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Prediction of Patient Survival in Deceased Donor Kidney Transplant using Korean Network for Organ Sharing Database

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Background: The Korean Network for Organ Sharing (KONOS) was founded in 2000 for organ allocation in Korea. It has been allowed researchers to fully access the nationwide population-based data about KT recipients. We propose a novel prediction approach of recipient survival based on machine learning techniques using KONOS data.

Methods: Our dataset is collected from 2000 to 2014 by the KONOS. Patients' survival of these recipients was investigated by the individual learners such as survival decision tree, cox regression, survival ridge/lasso regression, and ensemble learners such as survival bagging and random forest.

Results: We analyze records of 5,430 deceased donor kidney transplants (DDKT) with more than 31 attributes, among which we choose 15 independent attributes to learn our models. Survival lasso algorithm had created the most accurate prediction model, and it outperforms a conventional method such as Cox regression (Concordance index 0.709 vs. 0.660, respectively). Among various survival decision tree models, the tree using patient's survival duration and age was found to be the best performed model for test dataset (Concordance index 0.690). In recipients under 51.5 years, survival hazard ratio (HR) was predicted as 0.58 compared to overall recipients. Transplant era showed significant association with mortality. If more than 51.5-years-old patient received a transplant before 2006, predicted survival HR was 3.14. Even above the 51.5 years of recipients' age, if the age is not more than 61.5 years of age at the time of transplantation and transplant era was after 2006, survival HR is only 0.97. Consequently, patients with over 61.5 years and transplant era were after 2006 were depend on donor weight for survival HR. In heavy donor (over 75kg) for old recipients, survival HR was increased to 4.2.

Conclusion: We propose machine learning based models with estimated-death risks for presenting more accurate than conventional models. In our final model, recipient's age, transplant era and body weight of deceased donor were chosen as notable risk factors for mortality in DDKT recipients.

Keywords: deceased donor kidney transplantation, survival