Magnetic resonance imaging using ultrasmall superparamagnetic particles of iron oxide for abdominal aortic aneurysm: a risk prediction study

Rachael Forsythe,1 Olivia McBride,1 Jennifer Robson,1 Catriona Graham,2 Noel Conlisk,3 Peter Hoskins,1 Fiona Wee4 and David Newby1* on behalf of the MA3RS investigators

1British Heart Foundation Centre for Cardiovascular Science, University of Edinburgh, Edinburgh, UK
2Edinburgh Clinical Research Facility, Edinburgh, UK
3Institute for Bioengineering, University of Edinburgh, Edinburgh, UK
4Edinburgh Clinical Trials Unit, University of Edinburgh, Edinburgh, UK

*Corresponding author d.e.newby@ed.ac.uk

Declared competing interests of authors: David Newby reports that a patent (US 9275432 B2) held by the University of Edinburgh has been filed relating to the registration of medical images that were generated as part of this study.

Published September 2018
DOI: 10.3310/eme05040

Plain English summary

MRI using USPIO for abdominal aortic aneurysm

Efficacy and Mechanism Evaluation 2018; Vol. 5: No. 4
DOI: 10.3310/eme05040

NIHR Journals Library www.journalslibrary.nihr.ac.uk
Plain English summary

Abdominal aortic aneurysms (AAAs) are large swellings of the main blood vessel that carries blood throughout the lower half of the body. As AAAs grow, there are generally no symptoms or warnings but they can suddenly burst and if this happens it is usually fatal. Surgery to repair an AAA can prevent it rupturing and has the potential to save lives.

Population screening to identify the disease halves the death rate from AAAs and has led to the establishment of a national screening and surveillance programme for men. However, surveillance is complex because AAAs are unpredictable and what causes AAA growth is not fully understood. This makes it difficult to predict accurately if, and when, an AAA could burst, and how best to time major surgery. Therefore, a more accurate method is needed to predict these events so that better treatment decisions can be made about potentially life-saving surgery.

Ultrasmall superparamagnetic particles of iron oxide (USPIO) is a new class of compound that can be injected into the body to light up areas of inflammation and disease in AAAs. This requires a magnetic resonance imaging (MRI) scanner to see these areas of inflammation and damage. The Magnetic resonance imaging for Abdominal Aortic Aneurysms to predict Rupture or Surgery (MA3RS) study set out to assess whether or not USPIO-enhanced MRI can predict how quickly AAAs grow and when they will burst or need surgery. A total of 361 patients who were in the AAA surveillance programme were recruited from three study centres in Scotland. Patients underwent this specialised scan (USPIO-enhanced MRI) and were monitored in the clinic with serial ultrasound scans for a minimum of 2 years.

It was found that USPIO-enhanced MRI could identify active AAA disease and predict AAA growth and was associated with AAA rupture and repair. This has the potential to identify those patients at risk, improve their selection for surgery and ultimately improve their outcomes.
Criteria for inclusion in the Efficacy and Mechanism Evaluation journal
Reports are published in Efficacy and Mechanism Evaluation (EME) if (1) they have resulted from work for the EME programme, and (2) they are of a sufficiently high scientific quality as assessed by the reviewers and editors.

EME programme
The Efficacy and Mechanism Evaluation (EME) programme was set up in 2008 as part of the National Institute for Health Research (NIHR) and the Medical Research Council (MRC) coordinated strategy for clinical trials. The EME programme is broadly aimed at supporting ‘science driven’ studies with an expectation of substantial health gain and aims to support excellent clinical science with an ultimate view to improving health or patient care.

Its remit includes evaluations of new treatments, including therapeutics (small molecule and biologic), psychological interventions, public health, diagnostics and medical devices. Treatments or interventions intended to prevent disease are also included.

The EME programme supports laboratory based or similar studies that are embedded within the main study if relevant to the remit of the EME programme. Studies that use validated surrogate markers as indicators of health outcome are also considered.

