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Machine-Learning Models to Predict Tacrolimus Dosage in Liver Transplant Recipients

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Introduction : Tacrolimus is the most widely used immunosuppressive agents to prevent rejection after solid organ transplantation. However, the use of tacrolimus should be cautious due to its narrow therapeutic index. Machine learning techniques could be good modality to decide optimal dosage of tacrolimus, compared with traditional statistical models. We have implemented a new approach to find the optimal dose of tacrolimus by machine learning technique.

Methods : We retrospectively reviewed the postoperative tacrolimus levels of patients who underwent liver transplantation at the Seoul National University Hospital from March 2016 to March 2018. We implemented an artificial intelligence model predicting future tacrolimus level by tacrolimus concentrations. We investigated hyperparameters (the number of layers in the network and the number of nodes in each layer) using a grid search and found the model with the lowest validation error.

Results : A machine learning model was derived using data from the 187 patients. As a result of testing the model with 18 patients, the predicted value of the model had an error of 1.5 ug/L from the actual measured tacrolimus level. Simulating the model in random case with a calculated tacrolimus dose to ensure the next drug concentration to be within the therapeutic range, more than 95% of the final predicted tacrolimus level comes in the therapeutic window.

Conclusions : This is the first study to use machine learning models to predict optimal dosage after liver transplantation. Machine-learning model is useful to decide optimal dose of tacrolimus immediate postoperative period after liver transplantation.

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