



news

THE NEWSLETTER OF
THE BRITISH ASSOCIATION OF MR RADIOGRAPHERS

What emergencies should we prepare for?



MEDICAL

PROJECTILE

QUENCH

POWER
CUT

FIRE

FLOOD

CHEMICAL
SPILL

OXYGEN
DEPLETION

IN THIS ISSUE:

RF BURNS:
CURRENT GUIDANCE
PAGE 6

AUTISM FRIENDLY MRI



PAGE 7

ALL THE BEST FOR
THE FUTURE



PAGE 9

2021 THE YEAR OF MRI
SAFETY



PAGES 10 - 12

ULTRA FAST 3D



PAGES 14 - 15

BAMRR SAFETY
WEEK
PAGE 8



ARTIFICIAL
INTELLIGENCE
PAGE 13



WITH OUR SOLUTIONS YOU GET **OUR COMMITMENT**

COMMUNITY

Together we can do more. **We pledge to assist our partners** wherever we can, however we can, to achieve our mutual goal.

EXCELLENCE

We promise to continue to **strive for excellence**. We will not be satisfied with anything less than the highest quality, in order to deliver meaningful benefits to you and your patients.

INNOVATION

We re-affirm our ongoing commitment to conducting and supporting research that improves patients' lives and meets physicians' needs. **Ambitious and bold innovation** is in our DNA and we promise to keep it that way.

ETHICS

We promise that all our goods and services are designed to not only improve the lives of patients and physicians now, but also to **assure a better, more sustainable future** for generations to come.

Guerbet | 

COMMITTED

For more information
Tel: 0121 733 8542 email: uk.info@guerbet.com
website: www.guerbet.co.uk

UK-C-Ad-03-19

welcome



from your **BAMRR PRESIDENT**

Welcometo the Autumn edition of the BAMRR Newsletter. We have all been faced with many challenges continuing to do MRI scanning during the pandemic, involving mask wearing for patients, sourcing non metallic face masks, scanning of Covid positive patients, cleaning of scanners etc but we have all learnt many new skills of adapting and coping.

an enthusiastic experienced MRI Radiographer who has a keen interest in promoting education in MRI, send me a copy of your CV and a covering letter to Lisa.mcbain@nhs.net saying why you would like to join us on the board. This is a great opportunity for CPD and career advancement too. We have opportunities for helping with the website, assisting on our courses as well as the organising of our conference.

October 2nd sees our new President Zoe Lingham takeover and I wish her every success. I have enjoyed my year as President although I have missed face to face meetings. I will continue on the Policy board as secretary. I hope you enjoy this newsletter and a huge thank you to our newsletter editor Matthew Benbow for all his efforts.

Liz McBain
BAMRR President

We are all still working in the world of Covid which is still limiting our ability to do face to face events for health workers. However, we continue to advance our new website providing up to date news and safety info and depending on when you read this, we have our Annual 2021 virtual BAMRR Conference on 2nd October 10-5pm. Details on the website. After the success of this last year we have a fantastic selection of speakers with guest speaker Dr Frank Sherlock live from the USA.

BAMRR is run by a group of MRI Radiographers in our spare time or allocated work time. There is a great team atmosphere and sharing of information and experience. We are looking for some new board members, so if you are



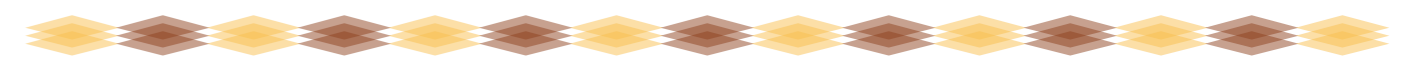
from your **EDITOR**

Welcome to the autumn 2020 BAMRR News.

As you can clearly see, we have decided to go back to a physical, paper, pick-me-up-and-read-me copy of BAMRR News. We tried the experiment of going for an e-magazine approach for the last few virtual editions, however we felt that it lacked some of the essence of a magazine and it just did not feel right. At BAMRR we see our Newsletter as being something people are more likely to physically pick up and read, maybe in a staff room whilst munching on a sandwich, so providing only on-line access was not working in this regard. I am really pleased and grateful to all the contributors to this edition. I was initially concerned that the offerings may be

reduced due to people's attentions being drawn elsewhere, but the MR community have come up trumps for me, so thank you all for your work. The intention and inclination to share experiences such that we can all progress to improve our services is clearly still as strong as ever.

Matthew Benbow
BAMRR Editor



Follow us
BAMRR is
now

on Facebook
& Twitter



On Facebook, search for “BAMRR” - be our fan and 'like' us and we will keep you update.



For tweeting visit
twitter.com/#!/BAMRR

WELCOME from our sponsor **GUERBET**

Guerbet wishes you a warm welcome to the Autumn edition of BAMRR News.

Guerbet Guerbet are delighted to continue sponsoring the BAMRR community and hearing all about your continued hard work and commitment to your dedicated professions.

At Guerbet UK we are busy getting back to in-person events and congresses and delighted to be seeing you all again.

We are also welcoming you to our new demo suite where we have brought our UNIK strategy for life, showcasing our flexible solutions, tailored to your specific needs and challenges, designed to add value at each step of the patient healthcare journey, interconnecting our comprehensive portfolio of products, solutions and services in diagnostic imaging.

We would love to extend an invitation for each of you to learn more or schedule a visit by contacting us on 0121 733 8542 or uk.info@guerbet.com. If you would also like any support with educational programmes or events please do get in touch with uk.events@guerbet.com.

Guerbet Laboratories Ltd
Avon House
435 Stratford Road
Shirley, Solihull
B90 4AA UK

Tel: 00 44 (0)121 733 8542
Fax: 00 44 (0)121 733 3120
email: uk.info@guerbet-group.com

Guerbet | Contrast for Life

BAMRR Policy Board Members, Autumn 2021

The co-ordination of the Associations activities is overseen and undertaken by an elected Policy Board. The board currently consists of the following who are members of BAMRR and working in different regions of the UK.

