Establishment of a terminal prognosis prediction model by applying time series analysis to real-world data

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Background: Several studies have reported a lack of benefit in continuing cancer chemotherapy during a patient’s pre-death terminal phase, and that late therapy might increase the risk of emergency hospital care. Despite the need for objective indicators providing decision support for discontinuing active intervention, there have been no objective markers and almost no related studies thus far.

Purpose: We attempted to establish a prognosis model to predict a patient’s death that could help physicians make a decision to discontinue palliative chemotherapy by using longitudinal laboratory test data including but not limited to CRP or albumin.

Patients and method: We enrolled 2595 cancer patients who had received chemotherapy at the outpatient oncology unit of Kyoto University Hospital between January 1997 and September 2014. Ninety laboratory test values obtained between the first day of chemotherapy administration and the last follow up date were used for modeling. In total, 7,760,865 time-inclusive data points were analyzed, with death within 3 months as the objective binary variable and the laboratory tests as the predictor variables. Univariate and multivariate logistic regression analyses were executed to evaluate the efficiency of prognosis prediction and calculate a cutoff value that could suitably recommend discontinuation of treatment.

Result: Using data from multiple types laboratory tests up to 3 months before death, the terminal prognosis prediction model derived from logistic regression analysis could predict the death event at the level of AUC >= 0.80.

Conclusion: Our model can predict death in the following 3 months with relatively high accuracy. We believe this model can assist the daily clinical practice of physicians by contributing to their terminal care recommendation decision process.