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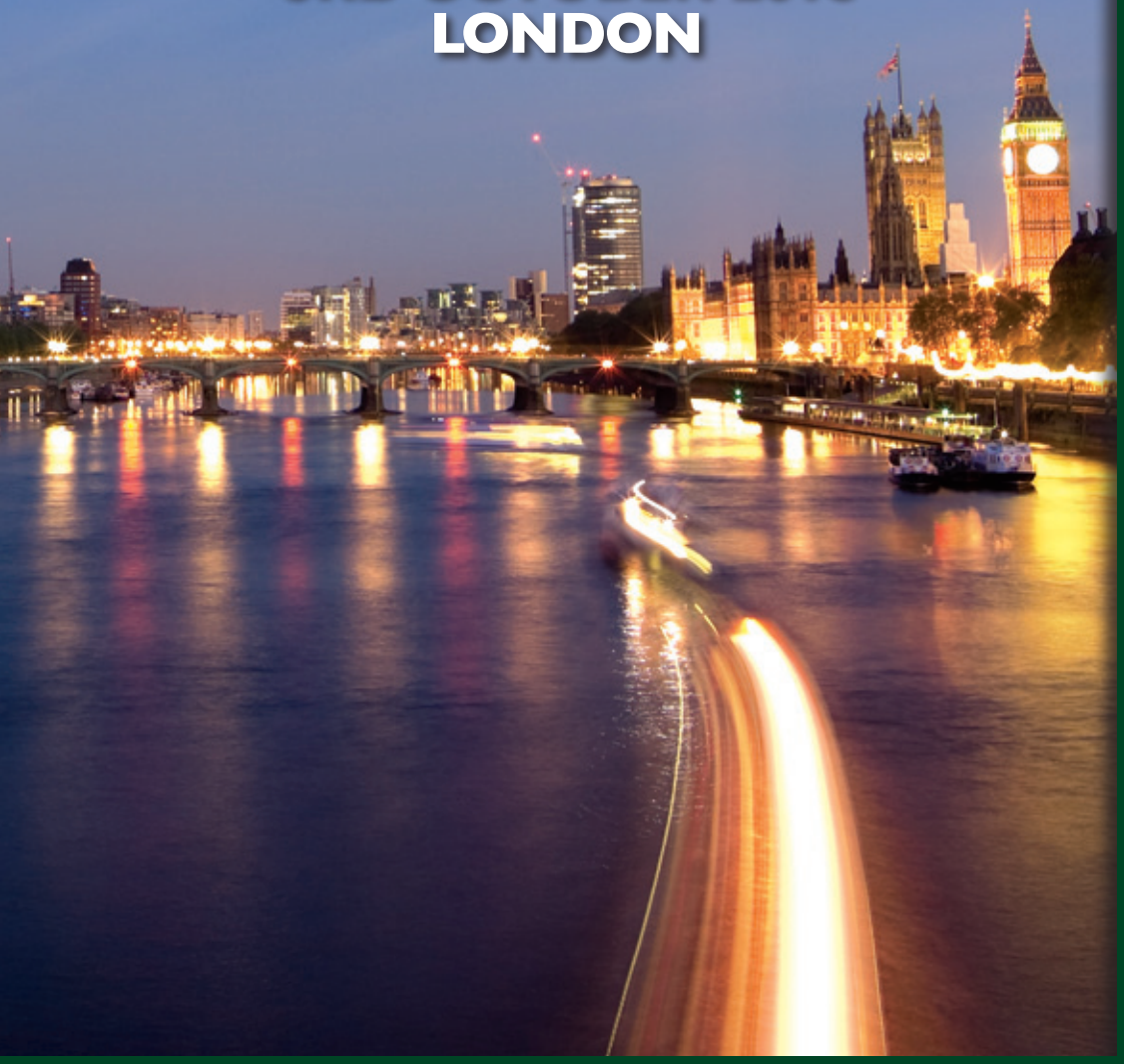
WINTER 2015

BAMRR news

THE NEWSLETTER OF
THE BRITISH ASSOCIATION OF MR RADIOGRAPHERS

SHARE YOUR POSTERS AND PROFESSIONAL KNOWLEDGE AT THE

BAMRR CONFERENCE 3RD OCTOBER 2015 LONDON



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PRESIDENT LETTER

Welcome to the Autumn 2014 Newsletter. Little did I think that when attending the early BAMRR meetings in the 1990s as a very green MRI Radiographer that one day I would be BAMRR President! It is an honour and Janine Sparkes is a tough act to follow indeed and I would like to thank the BAMRR Policy Board for supporting me in taking this role.

