

# Imaging biomarkers for early radiotherapy treatment response in Prostate Cancer

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## Background:

- The prostate is a gland in the male reproductive system.
- Prostate cancer is the most common cancer in NZ Men and 3<sup>rd</sup> highest cause of cancer death in NZ [1].
- Currently, Prostate Specific Antigen (PSA) level in blood is an important biomarker for detecting prostate cancer and assessing treatment response, where elevated PSA indicates tumour in prostate.
- However, PSA has limitations such as
  - Poor sensitivity and specificity.
  - cannot differentiate between local and distal failure.
  - difficult to track tumour response.
- Multiparametric MRI (mpMRI)**
  - is a non-invasive imaging technique
  - gives anatomical and functional information.
  - can use during radiotherapy for precise and accurate treatment.
- 'Biologically targeted radiotherapy' (BiRT) has been proposed as a method to enable personalized radiotherapy treatment tailored to an individual patient's tumour [3].
- We propose mpMRI could provide imaging biomarkers to help in BiRT treatment planning and early response assessment.**

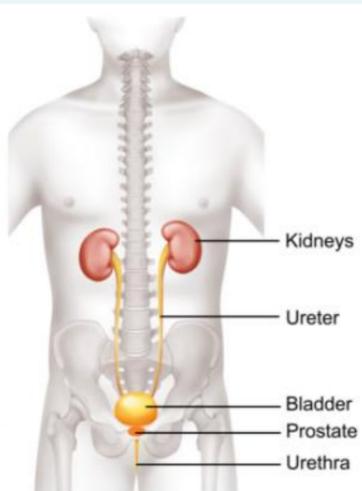


Figure 1: Prostate Anatomy [2]

## Methods:

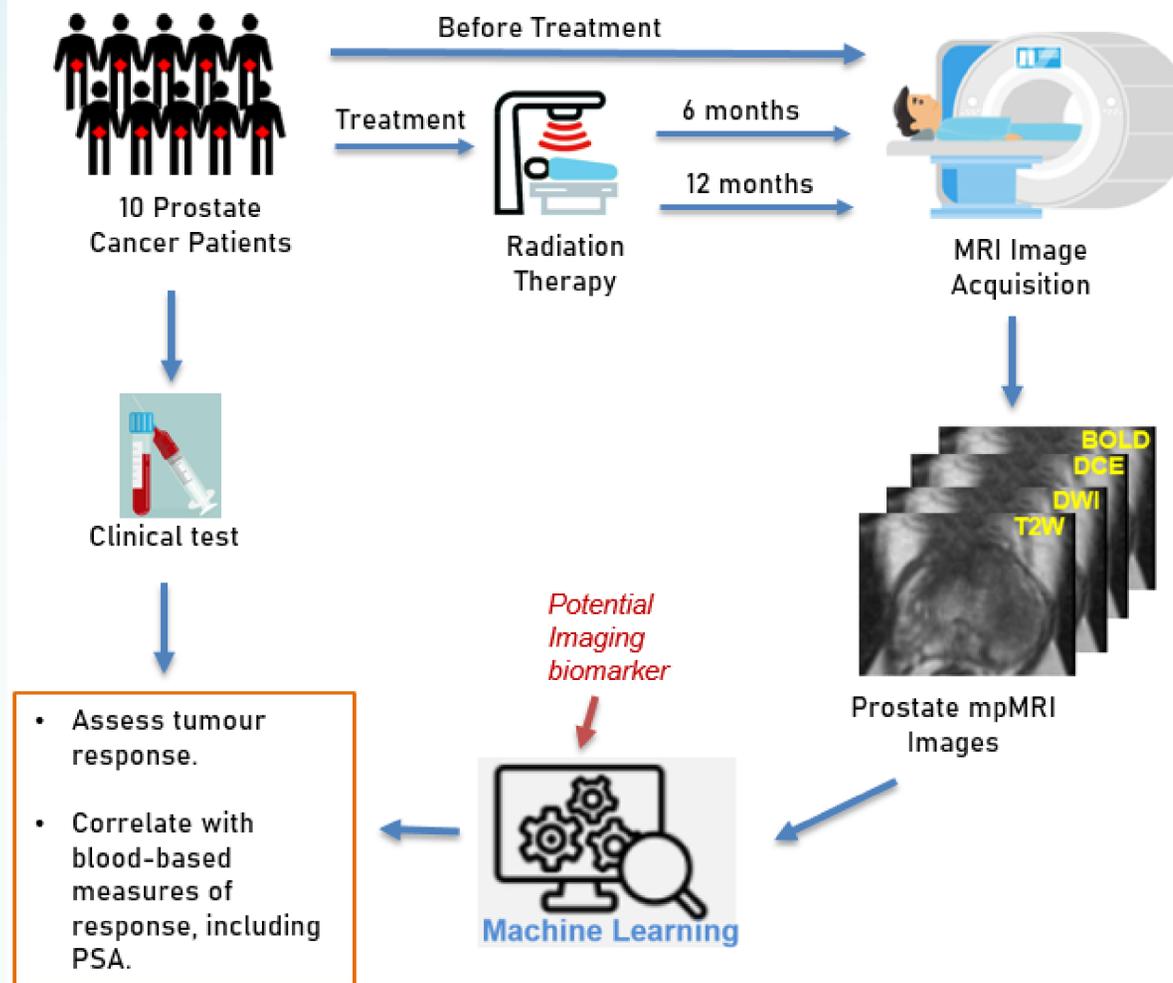
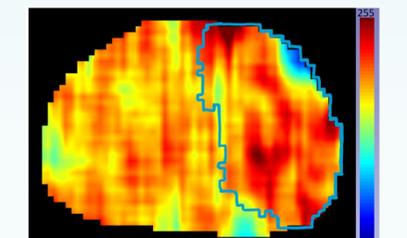


