Abstract

Background: Management of tacrolimus trough levels influences morbidity and mortality after lung transplantation. Several studies have explored pharmacokinetic and artificial intelligence models to monitor tacrolimus levels. However, many models depend on a wide range of variables, some of which, like genetic polymorphisms, are not commonly tested for in regular clinical practice. This study aimed to verify the efficacy of a novel approach simply utilizing time series data of tacrolimus dosing, with the objective of accurately predicting trough levels in the variety of clinical settings.

Methods: Data encompassing 36 clinical variables for each patient were gathered, and a multivariate long short-term memory algorithm was applied to forecast subsequent tacrolimus trough levels based on the selected clinical variables. The tool was developed using a dataset of 87,112 data points from 117 patients and its efficacy was confirmed using six additional cases.

Results: Shapley Additive exPlanations revealed a significant correlation between trough levels and prior dose-concentration data. By using simple trend learning of dose, administration route, and previous trough levels of tacrolimus, we could predict values within 30% of the actual values for 88.5% of time points, which facilitated the creation of a tool for simulating tacrolimus trough levels in response to dosage adjustments. The tool exhibited the potential for rectifying clinical misjudgments in a simulation cohort.

Conclusions: Utilizing our time series forecasting tool, precise prediction of trough levels is attainable independently of other clinical variables, through the analysis of historical tacrolimus dose-

concentration trends alone.