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Update from the United Kingdom Renal Imaging Network (UKRIN)

Sue Francis
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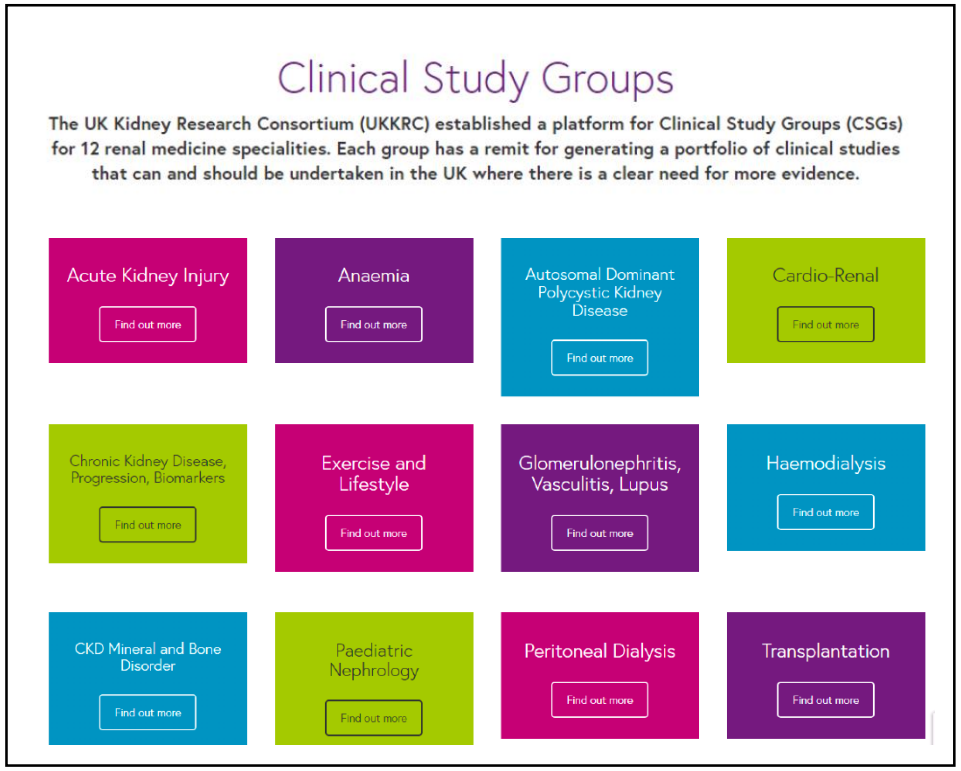
UK Renal Imaging Network
Transforming kidney health through technology

UK Renal Imaging Network (UKRIN)

UK Renal Imaging Network (UKRIN) brings together major UK renal MRI research centres through membership of a national group of MR physicists, radiologists, and clinicians dedicated to developing imaging methods to study the kidney.



UK Renal Imaging Network (UKRIN)

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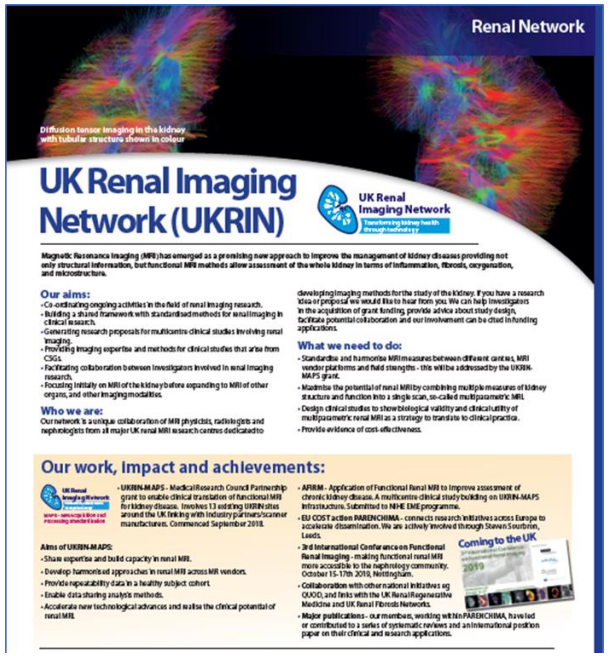
Primary Aims:

