Preliminary validation of a novel imaging and clinical scoring system to predict early mortality in spontaneous ruptured hepatocellular carcinoma treated with transarterial embolisation

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Introduction

Spontaneous ruptured hepatocellular carcinoma (rHCC) is an emergency associated with significant mortality, and treatments include transarterial embolization (TAE). However, clinical outcomes of rHCC after TAE remain **unpredictable** and a significant portion of patients **succumb early** despite a technically successful embolization.

We developed and preliminary validated **a scoring system** using a combination of clinical and imaging parameters to predict 30-day mortality in this group of patients.

Materials and Methods

Patient population

- Consecutive patients ≥ 18 years old with rHCC who underwent TAE during **Jan 2007 - Dec 2016** included into development cohort. The scoring system was validated in 20 rHCC patients underwent TAE during the period **of Jan 2017 - May 2018.**

Primary outcome: 30-day mortality after TAE.

TAE technique: Right femoral approach; Embolisation of feeding artery by Gelfoam slurry, PVA particles or combination of both.

Model development and Statistical analysis

- CT features reviewed by radiologists blinded to patient outcome. Clinical data retrieved from electronic patient record.
- Independent risk factors for 30-day mortality identified using univariate and multivariate binary logistic regression, ***for development of a scoring system.***
- Ability to predict 30-day mortality of the scoring system evaluated by receiver-operating-characteristics-curve analysis.

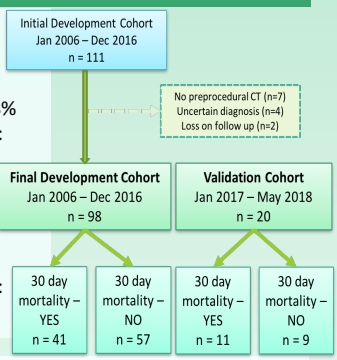
Results

Development cohort (n=98)

- Median age: 65 (IQR 56 – 75)
- Male : Female = 75 : 23
- Overall 30-day mortality: 41.8%
- Median maximum tumor size: 10.1cm (IQR 7.2 - 13.7)

Validation cohort (n=20)

- Median age: 60 (IQR 54 -67)
- Male : Female = 12 : 8
- Overall 30-day mortality: 55%
- Median maximum tumor size: 10.5cm (IQR 7.1 - 12.9)



In univariate logistic regression analysis,
Bilobar distribution, multifocality, large ruptured tumour and large maximum tumour were imaging predictors associated with 30-day mortality. Young age, low serum albumin and higher serum bilirubin level were clinical predictors associated with 30-day morality ($p < 0.05$).

In multivariate logistic regression analysis,
Bilobar distribution, bilirubin >2.5 mg/dL and albumin <30 g/L were independent predictors, which were then used to develop the proposed scoring system.

Results (Cont'd)

Table 1. Proposed scoring system according to multivariate logistic regression

	β coefficient	OR (95% C.I.)	p- value	Points†
Bilobar distribution	3.39	29.63 (6.35 - 121.69)	<0.001*	**3**
Bilirubin >2.5 mg/dL	1.78	5.90 (1.56 - 22.3)	0.009*	**2**
Albumin <30 g/L	1.40	4.06 (1.23 - 13.39)	0.021*	**1**

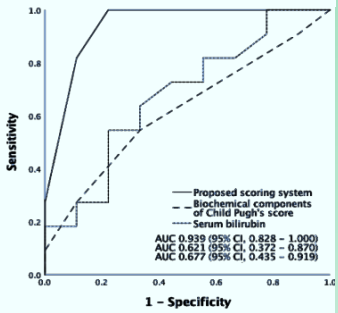
†Assignment of points to independent predictors based the corresponding beta coefficient.

Final risk scores (0-6) = Sum of points of all 3 variables (*Zero points given to each variable if criteria not met).

In ROC analysis, the 6-point score yield AUC of 0.904 (95% CI: 0.839, 0.969) in **development cohort** and of 0.939 (95% CI: 0.828, 1.000) in **validation cohort**.

The proposed scoring system yielded a ***higher AUROC*** than biochemical components of Child-Pugh score and serum bilirubin alone in both cohorts, suggesting ***better prediction ability.***

Fig 1. ROC curves of the scoring system and other metrics to predict 30-day mortality in validation cohort.



By applying the scoring system,
rHCC patients with scores of ≥4, 3 & ≤2 could be classified into low, intermediate and high risk groups (Table2).

Table 2. 30-day mortality rate according to the proposed scoring system

		Development cohort	Validation cohort
Risk group	Score	30-day mortality rate	30-day mortality rate
Low	≤ 2	2.6%	0%
Intermediate	3	31.8%	60.7%
High	≥ 4	86.8%	90%

In the validation cohort,
Risk score ≥4 was predictive of 30-day mortality, with *Sn of 81.2%, Sp of 88.9%, PPV of 90% and NPV of 80%.*

Clinical Implication

- **Bilobar tumor** + (bilirubin >2.5mg/dL and/or albumin <30 g/L) = High risk patients
- The proposed scoring system may provide ***important prognostic information*** to radiologists and rHCC patients.

Conclusion

Clinical and imaging parameters can be combined into a scoring system to accurately predict 30-day mortality after TAE in rHCC patients. The score may help interventional radiologists ***identify and counsel high risk patients.***