



Title: High-performance integrative mathematical models for pathological status prediction in a large series of PCa patients: added value of radiomics and mp-MRI

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Topic: Genitourinary

Presentation Format: Research Presentation

Purpose or Learning Objective

The most common systems used to risk-stratify PCa patients have been repeatedly shown to have suboptimal prognostic and stratification performances. The aim of the present study is to test the ability of high-performance mathematical models employing clinical radiological and radiomics features to improve the accuracy of non-invasive prediction of pathological features of PCa.

Methods or Background

A cohort of 949 patients who underwent mpMRI and prostatectomy at IEO between 2015 and 2018 was selected. The prostate gland was segmented with an internally-developed deep-learning segmentation algorithm. Gradient-boosted decision tree models were separately trained using clinical, radiological and/or radiomic features. The contribution of each feature category was assessed in the whole cohort and within different risk groups and PI-RADS categories through the cumulative SHAP value and the mean absolute error (MAE). A comparison regarding misclassified patients between the models and the clinical workflow was performed.

Results or Findings

The AUC performance of four models demonstrated that the model, including all variables, resulted in the best in most endpoints. Radiological features account for the largest contribution in improving the predictive performance, while radiomics appear to bring a measurable boost, although small. SHAP subgroup analyses showed that, although the mean/median influence of radiomic features is low, their contribution to individual patients' prediction can be very high; moreover, MAE values resulted lower in low-risk and low-PIRADS classes. The best prediction model outperformed the naïve one in all the considered endpoints in terms of AUC, whereas the accuracies were comparable.

Conclusion

Our results highlight the potential benefit of mathematical models for pathological feature prediction in PCa. These results are of considerable interest in informing clinical decision-making and can provide valuable information for personalising therapy and to guide the clinical course.

Limitations: Not applicable.

Funding for this study: No funding was provided for this study.

Has your study been approved by an ethics committee: Yes

Ethics committee - additional information: The ethics committee notification can be found under the number UID 2438.

Area of Interest: Pelvis

Imaging Technique: MR-Diffusion/Perfusion

Procedure: Radiation therapy / Oncology

Special Focus: Tissue characterisation