We are committed to providing an educational, developmental and safety role in MRI and offer members a plethora of information on the BAMRR Website, discounted BAMRR courses and the annual BAMRR conference which was a resounding success this year in Newcastle Upon Tyne. In 2015 it is the turn of the highly regarded BAMRR Basic MRI Course which has an excellent reputation in the MRI community, and the Annual Conference will be returning to London in October.

We aim to keep course and conference fees as low as possible and are grateful to our many sponsors including Guerbet who produce the Newsletter. BAMRR events are very good value for money with many benefits of membership. Don't forget to renew your BAMMR membership - this is now on a rolling year so you have a full years membership whenever you join!

I hope you enjoy the Newsletter and don't forget, contributions are always welcome!

David Reed
BAMRR President

from your EDITOR

Hello and welcome to the Autumn/Winter Newsletter which is packed full of interesting articles.

Congratulations to David Reed on his appointment as BAMRR president and I will take over as president elect.

The 31st Annual conference in my home town of Newcastle was very successful. It included some very interesting topics and pertinent safety discussions with delegates and speakers from across the United kingdom.

Many thanks to Janine for all her hard work over the past two years.

In this edition we have included a new competition for student Posters and look forward to receiving applications.. The winner will be published in the newsletter. Please use this newsletter to publish articles and share practice to improve patient experience and efficiency of MR machines send articles to me **jill.mckenna@nuth.nhs.uk**

I look forward to seeing you all at the BAMRR conference in London in October.

Happy reading !!!!

BAMRR Conference October 2014

Newcastle-Upon-Tyne

On Saturday the 4th of October 2014, the British Association of MR Radiographers (BAMRR) held their 31st Annual Conference in Newcastle-upon-Tyne.

The association promotes the professional development of Radiographers, and other associated professionals, within the specialty of MRI, through developing and delivering educational forums including the annual conference which is now a firm fixture in many members diary.

Designed and hosted by the BAMRR policy board, and with the support of our commercial sponsors, the day offers an opportunity for the MRI community to get together in a collective and democratic forum to discuss and guide the development of practice within the specialty.

Currently, BAMRR has a membership which encompasses Great Britain, Northern Ireland and the Republic of Ireland, and this patronage was evident by the cross-section of delegates who attended the event. Alongside the regular fixtures of proffered papers and the poster presentation competition, topics explored on the day were varied and included instrumentation, patient care, safety considerations and protocol development, all delivered by leading experts in the field of MRI.

Following the success of the day, the BAMRR team are already hard at work planning and designing next year's conference on Saturday the 03.10.2015 (venue TBC). If you are interested in attending this event, learning more about the organisation or joining, relevant information can be found at: www.bamrr.org/home.

outgoing PRESIDENT LETTER

The BAMRR policy board has once again been busy since the last newsletter. BAMRR provided a "further " MRI course in July this year in London . Guerbet provided sponsorship the course which enabled us to keep the cost of the course as low as possible. BAMRR is very grateful to Guerbet for their continued support.

The conference at Newcastle Thistle hotel was successful this year, it proved to be a very interactive conference with lots of discussion from the delegates. BAMRR would like to thank the sponsors of he conference once again for their continued support. The speakers were inspirational and we would like to thank them for giving up their time in aid of education.

Rebecca Bury, a long serving policy board member has left us this year due to increased commitment at work. Rebecca has been with the policy board for years and I am sure you would all want to join me in thanking her for all she has done for MRI education with BAMRR. We wish Rebecca every success in the future.

We have a new policy board member, Janice St. John Matthews. Janice is a senior lecturer at University of West of England,and I am sure BAMRR will benefit from her experience and skills.

I after two terms as president I am handing over to David Reed from Cheltenham and Gloucester Hospitals. I wish David every success during his term as president.

Thank you for your support

Janine Sparkes

New BAMRR MRI Safety Officer

◆ Denise Newsom

Some of you may recognise Denise Newsom from either working with her or having attended one of the Eden Learning CT or MRI courses. Denise of Eden Learning has recently taken over the role of MRI Safety Officer for BAMRR. Having worked in MRI for over twenty years in the NHS and private sector, this role fits in nicely with her clinical experience, interest in MRI safety and continuation of delivering education to MRI radiographers.

Over the last twenty three years, Denise has worked in several different departments, has practical experience in all of the clinical specialties in MRI and worked on all the makes of MR scanners including a very old Picker 0.5T to 1.5T rampable machine back in the early 90's where it took twelve minutes for one sequence! She has set up two MR departments, (Northampton and Glenfield, Leicester) from scratch so is very familiar with developing MRI departmental policies and all the safety issues that need to be considered. She successfully set up a Cardiac MRI service and established an MRI research site, working in collaboration with the University Department of Leicester.

