

COST ACTION B21
Physiological Modelling of MR Image Formation

MINUTES from the

Functional Renal MR Imaging and Modelling Working Groups Meeting

LOCAL ORGANISERS

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VENUE

Haukeland University Hospital
Department of Radiology
University of Bergen
Norway

4th - 6th October, 2007

Participants:

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Meeting web-site:

<http://biomedimageanalysis.uib.no/wikka.php?wakka=EUCostB21Workshop>

AGENDA

Thursday 4th October

Arrival

Friday 5th October

Renal MRI Working Group:

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|-------|---|
| 09.00 | Welcome
A Lundervold (NO) |
| 09.10 | Renal Disease – New Diagnostical Trends
B Iversen (NO) |
| 09.40 | Beyond Gd – New Imaging Techniques in Renal Disease
A Koay (UK) |
| 10.10 | Image-based Renal Modelling – Status and new Trends
S Sourbron (DE) / D Buckley (UK) |
| 10.40 | <i>Coffee</i> |
| 11.00 | Image Registration/Kidney Motion Correction
P Rogerlj (SI) |
| 11.30 | MRI Image Post Processing – Summary of Approaches
F Zoellner (NO) |
| 12.00 | Discussion |
| 13.00 | <i>Lunch</i> |

Renal Modelling Working Group:

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|-------|---|
| 14.00 | Texture Analysis for MRI
P Szczypinski |
| 14.30 | Discussion |
| 15.45 | <i>Coffee</i> |
| 16.00 | Discussion |
| 18.00 | Close |
| 20.00 | Dinner |

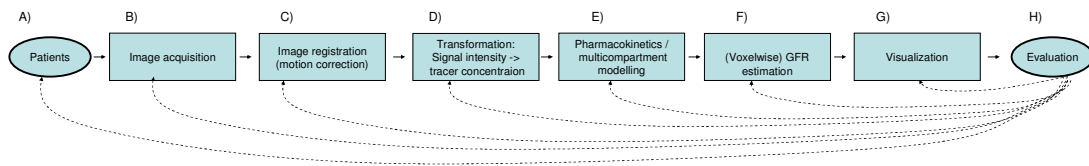
Saturday 6th October

- 09.00 Presentation of results of small working groups from Friday afternoon
- 09.15 How multidisciplinary renal imaging research is organised
Short reports from centers of the participants (ca. 15 min each)
- ◆ Bergen (Rørvik)
 - ◆ Munich (Sourbron)
 - ◆ Manchester (Buckley)
 - ◆ Aarhus (Pedersen)
- 10.15 Funding, Cooperations, Possibilities within COST and FP 7
R Lerski (UK)
- 10.45 *Coffee*
- 11.00 Discussions and follow-up planning
Follow-up (financial resources, multi-center projects and papers, consortium, meetings).
- Close

Resume

The workflow sketched at the previous COST B21 meeting (held 8th of December 2006 in Bergen, Norway) was used as starting point for discussions in order to show the step-by-step procedure from data acquisition towards physiological parameter estimation and clinical evaluation:

Workflow for voxelwise GFR-estimation from DCE MRI data using image registration techniques and pharmacokinetic modelling



During the meeting the following main problems and tasks were discussed and the following goals defined:

- data acquisition:
 - the different centres record data using different protocols and scanners
 - in Munich and Aarhus: 2D DCE-MRI data, whereas in Bergen and Manchester: 3D DCE-MRI are recorded
 - important aspects:
 - sufficient measurement time to capture data for GFR estimation in all subjects
 - free breathing (Munich, Manchester, Aarhus) versus segmented breath-hold (Bergen)
- image registration:
 - image registration (i.e. motion correction) seems to be a major bottleneck within the processing chain for every participating centre performing DCE-MRI research
 - motion-correction is essential for correct voxel-based or ROI-based estimation of physiological parameters (e.g. GFR)
 - however, evaluation of registration quality is difficult due to lack of gold standard methods
- future of COST Action:
 - prequalification proposal for a new COST action (Title: European network for functional magnetic resonance imaging of kidneys) submitted 28/9-07 by Michael Pedersen
 - participants agreed to collaborate on a full proposal if we have success in the first round
 - include additional research groups (Network of Pedersen/ Buckley)

- joint publication demonstrating collaborative research on functional magnetic resonance imaging of kidneys (status report December 15th)
 - o collecting a core data set comprising DCE-MRI data from healthy volunteers and patient data (contributed by Bergen and Manchester), data will be stored in Aarhus
 - o motion-correction of these data (performed by Bergen, Madrid?, Ljubljana, and Lodz)
 - o estimation of GFR (algorithms/code from Munich)
 - o evaluation of registration quality by regional GFR estimates
- A sharepoint (ftp) server is to be set-up. Website is:
 - o <http://www.sharepoint.sun.au.dk/sites/eukidneygroup>
 - o Username and password is to be sent to each participant (otherwise: contact Michael Pedersen: michael@mr.au.dk).

Data acquisition and organization of datasets

Groups: Bergen, Aarhus.

Actions: 10 DCE-MRI datasets obtained from the clinical MRI system in Bergen will be selected (Frank Zöllner). Five datasets coming from healthy volunteers and five datasets from patients with renal disease will be selected in order to be analyzed within the joint project (that will be reported in mid December). Also DCE-MRI data from the kidney project in Manchester will be provided for further processing. All data will be stored in DICOM format and be available to the group members from the above-mentioned website.

Image registration / motion correction

Groups: Bergen, Ljubljana, Lodz, Madrid, Manchester.

Actions: All groups mentioned above will continue the task of improving motion-correction, and by comparing results the best method will be selected. As a first step, two datasets, one acquired from a healthy volunteer, and one from a kidney patient will be registered in parallel by each group. Registered, and unregistered selected slices containing abdominal aorta will be subject to the GFR-estimation algorithm by Steven (executed in Munich or Bergen) for evaluation of motion-correction effects on GFR estimates and the goodness of model fit (parametric maps).

Pharmacokinetic modelling

Groups: Munich, Manchester, Aarhus.

- A model fit library is established
- 2 and 3 compartmental pharmacokinetic models will be used
- comparison of GFR obtained from DCE-MRI-based pharmacokinetics and eGFR from the blood samples
- animal models?

Software development

Groups: Lubljana, Lodz, Bergen, Madrid

Lodz (Piotr Szczypinski) will look into image-registration. The other sites will continue their work on image registration and segmentation. Pharmacokinetic model-fit is established in Munich and Manchester, and will also be provided to (or reimplemented) in other groups.

Clinical applications

Groups: Bergen (Svartstad/Iversen)

- secondary hypertension and ischemic renal failure
- polycystic renal disease
- graft dysfunction in patients undergoing renal transplantation

Wiki-page for the COST B B21 renal imaging and modelling working group:

- cf. <http://biomedimageanalysis.uib.no/wikka.php?wakka=EUCostB21Workshop>

Follow-up / long-term goals:

- Follow-up of present and proposed short-term activities December 15th 2007 with respect to a possible joint publication.
- Application to FP 7 (kfr. info from Dr. Lerski 8/10)
- Establish annual meetings for functional MR imaging of kidneys
- Coordinated software development for functional kidney imaging (long-term goal)

Bergen, 23/10-2007
Aarhus,

Arvid Lundervold / Frank Zöllner
Michael Pedersen