The Policy Board is composed of:



PRESIDENT
Zoe Lingham
Zoe.lingham@spirehealthcare.com



SOR REPRESENTATIVE
Alex Lipton
AlexL@sor.org



WEBSITE CO-ORDINATOR
Trudi Whitehead
trudi.whitehead@nhs.net



PAST PRESIDENT & SECRETARY
Lisa McBain
Lisa.McBain@hey.nhs.uk



SAFETY ADMINISTRATOR
Cath Mills
cath.mills@bmihealthcare.co.uk



WEBSITE CO-ORDINATOR
Chris Watson
Chris.Watson@phillips.com



MEMBERSHIP SECRETARY
Niamh Cleary
Niamh.cleary@affidea.com



UKIO CO-ORDINATOR
Jill McKenna
Jill.McKenna@nuth.nhs.uk



TREASURER
David Reed
drbamrr@gmail.com



COURSE CO-ORDINATOR
Rachel Watt
rachelwatt@nhs.net



NEWSLETTER EDITOR
Matthew Benbow
matthew.benbow@uhd.nhs.uk



COURSE CO-ORDINATOR
Helen Estall
helen.estall@uhl-tr.nhs.uk

COURSE UPDATE



Due to the continued Covid-19 restrictions, BAMRR have taken the difficult decision to postpone the Introductory Course scheduled for November 2021. We are very sorry to disappoint all delegates hoping to attend but do hope we will see you in the not too distant future when we reschedule. All delegates booked to attend will be contacted and offered a refund or transfer to the revised date.

Covid-19 Booking Promise:

We understand it is a difficult time to be making decisions about courses and hence we hope our booking promise will help – all delegates will be offered either a full refund, or transfer to an alternative date if that is suitable to the delegate, should our courses planned not be able to go ahead.

Booking now available for the Further Course May 2022.



The Metrasens website had regular posts that covered topics about incident prevention.

Check out the website for a whole host of resources about the topic of safety in MRI. One to watch... *'We're getting better, but MR safety is getting worse'* by Radiology Safety Specialist Tobias Gilk.

RF Burns

Cath Mills

BAMRR Safety Co-ordinator

As part of MR Safety week this year BAMRR focused on the important safety topic of RF burns. Burns are the most often reported MRI adverse incident in England, and the latest MHRA guidance states that the main safety issues for radiofrequency (RF) fields used in MR are thermal heating leading to heat stress induced current burns and contact burns.

MRI Radiofrequency (RF) burns are one of the risks associated to patients who are undergoing MRI.

Extract from MHRA current guidance:

At all frequencies, induced currents will lead to power dissipation within the body's tissues, which in turn will lead to accumulation of energy with time and a rise in body temperature. At frequencies above 0.1 MHz heating effects predominate and this has a major consequence for magnetic resonance imaging. The RF field distribution is not uniform – inhomogeneity increases with increasing field strength, and depends on coil design. Safety Guidelines for Magnetic Resonance Imaging Equipment in Clinical Use 13/86 Absorption of energy from radiofrequency fields used in MR results in the increased oscillation of molecules and the generation of heat. If this occurs in human tissue, a compensatory dilation of blood vessels results in an increase in blood flow and the removal of the excess heat, which is dissipated mainly through the skin. The electromagnetic and thermal characteristics of different organs and parts of organs will differ. The eyes are an example of organs that have very little blood flow. In fact, the lens of the eye has none, and therefore takes time to disperse thermal energy. The testes are organs separated from the main volume of the body and are regarded as heat sensitive. Normally their temperature is a few degrees below body temperature. A rise of 1°C is generally acceptable to a normal healthy person. The actual temperature rise at any time will depend on the balance between the energy absorbed and the energy transferred from the region of the body concerned. The ambient temperature, air flow, clothing and humidity all play a major role in the rate of dissipation. The lower the ambient temperature and the lower the humidity, the greater the transfer. Contact burns The radiofrequency field will induce currents in conductors and can raise their temperature significantly. Burns to volunteers and patients from contact with such metallic objects can be avoided by careful positioning and set up within the bore of the magnet. Examples of causes are contact with metal in clothing, coils, coil leads, ECG connectors and oxygen monitor probes.

Induced current burns Induced current burns are frequently not immediately sensed by the patients. As such, patients typically cannot warn the radiographer of discomfort or pain prior to thermal damage. There have been many reports to the MHRA of burns that have occurred when the arms or the legs have been positioned in such a way as to create a conductive loop pathway.

Safe practice advice to avoid burns caused by RF heating

Patient screening prior to MRI

Careful screening prior to MRI can significantly reduce the risk of a burn

- ◆ **Patient clothing** – always change patients into hospital gowns where possible. This ensures safety and will also avoid artefacts. Some fabrics in clothing can contain conductive fibres. The MHRA recommend appropriate hospital clothing should be worn that does not contain metallic fibres, labels, pockets, buttons or fasteners, nor should it inhibit heat loss.

Scan positioning and setup

Patient comfort and patient safety are paramount in MRI. It is important to take time to ensure the patient is comfortable as it will lead to greater compliance during their scan. With regard to patient safety, the prevention of burns is the major concern. Poor positioning of the patient and associated cables, leads and sensors, have been the cause of many burns reported to the MHRA. Electrical burns may not be painful immediately as they can start to cause tissue damage at temperatures as low as 43°C.

- ◆ ensure that sufficient insulation is placed between the cable and the patient if contact cannot be avoided
- ◆ do not loop conductive cables or allow cables to cross one another

- ◆ do not pass cables diagonally across the patient ensure that cables run parallel to the bore of the magnet and as close to the centre of the bore as possible
- ◆ ensure that cables do not touch the bore of the magnet
- ◆ ensure that cables exit the bore of the magnet as close to the centre as possible ensure that the patient's skin does not touch the bore of the magnet, or come within 1 cm of touching, transmitting RF coil elements.
- ◆ Use insulation such as the foam pads provided by the MR manufacturer
- ◆ if necessary ensure that no conductive loops form with any parts of the patient's body ie avoid skin-to-skin contact. Foam pads can be placed between the thighs, between the arm or hand and the trunk and between the ankles to avoid the formation of any conductive loops ensure that sensors are placed outside the scanning area whenever possible, as well as away from RF coils Foam pads, 1–2 cm thick, should be used to insulate the patient from cables, the bore and between limbs.

