長庚大學醫學院臨床醫學研究所
畢業生研究成果

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畢業論文題目（中文）：敗血症之生物標誌探討

畢業論文題目（英文）：Biosignature in sepsis

BACKGROUND

The among of sepsis is one in five deaths in the world currently, but the early prediction of sepsis researches is limited. Sepsis is a life-threatening condition of organ dysfunction caused, by the immune response of human body to infection. During infection, the body releases certain immune chemicals into the bloodstream to combat the infection. Sepsis occurs when the overwhelming immune response of human body to these chemicals is out of balance. As a result, blood flow is impaired, leading to tissue necrosis, organ necrosis, and finally causing death. Sepsis can be caused by many types of microbes including bacteria, virus, and fungi.The common clinical symptoms of sepsis include fever, rapid heartbeat, altered mental status, hyperglycemia, oliguria, and ischemia. A study indicated that 48.9million sepsis cases and approximately 11 million deaths due to sepsis in 2017, accounting for one in five of all deaths worldwide. Although death is preventable in certain cases, sepsis often leads to lifetime organ failure in survivors.

OBJECTIVE

Compare different scoring systems and combine them into a Rpart model which could predict 28-day mortality. Since the condition of sepsis patients changes very rapidly , and the changes involved depend on the complicated etiology and medical history of patient, the development of a risk assessment model is crucial in helping doctors with clinical management as well as patient monitoring. Owing to the high cost of medical treatment, we sought to identify a combination of scoring systems which would help determine the risk of mortality of sepsis patients. These include the Systemic Inflammatory Response Syndrome (SIRS), Organ Failure Assessment (SOFA), quick Sepsis-related Organ Failure Assessment (qSOFA), National Early Warning Score (NEWS), Modified Early Warning Score (MEWS), CHARM, and Mortality in Emergency Department Sepsis (MEDS). First, we have introduced certain definitions and terminologies associated with sepsis. Next, we have introduced the Receiver Operating Characteristic (ROC) curve, which helps compare the biomarkers studied, and Area Under the Curve(AUC) , which helps ascertain the prediction accuracy. Subsequently, we constructed the decision trees (Rpart model) to identify the best combination of scoring systems and understand their ability to predict the 28-day mortality of sepsis patients in intensive care units. Finally, we used the Area Under the ROC curve (AUROC) to determine the prediction accuracy of the model and compare each scoring system. The verification of the correlation between a disease and its scoring system will aid in disease diagnosis, and the diagnostic effect can be maximized by combining multiple scoring systems, all of which have been discussed in the study.

METHODS

A prospective observational study in the Chang Gung Memorial Hospital (CGMH) was conducted in Linkou. We enrolled 1478 ICU patients with infection that used to diagnosis sepsis as the predictor variables in six years. The clinical scoring systems (systemic inflammatory response syndrome [SIRS], sequential organ failure assessment score [SOFA], quick Sepsis-related Organ Failure Assessment [qSOFA], National Early Warning Score [NEWS], Modified Early Warning Score [MEWS], CHARM score, Mortality in Emergency Department Sepsis [MEDS]) for 28-day mortality was evaluated. To compare the sepsis mortality within 28 days between different scoring systems. Using the Recursive Feature Elimination method to select the significant of the features to build the Rpart model. Accuracy in predicting 28-day mortality, sensitivity, specificity, and area under receiver operating curve (AUROC) of the final model was evaluated the predictive validity in training (80%) and testing (20%) datasets.

RESULTS

The cohort study contained 1478 patients, and 28-day mortality was 4.6%. AUC of mortality was 0.79 (95%CI 0.74-0.84) for SOFA score, 0.68 (95%CI 0.62-0.73) for NEWS, 0.64 (95%CI 0.56-0.70) for qSOFA score, 0.59 (95%CI 0.51-0.66) for MEWS, 0.65 (95%CI 0.58-0.71) for MEDS, 0.69 (95%CI0.62-0.75) for CHARM score, and 0.55 (95%CI 0.48-0.62) for SIRS. The selected variables of the predictive model were age, any tumor, altered mental status, temperature, SIRS, SOFA score, qSOFA score, MEWS, CHARM score, MEDS, and NEWS. The final model had promising accuracy, specificity, and AUC as follows: in training (0.94, 0.74, 0.81, and 95% CI 0.78-0.85), and testing (0.93, 0.72, 0.82, and 95% CI 0.79-0.86) better than SOFA score (AUC: 0.79 , 95% CI 0.56-0.70).

CONCLUSION

The Rpart provided a simple prognosis model and performed well in early prediction of 28-day mortality.

KEYWORDS and REFERENCE

Sepsis, Biomarker, Decision Tree, Predict, Mortality

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