Improving the safety of MRI in Scotland: development and testing of a multi-interventional approach to reducing risks

Background
Global evidence of adverse MRI safety events continues. Safety, performance and wellbeing are potentially being put at risk by inadequate:

- Safety protocols
- Training
- Operational systems of work
- Physical and socio-cultural environments

As a consequence patients are being:
- Avoidably harmed (including death) by ferromagnetic objects and implant disturbance
- Burned by equipment and due to inadequate procedures

Evidence indicates that up to 90% of fatal incidents and injuries are not, as commonly believed, projectile-related
- 10% due to projectile/misfire effect
- 20% due to implant, quench, fire, acoustic, internal heating effects
- 70% due to burns

Should the health service be concerned? After all, very few MRI incidents get reported to the MHRA. Usually only incidents where large items have damaged MRI equipment tend to get reported.

Yes, we should be concerned because, when questioned, MRI radiographers revealed that many more incidents occur in the NHS than ever get reported. Incidents, especially near-misses, are rarely and inappropriately reported. This reflects evidence that only 1-10% of MRI incidents ever get reported.

Potentially there could be hundreds or thousands of unreported MRI incidents across the NHS.

Approach and Findings
With an AHP Career Learning Fellowship, I surveyed >100 9AMIR® leads, to determine what staff think about current MRI safety culture and if they support introducing minimum levels of safety education:

I established that MRI safety incidents do occur in the NHS. A lack of safety knowledge is considered to be a significant contributory factor. Over 90% of respondents thought standardised MRI safety education would improve safety practice with 70% believing that on-line is the most appropriate form that such training should take. The categories of staff involved in incidents suggests a need for specific on-line modules across the workforce.

Significantly, 80% of respondents said that if such training were available they would only want to work with staff who had this knowledge.

MHRA guidelines state there should be formal certification of MRI Authorised staff when the member of staff has satisfactorily completed training in their responsibilities and the safety requirements of MRI equipment. There appears no better, practical way to provide this to all staff than with an on-line course, which is standardised, accredited and free.

In collaboration with a host of experienced MRI radiographers, safety experts and relevant professional bodies, the first module is available for Category A staff: Radiographers, Radiologists, Physicists and Clinical Scientists.

With support from the panel of experts ready to review course content, there is great momentum for a suite of accredited on-line MRI safety modules to be made.

Next Steps
Production of MRI safety modules for all MRI staff is planned following review of the pilot module. Although MRI safety education is the priority, a range of methods are needed to mitigate MRI risks. Based on Human Factors principles and methods, the project seeks to develop and test a multi-interventional system to reduce harm by considering, for example, the results of a commissioned ergonomic assessment of MRI departments to enhance safety and performance. This involves an assessment of:

- the physical design and layout of MRI departments, including uniform design
- the use of ferromagnetic detection systems
- existing checking processes
- goals and constraints, and psycho-social risk factors

In addition a comprehensive literature search of MRI incidents is being conducted to attempt to improve safety incident reporting.

Incidents revealed from national survey
Orthopaedic Professor: insisted that the frame on his patient’s leg was safe to scan and refused to be persuaded otherwise. Senior radiographer countered and the request saving the patient from injury.
Anaesthetists brought in:
- Screwdriver - stopped by radiographer just before it would have flown towards anaesthetists’ head. Plus phones, paper, badges, pens and MRI Unsafe lanyards and stethoscopes.

Paediatric patients brought in:
- Coin wrapped in cuff of sleeve and hid large battery in pocket to see what would happen near the scanner.
Patient escort brought in:
- Steel toe-capped shoes and metal high heels - foot and shoes had to be wrenched from the scanner.

Operating Department Assistant:
- In emergency, ran towards scanner with arthroscopy - just prevented from reaching projectile zone brought scissors in pocket which flew through bone, narrowly missing anaesthetised child and radiographer.

Nurse brought in:
- Keys and hair pins after insisting she had removed them all - narrowly missed the patient and radiographer.

Radiographers:
- Scanning patients with MRI Unsafe aneurysm clips/pecomakers
- Using mappropriate padding - flesh/loop formed leading to 3rd degree burns

Scanning programmable shunts with no-one available to reprogramme them

Brought patient into scan room with his ferromagnetic crutch

Conclusions
There is an urgent need to protect everyone from preventable harm in MRI units. It’s critical to mitigate the range of system-wide hazards that contribute to incidents. A multifaceted approach is needed, beginning with introducing minimum levels of safety education. I have brought together all significant UK MRI professional bodies and organisations to collaborate on production of a suite of on-line safety modules. This approach outlined above will seek to introduce the changes required to improve NHS MRI safety culture, minimising the potential for adverse events, and contribute to ensuring development of safe and effective practitioners.

References
1 http://www.johnroscottrell.org/assets/19659A_39.pdf
3 Medicines and Healthcare Products Regulatory Agency
4 NHS Education for Scotland Allied Health Professionals Career Learning Fellowship Scheme
5 British Association of MRI Radiographers
6 https://www.nursingtimes.co.uk/news/radiography/2015/04/20/750926
7 Safety_guideline_for_magnetic_resonance_imaging_equipment_in_clinical_use.pdf section 4.7.2.7

Managing Patients Undergoing Anesthesia in the MRI Unit is available on the e-LH website: http://www.e-lh.org.uk/programmes/mri-safety-project/open-access-session/