Communication with the patient during the scan

- ◆ ensure that the patient is instructed to inform staff immediately if they feel any focal warming
- ◆ if the patient is unconscious or for any reason unresponsive ensure that the sites of all sensors are regularly checked for any evidence of heating
- ◆ The use of clothing or blankets as a form of insulation is not recommended. The MHRA recommends the use of foam pads, 1–2 cm thick, to insulate the patient from cables, transmitting RF elements, the bore and between limbs

Other important considerations

- ◆ Have a pathway in place for managing suspected burns. As part of safety week BAMRR created a suggested procedure -can downloaded via the website
- ◆ Have a risk assessment in place, template available from British Institute of Radiology website: Risk assessment for heating https://www.bir.org.uk/media/291810/ra_4_heating.pdf
- ◆ ensure that regular checks for damage are made on all coils, cables and leads for damage and do not use if damage is seen
- ◆ Use only high impedance leads; fibre optic leads are preferred
- ◆ Staff should be appropriately trained, and experienced MR Authorised person should review the screening form with the patient and should understand issues for potential hazards within the MR Environment
- ◆ ensure that you are familiar with and follow the manufacturer's instructions This includes using only the monitoring equipment, ECG wires, leads, electrodes and accessories recommended by the MR system manufacturer
- ◆ All suspected RF burns should be documented on local incident reporting system Report all RF burns to the MHRA via the yellow card system

(Reference: MHRA Safety Guidelines for Magnetic Resonance Imaging Equipment in Clinical Use, Feb 2021)



◆ Example of RF Burn



◆ Example of RF Burn associated with Tattoo



◆ Example of RF Burn - ECG pad not identified and removed during screening process



◆ Example of RF Burn - skin to skin contact inner thigh



Autism-friendly MRI: An innovative, UK-wide research project.

An innovative research project is being conducted by researchers at City, University of London, with funding from the Society and College of Radiographers CORIPS grant scheme. Dr Christina Malamateniou, the principal investigator of this project, has united a multidisciplinary, multi-national team in an attempt to improve accessibility of MRI scanning for autistic service users in the UK, but also to help further educate radiographers on this topic. Mr. Nikolaos Stogiannos was the dedicated research assistant for this project.

The researchers wanted to shed light in the -largely unexplored- challenges that autistic service users face when undergoing MRI examinations, and also to reveal any practice challenges when referring, booking, and scanning these patients. To achieve this, the research team conducted a thorough systematic review to map out all the reasonable and feasible adjustments which could be made when scanning autistic individuals with MRI. This review (currently under consideration for publication) highlights some very efficient interventions, with technology being increasingly used for this purpose (audiovisual material, mobile apps, motion-tracking devices, denoising software, etc.). However, the 'take home message' from this review is that effective communication and co-ordination of care are vital for a truly patient-centred service provision.

Furthermore, the research team conducted two UK-wide surveys to explore both the radiographers' and the patients' perspective from MRI scanning of autistic service users.

All UK-based MRI radiographers were invited to participate in the first survey, which has been accepted for publication in the Radiography journal. We are really grateful to BAMMR and to Matthew Benbow for kindly sharing this survey within its membership and to all BAMMR members who participated in this study. The results highlighted that, although many radiographers strive to provide a truly personalised service, there is a lack of relevant educational provisions which are specific and detailed enough to help the workforce understand autistic patient needs, and therefore efficiently adjust their practice. Most of the knowledge at the moment comes from loved experiences or personal interest and study. Challenges to MRI scanning for autistic individuals mainly related to referral and booking, or the failure to provide some essential reasonable adjustments to these patients (e.g., sensory adjustments to the MRI environment, communication with patients and carers, allowing more time, lack of specialist equipment and lack of local guidelines). In addition, this study highlighted the urgent need for autism-related training for radiographers, some changes in the academic curricula, and also for establishing specific guidelines for the radiography workforce which can be easily followed to improve accessibility.

In the second survey, currently in drafting stage, autistic service users have highlighted many challenges when undergoing MRI exams, and these are mainly related to a generally 'unfriendly' MRI unit environment, lack of adequate time, lack of information beforehand, or sensory challenges during the scan (loud acoustic noise, not being comfortable when inside the scanner, not being offered music etc.).

This research project will offer some invaluable knowledge related to autism-friendly MRI. However, given the complexity and heterogeneity of the autism spectrum, a customized approach for every patient should be followed within this framework. The team hopes to build on this knowledge and apply for further funding in the future.



MR Safety week in 2021 has been another successful year, with special emphasis on the fact that it is 20 years since the tragic accident where 6-year-old Michael Columbini was killed when a magnetic oxygen cylinder was taken into the MRI scan room by accident. Many international organisations in the MR community took the opportunity to promote best practice and excellence in MRI safety throughout the week across all social media platforms.



Here at BAMRR we published daily releases on our website, giving our members up to date information about Dementia in MRI, RF burns in MRI, a suggested burn procedure, links to the latest safety resources, podcasts and webinars, and there was also a safety quiz and wordsearch to test our member's safety knowledge. All information is available via the Safety page of the website.

The British Institute of Radiology focused on raising MR safety awareness by publishing safety advice sheets that focused on highlighting aspects of terminology behind MR Safety: Terminology, MR Unlabelled, and Myths and Maths. You can download the case studies via the BIR website.

MR safety week 2021



MR Unlabelled: a new MR safety term for the realities of clinical MRI

There are 3 established MR safety terms, MR Safe, MR Conditional or MR Unsafe. Historically, people were told to consider anything that was not labelled for MR safety as MR Unsafe. Under its current definition (= "unacceptable risk") this means unlabelled items should not be brought into the MR Environment. While this is a safe approach, in practice it can be overly conservative in some cases, resulting in patients being denied MRI scans where the needs of the MRI strongly outweigh the relatively low MR safety risks.

MR Safety week 2021



MR safety terminology

Clarity is required when describing the risk posed by bringing an object into the MR environment. There are 3 established terms which have specific definitions: MR Safe, MR Conditional and MR Unsafe. These terms have an associated colour-code and specified symbols which can be used on item marking. It is recommended that all equipment which may be taken into the MR Environment is clearly labelled using these markings. These terms are defined in the MHRA guidelines [1] in the following way:

