Gastrointestinal bleeding due to portal hypertension in cirrhosis: Prognostic value of the CAGIB score

Hémorragie digestive par hypertension portale chez les cirrhotiques : Valeur pronostique du CAGIB score

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Abstract

Introduction: Upper gastrointestinal bleeding (UGIB) due to portal hypertension (PH) is a severe complication of cirrhosis. No specific score is currently validated to assess prognosis in this setting. We aimed to evaluate the performance of the CAGIB score in predicting recurrence and early mortality following upper gastrointestinal bleeding in in cirrhotic patients.

Methods: We conducted a retrospective study including cirrhotic patients hospitalized for upper gastrointestinal bleeding in related portal hypertension from 2012 to 2022. The following scores were calculated: CHILD-PUGH, MELD, MELD-Na, MELD 3.0, ALBI, ROCKALL, GBS, NLR, and CAGIB. Their performance in predicting early recurrence (≤5 days), short-term recurrence (≤6 weeks), and early mortality (≤6 weeks) was compared using ROC curves.

Results: A total of 105 patients were included (mean age 63 years; F/M ratio 1.05). Bleeding originated from oesophageal varices in 94.3% of cases. Endoscopic treatment was performed in 96 patients (endoscopic band ligation in 90 cases). Short-term recurrence occurred in 20%, early recurrence in 3.8%, and early mortality in 13.3%. The CAGIB score was the best predictor of early recurrence (AUC=0.995; sensitivity=83.3%; specificity=99.6%) and early mortality (AUC=0.891; sensitivity=85.7%; specificity=83.5%) at a threshold ≥ -4.648.

Conclusion: The CAGIB score demonstrated superior prognostic performance for early recurrence and mortality following UGIB due to portal hypertension. It appears to be a reliable and reproducible tool for risk stratification in cirrhotic patients.

Key-words: Cirrhosis – Prognosis - Portal hypertension - Gastrointestinal bleeding -recurrence-mortality

Résumé

Introduction : L'hémorragie digestive haute (HDH) par hypertension portale (HTP) est une complication grave de la cirrhose. Aucun score spécifique n'est validé pour prédire son pronostic. Cette étude vise à évaluer la performance du score CAGIB dans la prédiction de la récidive et de la mortalité précoces après un épisode d'hémorragie par hypertension portale chez des patients cirrhotiques.

Méthodes : Nous avons mené une étude rétrospective incluant les patients cirrhotiques hospitalisés pour HDH par HTP entre 2012 et 2022. Les scores CHILD-PUGH, MELD, MELD-Na, MELD 3.0, ALBI, ROCKALL, GBS, NLR et CAGIB ont été calculés. Leur performance pour la récidive précoce (≤5 jours), la récidive à court terme (≤6 semaines) et la mortalité précoce (≤6 semaines) a été comparée par analyse des courbes ROC.

Résultats : Cent-cinq patients ont été inclus (âge moyen 63 ans, sex-ratio H/F = 1,05). Une rupture de varices œsophagiennes a été responsable du saignement dans 94,3 % des cas. Un traitement endoscopique a été réalisé chez 96 patients. La récidive à court terme était de 20 %, la récidive précoce de 3,8 % et la mortalité précoce de 13,3 %. Le score CAGIB a présenté la meilleure performance pour la récidive précoce (ASC=0,995 ; sensibilité=83,3 % ; spécificité=99,6 %) et la mortalité précoce (ASC=0,891 ; Se=85,7 % ; Sp=83,5 %) à partir d'un seuil ≥ -4,648.

Conclusion : Le score CAGIB est un marqueur pronostique fiable de récidive et de mortalité précoces après hémorragie digestive haute liée à l'hypertension portale.

