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Letter to the Editor

The SHARPEN clinical risk score predicts mortality in patients with infective endocarditis: An 11-year study ☆

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Infective endocarditis (IE) is associated with significant in-hospital mortality (up to 20%) [1]. Early identification of high-risk patients would help triage and management [2,3]. We developed a risk score based on clinical and laboratory parameters to aid prediction of in-hospital mortality.

All patients with definite IE (based on Duke's criteria) [4] over an 11-year period from January 2001 to December 2011 at our institution were studied. Demographic, clinical, echocardiographic and laboratory parameters were tabulated and mortality outcomes were determined. A risk score was then developed from the multivariable logistic regression model, by converting the B coefficients of the independent predictors of mortality into weights. The sensitivity, specificity, positive and negative predictive values, and the receiver operating characteristic (ROC) curve were derived. The Youden index was determined and patients were stratified into high, moderate, and low risk categories.

The results of the univariate and multivariate analyses are presented in Table 1. The mean age of the 233 IE patients was 50 (S.D. 19) years. There were slightly more males (n = 133, 57%). The commonest organism was *Staphylococcus aureus* (n = 112, 48%). All patients had echocardiography performed, including 79 (34%) who underwent transoesophageal studies.

The in-hospital mortality rate was 23% (n = 54). All deaths were due to IE or its complications, including severe sepsis (n = 26), pneumonia (n = 7), decompensated heart failure (n = 4), massive haemorrhage secondary to coagulopathy (n = 4), cerebrovascular accident (n = 5) and cerebral abscesses (n = 1).

The 51 patients who underwent valvular surgery had a mortality rate of 7.8% (n = 4), comparable to other series [5,6]. Of the 182 patients with indications for surgery [7], only 26.9% (n = 49) had surgery performed. The low mortality may thus be due to a stricter selection of candidates for surgery. Furthermore, 8 (36.4%) out of 22 of the patients with congenital heart disease underwent surgery.

Several factors (such as perivalvular abscess and cerebrovascular disease) previously published [8] were not significant mortality predictors in our cohort, possibly because of the small sample size. Two (out of 11) patients with peri-valvular abscess and 11 (out of 34) patients with ischaemic stroke had the observed outcome.

Only seven parameters (Systolic BP, Heart failure, Age, Renal function, Pneumonia, Elevated peak CRP and Non-intravenous drug abusers; SHARPEN) remained independently associated with inpatient mortality (Table 1). The risk score and its performance on receiver operating characteristic curve (ROC) are presented (AUC 0.86, 95% CI 0.80–0.91, $p < 0.001$, Fig. 1). The score segregated patients well into low, moderate, and high risk groups (Fig. 2). All 7 patients who scored 15 or greater died (100% mortality). This may be due to a small cohort, and requires a larger study for further analysis.

The patients were fairly distributed across the risk categories. Seventy (30.0%) were in the low risk category, of which 2 (2.9%) died. One hundred and two subjects (43.7%) were in the moderate risk category, of which 14 died (13.7%). Sixty one patients (26.2%) were in the high risk category, of which 38 (62.3%) died.

☆ All authors take responsibility for all aspects of the reliability and freedom from bias of the data presented and their discussed interpretation.

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Table 1
Results of univariate and multivariate analysis. Bold values indicate significance at *p*-Value < 0.05.

