Development and Assessment of an AI-Based Machine Learning Model for Predicting Urinary Continence and Erectile Function Recovery After Robotic-Assisted Radical Prostatectomy: Insights from a Prostate Cancer Referral Center

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Introduction:

Prostate cancer remains a significant health concern, with radical prostatectomy being a common treatment approach. However, predicting postoperative functional outcomes, particularly urinary continence and erectile function, poses challenges. Emerging artificial intelligence (AI) technologies offer promise in predictive modeling. This study aimed to develop and validate AI-based models to predict continence and potency following nerve-sparing robotic radical prostatectomy (RARP

Methods:

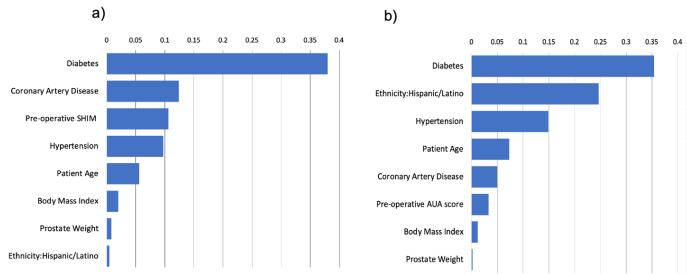
A cohort of 8,524 patients undergoing RARP was analyzed. Preoperative variables were collected, and two separate machine-learning Artificial Neural Network (ANN) models were trained to predict continence and potency at 12 months post-surgery. Model performance was assessed using area under the curve (AUC) values, with comparisons made to other machine learning algorithms. Feature importance analysis was conducted to identify key predictors.

Results:

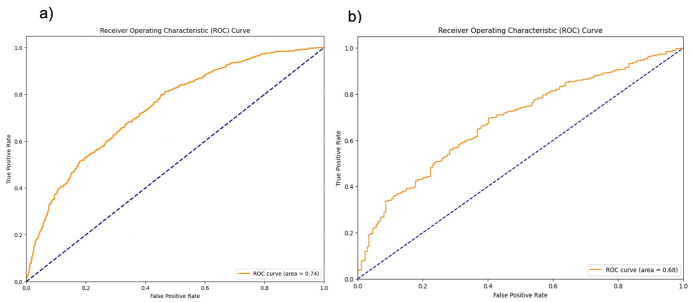
The ANN models demonstrated AUCs of 0.74 for potency and 0.68 for continence prediction, outperforming other algorithms. Feature importance analysis identified variables such as age, comorbidities, and preoperative scores as significant predictors for both outcomes.

Conclusion:

AI-based models show potential in predicting postoperative functional outcomes following RARP. Continued efforts in optimizing models and exploring additional factors are needed to improve predictive accuracy and clinical applicability. Multi-center studies and larger datasets will further contribute to enhancing the value of AI in clinical decision-making for prostate cancer treatment.



Feature importance analysis for using predicting a) potency and b) continence at 12 months using a Logistic Regression, Artificial Neural Network (ANN) machine learning model (Andor® Health, Orlando, FL, USA).



Performance of Artificial Neural Network (ANN) machine learning model (Andor® Health, Orlando, FL, USA) model for a) predicting likelihood of potency at 12 months. b) predicting likelihood of continence at 12 months. ROC: receiver operating characteristics.