

## Background

Global evidence of adverse MRI safety events continues<sup>1</sup>

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 processes<sup>2</sup>

Evidence indicates that up to 90% of fatal incidents and injuries are not, as commonly believed, projectile-related

- 10% due to projectile/missile<sup>3</sup> 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<sup>3</sup>.

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<sup>1</sup>.

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

## Approach and Findings

With an AHP Career Learning Fellowship<sup>4</sup>, I surveyed >100 BAMRR<sup>5</sup> leads, to determine what staff think about current MRI safety culture and if they support introducing minimum levels of safety education<sup>6</sup>.

I established that MRI safety incidents do occur in the NHS Figures 1&2. 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 MR Authorised staff when the member of staff has satisfactorily completed training in their responsibilities and the safety requirements of MRI equipment<sup>7</sup>*. 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 MR radiographers, safety experts and relevant professional bodies, the first module<sup>8</sup> 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<sup>8</sup>. Although MRI safety education is the priority, a range of methods are needed to mitigate MRI risks. Based on Human Factors principles and methods, this 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.

**\*The first on-line MRI safety module, supported by UK professional bodies (see logos below) is now freely available to NHS staff:**

**Managing Patients Undergoing Anaesthesia in the MRI Unit is available on the e-LfH website: <http://www.e-lfh.org.uk/programmes/mri-safety-project/open-access-session/>**

## 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. The 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.jointcommission.org/assets/1/18/SEA\\_38.PDF](http://www.jointcommission.org/assets/1/18/SEA_38.PDF)
- 2 Haik et al, Burns 35 (2009) 294-29
- 3 Medicines and Healthcare Products Regulatory Agency
- 4 NHS National Education for Scotland Allied Health Professionals Career Learning Fellowship Scheme
- 5 British Association of MR Radiographers
- 6 <https://www.surveymonkey.com/s/WYB2LYP>
- 7 Safety\_guidelines\_for\_magnetic\_resonance\_imaging\_equipment\_in\_clinical\_use.pdf section 4.7.2.7

## 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 countermanded the request saving the patient from injury.

### Anaesthetists brought in:

Screwdriver - stopped by radiographer just before it would have flown towards anaesthetist's head. Plus phones, pagers, badges, pens and MR Unsafe lanyards and stethoscopes.

### Figure 1



### 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 laryngoscope - just prevented from reaching projectile zone

Brought scissors in pocket which flew through bore, 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 MR Unsafe aneurysm clips/pacemakers

Using inappropriate padding - flesh loop formed leading to 3rd degree burns

Injecting contrast on patients with unsafe eGFRs

Scanning programmable shunts with no-one available to reprogramme them

Brought patient into scan room with his ferromagnetic crutch

### Figure 2



### Radiographic Department Assistant brought in:

Coin which flew from pocket and stuck into the edge of the bore of the scanner leaving a hole behind

### Estates staff:

Tried to bring in ferromagnetic ladders and tools

### Domestic:

Holiday-cover, out of hours, pressed the quench button in the control room to try to stop the noise from a faulty oxygen sensor alarming

### Parent/Carer:

Completed screening form but neglected to mention metallic lower limb prosthesis - stopped just before entering scan room with their child