- *Co-ordinate activities in renal imaging research*
- *Build a framework of standardised methods for renal imaging.*
- *Generate research proposals for multicentre clinical studies involving renal imaging*
- *Provide imaging expertise for clinical studies that arise from Clinical Study Groups*
- *Facilitate collaboration between investigators involved in renal imaging research*
- *Be inclusive of all imaging modalities*



Establishing the UKRIN and outputs

1st Meeting: LONDON February 2016
funded by ISMRM | British & Irish CHAPTER

Isky Gordon

UKRIN established June 2016

THE RENAL ASSOCIATION founded 1950 | BRS British Renal Society Multi-professional working | Kidney Research UK Funding research to save lives

- **2nd Meeting: NOTTINGHAM, June2016**
- **3rd Meeting: LEEDS, November 2016**
- **4th Meeting: NEWCASTLE, February 2017**
- **5th Meeting: KRUK, April 2017**
- **6th Meeting: KRUK, July 2017**
- **7th Meeting: GLASGOW, January 2018**
- **8th Meeting: MANCHESTER, June 2018**
- **9th Meeting: CAMBRIDGE, March 2019**
- **10th Meeting: NOTTINGHAM, 3rd Renal Meeting**
- **11th Meeting: SHEFFIELD, 21st January 2020**

- Website: https://kidneyresearchuk.org/research/research-networks/uk-renal-imaging-network/
- 150 on mailing list – Sign up!

September 2017
MRC Partnership grant submission

UK Renal Imaging Network – Transforming kidney health through technology
MAPS - MRI Acquisition and Processing Standardisation

September 2018 commenced
UK Renal Imaging Network (UKRIN): Enabling clinical translation of functional MRI for kidney disease, MRC Partnership, Sept 2018 – Sept 2021. £795,786

Normative healthy volunteer study

MRC Medical Research Council

NIHR | National Institute for Health Research

November 2018
NIHR EME submission to 'Functional Imaging' call

Application of functional MRI to improve assessment of chronic kidney disease (AFiRM study)
NIHR EME grant, Sept 2020 – Sept 2026. £1,975,786

CKD Study

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UKRIN-MAPS

(see Poster 09)

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MAPS - MRI Acquisition and Processing Standardisation

UKRIN-MAPS (MRI Acquisition and Processing Standardisation)

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UNIVERSITY OF CAMBRIDGE
UNIVERSITY OF LEEDS
UCL

AIMS:

- To develop **harmonized approaches in multiparametric renal MRI** across 1.5 and 3 T and MR vendors.
- To implement a "travelling kidney" study for within- and between-site reproducibility of phantom and *in-vivo* data.
- To set up a Data Analysis Centre (DAC) using the template of the Dementias Platform UK (DPUK) of open source XNAT informatics.
- To form a normative data set. 50 subjects at 1.5 and 3 T to establish reproducibility and biological variance

https://www.nottingham.ac.uk/research/groups/spmic/research/uk-renal-imaging-network/ukrin-maps.aspx

Twitter handle: @UKRIN_MAPS

MRC Medical Research Council

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MAPS - MRI Acquisition and Processing Standardisation