For more information about the EME programme please visit the website: http://www.nets.nihr.ac.uk/programmes/eme

This report
The research reported in this issue of the journal was funded by the EME programme as project number 11/20/03. The contractual start date was in October 2012. The final report began editorial review in June 2017 and was accepted for publication in January 2018. The authors have been wholly responsible for all data collection, analysis and interpretation, and for writing up their work. The EME editors and production house have tried to ensure the accuracy of the authors’ report and would like to thank the reviewers for their constructive comments on the final report document. However, they do not accept liability for damages or losses arising from material published in this report.

This report presents independent research. The views and opinions expressed by authors in this publication are those of the authors and do not necessarily reflect those of the NHS, the NIHR, the MRC, NETSCC, the EME programme or the Department of Health and Social Care. If there are verbatim quotations included in this publication the views and opinions expressed by the interviewees are those of the interviewees and do not necessarily reflect those of the authors, those of the NHS, the NIHR, NETSCC, the EME programme or the Department of Health and Social Care.

© Queen’s Printer and Controller of HMSO 2018. This work was produced by Forsythe et al. under the terms of a commissioning contract issued by the Secretary of State for Health and Social Care. This issue may be freely reproduced for the purposes of private research and study and extracts (or indeed, the full report) may be included in professional journals provided that suitable acknowledgement is made and the reproduction is not associated with any form of advertising. Applications for commercial reproduction should be addressed to: NIHR Journals Library, National Institute for Health Research, Evaluation, Trials and Studies Coordinating Centre, Alpha House, University of Southampton Science Park, Southampton SO16 7NS, UK.

Published by the NIHR Journals Library (www.journalslibrary.nihr.ac.uk), produced by Prepress Projects Ltd, Perth, Scotland (www.prepress-projects.co.uk).
NIHR Journals Library Editor-in-Chief

Professor Tom Walley  Director, NIHR Evaluation, Trials and Studies and Director of the EME Programme, UK

NIHR Journals Library Editors

Professor Ken Stein  Chair of HTA and EME Editorial Board and Professor of Public Health, University of Exeter Medical School, UK
Professor Andrée Le May  Chair of NIHR Journals Library Editorial Group (HS&DR, PGfAR, PHR journals)
Dr Martin Ashton-Key  Consultant in Public Health Medicine/Consultant Advisor, NETSCC, UK
Professor Matthias Beck  Professor of Management, Cork University Business School, Department of Management and Marketing, University College Cork, Ireland
Dr Tessa Crilly  Director, Crystal Blue Consulting Ltd, UK
Dr Eugenia Cronin  Senior Scientific Advisor, Wessex Institute, UK
Dr Peter Davidson  Director of the NIHR Dissemination Centre, University of Southampton, UK
Ms Tara Lamont  Scientific Advisor, NETSCC, UK
Dr Catriona McDaid  Senior Research Fellow, York Trials Unit, Department of Health Sciences, University of York, UK
Professor William McGuire  Professor of Child Health, Hull York Medical School, University of York, UK
Professor Geoffrey Meads  Professor of Wellbeing Research, University of Winchester, UK
Professor John Norrie  Chair in Medical Statistics, University of Edinburgh, UK
Professor John Powell  Consultant Clinical Adviser, National Institute for Health and Care Excellence (NICE), UK
Professor James Raftery  Professor of Health Technology Assessment, Wessex Institute, Faculty of Medicine, University of Southampton, UK
Dr Rob Riemsma  Reviews Manager, Kleijnen Systematic Reviews Ltd, UK
Professor Helen Roberts  Professor of Child Health Research, UCL Great Ormond Street Institute of Child Health, UK
Professor Jonathan Ross  Professor of Sexual Health and HIV, University Hospital Birmingham, UK
Professor Helen Snooks  Professor of Health Services Research, Institute of Life Science, College of Medicine, Swansea University, UK
Professor Jim Thornton  Professor of Obstetrics and Gynaecology, Faculty of Medicine and Health Sciences, University of Nottingham, UK
Professor Martin Underwood  Warwick Clinical Trials Unit, Warwick Medical School, University of Warwick, UK

Please visit the website for a list of editors: www.journalslibrary.nihr.ac.uk/about/editors

Editorial contact: journals.library@nihr.ac.uk