In addition to delivering CT and MRI courses, Denise continues to carry out clinical work in MRI; helping out her local hospital and on mobile MRI scanners in the veterinary world.

If you have any MRI safety queries, suggestions, come across anything new or unexpected and you wish to share and help others, please email her at bamrr@edenlearning.co.uk or through the website www.bamrr.org

BAMRR Annual Conference: Student Poster Competition.

The BAMRR policy board is pleased to announce a new scientific poster competition category for Undergraduate students at the 2015 Annual BAMRR conference. This is in recognition of the quality of work produced by Undergraduate students for assignment submissions and final year dissertations. Higher Education Institutes (UK, NI & RoI) are being encouraged to submit one student piece per institute relating to any area of MRI practice no later than the 31.07.2015. There is a cash prize of £150 for the winning poster, which will be announced at the conference.

Any queries relating to this new competition should be directed to: bamrrsec@gmail.com. (Please note that the piece should not have been submitted to any other student competition. The poster must be A1 and use Vancouver style references. It can be designed using any suitable platform i.e. power-point, PhotoshopTM, publisher etc. A marking template will be made available nearer the time.)

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Free Membership

Free BAMRR Membership for Undergraduate Radiography Students.

The British Association of MR Radiographers has a proud tradition of promoting the education and professional development of radiographers and associated professionals working in the field of MRI.

As of January 2015, BAMRR is inviting all undergraduate radiography students in the UK, Northern Ireland and the Republic of Ireland to join the organisation free of charge. This membership entitles students to the same benefits as full members and also provides a networking opportunity with individuals passionate about this field of imaging practice. Furthermore there are opportunities for student members to submit pro-offered papers and poster presentations* at the Annual BAMRR conference, thus enhancing their CV and employability.

Once qualified students can then transfer to either individual membership or join via MRI site membership (where applicable). Application forms and joining fees can be found on the BAMRR website: http://bamrr.org/membership/how-join-and-renew-membership

Cerebral Microhaemorrhage

Cerebral microhaemorrhage (CMH) are increasingly detected on MRI scans of the brain particularly with the increased availability of higher strength magnets. In the literature, most studies define a microhaemorrhage as smaller than 5mm, but a limit of 10mm has also been used. The prevalence of CMH increases with age and the incidence in one population based study was 10%, with hypertension as an established risk factor.

Pathologically, CMH are composed of clusters of haemosiderin-containing macrophages and are often perivascular, haemosiderin remains in the macrophages for many years after the initial haemorrhage.

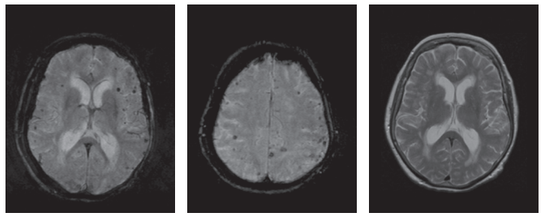
CMH are best seen on T2* gradient echo or susceptibility weighted imaging (SWI). They show as small ovoid areas of signal drop out with a 'blooming' affect, the blooming over estimates the size of the lesion. T2* and SWI imaging are more sensitive to CMH than conventional spin echo imaging due to the local magnetic field inhomogeneity and paramagnetic properties of haemosiderin. T2 and T1 signal varies depending on the age of the haemorrhage and small lesions may not be seen on T1 weighted imaging.

In patients with both ischaemic and haemorrhagic stroke, the presence of CMH is associated with an increased risk of future stroke. However, it is currently uncertain whether the presence of CMH in ischemic stroke can predict thrombolysis associated intracranial haemorrhage. A trend towards an increased risk of symptomatic intracranial haemorrhage in patients with ischemic stroke who are thrombolysed has been suggested by recent meta-analyses.

Most common causes of CMH:

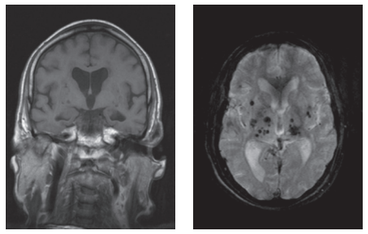
Cerebral Amyloid Angiopathy (CAA) is a form of angiopathy where amyloid deposits form in the walls of blood vessels in the CNS. It usually affects patients over the age of 65 and is often accompanied by small vessel cerebrovascular disease. CMH in CAA tend to be peripheral and/or subcortical.