WP1: Governance, Network Activities and Patient Engagement

Co-organised by

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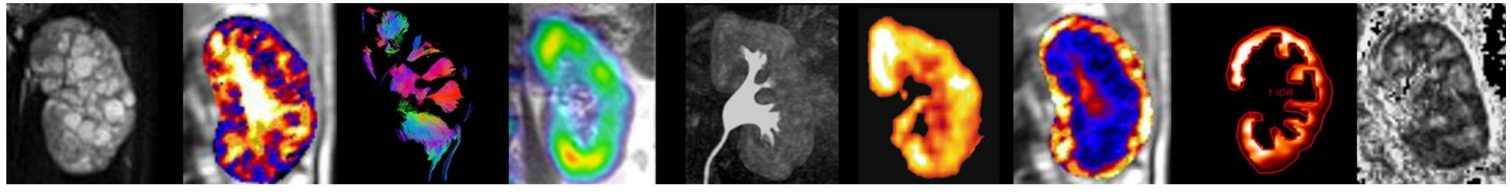
parenchima COST

cost
EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

Funded by the Horizon 2020 Framework Programme of the European Union



Kidney Research UK
Funding research to save lives

Patient Engagement

- Patient Engagement Team ensuring patient input into future trial trial. Development of patient MRI information including leaflets, patient videos illustrating case studies of the MRI scan experience.

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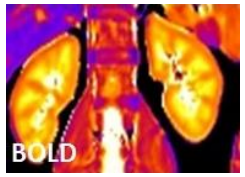
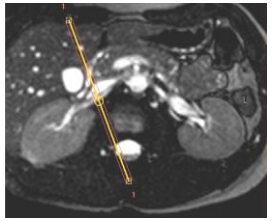
WP2: Protocol Optimisation and Harmonisation