Mots-clés : Cirrhose - Hémorragie gastro-intestinale – Hypertension portale - Mortalité - Récidive - Pronostic

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LA TUNISIE MEDICALE-2026; Vol 104 (01): 43-50 DOI: 10.62438/tunismed.v104i01.6058

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Introduction

Upper gastrointestinal haemorrhage (UGIH) related to portal hypertension (PH) is one of the major complications of cirrhosis, occurring at a rate of 10-15% per year according to the American Association for the Study of Liver Diseases (AASLD) (1).It represents a turning point in the course of cirrhosis and is a major cause of mortality, with a recurrence and an early mortality rates of 7-20% and 10-20% respectively at six weeks, despite a codified management (2–4).

Rupture of oesophageal or gastric varices represents the main cause of upper gastrointestinal haemorrhage due to portal hypertension. The management is based on medical measures associated to endoscopic procedures. However, the challenge of this management highlights the importance of stratifying high-risk patients to guide therapeutic options.

Several prognostic scores have been developed to assess the severity of cirrhosis, such as Child-Pugh, MELD score (Model of End stage Liver Disease) and ALBI (albumin-bilirubin) (5), or to stratify the risk of gastroduodenal ulcer bleeding, such as the Rockall and Glasgow-Blatchford scores (6). However, their use in portal hypertension haemorrhage remains limited, as there is no consensus on an appropriate score for this condition.

Recently, the Cirrhosis Acute Gastro-Intestinal Bleeding (CAGIB) score, developed by a Chinese team, has been proposed as a specific model for PH haemorrhage (7). However, its performance has not yet been validated on a large scale.

The aim of our study was to evaluate the performance of the CAGIB score in a Tunisian cohort of cirrhotic patients presenting with upper gastrointestinal bleeding due to PH.

Methods

Characteristics of the study

We conducted a single-centre, retrospective and descriptive study in the gastroenterology department of Mohamed Taher Maamouri Hospital in Nabeul including the records of patients from January 2012 to December 2022.

Study population

Inclusion criteria:

We included cirrhotic patients having had an episode of UGIH due to PH. The diagnosis of cirrhosis was based on compatible clinical, laboratory, and radiologic evidence.

Endoscopic diagnosis of PH haemorrhage was established in the presence of active bleeding from a varix, a platelet plug or ulcer on a varix, or in case of finding blood in the upper digestive tract with oesophageal or gastric varices, in the absence of other potential sources.

Cirrhotic patients were also included if they presented with hematemesis, melena, or rectal bleeding (with or without deglobulisation), or isolated deglobulisation and the absence of any other lesion that could explain the bleeding episode.

Non-inclusion criteria:

Patients with UGIH related to non-cirrhotic PH or to lesions not associated with PH (as peptic ulcer disease or bleeding oesophagitis) confirmed by upper gastrointestinal endoscopy were not included.

Exclusion criteria:

Patients with missing data, patients who were lost to follow-up or whose follow-up was less than two months were excluded from the study.

Data collection:

Data were collected retrospectively from patients' medical records including:

- General data (age, sex, lifestyle habits such as smoking, alcohol or drug abuse, medical history) and the characteristics of the cirrhosis, such as the length of illness, the aetiology and the complications.
- The initial assessment of PH:
  - presence or not of oesophageal varices (OV) and gastric varices (GV) and their classification according to the established classifications (New Italian Endoscopic Club (NIEC) for OV and Sarin for GV) (8,9).
  - Presence or absence of hypertensive gastropathy.
- Previous prophylactic and therapeutic procedures carried out for the management of UGIH due to PH were recorded.
- The clinical, biological and endoscopic characteristics of the current UGIH episodes and their therapeutic management according to Baveno VII consensus (10) were also detailed.

Calculation of the scores:

The following prognostic scores were calculated for each patient: Child-Pugh, MELD score (Model of End stage Liver Disease) (and its variants MELD-Na and MELD 3.0), ALBI, ROCKALL, Glasgow Blatchford, AIMS 65, neutrophil to lymphocyte ratio (NLR) and the CAGIB score.

