Abstract Submission No. : 9101
May 27(Fri) 16:50-18:50 KSN Research Fund Project

Prediction of Death in Dialysis Patients Using Artificial Intelligence

Jung Nam An
Hallym University Sacred Heart Hospital, Korea, Republic of

The prevalence of end-stage renal disease patients is rapidly increasing due to the increase in chronic diseases such as diabetes and hypertension and the aging of the population, and Korea has a high prevalence compared to other countries around the world. The number of patients with end-stage renal disease is expected to continue to increase in the future.

The prognosis of dialysis patients is improving, but the mortality rate is still higher than that of other disease groups, so the 5-year survival rate for hemodialysis patients is 61.5% and peritoneal dialysis patients 61.7%, like some cancer patients. Cardiovascular complications are the most common cause of death in dialysis patients regardless of age, and they have both traditional risk factors and specific risk factors related to dialysis status. As such, the continuously increasing number of end-stage renal disease patients are burdened with medical and socioeconomic burdens due to high mortality and medical expenses. It is very important to predict the mortality risk of dialysis patients and to identify and manage the mortality risk factors in advance to reduce mortality and medical costs. Machine learning is receiving more and more attention in the medical field, and its application is expanding across all fields, and it has proven its clinical usefulness and potential in various diseases in the field of nephrology. However, no prognostic model has been established in hemodialysis patients so far, and there is no prognostic predictive model using vital signs and weight changes during dialysis, and dialysis-related clinical variables. We aimed to build a prognostic prediction model that can predict the death of dialysis patients through a deep learning technique using dialysis-related clinical variables and vital signs during dialysis that change in real time in addition to traditional risk factors. In this study, data of patients who underwent maintenance dialysis at Hallym University Sacred Heart Hospital from January 2015 to December 2019 were extracted from electronic medical record. Changes in vital signs (before dialysis, during dialysis, immediately after dialysis), dry weight, weight gain between dialysis, ultrafiltration amount, blood test results, and in-hospital deaths were investigated. Out-of-hospital deaths were investigated using data from the National Statistical Office. Using refined data, a recurrent neural network-based long short-term memory deep learning model that can predict death from vital signs was trained.

Of a total of 1,772 patients, 322 died in-hospital and 337 died out-of-hospital. Among these, patients with vital signs measured during dialysis within 72 hours were included. When learning with 4-fold cross validation for the prediction of death within 72 hours from each vital sign measurement time during dialysis (including both out-of-hospital and in-hospital death), the performance was AUROC 0.9591±0.0115 and AUPRC 0.2408±0.0290. Afterwards, the test set was composed of only 16 patients who died out of hospital within 100 hours from the time of the last vital sign measurement. As a result of checking the predictive performance, it was AUROC 0.8714 and AUPRC 0.1440.

In this study, a death prediction model using a deep learning technique that maximizes the correlation between data was constructed using vital signs and test results during dialysis, which are regularly measured in hemodialysis patients. A prospective study will be needed.