Core
Advanced

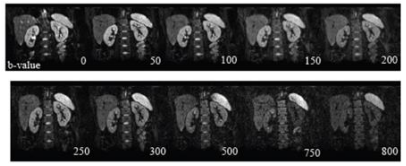
MRE

BOLD



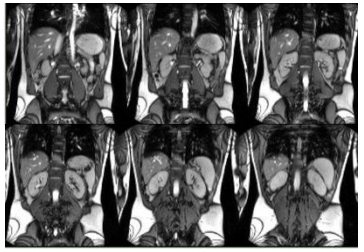


MT



Oxygenation

DWI/DTI

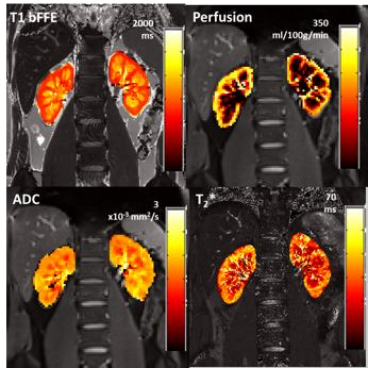


Structure

Volume

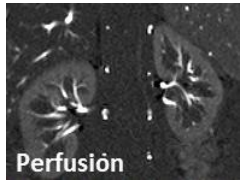
T_1

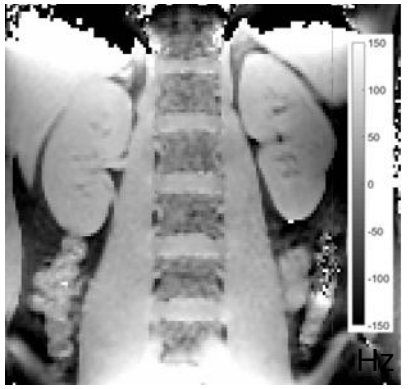
Phase Contrast MRI



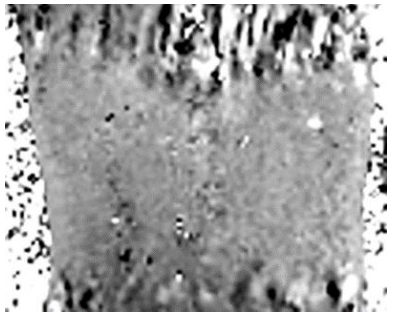
Haemodynamics

ASL





B_0 mapping



B_1 mapping

Lead vendor sites- Nottingham: Philips, Cambridge = GE, UCL = Siemens

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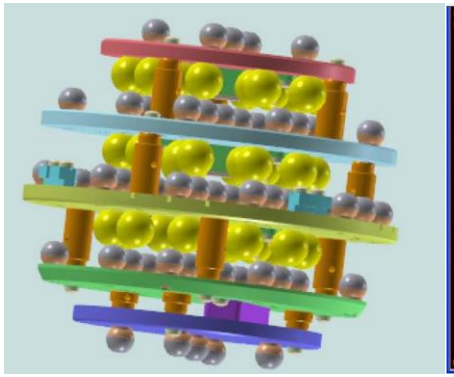
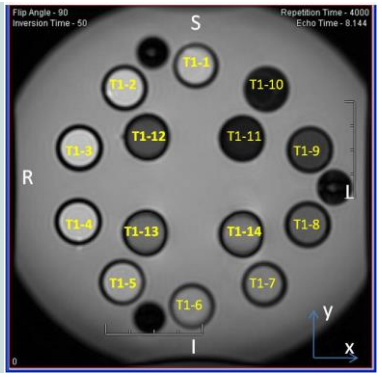
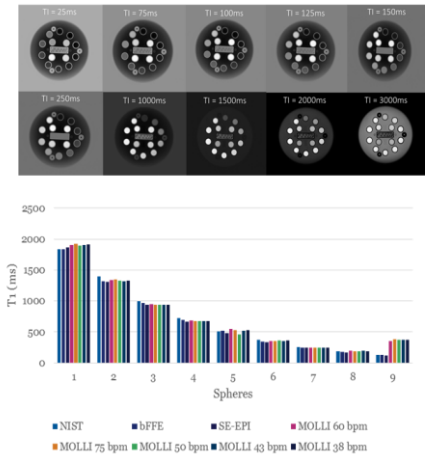
WP2: Protocol Optimisation and Harmonisation

T_1 and T_2 mapping

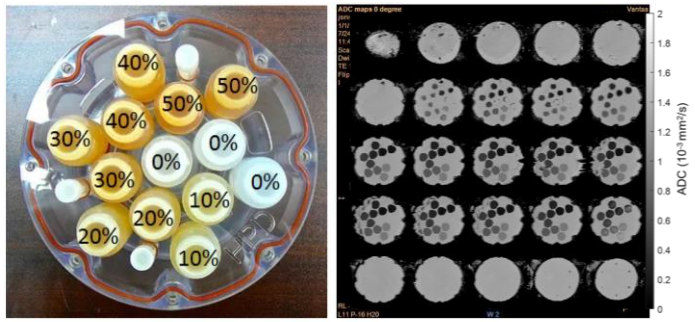






https://collaborate.nist.gov/mriphantoms/bin/view/MriPhantoms/MRISystemPhantom

DWI



Qalibre MD Diffusion Standard Model 128 phantom

Quality control (QC) procedures.

- Phantom-based and *in-vivo* metrics-informed QC protocols. Standardised QC phantoms and flow phantoms.
- Standard operating procedures (SOPs) for QC. XNAT-based pipelines for evaluating in-vivo image quality.
- Subject-specific QC data metrics, and SOPs.

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WP 2: Protocol Optimisation and Harmonisation

Conduct a "travelling kidney" across MR vendors.

- Standardised MR measures and physiological criteria– age, sex, BMI, blood pressure, time of day of scan, hydration status, etc.
- Nine healthy subjects imaged twice on each vendor to assess test-retest and between-site variability.
- Five subjects scanned 5 times at their home site at 1.5T and 3T.

➢ ***Mini-travelling kidney study underway comprising: B0 and B1 mapping, T_1 mapping, DWI and BOLD mapping, and pilot ASL measures.***

Collect normative data set.

- Data collected across UKRIN sites for both 3 T and 1.5 T.
- 6 x (2 sites) x (3 vendors) = 36 subjects for each field strength.

➢ 50 subjects' at both 1.5 T and 3T to establish reproducibility and biological variance for future clinical multi-centre trials.