The ROCKALL, Glasgow Blatchford and AIMS 65 scores were calculated using the calculator available on MDCalc, including several variables: initial heart rate, systolic blood pressure, presentation with melena or syncope, level of haemoglobin, blood urea nitrogen, coexistent hepatic disease, heart failure or other significant comorbidities, age and the results of endoscopic examination.

The MELD score and its two variants, the ALBI score and the CAGIB score were calculated using the following formulae:

MELD = 3.78 × ln[serum bilirubin (mg/dL)] + 11.2 × ln[INR] + 9.57 × ln[serum creatinine (mg/dL)] + 6.43 (11).

MELD-Na = MELD + 1.59 × (135 – serum sodium [mmol/L]) (12).

MELD 3.0=1.33 × (female sex) + 4.56 × ln[serum bilirubin (mg/dL)] + 0.82 × (137 – serum sodium [mmol/L]) – 0.24 × (137 – serum sodium [mmol/L]) × ln[serum bilirubin (mg/dL)] + 9.09 × ln[INR] + 11.14 × ln[serum creatinine (mg/dL)] + 1.85 × (serum albumin [g/dL] – 3.5) – 1.83 × (serum albumin [g/dL] – 3.5) × ln[serum creatinine (mg/

dL)] + 6 (13).
For the MELD, MELD Na and MELD 3.0 scores, we set a threshold of 20 to divide the patients into two groups (14).
ALBI score= (log10 bilirubin [µmol/L] × 0.66) + (albumin [g/L] × −0.0852). As a result, ALBI grades 1, 2, and 3 were developed as follows: ALBI score ≤ −2.60 (ALBI grade 1), > −2.60 to ≤ −1.39 (ALBI grade 2), and > −1.39 (ALBI grade 3).
CAGIB score = diabetes (yes = 1, no = 0) × 1.040 + Hepatocellular carcinoma (yes = 1, no = 0) × 0.974 + Total bilirubin (µmol/L) × 0.005 - ALB (g/L) × 0.091 + ALT (U/L) × 0.001 + creatinine (µmol/L) × 0.012 - 3.964.

Progression after the UGIH episode:
Patient outcomes were monitored by noting the failure of first-line treatment, the early recurrence (within five days), the short-term recurrence (within six weeks), and the early mortality (within six weeks). These criteria were used to assess the performance of the prognostic scores.

Statistical study

Data were entered and analysed using SPSS version 22 software. Qualitative variables were expressed as simple and relative frequencies, while quantitative variables were presented as means, standard deviations and extreme values. Survival curves were generated using the Kaplan-Meier model and compared using the log-rank test. Score performance was analysed using receiver operating characteristic (ROC) curves and the Mann-Whitney test, with statistical significance set at $p<0.05$.

Ethical considerations

Strict anonymity of the individual data was respected throughout the study. Given the retrospective nature of the study, it was not possible to obtain informed consent from the patients. There were no conflicts of interest in this work.

Results

Study population

General patients' characteristics
The study included 105 cirrhotic patients having had an episode of upper gastrointestinal bleeding secondary to PH. The mean age of patients was 63.06 ± 13.32 years [19-89]. The F/M ratio was 1.05. Alcohol consumption was reported in 8.6% of patients, with a median weekly consumption of 25g.

