P1392 MACHINE LEARNING ALGORITHM AS A PROGNOSTIC TOOL FOR VENOUS THROMBOEMBOLISM IN ALLOGENIC TRANSPLANT PATIENTS

Topic: 22. Stem cell transplantation - Clinical

Rui-Xin Deng1, 2, 3, 4, Yun He1, 2, 3, 4, Xiao-Lu Zhu1, 2, 3, 4, Hai-Xia Fu1, 2, 3, 4, Xiao-Dong Mo1, 2, 3, 4, Jing-Zhi Wang1, 2, 3, 4, Kai-Yan Liu1, 2, 3, 4, Xiao-Jun Huang1, 2, 3, 4, Xiao-Hui Zhang1, 2, 3, 4

1 Peking University People’s Hospital, Peking University Institute of Hematology, Beijing, China; 2 Collaborative Innovation Center of Hematology, Peking University, Beijing, China; 3 Beijing Key Laboratory of Hematopoietic Stem Cell Transplantation, Beijing, China; 4 National Clinical Research Center for Hematologic Disease, Beijing, China

Background:
As a serious complication following allogenic haematopoietic stem cell transplantation (allo-HSCT), venous thromboembolism (VTE) is significantly related to poor survival and increased nonrelapse mortality. Therefore, distinguishing patients at high risk of death who should receive specific therapeutic management is key to improving survival. Here, we established the first machine-learning-based model to predict posttransplant VTE prognosis to facilitate physician decision-making.

Aims:
This study aimed to establish a machine-learning-based prognostic model for selecting posttransplant VTE patients who are at a higher risk of death.

Methods:
We retrospectively evaluated 256 consecutive VTE patients who underwent allo-HSCT at a single centre between 2008 and 2019. These patients were further randomly divided into 1) a derivation (80%) cohort of 205 patients and 2) a test (20%) cohort of 51 patients. The least absolute shrinkage and selection operator (LASSO) approach was utilized to choose the potential predictors from the primary dataset. Eight machine learning classifiers were utilized to produce eight candidate models. A 10-fold cross-validation (CV) procedure was used to internally evaluate the eight models and to select the best-performing model for external assessment using the test cohort. We assessed the prognostic model performance by evaluating the discrimination [area under the curve (AUC)], calibration (calibration plot), and net benefit [decision curve analysis (DCA)].

Results:
In total, 256 of 7238 patients (3.5%) were diagnosed with VTE after transplantation. Among them, 118 patients (46.1%) had catheter-related venous thrombosis (CRT), 107 (41.8%) had isolated deep-vein thrombosis (DVT), 20 (7.8%) had isolated pulmonary embolism (PE), and 11 (4.3%) had concomitant DVT and PE. The two-year overall survival (OS) rate was 68.8%.

Using LASSO regression analysis, eight potential features were selected from the 54 candidate variables. The optimal algorithm based on the validation cohort with 10-fold CV runs was a logistic regression classifier. Therefore, a prognostic model was then established to predict 2-year outcome, which was named BRIDGE (bacteraemia, relapse, IFI and fib, grade II-IV aGVHD and FDP, age, and history of stroke). The AUCs of the BRIDGE model were 0.883 (95% CI 0.831-0.937), 0.871 (0.720-0.994), and 0.858 (0.740-0.976) for the training, validation, and test cohorts, respectively. The calibration plots showed a high agreement between the predicted and observed outcomes. Decision curve analysis indicated that VTE patients could benefit from the clinical application of the prognostic model.
Patients were further classified into low-risk, intermediate-risk, and high-risk categories while considering the observed death distribution of the total cohort by tertiles of 2-year outcome probability according to the BRIDGE score. Significant differences in Kaplan–Meier estimations of overall survival were obtained. A BRIDGE risk score calculator for predicting the study result is available online (47.94.162.105:8080/bridge/).

Image:

Summary/Conclusion:

We explored the BRIDGE risk score as a machine-learning-based tool that combines clinical and laboratory risk factors to precisely predict the risk for all-cause death in VTE patients after allo-HSCT. Identifying VTE patients who are at a high risk of death can help physicians treat them in advance, which will improve patient survival and prognosis.