Grant agreement no. 667510

GLINT

Research and Innovation Action
H2020-PHC-2015-two-stage

D7.7 Scanning of 1st adult patient for head- and neck tumours and gliomas

Work Package:	1
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Lead beneficiary:	UCL
Contributors:	UCL
Reviewers:	MPG

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Dissemination Level		
PU	Public	YES
CO	Confidential, only for members of the consortium (including the Commission Services)	
CI	Classified, as referred to in Commission Decision 2001/844/EC	

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1 Version log

Version	Date	Released by	Nature of Change
V1.0	16/02/2017	Sola Adeleke	First version
V1.1	17/02/2017	Patxi Torrealdea	Adding technical details
V1.2	20/02/2017	Mina Kim	Formatting the original report into the EC template, Adding acronyms, Revision.
V1.3	02/03/2017	Mina Kim	Final version

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2 Definition and acronyms

Acronyms	Definitions
FDG	Fludeoxyglucose
T2w-mDixon	T2 weighted-modified Dixon
SE	Spin echo
SL	Spin lock
glucoCEST	Glucose Chemical exchange saturation transfer
mM	millimolar

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3 Introduction

3.1 Background and the need

As current standard of care FDG PET-CT delivers a considerable amount of radiation dose, there is a need to develop a new imaging technique that could provide a better or at least similar biological or clinical information but without the radiation impact. For the first time in a scanner (3T MR Phillips Achieva scanner), 20% dextrose infusion was administered with an IRadimed MRI compatible pump and we then performed an exchange sensitive MRI scan.

3.2 Objectives

- To assess the reproducibility of exchange-sensitive MRI signal and proof-of-concept study in cancer patients
- To characterize head and neck tumours (lymphoma and head and neck squamous cell cancer) by detecting glucose uptake within them and how this technique compares with current reference standard technique FDG PET-CT.

3.3 Position of D7.7 in the project

This work package serves an important step towards validating the exchange sensitive MRI technique and also evaluating its translational potential in the clinic.

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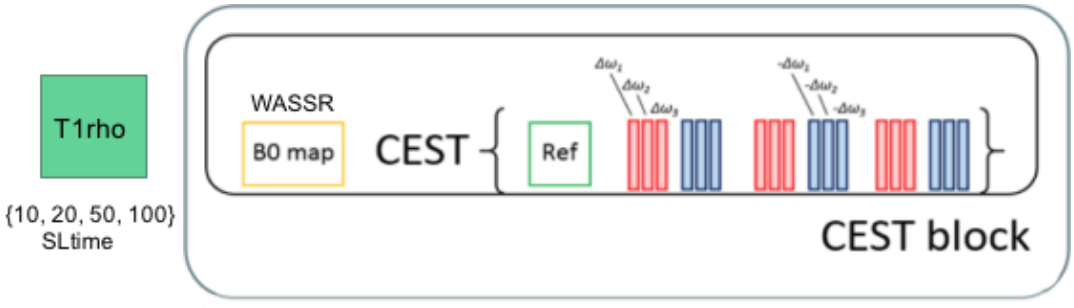
4 Methodology and Approach for D7.7

MRI sequences:

- A set of MRI scans were acquired aimed to observe contrast as glucose was infused:
  - Localizer
  - T2w-mDixon
  - T1rho: with SE and SLtimes of 10, 20, 50 and 100 ms
  - CEST block: B0map + Reference + 6x {±3, ±2.75, ±2.5, ±2.25 +2} ppm

- Image resolution for CEST and T1rho was set to 1.8 x 1.8 x 4.4 m^3. The readout consisted of a 3D gradient echo with a CENTRA k-space sampling acquisition which enabled to acquire 3 slices with a single saturation phase.
- The exchange sensitive sequences (CEST and T1rho) were alternatively acquired throughout to be able to compare them and decide on best method for the final protocol in future clinical studies for cancer detection using GlucoCEST.