Characteristics of the cirrhosis
The mean length of illness was 4 years [0-18]. The main identified aetiologias were hepatitis C (26.7%), hepatitis B (17.1%) and metabolic dysfunction-associated fatty liver disease (11.4%). Fifty-one patients (48.6%) had one or more comorbidities associated with cirrhosis mainly represented by diabetes in 33.3% of cases (n=35) and hypertension in 31.4% of cases (n=33). In our cohort, 9.5% of patients (n=10 cases) had hepatocellular carcinoma. Hepatocellular carcinoma was classified as BCLC A in one patient, BCLC B in one patient, BCLC C in 3 patients and BCLC D in 5 patients. No patient had chronic hepatic encephalopathy or hepatorenal syndrome. Fifty-three patients (50.5%) had a previous history of oedematoascitic decompensation.
At the time of enrolment, 45.7% of patients (n=48) were known to have endoscopic signs of portal hypertension. All these patients had oesophageal varices classified as grade II in 54.2% of cases (n=26) and grade III in 41.7% of cases (n=20). Two patients had OV classified as grade I with no red signs. Among these population, eight patients had gastric varices (16.7%) classified as GOV 1 in 7 cases and GOV 2 in only one case.
Primary prophylaxis against variceal bleeding was initiated in 83.3% (n=40) of patients with known uncomplicated varices. It was based on beta-blockers in 35 patients (propranolol with a mean dose of 52 mg per day [40-160]). Endoscopic band ligation for OV as primary prophylaxis was carried out in 5 cases due to contraindication to beta-blockers without achieving eradication of varices. Of the remaining patients who did not receive primary prophylaxis (n=8), six patients had grade II or III OV with a contraindication to non-selective beta-blockers. They were candidates for oesophageal band ligation, which was not performed.

History of gastrointestinal variceal haemorrhage:
Eight patients (7.61%) had one or more episodes of gastrointestinal haemorrhage due to rupture of oesophageal varices. Endoscopic treatment was performed in all of these patients and the varices' eradication was not achieved in any case. Six patients were on secondary beta-blocker prophylaxis with propranolol with a mean dose of 68 mg per day [40-160].

Characteristics of the episodes of upper gastrointestinal haemorrhage

Clinical and biological presentation:
In 92.4% of patients, the current episode represented a first variceal haemorrhage, inaugural of the cirrhosis in 46.6% of cases. Haematemesis associated with melena was the most common presentation (51.4%), followed by isolated haematemesis (37.2%). The median consultation time after haemorrhage was 25.2 hours ±41,32 [1-72]. On the other hand, it was a bleeding recurrence in 7.61% of cases (n=8) with a mean delay of 8.37±7.78 months [2-21] from the last episode of UGIH. Only seven patients (6.7%) were included with haemorrhagic shock on admission. Eight cases (7.6%) of renal failure were noted in our patients in the acute phase. We observed ascites in 44 patients (41.9%) associated with lower limb oedema in 30 patients (28.6%). Forty patients (38%) had a haemoglobin level ≤8g/dl. Volemic expansion with crystalloids or macromolecules was indicated in all patients. Catecholamines were required in 8 patients (7.6%). Forty-five patients (42.9%) were transfused with packed red blood cells with an average number at 1.9

[1-6]. All patients received octreotide by electric syringe pump for a period of 5 days and were given preventive antibiotics such as ofloxacin 200 mg x 2/day or ceftriaxone 1 g/day. A combination of lactulose and rifaximin was used in 30 patients (28.6%), for curative purposes in 19 cases (18.1%) and as a preventive measure in 11 cases (10.5%).

Management and endoscopic data:

Endoscopic exploration was performed in all patients, with a mean delay of 29.8 ± 42.4 hours [1-144]. Stigmata of recent bleeding were present in 58% of patients. Ruptured oesophageal varices (VO) were the dominant aetiology (94.3%), followed by gastric varices (17.1%). Endoscopic management was performed in 96 patients (91.4%) with a delay of 31.6 ± 40.3 hours [12-192]. According to gastrointestinal exploration, 85.7% (n=90) of patients underwent endoscopic band ligation and one patient had sclerotherapy injection of the OV. Gastric varices obturation with glue injection was performed in 5.8% of patients (six patients). No complications were reported. Nine patients (8.6%) did not receive endoscopic treatment due to a lack of technical limitations: eight with acute esophageal variceal bleeding, in whom band ligation was not possible due to unavailability of band ligation devices, and one with type II gastroesophageal varices, in whom cyanoacrylate injection (Glubran®) could not be administered.

