Development and External Validation of a Machine Learning Model for Prediction of Survival in Extremity Leiomyosarcoma

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INTRODUCTION:
Machine learning (ML) algorithms to predict cancer survival have recently been reported for a number of sarcoma subtypes, but none have investigated leiomyosarcoma (LMS). ML is a powerful tool that has the potential to better predict mortality rates for patients with LMS.
METHODS:
The Surveillance, Epidemiology, and End Results (SEER) database was queried from 2004 to 2015 for cases of histologically confirmed LMS (n=634). Patient, tumor, and treatment characteristics were recorded, and ML models were developed to predict 1-, 3-, and 5-year survival. The best performing ML model was externally validated using an institutional cohort of LMS patients (n=46).
RESULTS:
All ML models performed best at the 1-year and 3-year timepoint and worst at the 5-year timepoint. On internal validation within the SEER cohort, the best models had c-statistics of 0.76 to 0.75 at the 5-year timepoint. The Random Forest (*RF*) model was the best performing model and used for external validation. The *RF* model had excellent survival predictive capability with c-statistics of 0.90, 0.96, and 0.87 at the 1-, 3-, and 5-year timepoints.
DISCUSSION AND CONCLUSION: Machine learning models perform well for survival prediction in LMS. Future studies are needed to further validate the machine learning approach for LMS prognostication.

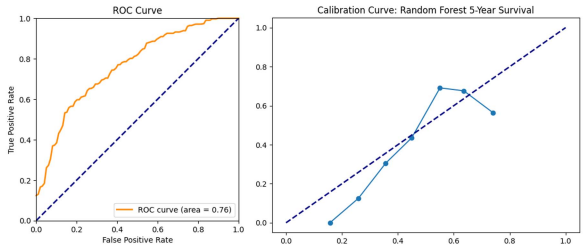

Figure 1. Receiver operating characteristic curve (left) and calibration curve (right) for 5-year survival for the performance of the Random Forest model on internal validation within the SEER dataset.

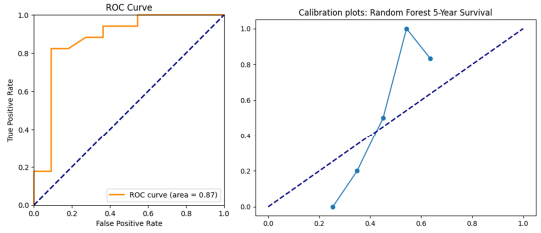

Figure 2. Receiver operating characteristic curve (left) and calibration curve (right) for 5-year survival for the performance of the Random Forest model on external validation within the institutional dataset.