MR Safety week 2021

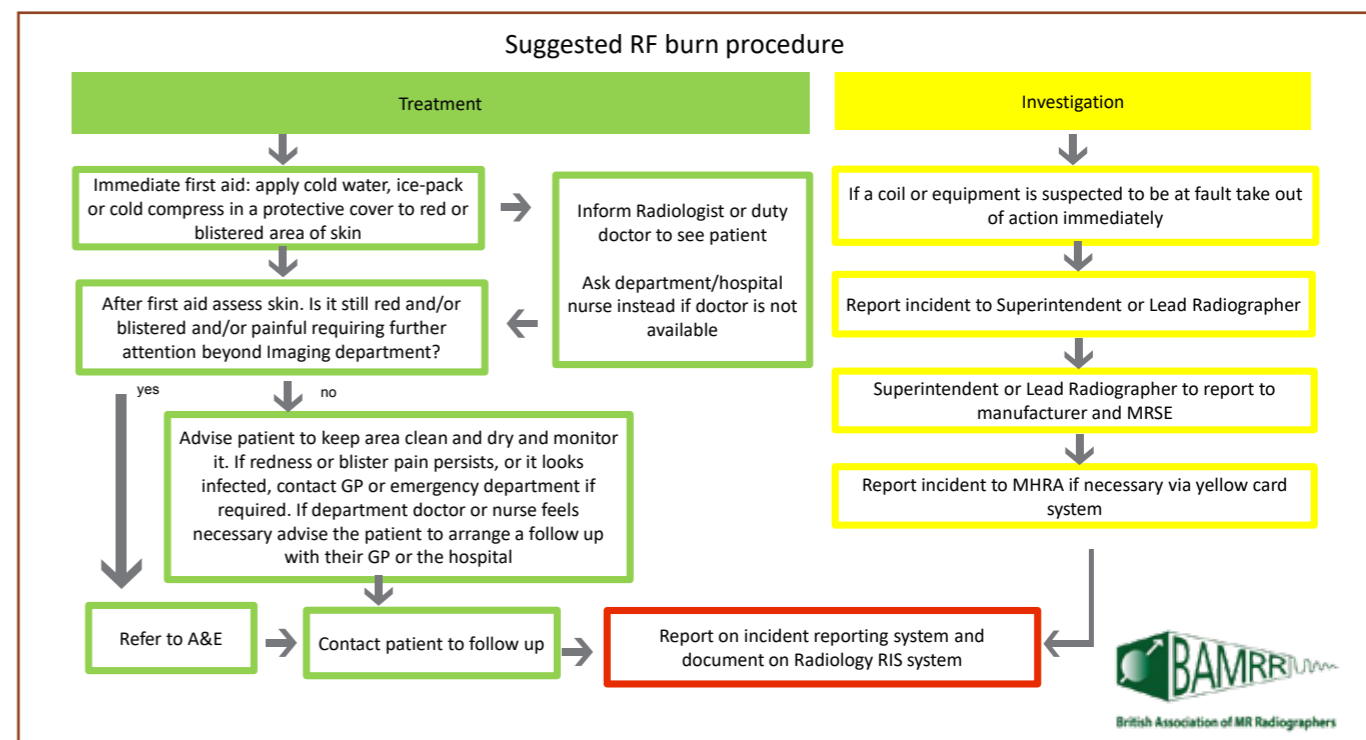


MRI safety: myths and maths

Donald W McRobbie, PhD, MSc, BSc, FIPEM, MACPSEM
Associate Professor, School of Physical Sciences, University of Adelaide, Australia
Author of Essentials of MRI Safety www.drdonaldmcrobbie.com

In recent years MRI safety has received increased media attention with growing public concern. From controversies over the side-effects of gadolinium to projectile accidents, a serious MRI incident always makes news. It doesn't have to. It is possible to practice completely without incident, as long as one can distinguish between the myths and maths of MRI safety. Surely, we don't need maths?

We do. It is essential because MRI safety without a solid theoretical and numerical foundation is just guesswork, folklore or worse. Here are some examples.



Over the past two years IPEM has been working to set up an MRSE exam in the UK, with input from BAMRR and other UK organisations and experts. IPEM set the final course content in September 2020 and it was successfully launched earlier this year. The certification model that IPEM has adopted requires both knowledge and experience. The knowledge is demonstrated by successfully completing the American Board of Magnetic Resonance Safety (ABMRS) exam, and the experience of an applicant is assessed from a structured portfolio demonstrating a broad range of MRSE activities. BAMRR have been part of the task and finish group involved in setting the up the structure of the portfolio and the application process. For more details see the IPEM website.

<https://www.ipem.ac.uk/TrainingWorkforce/MagneticResonanceSafetyExpertsMRSE.aspx>

Daniel Wilson

Clinical Scientist, University of Leeds
On behalf of IPEM

Over the past two years IPEM has been working to set up an MRSE certificate of competence scheme in the UK, with input from BAMRR and other UK organisations and experts. The scheme was opened for applications at the beginning of September 2021. The certification model that IPEM has adopted requires both knowledge and experience. The knowledge is demonstrated by successfully completing the American Board of Magnetic Resonance Safety (ABMRS) MRSE exam modified for the UK context, and the experience of an applicant is assessed from a structured portfolio demonstrating a broad range of MRSE activities. BAMRR have been part of the task and finish group involved in setting the up the structure of the portfolio and the application process. For more details see the IPEM website.

<https://www.ipem.ac.uk/TrainingWorkforce/MagneticResonanceSafetyExpertsMRSE.aspx>

All the best for the future....

On October 2nd we are saying goodbye to 2 of our board members Paola Griffiths and Jonathan Coupland.



Paola joined in 2013 and has contributed hugely to the board with organizing the Advanced MRI courses and Intro course and helping set up and run our old and new websites. Her many years of experience as an MRI Radiographer and great IT skills have benefited us all. Thank you also for Paola's year as President

Jonathan joined the board in 2017. He has had a major role in delivering our Intro course by running hands on sessions and giving excellent lectures. Jon will hopefully continue as a guest speaker for us at our Intro courses as he pursues his career in Sales with Phillips. A huge thank you to you both, from everyone on the board, past and present.





2021 The Year of MRI Safety

Why this is such a poignant year for promoting the need for MRI safety awareness and vigilance.

Plus, the precursor to a series of articles on what to consider when designing your emergency response SOPs.

Barbara Nugent, founder of MRI Safety Matters®, Associate Advisor to the Safety, Skills and Improvement Research Collaborative at NHS Education for Scotland, Visiting Lecturer, City, University of London, Organiser of the European MRSO/MRMD course and ABMRS UK-modified exams.

MRI Safety Week and the role that social media plays in promoting MRI safety

MRI Safety Week is recognised annually in the last week of July by MRI interested groups. It is a poignant seven days for members of social media platforms such as Facebook (fb) to emphasise MRI safety concerns, for example, the [UK MRI Safety fb Group](#), the [MRI Safety fb Group](#), Twitter and LinkedIn. Lessons learned from adverse events and how others deal with prevalent issues are shared. Professional groups in the UK also come together under the umbrella of the British Institute of Radiology to provide specific safety content and can use these social media platforms to promote guidance.