The main outcomes:

The control of UGIH was not possible in 3.8% of patients (n=4) despite medical and endoscopic management complicated by instant death. An early recurrence of bleeding was noted in 4 patients with an average delay of 72 hours [10-120]. Two cases were fatal within 24 hours. Short-term recurrences were observed in 21 patients (20%) with a mean time to onset equal to 18 days and extremes ranging from 10 hours to 6 weeks. A second endoscopic haemostasis procedure was performed in 48.8% of them (n=9).

Following the acute episode, 77 of the 91 surviving patients were started on β-blockers for secondary UGIH prophylaxis. It was propranolol in all cases with a mean dose of 80mg [40-160mg].

Eighty-three patients underwent secondary prophylaxis with endoscopic band ligation. The mean time between sessions was 25 days [21-128 days] with a mean number of sessions of 2 [0-4]. Secondary prophylactic glue injection was performed in two patients.

Fourteen cases of death were recorded in our study during the first 6 weeks following the haemorrhagic episode, representing a mortality rate of 13,3%. The median time to death was 11 days [2-30]. Survival rates at 1, 2 and 3 years were 91.3%, 85% and 80.2% respectively.

Performance of prognostic scores

Prediction of early recurrence:

The CAGIB score showed an excellent performance in predicting early recurrence, with an AUROC of 0.995 (Table 1). When looking at the parameters constituting the CAGIB score, the presence of hepatocellular carcinoma (HCC) was strongly associated with early recurrence (20% in case of early recurrence (group 1) versus 2.1% in the group without early recurrence (group 2) (p = 0.005) and as well as high total bilirubin levels (182.35 UI/L in group 1 versus 42.55 UI/L in group 2 p = 0.007, respectively).

Table 1. Performance of prognostic scores in predicting early haemorrhagic recurrence

	AUROC [CI 95%]	P	Cut-off	Sensibility (%)	Specificity (%)
Child-Pugh	0.868 [0.755-0.981]	0.003	7.5	83.3	73.7
Child Pugh class	0.86 [0.746-0.975]	0.003	Child-Pugh class B	66.7	87.9
MELD	0.878 [0.761-0.995]	0.002	20.5	83.3	87.9
MELD-Na	0.888 [0.77-1]	0.001	21.5	83.3	86.9
MELD 3.0	0.9 [0.801-0.999]	0.001	20.5	83.3	84.8
Rockall	0.801 [0.658-0.943]	0.014	7.5	66.7	80.8
ALBI	0,817 [0,631-1]	0,009	-1,82	83,3	64,6
ALBI grade	0,766 [0,557-0,975]	0,029	Grade 2	66,7	83,8
AIMS-65	0,763 [0,573-0,952]	0,031	1,5	83,3	53,3
GBS	0,511 [0,307-0,715]	0,928	-	-	-
NLR	0,62 [0,368-0,873]	0,324	-	-	-
CAGIB	0,955 [0,889-1]	<0,001	-3,251	83,3	99,6

AUROC: the area under the receiver operating characteristic curve, **MELD**: Model of End Stage liver disease, **ALBI**: albumin-biirubin,**GBS**: Glasgow Blatchford score, **NLR**: neutrophil to lymphocyte ratio, **CA**GIB: Cirrhosis Acute Gastro-Intestinal Bleeding

Prediction of short-term recurrence

Concerning the recurrence at six weeks, the CAGIB score did not show significant performance (AUC = 0.625, p = 0.078) (Table 2).

Prediction of mortality:

The CAGIB score had an excellent performance with an AUC of 0.891, a sensitivity and a specificity of 85.7% and 83.5% respectively, in predicting mortality from values greater than or equal to -4.648 with an OR equal to 18.

By studying the components of the CAGIB score separately, we found that mortality was significantly higher in cases of HCC (80% versus 6.3%; p<0.001) and significantly associated with higher levels of ALT and total Bilirubin (77.5 UI/L versus 29 UI/L (p=0.001) and 45.3 UI/L versus 19.6 UI/L (p=0.001) respectively, and with lower levels of albumin (30.8 g/L versus 33.4 g/L ; p=0.031).