◆T2* axial images ◆T2 axial



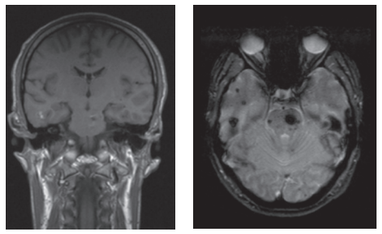
Hypertensive cerebral angiopathy is microangiopathic change in the deep penetrating brain arterioles caused by chronic systemic hypertension. CMH are more commonly found in the thalamus, basal ganglia, cerebellum and pons in this condition:

◆T1 coronal ◆T2* axial



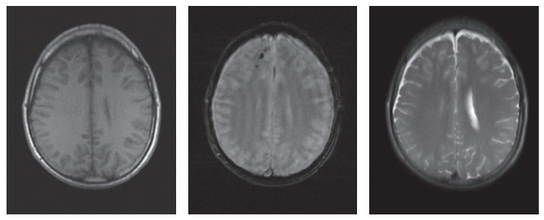
Cavernoma are low-flow cerebral vascular malformations without a nidus or enlarged supplying artery. They are described as 'mulberry-like' clusters with surrounding haemosiderin. They have a characterisitic 'popcorn' appearance on T2 imaging and don't generally enhance.

◆T1 coronal ◆T2* axial



Diffuse axonal injury (DAI) is a traumatic brain injury associated with rapid acceleration or deceleration, causing shearing of the axons. The most common sites for CMH include the grey-white matter junction, corticomedullary junction, splenium and dorsolateral brainstem. MRI can show multiple small hyperintensities on FLAIR/T2 owing to the presence of white matter oedema and petechial tissu-tear CMH.

◆T1 axial ◆T2* axial ◆T2 axial



Minimising Claustrophobia in MRI Radiotherapy Planning of the Head and Neck

Louise Jordan BSc (Hons) – Newcastle Upon Tyne Hospitals

Aim

MRI is a valuable tool in planning Radiotherapy treatment of head and neck tumours, however, refusal of MRI examinations due to claustrophobia has been reported to be up to 30%. Techniques must be adopted in order to minimise refusal of MRI in this claustrophobic and anxiety inducing situation.

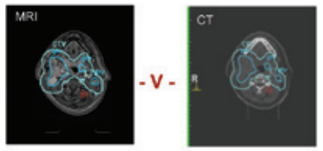
Background

Claustrophobia

- Claustrophobia is defined as a fear of confined or enclosed spaces. The DSM-IV[1], classifies claustrophobia as an anxiety disorder, with components of fear of restriction and suffocation[2].
- Estimations vary widely of the number of patients who refuse MRI examinations due to claustrophobia with publications reporting up to 30%, including many patients who do not normally consider themselves claustrophobic[3].

Benefit of MRI in radiotherapy planning of head and neck tumours

- MRI is used in the radiotherapy planning of head and neck tumours as it provides excellent characterisation of soft tissue structures and visualisation of tumour extent.
- The superior image contrast resolution of MRI allows improved target volume delineation for radiotherapy treatment planning margins compared to outlining on CT alone[4].



- The patient is immobilised to plan and execute radiotherapy of head and neck tumours to avoid damaging adjacent sensitive anatomy such as optical structures, facial nerves, salivary glands and major blood vessels.

Minimise MRI Scan Time

Sequence acquired	Why necessary	Method of minimising scan time	Time
Haste	To act as a localiser	Low SNR and contrast required	18 secs
T2-weighted Axial Turbo Spin Echo	To fuse with CT and outline Organs at Risk (OAR)	-Reduce phase oversampling to 20% -Reduce averages to 1 -Reduce phase Field of View to 87.5% -Use parallel imaging technique – (ie GRAPPA with acceleration factor of 2)	3.38 mins
Contrast injected	To highlight tumour	-Patient already cannulated prior to scan - Ensure relevant checks and medical consent cover already organised	Should be no longer than 2 minutes
T2-weighted Axial 3D sequence	To fuse with CT images to outline Gross Tumour Volume (GTV)	-Use phase partial fourier technique and reduce to 7/8 -Reduce phase oversampling to 40% - Use parallel imaging technique	6.23 mins

The Beam Directional Shell (BDS)

The BDS is an immobilisation 'mask' which is custom made for each patient to support the head and neck and replicate position during radiotherapy planning and throughout treatment. The mask making technique itself has anxiety inducing elements to it.

