A clinical prediction model predicted 30-day and 1-year mortality in patients hospitalized for heart failure

Lee DS, Austin PC, Rouleau JL, et al. **Predicting mortality among patients hospitalized for heart failure: derivation and validation of a clinical model.** JAMA. 2003;290:2581-7.

QUESTION

In patients presenting with heart failure, does a clinical prediction model adequately stratify the risk for death at 30 days and 1 year?

DESIGN

2 cohort studies, 1 for derivation and 1 for validation.

SETTING

Derivation cohort: 34 hospitals; validation cohort: 14 hospitals in Ontario, Canada.

PATIENTS

Newly admitted patients (2624 for derivation [mean age 67 y, 51% women] and 1407 for validation [mean age 75 y, 51% women]) with a primary diagnosis of heart failure meeting modified Framingham heart failure criteria. Exclusion criteria included development of heart failure after admission, transfer from another acute care facility, and age ≥ 105 years.

DESCRIPTION OF PREDICTION GUIDE

Potential candidate variables were identified based on literature review, expert opinion, and availability. Data on left-ventricular function were collected when available.

Score-based prediction rules for 30-day and 1-year mortality were developed using a coefficient-based scoring method of 30-point increments (very low ≤ 60, low 61 to 90, intermediate 91 to 120, high 121 to 150, and very high > 150 points).

MAIN OUTCOME MEASURES

Performance of model in predicting all-cause 30-day and 1-year mortality.

MAIN RESULTS

Mortality rates at 30 days and 1 year were 10.7% and 32.9%, respectively, in the derivation cohort, and 10.4% and 30.5% in the validation cohort and increased with increasing risk scores (Table). Multivariate analysis showed predictors of 30-day and 1-year mortality were increased age, decreased systolic blood pressure, increased respiratory rate, hyponatremia, and increased urea nitrogen levels; and the comorbid conditions of cerebrovascular disease, dementia, chronic obstructive pulmonary disease, cirrhosis, and cancer.

CONCLUSION

In patients with heart failure, a prediction model based on clinical data gathered within the initial hours of hospital presentation predicted all-cause mortality at 30 days and 1 year.

Sources of funding: Ontario Ministry of Health; Canadian Institutes of Health Research; Heart and Stroke Foundation.

For correspondence: Dr. J.V. Tu, Institute for Clinical Evaluative Sciences, Toronto, Ontario, Canada. E-mail tu@ices.on.ca. ■

30-day and 1-year mortality rates by risk category in heart failure

Risk categories (score)	30-day mortality rate		1-year mortality rate	
	Derivation	Validation	Derivation	Validation
Very low (≤ 60)	0.4%	0.6%	7.8%	2.7%
Low (61 to 90)	3.4%	4.2%	12.9%	14.4%
Intermediate (91 to 120)	12.2%	13.7%	32.5%	30.2%
High (121 to 150)	32.7%	26.0%	59.3%	55.5%
Very high (> 150)	59.0%	50.0%	78.8%	74.7%

COMMENTARY

Prognostic factors have been identified in heart failure patients enrolled in clinical trials. However, unselected admitted heart failure patients may have different prognostic factors. From this group of patients, Lee and colleagues identified those who met modified Framingham heart failure criteria (1, 2) using the Canadian Institute for Health Information hospital discharge abstract (3). Using presentation features, laboratory values, and preexisting comorbid conditions, they constructed risk scores to predict 30-day and 1-year mortality.

Risk-assessment methods are well known for patients with coronary artery disease but not for heart failure patients. Identifying patients at high risk could be helpful for targeting patients in need of treatment in specialized care units. Furthermore, end-of-life issues could be dealt with earlier. Identification of low-risk patients who could be discharged early to outpatient care is also important in the present era of cost containment.

This study is a retrospective analysis, and the amount and management of missing data are not stated. Furthermore, limited information exists about the data abstraction methods and the interrater reliability of the abstractions for all variables (4). Also, ventricular function was assessed in only 62% of the derivation cohort and 49% of the validation cohort. The authors state that the model does not significantly change if ventricular function is included. This might be true even in the patients without such an assessment, but this is not shown.

Lee and colleagues have indicated that such initial routine clinical findings as age, vital signs, biochemistry, and comorbid conditions could be used to predict both 1-month and 1-year mortality in unselected heart failure patients. This finding needs to be shown in a prospective validation study.

Peter Henriksson, MD, PhD
Karolinska Institute at Danderyd University Hospital
Stockholm, Sweden

References

1. **Senni M, Tribouilloy CM, Rodeheffer RJ, et al.** Congestive heart failure in the community: a study of all incident cases in Olmsted County, Minnesota, in 1991. Circulation. 1998;98:2282-9.
2. **Vasan RS, Larson MG, Benjamin EJ, et al.** Congestive heart failure in subjects with normal versus reduced left ventricular ejection fraction: prevalence and mortality in a population-based cohort. J Am Coll Cardiol. 1999;33:1948-55.
3. **Jong P, Vowinckel E, Liu PP, Gong Y, Tu JV.** Prognosis and determinants of survival in patients newly hospitalized for heart failure: a population-based study. Arch Intern Med. 2002;162:1689-94.
4. **Worster A, Haines T.** Advanced statistics: Understanding Medical Record Review (MRR) Studies. Acad Emerg Med. 2004;11:187-92.