Comparing to the other scores, the CAGIB score was the best predictor of mortality (AUC=0.891). The AUROC for the different scores are summarised in table 3.

Table 2. Performance of prognostic scores in predicting short-term recurrence

	AUROC [CI 95%]	P	Cut-off	Sensibility (%)	Specificity (%)
Child-Pugh	0,55 [0,409-0,691]	0,478	6,5	52,4	50
Child Pugh class	0,522 [0,381-0,663]	0,755	1 Child-Pugh class A	52,4	50
MELD	0,597 [0,454-0,741]	0,169	17,5	42,9	82,1
MELD-Na	0,564 [0,421-0,707]	0,365	15,5	47,6	61,9
MELD 3.0	0,587 [0,446-0,729]	0,217	17,5	42,9	77,4
Rockall	0,493 [0,347-0,639]	0,92	7,5	28,6	79,8
ALBI	0,659 [0,533-0,785]	0,025	-1,885	66,7	60,7
ALBI grade	0,621 [0,488-0,755]	0,087	2 (Grade 2)	33,3	84,5
AIMS-65	0,459 [0,317-0,601]	0,564	-	-	-
GBS	0,548 [0,403-0,694]	0,496	6,5	71,4	32,1
NLR	0,536 [0,398-0,675]	0,608	2,323	71,4	40,5
CAGIB	0,625 [0,491-0,758]	0,078	-5,084	61,9	63,1

AUROC: the area under the receiver operating characteristic curve, **MELD**: Model of End Stage liver disease, **ALBI**: albumin-biirubin, **GBS:** Glasgow Blatchford score, **NLR:** neutrophil to lymphocyte ratio, **CAGIB**: Cirrhosis Acute Gastro-Intestinal Bleeding

Table 3. Performance of the different prognostic scores in predicting mortality

	AUROC [CI 95%]	P	Cut-off	Sensibility (%)	Specificity (%)
Child-Pugh	0,843 [0,744-0,941]	<0,001	7,5	78,6	78
Child Pugh class	0,808 [0,694-0,923]	<0,001	1 Child-Pugh class A	92,9	56
MELD	0,838 [0,73-0,947]	<0,001	14,5	78,6	75,8
MELD-Na	0,85 [0,755-0,944]	<0,001	17,5	78,6	78
MELD 3.0	0,851 [0,757-0,945]	<0,001	15,5	85,7	74,7
Rockall	0,688 [0,533-0,842]	0,024	5,5	85,7	38,5
ALBI	0,752 [0,622-0,881]	0,003	-1,82	64,3	65,9
ALBI grade	0,701 [0,546-0,855]	0,016	2 (Grade 2)	50	85,7
AIMS-65	0,728 [0,595-0,861]	0,006	1,5	78,6	56
GBS	0,577 [0,415-0,738]	0,358	6,5	92,9	35,2
NLR	0,755 [0,603-0,907]	0,002	4,544	71,4	80,2
CAGIB	0,891 [0,788-0,993]	<0,001	-4,648	85,7	83,5

AUROC: area under receiver operating curve, **MELD**: Model of End Stage liver disease, **ALBI**: albumin- Bilirubin, **GBS**: Glasgow Blatchford score, **NLR**: neutrophil to lymphocyte ratio, **CAGIB**: Cirrhosis Acute Gastro-Intestinal Bleeding

Survival, calculated by the Long Rank test, for the different grades of the CAGIB score (< - 4.6646 and ≥ - 4.6646) was 115.402 and 22.785 months respectively, with a p<0,001 (Figure 1).