Step 1. The patient wears a swimming cap to create a smooth surface. The plaster covers the ears, making it difficult to hear anything. The sounds of the technician shaping and smoothing the plaster is amplified and reverberates in the ears

Step 2. The face and neck is encased in plaster. When it hardens it causes difficulty in swallowing, resulting in feelings of suffocation and restriction. The patient must lay motionless for 3-5 minutes.

The plastic shell is then moulded from the plaster cast.

Anxiety Reduction Techniques

Multi Disciplinary Team

- Pre-treatment patient preparation is essential and departments should strive to achieve a successful multi disciplinary approach.
- All appointments occurring in the same hospital department offers continuity for the patient and also ensures staff are knowledgeable at each step of the care pathway.
- Clinicians, Mould Room Technicians and Therapy/Diagnostic Radiographers each have a significant influence on the patient experience.

Patient Information Leaflets.

- Anxiety can be appeased with increased pre scan information[3,6].
- All patients should receive written information detailing the procedure and what to expect.
- Online information can also be helpful[5].
- A visit to the department, allows the patient to familiarise themselves with the environment, whilst giving staff the opportunity to build rapport and alleviate fears.

Ambient Environment

- Music, lighting and artwork are sensory distractions which have been found useful in alleviating anxiety by offering a more welcoming and ambient clinical environment[7]

Communication

- Once the mask is fitted, the jaw is immobilised and the patient is unable to talk.
- The Radiographer must establish good communication with the patient prior to scanning, during set up and throughout the scan with pre arranged hand signals.
- The patient is given the call button should they need to alert the Radiographer at any time.

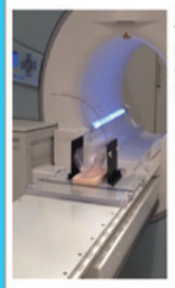
Wide Bore Scanners

- Modern scanners with open design and short wide magnetic bores can reduce the incidence of claustrophobia by a third[10]

70cm wide bore MRI scanner with ambient lighting, (Siemens AG, Muenchen, Germany) and light box art work to provide a more welcoming environment.

(Image courtesy of MAELOR, Wrexham Hospital)

MRI Procedure



The back of the mask is attached to the table top insert. The patient lays into the mask cradle and the top of the mask is securely fastened into position over the face. Once the mask is fitted, the head, neck and shoulders are restricted and cannot be moved. Two MRI body array coils are used to cover the required field of view.

References: [1] APA, (2000). Diagnostic and Statistical Manual of Mental Disorders. Washington DC. [2] Harris, L. Robinson, J. Menzies, RG. (1999) Evidence of fear of restriction and fear of suffocation as components of claustrophobia. Behaviour Research and Therapy Vol 37:129-138 [3] Grau, S. Price, G. Matthews, A.(2000) Reduction of anxiety during MR imaging: a controlled trial. Mag Res Imaging vol 18:281-286. [4] Emami, B. Sethi, A. Petruzzelli, G. (1991) Influence of MRI on target volume delineation and IMRT planning in nasopharyngeal carcinoma. Radiation Oncology, vol 57: (2):481-488. [5] Newbold, K. Partridge, M. Cook, G. Sohaib, S. Charles-Edwards, E. et a., (2009) Advanced imaging applied to radiotherapy planning in head and neck cancer: a clinical review. British Journal of Radiology, Vol 79:104-501. [6] Facos, M (2011) Effect of pre-instruction on anxiety levels of patients undergoing magnetic resonance imaging examinations. East West Health Journ vol 7:3:9-525. [7] Klassen, J. Liang, Y. Tjosvold, L. Klassen, T. Hartling, L (2008) Music for Pain and Anxiety in Children Undergoing Medical Procedures: A Systematic Review of Randomized Controlled Trials. Ambulatory Pediatrics (8):117-126. [8] Guo, X. Johnson, R. Deng, H. Liao, J. et al (2009) Evaluation of non-eat risk factors for nasopharyngeal carcinoma in a high-risk population of Southern China. International Journal of Cancer Vol 124 (12):2942-2947. [9] Jemal, A. Bray, F. Center, M. Ferlay, J. Ward, E. Forman, D. (2011) Global Cancer Statistics. Cancer Journal for Clinicians. Vol 61 (2): 69-90. [10] Dewey, M. Schink, T. dewey, C. (2007) Claustrophobia during magnetic resonance imaging: Cohort study in over 55,000 patients. Journal of Mag Res Imag, Vol 25:1023-1027.

MRI Safety First

RF Identification Tags in Hospital Linen.

Denise Newsom, Eden Learning
BAMMR Safety Officer

Here is some information about the use of RF identification tags in hospital linen, which I was not familiar with and so want to raise awareness to all MRI staff because these tags can cause artefacts on MRI images. As far as we are aware they do not cause a heating effect.