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5 Report Activities carried-out and results

Activities carried out

Clinical activities:

- Patients were identified at multidisciplinary team meetings (MDTs) or from daily FDG PET scan lists at the nuclear medicine department or from PACS (picture archiving and communication system).
- They were then approached either by telephone or in-person in clinics. If they are agreeable, a study information sheet was given or sent to them.
- They were given enough time to consider (at least 24hrs) after which a consent document was signed and final arrangement made for their scan appointment.
- They both arrived fasted for at least 8hrs.
- We've scanned two patients so far. The first patient arrived at 7am on 23rd of January 2017 and CEST 002 at 8am on 14th of February 2017. Following completion of the experiments, they left the department at 11am and 12 pm, respectively.
- On arrival, the whole experiment was reviewed again with the patients.
- For each participant, 2 venous access cannula were cited at the ante-cubital fossa and the other on the dorsum of the hand.
- Baseline blood glucose measurements ensured that fasting blood glucose is less than 7mM/l, random glucose less than 10mM/l and the highest rise in glucose from baseline during infusion didn't exceed 10mM/l rise.
- Once the baseline glucose measurements are satisfactory, the MRI safety questionnaire and checks were conducted by the duty radiographer and the MR physics team.
- Participants were then moved inside the scanner accompanied by 3 people (a clinical fellow, an imaging research nurse and research practitioner).
- Anatomical localization images were acquired which took roughly between 10-20mins and then important CEST images were acquired once the glucose infusion was commenced.

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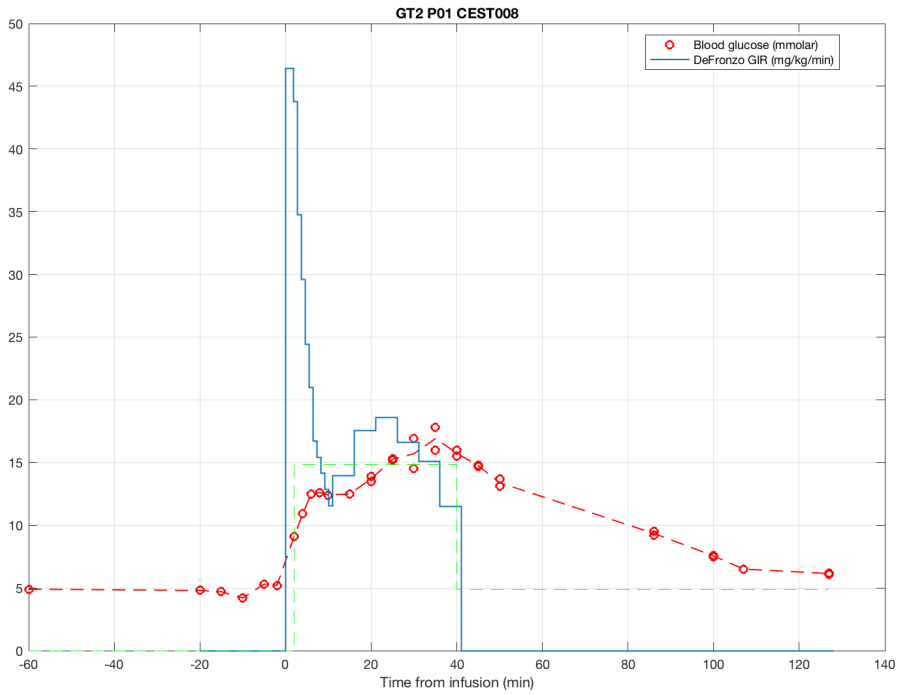
- In the first 10mins, 2 mins-glucose monitoring were carried out but were reduced to every 5mins monitoring afterwards
- The glucose infusion ran for as minimal time as possible. For about 30min but didn't exceed 1hr.
- Once the scans were completed and glucose infusion discontinued, the participants were monitored for up to 1hr and had regular blood glucose monitoring to ensure the glucose levels reverted back to normal. The participants were advised how to identify and prevent hypoglycaemic episodes at home.
- The images acquired went through post-processing afterwards.
- Participants were contacted by the research team the following day to ensure they were well and didn't have any adverse events.

