



UNIVERSITATEA DE MEDICINĂ,
FARMACIE, ȘTIINȚE ȘI TEHNOLOGIE
„GEORGE EMIL PALADE”
DIN TÂRGU MUREȘ

”GEORGE EMIL PALADE” UNIVERSITY OF MEDICINE, PHARMACY, SCIENCE, AND
TECHNOLOGY OF TÂRGU MUREȘ - SCHOOL OF DOCTORAL STUDIES

**Summary of the Doctoral Thesis: „ The Role of MRI-Based Imaging Biomarkers
in the Characterization and Prognosis of Pelvic Tumors”**

PhD Student: Petresc (Boca Bianca)

Scientific Coordinator: Prof. Dr. Buruian Mircea Marian

Rectal and bladder cancers are prevalent oncological diseases that present significant challenges in staging, treatment selection, and assessment of therapeutic response. Magnetic Resonance Imaging (MRI) is the gold standard for local evaluation of both tumor types. However, its interpretation remains largely subjective. Radiomics, an emerging field focused on the quantitative analysis of medical images, offers promising opportunities for identifying clinically and prognostically relevant non-invasive imaging biomarkers. The radiomic features can be considered as imaging biomarkers which can support more objective and reproducible tumor characterization and prognosis.

This thesis is structured around two major research directions. The first one focuses on rectal cancer and involves original studies aimed at developing radiomic models and evaluating their ability to predict the response of locally advanced rectal cancer to neoadjuvant chemoradiotherapy, as well as estimating the risk of developing metachronous metastases. The second research direction centers on bladder cancer and involves a systematic review of the literature assessing the current role of MRI-based radiomics, along with a critical appraisal of study quality using the Radiomics Quality Score (RQS).

The first original study evaluated the utility of radiomic features extracted from T2-weighted MRI images for predicting the lack of-response to neoadjuvant treatment in patients with locally advanced rectal cancer. The goal was also to develop a radiomic score capable of early identification of non-responders. The resulting model showed strong predictive performance, achieving an AUC of 0.94 in the training set and 0.80 in the testing set. The study's originality lies in its focus on predicting treatment failure, a relatively

underexplored area in the literature, as well as in the comprehensive use of the entire tumor volume for feature extraction, including features from wavelet-filtered images.

The second study investigated the predictive value of first-order radiomic features extracted from ADC maps in identifying patients at risk of developing metachronous metastases in rectal cancer. Among the extracted features, the 90th percentile and uniformity were the most predictive. The developed model, based on seven first-order features, achieved an AUC of 0.8, highlighting the potential of radiomics for tailoring post-treatment oncologic surveillance.

The third study was a systematic review of the published literature on the role of MRI-based radiomics in bladder cancer. It included 26 studies published between 2017 and 2023 that explored the use of radiomic features for predicting tumor stage, histological grade, molecular markers, and treatment response. The review identified significant methodological heterogeneity and moderate overall study quality, with an average RQS score of 11.7 out of 36. This underscores the need for standardization of the radiomic workflow and external validation of proposed models. This review is the first to specifically assess the quality of MRI-based radiomics research in bladder cancer, offering a comprehensive overview of current progress and limitations in the field.

Together, these three studies contribute to the advancement of radiomics as a promising tool in precision oncology imaging. The findings support the role of radiomic features as quantitative imaging biomarkers for tumor characterization and prognosis, while also highlighting the urgent need for multicenter validation and standardized implementation before radiomics can be adopted into routine clinical practice.