These tags have been introduced to prevent linen going missing and to identify to which hospital the sheets belong. Please see the following articles that will explain more fully. http://www.bbc.co.uk/news/uk-wales-25658688

https://www.rfidjournal.com/purchase-access?type=Article&id=10631&r=%2Farticles%2Fview%3F10631%2F2

An RF identification tag is sewn into the hem of hospital linen, including towels, sheets and pillowcases. Each tag is uniquely identifiable and enables the system to keep track of every individual piece of linen. The tags are designed to endure extreme temperatures and chemicals to which linens are exposed to during laundering and are able to withstand hundreds of wash-and-dry cycles.

These RF tags are currently found in higher quality linen products, but these occasionally leak into the circulation of more standard non-tagged products, so this article is to make you aware they are being used and for you to check carefully any pillow cases or sheets which are positioned with the patient on your MRI system. Geoff Charles-Edwards, a physicist from Guy's & St Thomas', London has provided the following photograph.

Geoff scanned the RF Tagged sheet with a phantom bottle and recorded the following artefact. In a very basic heating assessment there was no noticeable difference in temperature when touching this part of the sheet immediately following a 2 minute high SAR sequence at 1.5 T.

The linen discussed in this article is supplied by Berendsen (formally known as Sunlight) who supply many NHS Trusts and Private Hospitals, so this is something for you to look out for and share with your colleagues.

http://www.berendsen.co.uk/linen-services-nhs-trusts

This article can also be found on the Safety Page of the BAMRR website

Photo demonstrating an RF Indentification tag in a hospital sheet

MRI image of artefact caused by the RF tag in the sheet

States of Jersey

WHOLE BODY DIFFUSION WEIGHTED MR IMAGING: CONCEPTS AND BENEFITS

University of Cumbria

MARY DAVIS BSc (HONS)

BASICS OF DIFFUSION WEIGHTED IMAGING (DWI)

The DWI signal is obtained from the random Brownian motion of water molecules. Within biological tissue water motion is restricted due to interactions with macromolecules and cell membranes (limited diffusion). DWI measures diffusion of intra/extra cellular and intravascular spaces; Intravascular spaces having greater diffusion due to blood flow[4].

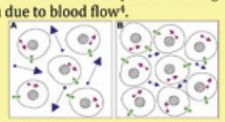


Fig.1 Schematic: Diffusing water molecules -intracellular spaces (purple arrows), water molecules in the extracellular spaces (blue arrows), and diffusing water molecules from the intracellular to extracellular spaces, and vice versa (green arrows). (A) Normal tissue; the largest amount of water diffusion takes place in the extracellular spaces (blue arrows). (B) Tissue with increased cellular density (e.g. tumor tissue) has relatively less water diffusion in the extracellular spaces (blue arrows), and consequently an overall more impeded diffusion[4].

Tissues associated with impeded diffusion include tumours, cytotoxic edema, abscesses and fibrosis. Areas of low cellularity enable water molecules to flow freely between defective cells from extra to intra cellular spaces.

The basis of DWI is to detect and quantify water diffusion in vivo. This is achieved by applying symmetrical Diffusion Sensitizing Gradients (DSG) either side of a 180° pulse in three orthogonal planes. Figure 2.

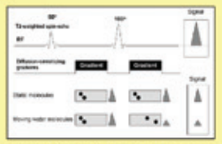


Fig. 2 Measurement of water diffusion. Stationary molecules are unaffected by diffusion sensitizing gradients and measured signal intensity is preserved. By contrast, moving water molecules acquire phase information from first MPG, which is not entirely rephased by second MPG, thereby leading to signal loss. Hence, water diffusion is detected as attenuation of measured MR signal intensity. RF = radiofrequency pulse [5].

Highly cellular tissue with impeded water movement is limited, having little impact on T2 decay maintaining T2 signal. Moving water molecules are not fully rephased leading to a reduction in T2 signal intensity. Water movement = reduction in signal on DWI images proportional to degree of signal loss.

Varying the amplitude, duration and time interval between the paired DSG influence the sensitivity of the DWI sequence to water motion, these three factors are proportional to the 'b' value[6].

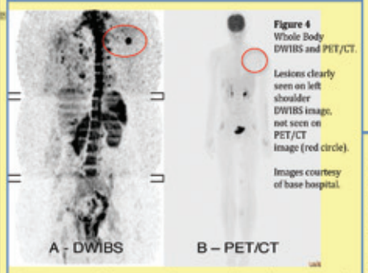


Figure 4 Whole Body DWIBS and PET/CT. Lesions clearly seen on left shoulder DWIBS image, not seen on PET/CT image (red circle). Images courtesy of base hospital.