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WP 3: Data Analysis and Study Design

To develop a **Data Analysis Centre** (**DAC**) for centralised image processing.

Software for processing multi-parametric renal MRI

- Create a repository of training data, and library of renal MRI image processing and analysis algorithms.
- Harmonise image processing algorithms into a modular architecture.
- Create a user interface for image visualisation, segmentation and processing.

Central Quality Control

- Develop SOP's, training protocols and qualification procedures.
- Implement automated phantom QC measurements and patient QC metrics in XNAT.
- Develop SOP's, training protocols and qualification procedures for observers performing/interpreting the QC measurements.

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WP4: Data Management and Sharing

Online, user-friendly data sharing platform

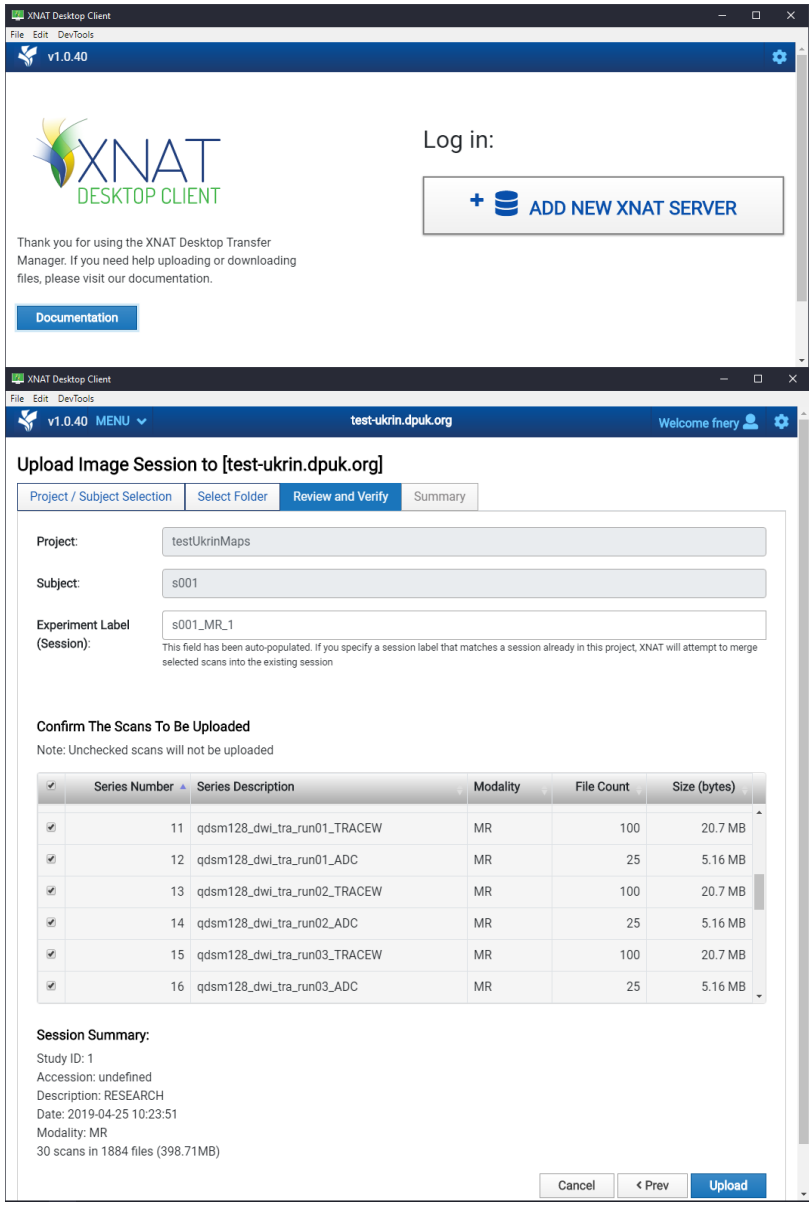
- XNAT-based informatics platform, enabling data to be uploaded easily via a web-based interface. XNAT system allows customised definition of data types and meta-data fields.

