MULTIMODALITY FUNCTIONAL IMAGING IN RADIATION THERAPY: RELATIONSHIP BETWEEN FUNCTIONAL IMAGES OF HEAD AND NECK CANCER

Author: Moisés Mera Iglesias[1] **Thesis Advisor**: José Luis Alba Castro[1,2]

[1] Universidade de Vigo, Spain; [2]Telecommunications Engineering School (Associate Professor)

MOTIVATION OF THE WORK

The motivation of this Ph.D programme is to explore the relationship between functional images of head head and neck cancer and the issue of registration metric between different functional images.

This work is part of a research project named "Adaptive Radiation and Prediction of Tumor Response based on Functional Studies of MRI and PET / CT in Head and Neck Cancer"' funded by a FIS (IP: PI11/02035) grant. The overall objective of the project is to establish an integrated information network from which predictive models of tumor response can be developed, and the effects to critical organs for patients with head and neck tumors based on functional data in vivo can be assessed.

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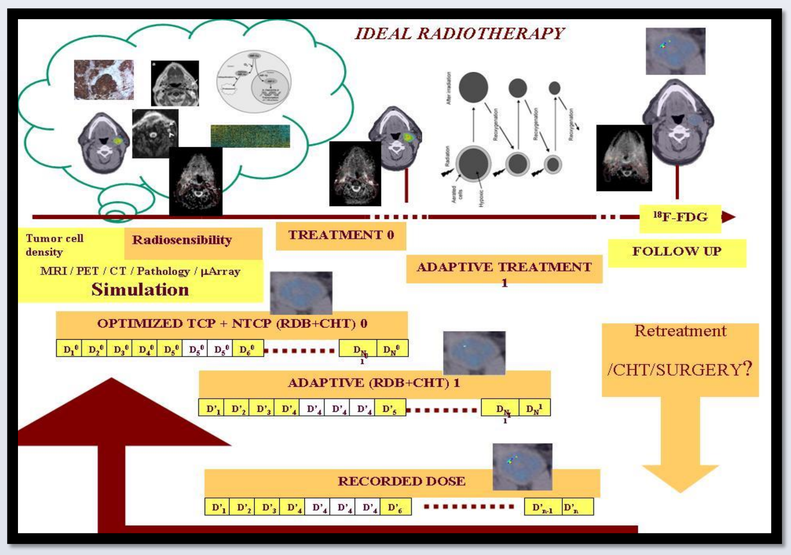

Fig. 1. Ideal Radiation: The radiation planning should be tailored to the individual patient's response to treatment, based on functional images.

THESIS OBJECTIVES:

Multimodality imaging can provide useful anatomical and functional data about tumors, including tumor cellularity measured by diffusion weighted (DW)-MRI and glucose metabolic status measured by 18F-fluorodeoxyglucose (18F-FDG) PET [1]. In order to characterize the tumor and to implement new predictive models based on functional imaging data, we must ensure we can extract as much information as possible from the available data. Our objective is explore the relationship between ADC, SUV, and DCEMRI related parameters to evaluate their influence in tumour response

In summary, the main objectives envisaged at the outset for the Ph.D programme are the following:

1. **Get functional imaging of patients with this pathology**

This study was approved by local institutional review board and we obtained informed consent from all patients

2. **Anatomically register between differents modality of images and extract as much information as possible from the available data.**

The project developed a home-made software [2] for register and extracts data from images .