Motion artefacts are 'averaged out' as signal averaging is conducted on the reconstructed image, not in k-space. Imaging at multiple stations of the body enables a composite whole-body image to be reconstructed. Maximum Intensity Projections (MIP) images displayed on an inverted grey scale resemble PET-like images [2].

INTRODUCTION

Established whole-body imaging techniques such as CT, 2-FDG-Positron emission tomography (FDG-PET) and hybrid positron emission tomography (PET-CT) have limitations including repeated high doses of radiation, reduced spatial and contrast resolution, long preparation times, limited availability and cost[1]. Research[2,3] has presented a unique approach to whole-body diffusion weighted imaging (DWI) with background suppression (DWIBS) during 'free breathing'. Functional and anatomical MRI information is evaluated with concomitant whole-body MRI sequences, providing both qualitative and quantitative information. Continued research has highlighted the potential of DWIBS to offer early detection of tumours and metastases in cancer patients non-invasively without the use of ionising radiation[1].

b Value

Signal attenuation is dependent on the magnitude of diffusion (intra-voxel 'incoherent' motion) and the amount of diffusion weighting, determined by the 'b' value.

$$b = \gamma^2 G^2 \delta^2 (\Delta - \delta/3)$$

Where: - δ = duration of 1 MPG, Δ =interval in leading edges of MPG, G= Strength of MPG, γ= Gyromagnetic ration of a particle 42.58 MHz/T for hydrogen 1.

A b value of 0 creates a T2-weighted EPI anatomical reference scan. The b values used should attenuate healthy background tissue more than lesions. The greater the b value, the stronger the diffusion weighting = higher contrast in lesions.

Water molecules with increased motion demonstrate signal attenuation at lower b values (b=50-100s/mm²), slower moving molecules occurring in a diffusion measurement is 8 μm, compared to the mean size of cells within the human body of approximately 10 μm; enabling DWI to depict changes on a cellular spatial scale within the microenvironment of tumours before and after treatment [5].

APPARENT DIFFUSION COEFFICIENT (ADC) MAPPING

DWI has overlaying T2 contrast; tissues with a long T2 can simulate restricted diffusion (T2 shine through) and limit image interpretation. A parametric ADC map is a synthetic representation of the Diffusion Weighted Image without T2 shine through. MRI post processing software takes a measurement of at least two b values to create an ADC map. To measure the strength of diffusion independent of anisotropy, images from different orientations are measured and averaged. Calculating intensity on a pixel-by-pixel basis yields a quantitative estimation of the ADC. Reduced diffusion on a b 1,000 diffusion image is hyper-intense conversely on the ADC map it will be hypo-intense [1].

Figure 3

$$ADC = (1/b_1 - b_0)\ ln\ (S[b_1]1/S[b_0])$$

b_0 and b_1 represent two 'b' values, the signal intensity of the selected region of interest (ROI) on the slice level acquired with b value b_1 and $s/[b_1]$, the signal intensity of the same ROI on the same slice level acquired with b value b_0. 1

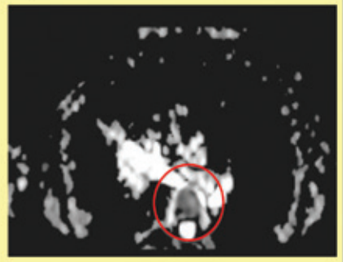


Fig 3 ADC map demonstrating area of restricted diffusion in a lumbar vertebra Images courtesy of base hospital

DEVELOPMENT OF THE DWIBS SEQUENCE

Whole Body DWI acquired using Breath Hold or Gated techniques to reduce potential movement from within the body has several limitations: -

- Scan times restricted to a breath hold impeded thin slice acquisition.
- Reduced SNR and number of excitations
- Inadequate fat suppression in standard spin echo –EPI (SE-EPI) sequences with chemical shift selective (CHESS) technique
- Sub optimal fat suppression in the periphery of image in 2D viewing
- Fat superimposed on 3D images, potentially concealing pathology
- Sensitivity to pulsatile and susceptibility artefacts.
- Developing Non-breath Hold sequence utilises: -
- Multiple slice excitations and signal averages over a longer time
- Short T1 inversion recovery (STIR)-EPI for robust fat suppression
- Improved spatial resolution enabling multi-planar image reformatting
- High b values (1,000 s/mm@ optimum for whole body imaging)
- Extended moving table top
- Fast gradient slew rates, specific RF coils
- Short TR and TE to facilitate fast imaging sequences
- Limitations and Solutions -
- Low SNR and Susceptibility artefacts - reduced by using minimum TE<100 sec, increasing signal averages, slice thickness (6-7mm) and FOV.

