin, prognostic nutritional index, FIB-4 and their combinations helped identify cancer patients who have a life expectancy less than 2 weeks.
Non-malignant diseases				
Luo *et al.*[138]	Retrospective	3,381	Heart failure	The ALBI score was useful at predicting the mortality of patients with heart failure requiring ICU admission.
Yamada *et al.*[139]	Retrospective	180	Heart failure	ALBI score had a predictive value for death from heart failure in patients who underwent cardiac resynchronisation therapy.
Han *et al.*[140]	Retrospective	9,749	Heart failure	ALBI score was an independent prognosticator of in-hospital mortality.
Saito *et al.*[141]	Retrospective	274	Heart failure	Higher ALBI score was associated with higher all-cause mortality in cardiac resynchronisation therapy recipients.
Matsue *et al.*[142]	Retrospective	1,190	Acute heart failure	ALBI score, but not the MELD score excluding prothrombin time was associated with fluid overload and was associated with 1-year mortality.
Kawata *et al.*[143]	Retrospective	262	Acute heart failure	ALBI score was independently associated with in-hospital mortality in patients hospitalised for acute heart failure.
Shi *et al.*[144]	Retrospective	284	Acute pancreatitis	ALBI score could be a useful marker of in-hospital mortality better than SOFA, SAPS II, APACHE II, Ranson and Glasgow scores.
Liu *et al.*[145]	Retrospective	812	Aortic dissection	ALBI score as well as MELD score and APRI was associated with in-hospital and follow-up mortality in patients with type B aortic dissection treated with thoracic endovascular aortic repair.

ALBI, albumin-bilirubin; APACHE, acute physiology and chronic health evaluation; APRI, aspartate aminotransferase-to-platelet ratio index; CRP, C-reactive protein; eGFR, estimated glomerular filtration rate; ICU, intensive care unit; MELD, model for end-stage liver disease; SAPS, simplified acute physiology score; SOFA, sequential organ failure assessment.

Abbreviations

ALBI, albumin-bilirubin; APRI, aspartate aminotransferase-to-platelet ratio index; HCC, hepatocellular carcinoma; MELD, model for end-stage liver disease.

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Conflict of interest

The authors declare that there is no conflict of interest on this review.

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Authors' contributions

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Supplementary data

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