To work safely in such a complex modality as MRI requires that MRI radiographers have access to the latest advice regarding, for example, any new implant. A lack of guidance can impact how, or if, a patient can be scanned. In this respect, social media can provide almost immediate suggestions on where to source an implant's instructions for use. Posted comments can also

describe how a team either previously safely scanned such a device or reasons why the device cannot be scanned. Learning from others' experiences by communicating in this way has become, for many, an essential route to find current opinion on various MRI safety topics and concerns. As there is no UK database or directory of patient implants to be found, social media messaging has become a useful way to direct someone expediently to salient advice. Posting questions or advice can signpost members to guidance in websites such as [mrisafety.com](#) or to imaging teams which may have already tested or scanned novel implants. Providing feedback saves others clinical time by avoiding them having to search for such guidance. The ability to access knowledge in this way from the MR community can help to facilitate safe scanning and avoid delays in the service. Such community groups present a platform for members to discuss myriad topics such as infection control best practices, implant concerns, MRI safety training, adverse incidents, and patient compliance ideas. The need for such a communal forum is evident and the immediacy of a response from peers is one of many reasons why these MRI communities developed. Dedicated MRI safety forums have proven to be an essential tool

for thousands of MRI workers and appear to be increasingly being considered as an acceptable way to gauge opinions and source advice. Having an easily accessible, free facility for all MRI workers to post safety related questions and to receive almost instant responses has become expected. Comments are posted from industry and healthcare experts, including experienced MRI radiographers, technologists, physicists and radiologists. The [UK MRI Safety fb Group](#) is open to all who work in MRI regardless of any collegiate or professional affiliation. Created in 2015, it now has over 3000 members, with each initially vetted to try to ensure that only those who work in the industry join. The administrator (the author) believes that this forum must be made a safe place for MRI staff to speak freely on any topics related to MRI safety. To that end it would not be appropriate for patients and the general public to be part of the group.

While there are many standards regarding what an MRI safety curriculum should contain, there is still no minimum standard of MRI safety education mandated for MR radiographers or radiologists. Dedicated MRI safety fb groups have therefore, through necessity, become a crucial link for promoting MRI safety education.

Preventing reinvention of the wheel by sharing departmental Standard Operating Procedures (SOPs)

Just as fb members can provide information on implants and current practices, which can save other staff time by not having to search for it, sharing departmental SOPs when developing emergency procedures could save staff time too. A list of the factors to consider when proposing any SOP content could prevent some MRI units having to start from scratch. MRI departments must create and provide similar documentation, be it proof of training, risk assessments, infection control, health and safety or local rules. However, much time and energy on this task could be saved if we had more generic content easily available to all. We are all on a similar mission to scan patients and, broadly speaking, we all have similar equipment and training, so why do we all have to reinvent the wheel every time SOPs, and any policy and procedures are to be developed? If we shared and copied more of our SOP content, we could gain more time with the bonus of ensuring our content was comprehensive and appropriate. We would inevitably also start to encourage standardisation regarding, for example, screening forms and what emergency processes to follow.

Our unique MRI environment requires nuanced ways of working

The unique challenges of working in an MRI environment necessitate unique emergency responses and specialised knowledge. Rapid, effective reactions in a critical situation can prevent injuries and fatalities. Knowing how our peers are trained to react to emergencies could encourage similar training and drills to be run, and such training to evolve so that emergency practices become standardised. In time, a compilation of approved approaches in how best to deal with any incident could become available. Currently, departments may know what emergencies could occur; but they have no rule book to follow to identify what they need to do. Having an emergency-type handbook could offer up useful material for any department to create their own step-by-step guidelines, helping MRI Leads to quickly analyse their workplace issues and design bespoke solutions.

Social media platforms can help MRI staff to learn more about emergencies

MRI staff all have similar emergency scenarios to tackle, yet there is no universal, official resource they can be directed to or obtain advice from on the precise steps to take to mitigate or react to an event. Amalgamating appropriate suggestions from the MR community with generic advice could provide units with comprehensive content for their emergency SOPs. The resulting guidance

would be considered practical and up to date, honed from the experiences of practising radiographers. Such a resource, for the reasons given, could benefit MRI staff and consequently all stakeholders and service users. Updated regularly, a supply of readily available content would need to be placed where all MRI staff could access it, regardless of any affiliations. Social media platforms aimed at and designed for MRI staff may, in some respects, be a suitable vehicle for easy access to such material. Those who have resisted joining social media may, however, be seen as at a disadvantage by having to rely on more traditional methods to try to identify contemporary safety material.

What MRI Safety Week commemorates

MRI Safety Week commemorates the first reported patient death caused by an oxygen cylinder becoming a projectile in a scan room. The circumstances surrounding the death of six year old Michal Columbini, in a Rochester (New York state) MRI unit in 2001, have been well documented and analysed¹. As with any incident, there were multiple opportunities for the tragedy to have been averted if appropriate interventions had been put in place. As it is now twenty years since Michael's death, this year is being referred to as The Year of MRI Safety in some quarters, as highlighted by the world's largest [MRI Safety fb Group](#) community. There is also a dedicated Twitter account for this year ([Twitter.com/mryearof](#)) containing discussions on many MRI safety topics.

Two decades on from that preventable death, avoidable projectile incidents still occur. Although lessons have been learned² projectiles still maim^{3,4,5,6} and kill people⁷. Perhaps in the UK some might believe that horrific MRI events like those that occur in other countries do not happen here: that would be a mistake. Serious incidents have occurred and continue to occur in the UK. There is evidence that many incidents are witnessed but not reported, especially near-misses. Even if incidents are reported, with no publicly available access to the incident database held by the MHRA then we miss the opportunity to learn from these reported adverse events.