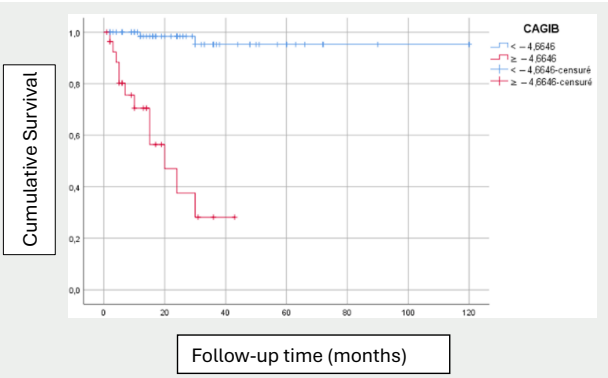


Figure 1. Survival curve according to CAGIB score

Table 4 summarises the results of mean survival according to the different prognostic scores.

Table 4. Study of survival in our cirrhotic population according to prognostic scores

Scores	Cut-off, class or grade of the scores	Survival		P
		Mean	Standard deviation	
Child Pugh	Class A (5-6) Class B (7-9) Class C (10-15)	117,429 56,423 22,228	4,98036 10,9368 7,27748	<0,001
MELD	< 20 ≥ 20	109,244 22,403	8,4672 6,74828	<0,001
MELD-Na	< 20 ≥ 20	110,648 35,204	8,19476 12,43424	<0,001
MELD 3,0	< 20 ≥ 20	110,776 34,522	8,1144 12,52636	<0,001
AIMS-65	0-1 > 1	112,502 87,582	8,21632 16,51496	0,025
ALBI	Grade 1 Grade 2 Grade 3	118,258 57,356 21,342	5,14536 9,58732 8,37489	<0,001
GBS	2-6 > 6	115,227 92,956	9,13948 13,279	0,049
CAGIB	< – 4,6646 ≥ – 4,6646	115,402 22,785	6,419 7,11284	<0,001

AUROC: the area under the receiver operating characteristic curve, **MELD**: Model of End Stage liver disease, **ALBI**: albumin-bilirubin, **GBS**: Glasgow Blatchford score, **NLR**: neutrophil-lymphocyte ratio, **CAGIB**: Cirrhosis Acute Gastro-Intestinal Bleeding

Discussion

The purpose of this study was to evaluate the performance of the CAGIB score in the prediction of early recurrence and mortality during a variceal upper GI bleeding episode and according to our results, we could conclude its superiority comparing to the previous scores.

In fact,Bai et al (7) conducted a multicentre study in China including cirrhotic patients with upper GI haemorrhage over nine years. A total of 1682 patients were enrolled. Multivariate logistic regression analysis demonstrated that HCC, diabetes, total bilirubin, albumin, ALT and

creatinine were independent predictors of early mortality. A prognostic model called CAGIB was developed using a formula combining each of the parameters found with coefficients. In our study, we studied the six clinical and biological parameters included in the CAGIB score. The presence of HCC was significantly associated with mortality. In fact, HCC is one of the most frequent causes of cancer-related death (15) and 80% of HCCs are diagnosed in cirrhosis (16).HCC can worsen portal pressure either by compression or by tumour thrombosis and is therefore considered to be an independent factor of recurrence and early mortality in cirrhotic patients with UGIH, according to several studies (17–21).Among the biological parameters studied (total bilirubin, albumin, creatinine, ALT), a high level of ALT and bilirubin were significantly associated with early mortality. Bilirubin levels are included in various prognostic scores for cirrhosis, as the Child Pugh and MELD scores. It represents also an indicator of liver failure and was associated in several studies to early recurrence and mortality (17,22–27).Furthermore, during UGIH related to PH, the acute blood loss leads to a liver ischaemia (28).Hypoxic hepatitis, characterised by a quick rise in serum transaminases due to hepatic cell necrosis (29) can be observed in acute GI haemorrhage in cirrhotic patients (21) and worsen the patient's prognosis (30).In the studies by Bai et al (7), Zhao et al (31)and D'amico et al (17), it was noted that the ALT level was an independent factor of mortality. Moreover, according to the literature (7,26,31), elevated creatinine is an independent risk factor for mortality.

We conducted literature research on the performance of the CAGIB score in predicting recurrence and mortality. Few studies were found. The results are summarised in table 5.