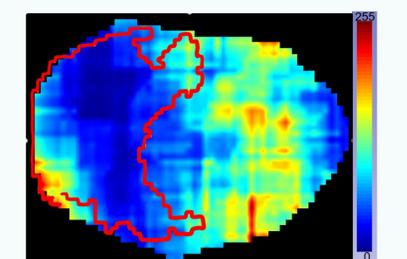
Figure 3: Project Workflow

## Results:

- Image processing pipeline developed with retrospective analysis of mpMRI data from 70 patients co-registered with ground truth histology data [4].
- 1820 quantitative features derived from each of four mpMRI sequences - T2W, DWI, DCE and BOLD, and identified four features as potential markers for identification of prostate tumour.



TTP wavelet texture feature colormap; tumour is outlined in blue.



ADC gradient texture feature colormap; tumour is outlined in red.

- mpMRI-based texture features have the potential to be used as biomarkers for treatment response monitoring.**

## Aims:

- Develop novel imaging biomarkers to enable early response assessment of radiotherapy for prostate cancer, by extracting quantitative information from mpMRI images using machine learning and artificial intelligence.
- Conduct a longitudinal study at Auckland City Hospital to develop, test and assess potential mpMRI biomarkers.

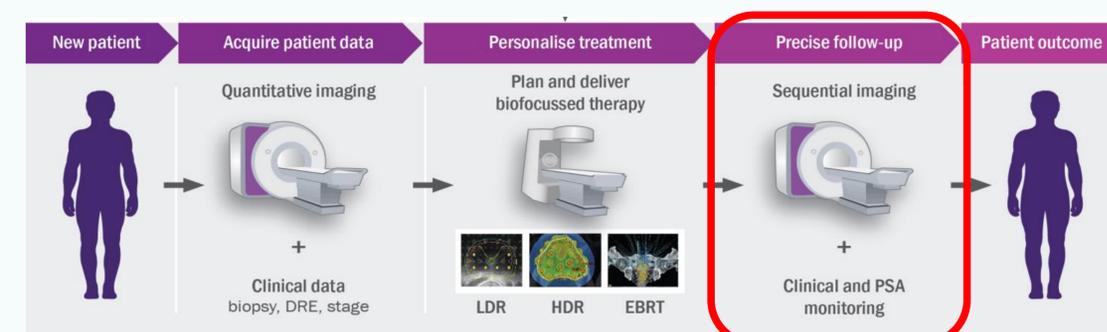


Figure 2: BiRT Framework

## References:

- [1] Prostate Cancer - Prostate Cancer Foundation of New Zealand. URL <https://prostate.org.nz/prostate-cancer/>.
- [2] Prostate cancer - symptoms, diagnosis, treatment. URL <https://www.southerncross.co.nz/group/medical-library/prostate-cancer-symptoms-diagnosis-treatment>.
- [3] Her EJ, et al. (2020) Progress towards Patient-Specific, Spatially-Continuous Radiobiological Dose Prescription and Planning in Prostate Cancer IMRT : An Overview. *Cancers (Basel)*, 12(4), p.854.
- [4] Reynolds HM, et al. (2015) Development of a registration framework to validate MRI with histology for prostate focal therapy, *Med Phys*, 42(12):7078-89.

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