Data sharing

- Sharing of each harmonised protocol.
- Upload scans to the central system for sharing or identify the data's existence via the cross-site "aggregator"

Standardised data analysis pipelines

- Analysis pipelines optimised for renal MRI data shared via the DPUK informatics platform XNAT servers, enabling a flexible and uniform interface to a broad range of software.



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Future Directions

Working with the Fibrosis Network and QUOD

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Inflammation /Fibrosis

- T1 mapping
- T2 mapping
- DWI/DTI

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UK Renal Fibrosis Network

Kidney Research UK
Funding research to save lives

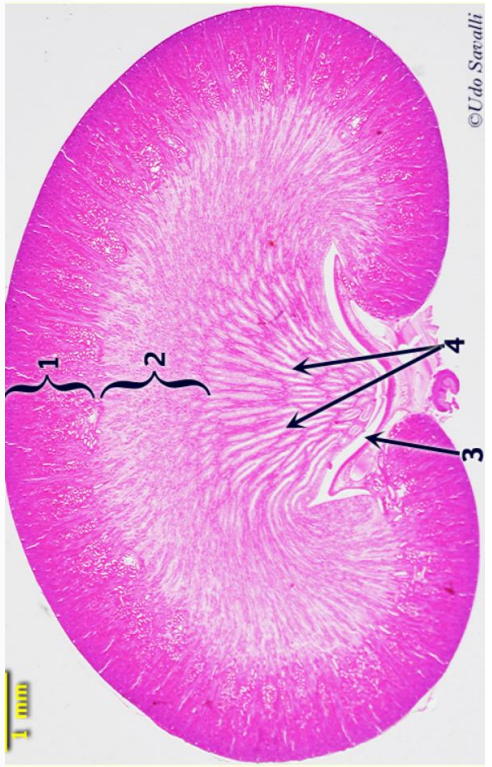
QUOD
Quality in Organ Donation

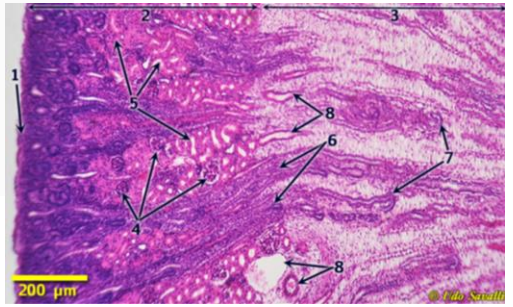
Whole organ imaging

0.25 mm isotropic pig kidney

T_1 mapping

Whole organ histology





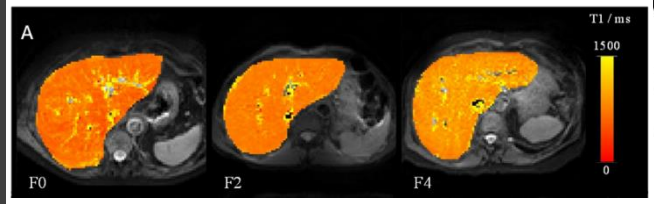
Using imaging in multimorbidity

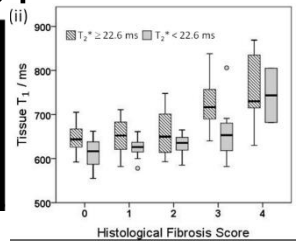
‘Diseases across organ systems often co-exist due to shared risk-factors, inflammation or fibrosis are common to many organ systems.’

