



MÁSTER EN INVESTIGACIÓN BIOMÉDICA

Research Project Proposal

Academic year 2022-2023

Project Nº 36

Title: *Creation of a risk stratification model in initial prostate carcinoma based on machine learning and radiomics on PET-PSMA images.*

Department/ Laboratory *Laboratory where the project will be carried out indicating Department, Area, Faculty, CUN, CIMA etc.*

Nuclear Medicine Department, CUN

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Summary

Introduction

Prostate cancer (PC) is the most frequent tumour in men in Europe. The correct staging of PC, as well as its risk stratification, directly affects the treatment decision and patient management. Nevertheless, the correct stratification is still imprecise, since up to 40% of patients treated with curative intent present reappearance of the disease in the first 5 years after treatment. In recent years, new imaging modalities have been emerging for a more precise evaluation of PC, such as the labelling of prostate-specific membrane antigen (PSMA) with Gallium-68 (68Ga), for obtaining images by Positron Emission Tomography (PET). PSMA is approximately 1000-fold overexpressed in tumour cells relative to normal prostate cells. PET-PSMA has shown to be a useful tool in identifying patients who would not be good candidates for curative surgery (prostatectomy), such as those having extraprostatic disease, since patients with extraprostatic disease are much more likely to present biochemical recurrence after the treatment compared to patients with disease confined to the prostate.

Radiomics refers to the analysis of medical images using specific software that allows obtaining image biomarkers related to tumour heterogeneity, through the recognition of complex patterns that are difficult for humans to process. The development of quantitative imaging methods together with *machine learning* have also made it possible to translate this data into personalized medicine, since it enables more precise risk and prognosis stratifications, focused on targeted therapies.

Being able to use *machine learning* to determine if the analysis of the textures of the lesions detected in the PET-PSMA studies increases the precision of the staging of patients with PC (and consequently their risk stratification), would make it possible to define the most effective treatment for each patient.

Goals

To define whether texture analysis (radiomics) of preoperative PET-PSMA studies provides additional information in risk stratification in patients with PC. For this, the findings of the PET-



PSMA (location, number and quantitative and texture analysis) studies will be correlated with those of the surgical piece (obtained in the prostatectomy) as well as with those of the lymph node dissection, especially focused on those variables that have been shown to be related to greater tumour aggressiveness (Gleason score, preoperative PSA, lymph node infiltration and local invasion).

Methodology

Observational retrospective cohort study in patients studied by PET-PSMA for pre-surgical PC staging, who underwent radical prostatectomy from January 2019-December 2022 (approximately 300 patients). To correlate findings of the PET-PSMA (location, number and quantitative and texture analysis) with the follow-up (persistence/early recurrence). Due to the high complexity of Artificial Intelligence analysis through *Machine Learning*, researchers from the Institute of Data Science will perform it and Artificial Intelligence of the University of Navarra will perform it.

yes	
no	x

Does the project include the possibility of supervised animal manipulation to complete the training for animal manipulator?