3. **Explore the relationship between ADC, SUV, and DCEMRI**

RESULTS

We explored the relationship between ADC, SUV, and DCEMRI related parameters to evaluate their influence in tumour response in a case where we have, in the same slice, a necrotic volume, a hypoxic area and a well vascularized tumour volume (Fig.3). On november 2014 we published a paper [2] and this year we contribute in a oral presentation [3] at ISMRM 24th annual meeting 2016 (Fig.2) about this

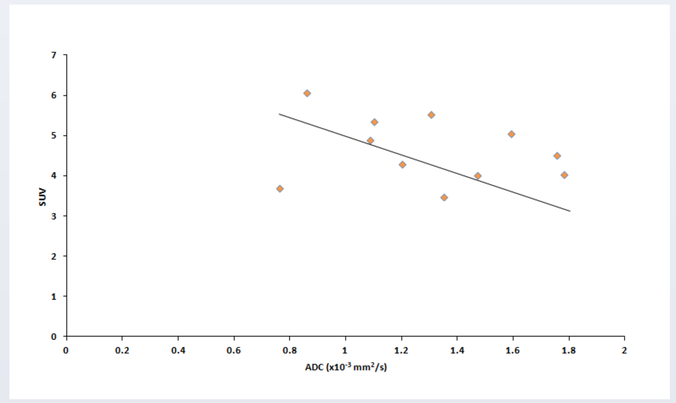

Fig.2. The relationship between SUV and ADC in HPV– HNSCC patients showing an inverse correlation between the two metrics.

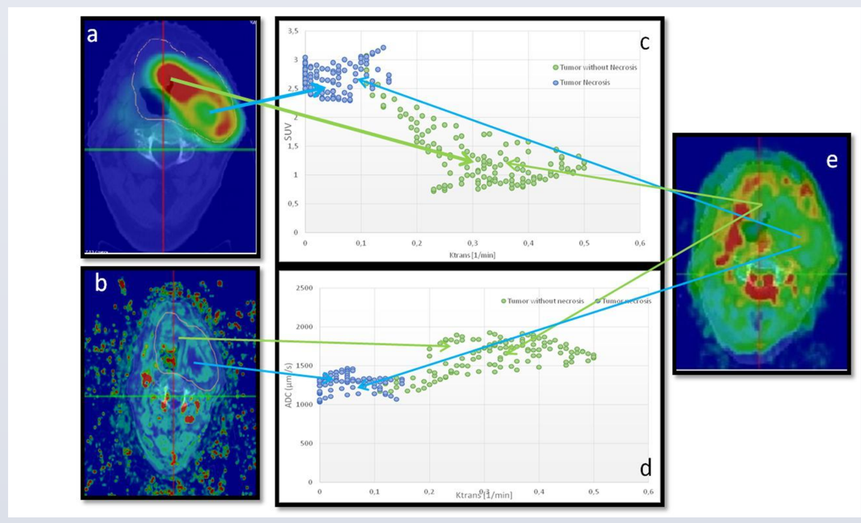

Fig.3 In this figure SUV versus Ktrans and ADC is represented. (a) PET/CT. (b) Ktrans map overlaped to simulation CT (c) In the hypoxic area (excluding necrotic area), high SUV values are obtained indepently for all low Ktrans values, because of the addition of the Warburg effect and the Pasteur effect. (d) In the well vascularized area, SUV values are decreasing with Ktrans, as expected, because a reduction in ADC implies an increase in tumour cell density. (e) ADC map overlaped to simulation CT.

Data analysis was performed with an own home software developed for this project [4]. Partial validation of the deformable register was made using a commercial software and introduced in the ESTRO 2015 Congress. We are working in a paper about total validation

Fig.3 In this figure we compare the register between 2 X-ray CT made whit our home software (ARTFIBIO) versus commercial software Velocity©. For this we use NCC and Mutual Information metrics

RESEARCH PLAN

		2014				2015				2016				2017	
TASK	DESCRIPTION	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
1.	LITERATURE REVIEW														
2.	COLLECTING DATA														
3.	DATA ANALYSIS														
4.	SOFTWARE VALIDATION														
5.	PUBLICATION														
6.	THESIS														

The research plan schedule is shown in the timetable:

- Green color indicates completed work
- Yellow color indicates future assignments

PLANNING FOR 2016-2017:

We had to rethink our planning for labor reasons. Next year we expect to complete the register validation and to publish it in a second paper.

Once finished this, in the second trimester of 2017 we hope to have completed the thesis redaction.

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