	Mortality (n)[a]	Univariate analysis		Multivariate analysis	
		Odds ratio (95% CI)[b]	*p*-Value	Odds ratio (95% CI)[b]	*p*-Value
Demographics					
Age	61 (S.D. 16)	15 (9.3–20)	<**0.001**	1.053 (1.030–1.087)	**0.001**
Male	32 (24%)	1.1 (0.61–2.1)	0.712		
Chinese	35 (29%)	2 (1–3.7)	**0.037**		
Past medical history					
Diabetes mellitus	24 (40%)	3.2 (1.7–6.1)	<**0.001**		
Hypertension	28 (39%)	3.3 (1.8–6.2)	<**0.001**		
Chronic kidney disease	9 (45%)	3.1 (1.2–7.8)	**0.024**		
Congenital heart disease[c]	2 (9.1%)	0.31 (0.07–1.4)	0.100		
Preexisting prosthetic valve	2 (13%)	0.49 (0.11–2.3)	0.530		
Non intravenous drug abuser	46 (27%)	2.7 (1.2–6.1)	**0.014**	5.6 (1.2–25.5)	**0.027**
Presenting features					
Fever[d]	29 (19%)	0.46 (0.25–0.86)	**0.014**		
Hypotension[e]	29 (44%)	4.5 (2.3–8.5)	<**0.001**	6.3 (2.1–18.8)	**0.001**
Valvular regurgitation	39 (20%)	0.4 (0.19–0.84)	**0.013**		
Peri-valvular abscess	2 (18%)	0.73 (0.15–3.5)	1.000		
LVEF[f] (%)	55 (S.D. 16)	−3.1 (−7.8–1.6)	0.197		
PASP[g] (mm Hg)	48 (S.D. 27)	7.9 (1.2–15)	**0.021**		
Microorganisms					
Staphylococcus aureus	29 (26%)	1.3 (0.73–2.5)	0.344		
Coagulase negative *Staphylococci*	3 (38%)	2.1 (0.47–8.9)	0.392		
Streptococcus viridans	0 (0%)	N.A.	**0.044**		
Any *Streptococci*	7 (12%)	0.35 (0.15–0.83)	**0.014**		
Laboratory findings					
Creatinine (μmol/L)	276 (S.D. 315)	140 (50–230)	**0.003**	1.003 (1.001–1.005)	**0.001**
Urea (mmol/L)	16 (S.D. 10)	6 (2.7–9.3)	<**0.001**		
Peak CRP (mg/L)	186 (S.D. 131)	56 (13–99)	**0.011**	1.005 (1.001–1.009)	**0.015**
Complications					
Heart failure	21 (34%)	2.1 (1.1–4.1)	**0.020**	3.8 (1.3–10.6)	**0.012**
Admission to intensive care unit[h]	33 (38%)	3.5 (1.9–6.7)	<**0.001**		
Pneumonia	18 (41%)	2.9 (1.5–5.9)	**0.002**	4.9 (1.5–16.1)	**0.009**
Intracranial haemorrhage	10 (48%)	3.5 (1.4–8.7)	**0.012**		
Ischemic stroke	11 (32%)	1.7 (0.78–3.8)	0.170		
Embolic events[i]	15 (25%)	1.2 (0.59–2.3)	0.721		
Required renal replacement therapy	12 (63%)	7 (2.6–19)	<**0.001**		
Peri-valvular abscess	2 (18%)	0.73 (0.15–3.5)	1.000		
Underwent valvular surgery	4 (7.8%)	0.23 (0.08–0.66)	**0.003**		

[a] Continuous variables expressed as [Mean (S.D.)].
[b] 95% Confidence Interval in parentheses; Continuous variables expressed as Mean Difference.
[c] Moderate to high risk, as defined by American Heart Association recommendations for bacterial endocarditis (as per the Modified Duke's criteria).
[d] Defined as temperature >38 °C, as per the Modified Duke's criteria.
[e] Systolic blood pressure <90 mmHg at presentation.
[f] Left ventricular ejection fraction.
[g] Pulmonary artery systolic pressure.
[h] Excluding admission for post-operative monitoring only.
[i] Excluding cerebrovascular events.

The SHARPEN Risk Score

Parameter		Points
Systolic blood pressure < 90mmHg at presentation		3
Heart failure		2
Age (years)		
	< 50	2
	50 to 65	4
	>65	6
Raised serum creatinine >200μmol/L		2
Pneumonia		2
Elevated Peak CRP > 200mg/dL		2
Non-intravenous drug abuser (Non-IVDA)		3
Total score		**2 to 20**

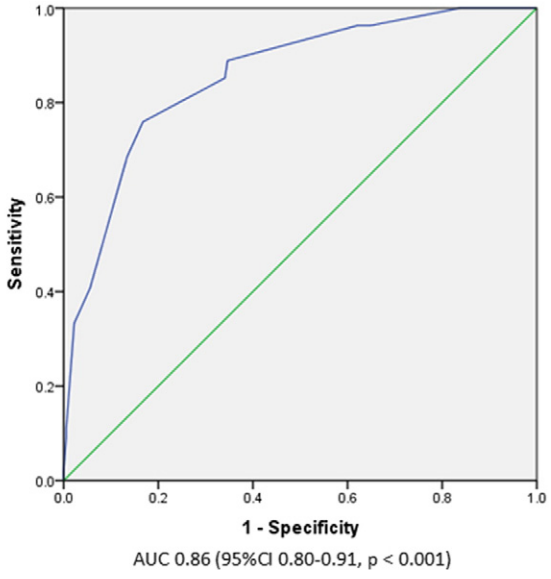

Fig. 1. The SHARPEN risk score.