There are many causes of MRI incidents^{8,9,10,11} and there is no simple answer to prevent accidents. However, the MR community would surely benefit from sharing experiences. Knowing how easily an incident can occur may help to underscore how prevalent incidents are and help to encourage more ways to stop them from happening again and again. How do we change any poor embedded working practices and encourage a checklist culture if the same events recur; but we don't know about them? It often seems that the only incidents we do hear about are those considered serious enough to be published by the media¹². The issues are compounded by the fact that while it is not disputed that MRI safety standards exist, there still does not exist any minimum standard of MRI safety education mandated for MRI staff. Although recommended¹³, no ferromagnetic detection (FMD) systems¹⁴ are mandated either, as a 'last line of defence'. No universal checklists are used, or standardised universal screening form questions agreed upon, to try to ensure that any questions asked are appropriate or relevant for that patient. No safety pauses, which would encourage a final and thorough checkpoint assessment before entering the scan room, have yet been seen as essential to be built into the average workflow. With no mandate to report all incidents and no easy access to the national incidents reported, MRI staff will likely not learn from the incidents that occur in UK MRI scan rooms. No nationally mandated policy to prevent lone working exists for MRI workers either; yet there is global evidence of lone workers in MRI units being killed^{15,16}. Even though a just culture¹⁷ should exist, a blame culture still appears to be prevalent when incidents occur; which may be a contributory factor as to why many incidents go unreported. Can we consider that the UK is any safer in terms of MRI safety policies and procedures than anywhere else? If the subject of MRI safety concerns were to have had the same interest and attention as radiation hazards in CT, perhaps we would now be in a far better position regarding clinical governance and legislation to always ensure adequate staff and patient safety. Added to this background, there is also a paucity of guidance to follow to help with devising departmental emergency

Cont'd page 12

Cont'd from page 11

SOPs. It could be considered that often only the vigilance of frontline MR Radiographers, acting as that *final barrier of defence* is the main reason why more deaths and injuries are averted in scan rooms.

Even though the radiologist has a responsibility for the safety of their patients, the radiologists may be viewed as a *nominal gatekeeper* of MRI safety. Radiologists are often not present in the unit and may not be as well trained as the radiographer with regard to MRI safety concerns¹⁸. MRI safety is delegated to the MR Responsible Person, an MR Lead, but they may struggle to find appropriate training for the role. Provision of MR Safety Officer (MRSO) training, or similar, in the UK could benefit all MR radiographers by providing a recognised standard of safety education. The provision of MR Medical Director (MRMD) training, or similar, could benefit radiologists¹⁹. The SCoR representative **Charlotte Beardmore, is the new president of the European Federation of Radiographer Societies (EFRS)** and is involved in a project to set minimum standards for MRI safety education for European radiographers. Hopefully the results of that project will see a similar push for minimum standards of MRI safety education to be promoted in the UK.

We may never be able to fully mitigate all the risks in MRI but, by sharing our common concerns and safety goals, we may be able to analyse the problems better to find solutions. We need to consider the current adequacy of safety training provision and consider what policies, processes and risk assessments could be shared. The impact of Human Factors on any safety interventions needs also to be understood. There is little point in providing FMDs, for example, if the staff are allowed to wear ferrous clothing. Constant FMD alarming could cause *alarm fatigue* to set in. A holistic approach when designing and implementing interventions is required²⁰.

The Year of MRI Safety

In this *Year of MRI Safety*, as part of *MRI Safety Week*, two decades since Michael's death, there are still no SOPs universally available or developed to deal with all the emergencies that working in MRI units can present. We need to create appropriate, comprehensive content and make it freely available. To that end, as part of *MRI Safety Week*, the MR community contributed ideas as to what departments could consider when developing their own SOPs. Prompted to share the content, as a series of "What to do in the event of..." scenarios and continuing with that concept, a more in-depth series of articles describing how to deal with emergencies will be posted in future BAMRR newsletters and shared on social media. Discussing joint solutions for common MRI safety concerns like this may encourage new standards to be set and serve to promote a universal level of patient and staff care.

To comment on this article and to get involved in the project to develop emergency SOP content, please contact Barbara at mrisafetymatters@btinternet.com

MRI Safety Matters® is bringing Dr Emanuel Kanal's 2nd European MRSO/MRMD course and the ABMRS UK-modified MRSO/MRSE/MRMD exams back to London in May for radiographers, physicists/clinical scientists and radiologists.

- Gilk T, Latino R J. Patient Safety & Quality Healthcare Magazine MRI Case: Root Cause Analysis – Tobias Gilk & Reliability Center death of Michael Columbini 2011. (Root-cause-analysis of projectile incident (Michael Columbini))
- Watson R E. Lessons learned from MRI safety events. *Curr Radiol Rep* 2015;3:37. <http://dx.doi.org/10.1007/s40134-015-0122-z>
- Manufacturer and User Facility Device Experience. US Food and Drug Administration. www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfMAUDE/Search.cfm (accessed February 20, 2019) Ferromagnetic table struck patient, April 4, 2009. MFR Event Report No:2240869-2009-00002.
- Manufacturer and User Facility Device Experience. US Food and Drug Administration. www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfMAUDE/Search.cfm (accessed February 20, 2019) Ferromagnetic flat screen monitor struck a volunteer; August 17, 2009; MFR Event Report No: 2240869-2009- 00031
- Mishra L. Two stuck to MRI machine for 4 Hrs. *Mumbai Mirror* [online]. Available from: www.mumbaimirror.com/mumbai/cover-story/Two-stuck-to-MRI-machine-for-4-hrs-articleshow/45103043 (accessed November 11, 2015)
- Manufacturer and User Facility Device Experience. US Food and Drug Administration. www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfMAUDE/Search.cfm (accessed February 20, 2019) Ferromagnetic cart struck vendor's training specialist, July 15, 2009. MFR Event Report No: 2240869- 2009-00027.
- Molloy M. Visitor killed by taking ferromagnetic oxygen cylinder into scan room. Available from: www.telegraph.co.uk/news/2018/01/29/indian-man-dies-freak-mri-machine-accident-mumbai-hospital/ (accessed February 20, 2019).
- Manufacturer and User Facility Device Experience. US Food and Drug Administration. www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfMAUDE/Search.cfm (accessed February 20, 2019) Ferromagnetic scissors embedded in technician's forehead, June 5, 2009; MFR Event Report No: 3003768277-2009-0061.
- Mufti S, Sheikh M A, Hakim A et al. Near-miss lethal accident case in MR suit of a tertiary care hospital. *Case Rep Radiol* 2011;793570. doi: 10.1155/2011/793570.
- A Deadly Trend/ Statistics Show MRI Accidents up 277% <http://mrioptimize.com/published-articles/deadly-trend-statistics-show-mri-accidents-277/>
- Gilk T, Posh J. Reducing MRI accidents: nine best practices that could have prevented 74% of reported injuries. www.metrasens.com/mri-safety/mri-safety-infographic/2019-Metrasens
- Patient and radiographer narrowly escape injury at Southampton General Hospital by Melanie Adams 27th February 2012, Southern Daily Echo, accessed 5th September 2021 Patient and radiographer narrowly escape injury at Southampton General Hospital | Daily Echo
- Section 5.4.11 Ferromagnetic material detectors: MHRA Safety guidelines for Magnetic Resonance Imaging Equipment in Clinical Use (February 2021) MHRA (publishing.ervice.gov.uk)
- Shellock FG, Karacozoff AM. Detection of implants and other objects using a Ferromagnetic detection system: implications for patient screening before MRI. *American Journal of Roentgenology*. 2013;201: 720-725. 10.2214/AJR.12.10332 <https://www.ajronline.org/doi/abs/10.2214/AJR.12.10332>
- No vacation for MRI safety mrimetaldetector.com/blog/2010/06/no-vacation-for-mri-safety-recent-death. June 15, 2010
- Engineer Paul Ambrose died when he was overcome by fumes as he installed medical equipment in a New York hospital. *Oxford Mail* 22nd September 2000 Nitrogen gas kills man in hospital | Oxford Mail accessed 5th September 2021
- NHS England website. A just culture guide, accessed 5th September 2021, NHS England » A just culture guide
- Nugent B. The Need for MRI safety education in the NHS RAD Magazine, 45, 529, 22 24 (Jun 2019) <https://www.radmagazine.co.uk/scientific-article/the-need-for-mri-safety-education-in-the-nhs/>
- Pickup L, Nugent B, Bowie P.A preliminary ergonomic analysis of the MRI work system environment: implications and recommendations for safety and design *Radiography* (Apr 2019) *Radiography*, <https://doi.org/10.1016/j.radi.2019.04.001> [https://www.radiographyonline.com/article/S1078-8174\(18\)30147-0/pdf](https://www.radiographyonline.com/article/S1078-8174(18)30147-0/pdf)

