Prediction of Tacrolimus blood levels by using the neural network with genetic algorithm in liver transplantation patients.

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Abstract

The neural network (NN) is a technique using an artificial intelligent concept in predicting outcomes by using various input variables. Tacrolimus pharmacokinetics has wide inter- and intra-subject variability and it is often difficult to predict its blood concentrations by dose alone. The objectives of this study are to select the clinically significant variables and to predict the blood concentration of tacrolimus in liver transplant patients by NN combined with genetic algorithm (GA). A total of thirty-two adult liver transplant patients from the University of Iowa Hospitals and Clinics were selected and the patients' data were retrospectively collected. These patient were randomly assigned into two groups: either the training group (n = 10), or testing group (n = 22). A back propagation (BP) NN was developed which contained two hidden layers. A dynamic BP NN based on the time series concept was trained by using the current and previous data sets to predict the trough levels of tacrolimus. The mean of the NN prediction for tacrolimus blood levels was not significantly different from the observed value by a paired t-test comparison (12.05+/-2.67 ng/ml vs. 12.14+/-2.64 ng/ml, p = 0.80). The average difference of the testing sets between the observed and predicted levels was 1.74 ng/ml with a range from 0.08 to 5.26 ng/ml which is clinically acceptable range. Thirty-seven out of 44 data sets (84%) in the testing group were within 3.0 ng/ml of the observed values. This study demonstrated that tacrolimus blood concentrations are precisely predictable in liver transplant patients using patients variables by NN.