Results of Hyperglycemic clamp

Patient 1:



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Patient 2:

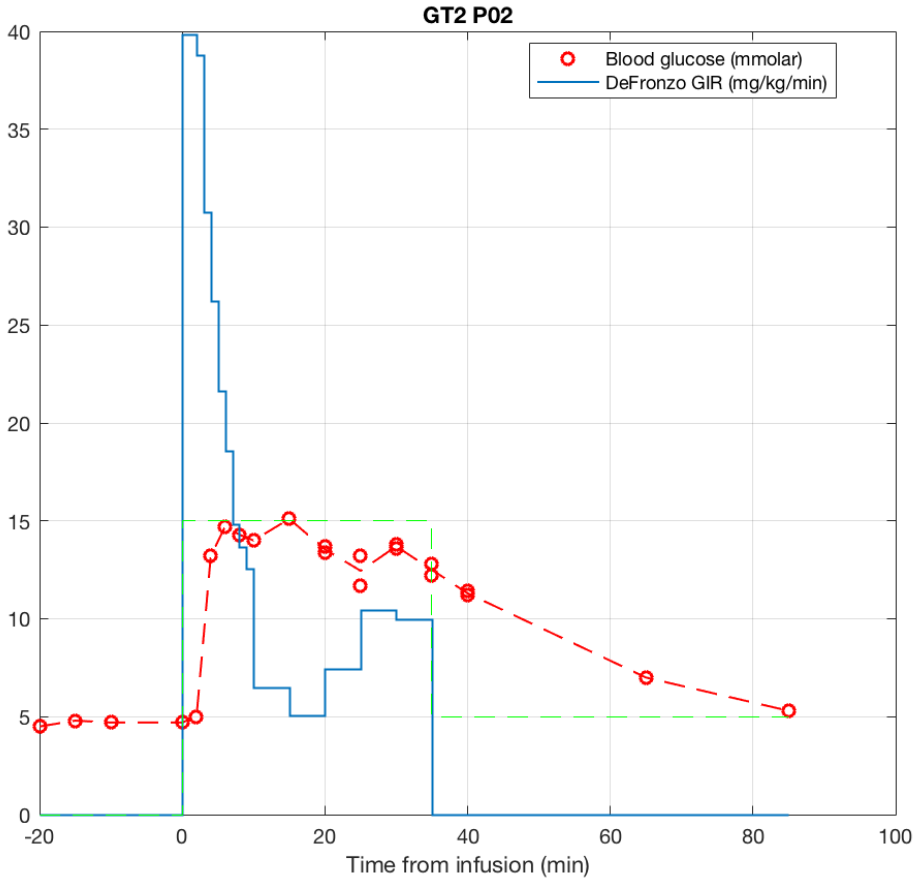

Image results

- Patient 1: Due to a bug in the software, all images were scanned at the default frequency offset of 0 ppm which rendered the data unusable. The problem has been address with Philips engineers and it has been temporarily amended until final solution.
- Patient 2: Images were acquire as described above, this time with the correct frequency offsets. Images of the neck during the MRI session display large degree of movement due to breathing, swallowing and patient handling during blood sampling. Due to the small size of the tumor, assessment of the real glucoCEST contrast is not possible without a robust registration pipeline.

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6 Conclusions

Scanning of 1st two adult patients for head- and neck tumours have been accomplished despite of a minor software problem for one patient. However, the consequences of registration misalignment on the glucoCEST raw data remain to be further investigated, particularly for cases of limited registration possibilities due to the thick and non-isotropic slice acquisition.

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7 Bibliography / References

Include Bibliographical references, if applicable

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