Artificial intelligence in radiography: a world of new opportunities and challenges lies ahead

Artificial intelligence (AI) is rapidly being tested and implemented in different aspects of clinical MRI practice.

After initial consultations, Radiography has started to catch up with developments in a very dynamic way.

The AI working group of the Society and College of Radiographers, a group of 17 AI experts from all areas of practice, modalities and disciplines of radiography, has developed specific guidelines to for the safe and efficient implementation and adoption of AI in clinical practice, education and research. These guidelines also signpost and propose critical partnerships the radiography workforce needs to seek out to ensure a seamless, multidisciplinary service: <https://www.sor.org/learning-advice/professional-body-guidance-and-publications/documents-and-publications/policy-guidance-document-library/artificial-intelligence-guidance-for-clinical-imag>

The hope is that this document will serve as a reference for all UK radiographers and that it will be updated accordingly and as needed, given the fast-changing developments on AI in medical imaging and radiotherapy. The shortened version of this document is also available as a paper: [https://www.radiographyonline.com/article/S1078-8174\(21\)00108-5/fulltext](https://www.radiographyonline.com/article/S1078-8174(21)00108-5/fulltext)

The AI working group has also achieved the integration of the voice of radiographers in many other healthcare settings and organisations where AI is relevant, such as NHSX, AXREM, BSI standards and other.

There are more papers published in radiography, trying to explain how a digital future will look like: <https://www.sciencedirect.com/science/article/pii/S107881742100095X>

There is certainly more to expect from this field, hopefully with increasing radiographer involvement and input in decision making, research and educational provisions.

If you would like to enquire more about AI in radiography in the UK, please contact Dr Christina Malamateniou postgraduate and doctorate programme director at City, University of London (christina.malamateniou@city.ac.uk).




BAMRR COURSES 2022



Further MRI Course

Saturday 14th May 2022

Millennium Gloucester Hotel, LONDON

Course registration & payment details on the BAMRR website: www.bamrr.org





Ultra Fast 3D Gradient Echo

I suspect that at my DGH we are pretty typical in that around 20% of the MRI examinations we perform are of the brain. As it is a common examination, a wide range of sequences have been developed over the years to target specific conditions such as bleeds, infarcts and aneurysms. However it remains one of the most important tasks to simply delineate brain anatomy, differentiate soft tissue contrasts and achieve good gadolinium enhancement, and in doing so demonstrate a wide range of diseases that may be lurking within this complex organ.

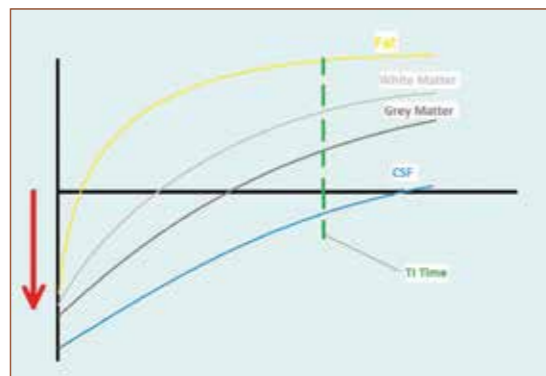
One sequence that was introduced around 30 years ago but is still going strong is the Ultrafast 3D gradient Echo. This uses a Non selective Magnetisation Prepared 180° RF pulse with RApid spoiled Gradient Echo sampling, and is called the MPRAGE (Siemens), 3D TI-Turbo FE (Phillips), BRAVO 3D (GE) or 3D Fast FE-IR (Canon).

It utilises an inversion preparation pulse, combined with an appropriate pre-scan delay (TI time) to ensure that differential tissue recovery maximises contrast differences, in particular grey and white matter (fig 1).



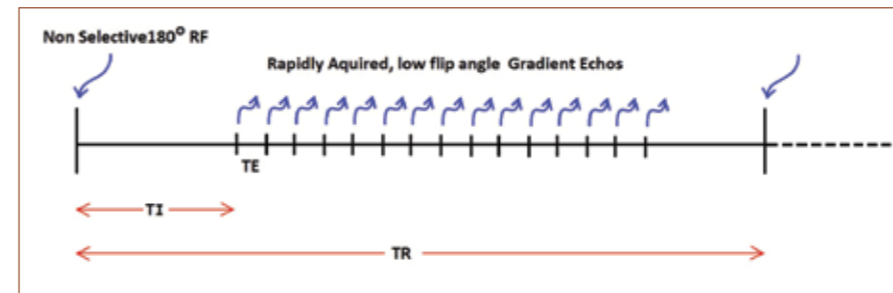
◆ Fig 1 - Normal contrast enhanced appearances and contrasts of an Ultrafast 3D Gradient Echo

Here we can see that (aside from gadolinium of course) fat has recovered most quickly and therefore returns the brightest signal. White matter has also comfortably passed its T1 time and so also has somewhat high signal. Grey matter has passed its T1 time, but to a lesser degree and so is darker. Fluid is lagging well behind and is therefore low signal (fig 2). The net result is very good tissue contrast and as such is a useful sequence for a wide range of brain anatomy and pathologies, for example in the diagnosis of epi-lepsy where grey/white differentiation is important, or in dementia, e.g. Alzheimer's where grey matter loss can be seen. (1)