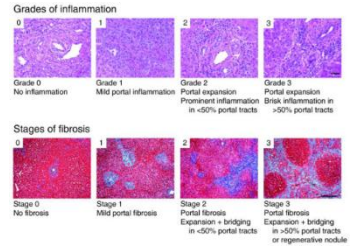
Royal College of Physicians

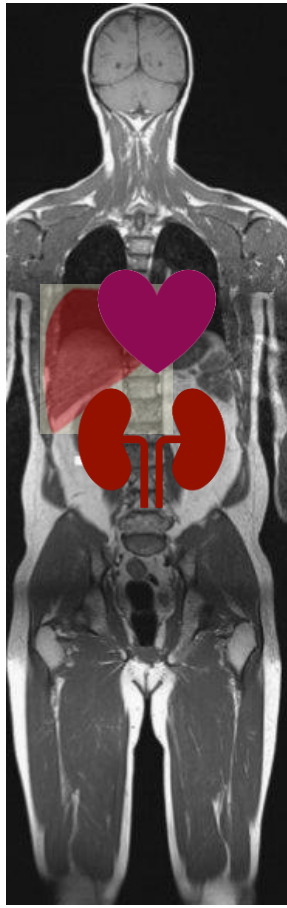
Cardiovascular, metabolic and kidney disease: crosscutting science and best practice

Liver fibrosis and portal hypertension

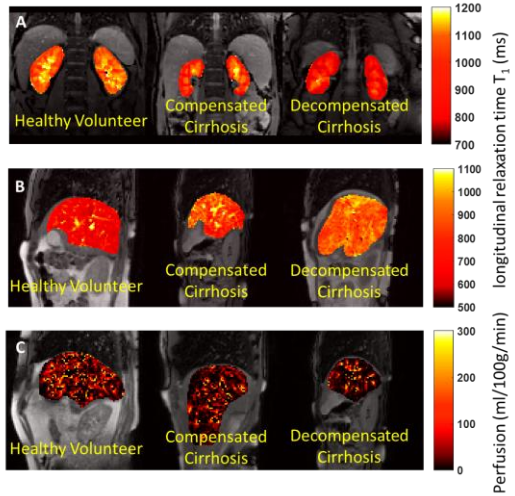


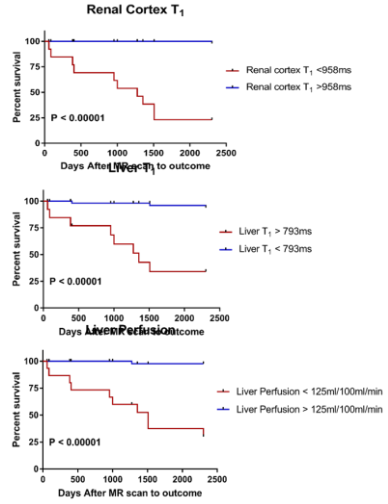




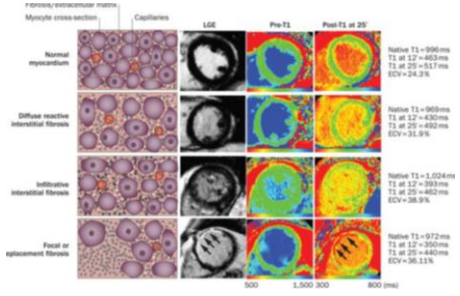


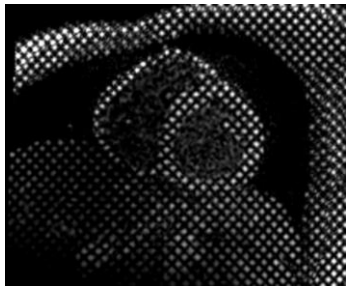
Predicting decompensation of liver cirrhosis





Cardiac imaging in kidney disease





Acknowledgements

Everyone involved with the

UK Renal Imaging Network
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Website:
https://www.kidneyresearchuk.org/research/uk-renal-imaging-network

Twitter handle: @UKRenalImaging

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Twitter handle: @UKRIN_MAPS

THE RENAL ASSOCIATION
founded 1950

BRITISH RENAL SOCIETY
MULTI-PROFESSIONAL TEAM

Kidney Research UK
Funding research to save lives

MRC Medical Research Council