Risk prediction for heart failure within 1-year in ICU patients

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***Abstract*— The aims of this study is to develop a clinical risk prediction model for estimating incidence of heart failure (HF) within one year. Thirty-six demographic and laboratory results were analyzed as potential predictors of HF. The Cox proporational model identified age, cardiac arrhythmias, pulmonary circulation, diabetes, renal failure, blood urea nitrogenand, activated partial thromboplistin time as the 7 most important predictors of HF incidence. The predictive model was robust, with prospectively validated C-statistics of 0.71 for predicting HF from admission to one-year after discharge.**

I. Introduction

Heart failure can cause a number of symptoms including shortness of breath, leg swelling, and exercise intolerance. How to predict HF and thus prevent before its occurrence should be studied. It has been demonstrated that conventional predictors of heart failure included age, sex, obesity, myocardial infarction and other forms of ischemic heart disease, hypertension, valvular heart disease, and cardiomyopathy in [1]. Except for the conventional risks, biomarkers and generic risk factors are studied to predict HF were studied in [2][3].

This paper aims to establish a short-term 1-year HF prediction model based on the potential conventional risk factors and laboratory results for ICU patients.

II. Methods and Results

Our study is based on the public MIMIC II database, in which 3,048 individuals are with multiple stays and during which 555 subjects developed HF over 1-year follow-up period. Cox proportional hazards models were used to assess association of potential conventional predictors such as age, sex, cardiac arrhythmias and laboratory results such as SCR (Serum Creatinine), BUN (Blood Urea Nitrogen), Glucose, APTT (activated partial thromboplstin time), TBIL (total bilirubin) with HF. To estimate the performance of the predictive model, we evaluated the performance of the established models with and without laboratory results in terms of receiver operating characteristic (ROC) curve.

The forest plot of HF prediction based on conventional risk factors and laboratory results is demonstrated in Figure 1. It can be seen the overall hazard ratio of the proposed multivariable predictive model is with better classification performance than any models with uni-variable. The ROC curve for the predicted risk scores with and without laboratory results presented as Figure 2 (C-index of 0.71 versus 0.70).

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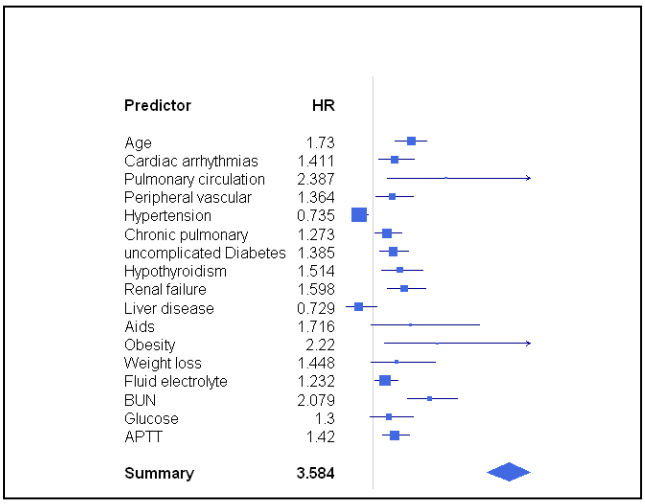
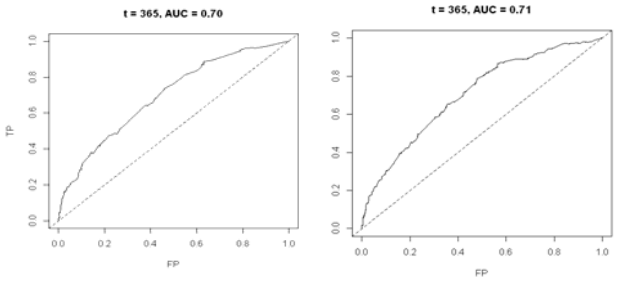


Figure 1 Forest plot analyses of HF incidence prediction based on conventional risk factor and biochemical indexes



(a) (b)

Figure 2 ROC curves for the predicted risk scores (a: conventional risk factors alone b: combined with laboratory results)

III. Conclusion

In ICU patients' cohort, we found that conventional risk factors predicted heart failure within one year with reasonable accuracy and that the addition of laboratory results to conventional risk factors modestly improved discrimination and thus substantially improved risk classification performance for heart failure.

References

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