Table 5. Performance of the CAGIB score according to the literature

Authors/Year	Population	Purpose	Performance of the CAGIB score in predicting in-hospital death comparing to other scores (AUROC)			
Bai et al.,2019 [5]	2 cohorts: *A training cohort:865 patients *A validation cohort:817 patients	Elaboration and validation of the CAGIB score		The Training cohort	The validation cohort	
			Child-Pugh	0.762	0.693	
			MELD	0.778	0.662	
			MELD-Na	0.765	0.660	
			NLR	0.587	0.538	
			CAGIB	0.829 (Cut off:> 4.6664)	0.714	
Zhao et al.,2020 [26]	379 patients	Evaluation of the CAGIB score A significant difference between Child Pugh vs NLR and CAGIB vs NLR	Scores		AUROC	
			Child-Pugh		0.842	
			MELD		0.798	
			NLR		0.688	
			CAGIB		0.840	
Chen et al.,2023 [27]	3 cohorts: *The training cohort:308 patients (China) *2 external validation cohorts: *The first cohort:247 patients *The second cohort:302 patients	Elaboration of a new nomogram called LVCB (Liver cirrhosis and variceal bleeding) predictor of mortality in cirrhotic patients with acute variceal haemorrhage (including INR, albumin, eGFR)		Training cohort	First validation cohort	Second validation cohort
			MELD	0.794	0.824	0.821
			LVCB	0.846	0.859	0.833
			CAGIB	0.782	0.799	0.813
Xu et al.,2021 [22]	3 cohorts: *MIMIC III:813 patients divided into training and validation cohorts The training cohort: 569 patients The validation cohort: 244 patients *MIMIC IV:930 patients	Elaboration of a new nomogram predictor of in-hospital death in cirrhotic patients with LCEV(a nomogram including age, Elixhauter score (33), anion gap,sodium,albumin, bilirubin,INR, use of vasopressors, severity of the bleeding)		Training cohort	Validation cohort	MIMIC IV
			MELD	0.724	0.699	0.721
			OASIS	0.662	0.766	0.698
			Nomogram	0.867	0.846	0.840
			CAGIB	0.611	0.601	0653
Our study 2025	105 Tunisian cirrhotic patients	Evaluation of the performance of the CAGIB score	Scores		AUROC	
			Child-Pugh		0.843	
			MELD		0.838	
			MELD Na		0.850	
			MELD 3.0		0.851	
			ALBI		0.752	
			Rockall		0.688	
			Glasgow Blatchford		0.577	
			AIMS 65		0.728	
			NLR		0.755	
			CAGIB		0.891	

MELD: Model End Stage Liver Disease, **NLR**: neutrophil -lymphocyte ratio,**CAGIB**: cirrhosis acute gastro-intestinal bleeding, **LVCB:** Liver Cirrhosis and Variceal Bleeding, **LCEV:** Liver Cirrhosis Oesophageal Varices, **MIMIC III and IV:** Medical Information Mart for Intensive Care III and IV, **ALBI:** albumin-bilirubin,

Our study has a number of advantages. It is the first work carried out in Tunisia to study the prognostic performance of the CAGIB score in UGIH related to PH. The management of this complication is standardised in our hospital, which avoids the risk of bias. Nevertheless, there are a few limitations to our study that need to be acknowledged. Firstly, this is a retrospective and a single-center study; the lack of data from multicenter may cause potential bias. Furthermore, the population included was heterogeneous regarding aetiology as well as cirrhosis characteristics, and patients were followed up for inconsistent lengths of time.

Conclusion

Upper gastrointestinal haemorrhage related to portal hypertension is a serious complication in cirrhotic patients that requires well-controlled management and risk stratification to reduce recurrence and mortality. According to our results, we can propose the CAGIB score as an easy to calculate tool, including objective clinical and biological parameters, for predicting early recurrence and mortality with a threshold greater than -4.648. However, further large-scale studies are needed to validate this score.

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