◆ Fig 2 - In a 1.5T scanner TI times are in the order of: Fat 180, White Mat-ter 400, Grey Matter 650 and CSF 3500 (all would be higher at 3T)

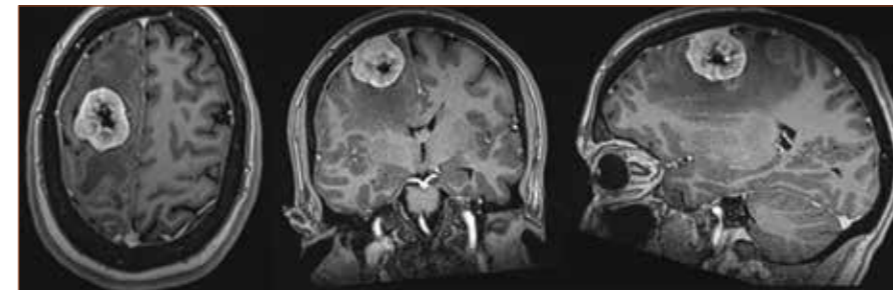
Following this TI time, a series of short TE echos are sampled very closely together, which is achieved by the use of very low flip angles. As well as allowing a very reasonable scan time, this has the added benefit (when combined with a high bandwidth) of keeping susceptibility artefacts to a minimum, which can be a problem with gradient echo imaging (fig 3).



◆ Fig 3 - Simplified Ultrafast 3D GE Pulse Sequence Diagram

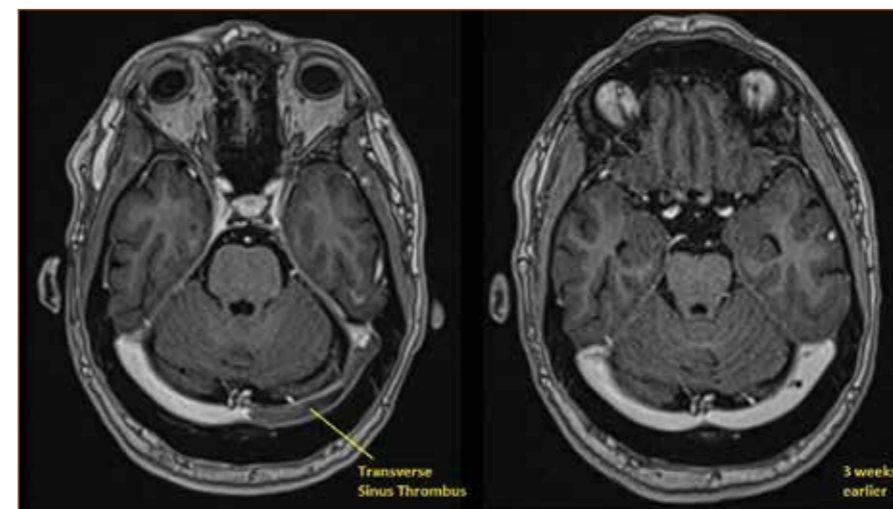
Slice selection is performed by a phase encoding gradient, making this a 3D sequence. Multiplanar reformats can then be created retrospectively to aid diagnosis and localisation of lesions.

Image weighting in truth is a mixture of T2*, PD and T1, however with the TI time set to produce good fluid (CSF) suppression. T1 is very much the dominant influence and so this sequence is very suitable where high resolution (isotropic), contrast enhanced imaging is required, e.g. to characterise brain tumours or MS plaques (fig 4). A word of caution however is that it can suffer from limited lesion conspicuity if lesions are small, or where enhancement uptake is otherwise lessened. Subtraction techniques have been shown to have some benefit in this scenario. (2,3)



◆ Fig 4 - Whilst this post contrast MPRAGE was scanned in the axial plane, the isotropic multiplanar reconstructions show the size, extent mass effect and origin of this atypical meningioma.

Venous anatomy is also well seen and might be a worthwhile addition when sinus thrombosis is a differential diagnosis (fig 5).



◆ Fig 5 - Patient presented with headache and seizures so was scanned with little to show. Symptoms persisted so he was rescanned 3 weeks later which showed a new, large transverse sinus thrombus.

Many sequences have come and gone over the years as they have been superseded by better alternatives, but the Ultrafast 3D Gradient Echo still has an important role to play as a worthy workhorse to have within your brain sequence tree..

Other Reading

- <https://pubmed.ncbi.nlm.nih.gov/1535892/>
- <http://mriquestions.com/mp-rage-v-mr2rage.html>
- https://www.radiologymasterclass.co.uk/tutorials/mri/mri_sequences

References

- 1 Magnetic resonance imaging in Alzheimer's disease and mild cognitive impairment
Chandra A, Dervenoulas G and Politis M
Journal of Neurology 266(6), 2019
- 2 A comparison of magnetization prepared 3D gradient echo (MP-RAGE) sequences for imaging of intracranial lesions. Blüml S, Schäd LR, Scharf J, Wenz F, Knopp MV and Lorenz WJ, Magn Reson Imaging 14(3):329-35, 1996
- 3 Improved Detection of Active Multiple Sclerosis Lesions: 3D Subtraction Imaging
Moraal B, Wattjes MP, Geurts JJG, Knol DL, Van Schijndel RA, Pouwels JW, Vrenken H and Bar-khof F 2010 <https://doi.org/10.1148/radiol.09090814>, Published Online: Mar 2010

Renew or begin your membership now!



WE OFFER
GUIDANCE
INFORMATION
ON ALL
MRI ISSUES, eg
MRI SAFETY



WE FORGE
LINKS WITH
OTHER
ORGANISATIONS,
eg SOR,
MHRA, BIR



FREE
NEWSLETTER
TO KEEP YOUR
DEPARTMENT
UP TO DATE
WITH CURRENT
ISSUES

WE PROMOTE
EDUCATION
TRAINING FOR MR
RADIOGRAPHERS
THROUGH
VALIDATED
COURSES AND
CONFERENCES.
(reduced rates for
members!)

WE
PROMOTE
DISCUSSION
FORUMS
VIA OUR
WEBSITE



DOWNLOAD A SUBSCRIPTION FORM TODAY!
FOR DETAILS AND SUBSCRIPTION RATES, SEE OUR WEBSITE:

www.bamrr.org