Parallel imaging facilitates rapid imaging, reducing motion artefacts and improves accuracy of ADC by allowing multiple b values to be acquired. Ghosting and chemical shift artefacts are reduced by fat saturation. [6]

DWI SEQUENCE PARAMETERS BASE HOSPITAL

Images acquired using a Philips Achieva 1.5T scanner with Pulsar Gradients maximum slew rate = 80 $Tm^{-1}S^{-1}$, Philips (2013) with concomitant whole-body T1 and STIR sequences acquired in 8 stacks, total scan time 24 minutes

IMAGING PLANE/ PHASE ENCODING DIRECTION	AXIAL/ AP TO MINIMISE IMAGE DISTORTION
FOV (CM)	530 X 264
MATRIX SIZE	108 X 41
TR/TE	3,085/65
EPI FACTOR	41
IMAGING FACTOR	INHERENT BODY COIL
NO. OF SIGNAL AVERAGED	2
SECTION THICKNESS	6 CONTIGOUS
DIRCTION OF DIFFUSION SENSITIZING GRADIENTS	TETRAHEDRAL ENCODING
RECEIVER BANDWIDTH	5.290
FAT SUPPRESION	STIR (180 MS)
b VALUE (S/MM2)	0, 1000
ACQUISITION TIME PER STATION	2.09

CONCLUSION

A global shortage of 99mTc isotope, restricted availability, preparation times and costs together with exposing already weakened patients to repeated, potentially high doses of radiation with CT and reports of false negative results in both PET/CT and bone scans has prompted research into whole-body DWIBS imaging [4].

Proven to have high diagnostic sensitivity for detecting tumours and monitoring response to treatment whole-body DWIBS in conjunction with whole body MRI sequences, patient history and clinical examination is essential to avoid false-positive diagnosis; abscesses can appear as tumours and organs such as the liver, spleen gallbladder and kidneys also highlight.

Whilst MRI is proving to be a viable alternative imaging technique, DWIBS sequences need to be standardised in order for DWIBS to become a robust alternative. Recommendations to use Whole-body DWIBS imaging to compliment findings of other imaging modalities[4] are currently used at the base hospital.

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BAMRR

Further MRI Course

By Paola Griffiths - Course Co-ordinator

On a sunny and hot day in July, a lovely group of 34 keen MRI Radiographers assembled in a Kensington Hotel to learn more about MRI. The course, developed by the BAMRR study day committee, was aimed at radiographers with some MRI experience who were looking to expand their knowledge and understanding of more advanced scanning and complex studies. Guerbet kindly supported this event. The programme covered a variety of advanced topics including scanning of the prostate, rectum, MSK, female pelvis, cardiac and liver imaging. It also included a MRI Physics refresher together with updates in MRI safety and contrast agents. The format of the two day course was primarily lectures, however there were a number of opportunities for the delegates to interact with learning materials and ask MRI related questions.

MRI SAFETY

Cerebral microhaemorrhage (CMH) are increasingly detected on MRI scans of tDenise Newsom Eden Learning and Bamrr Safety Advisor

We started the Friday session with an excellent talk from Denise Newsom and MRI safety. She covered safety with anupdate of the Current Legislation and the role of the MR Safety Expert, within the MRI Safety Framework. Implant safety was discussed and how to understand the 'conditional' MRI data and how to interpret this in the MRI Unit and make an informed decision on scan in order to comply.

Magnets in your PANTS was a hot topic for hot flushes much to the amazement and amusement of the group.

Also importantly HospitalLinen are now coming with RFIDTags, as hospitals are starting to use them to track t heir linen stock. Importantly MRI radiographers need to look out for them as they can cause burns to patients.

Feedback - Very interesting with regards to current practice

MRI PHYSICS TO INFINITY AND BEYOND

Dr Geoff Charles Edwards, Guy's and St Thomas NHS FT Trust, London

Geoff gave an excellent talk on MRI physics on the first day while the delegates were fresh and he did an excellence job using graphics and visual aids to demonstrate k-space, grappa, blade and propeller.

Geoff also went over DWI which was very relevant as more and more this iscoming into main stream imaging and a good understanding is important to MRI Radiographers.

Feedback - Good overview, extra DWI helpful, excellent

MRI PROSTATE AND MRI RECTUM

Dr Christine Heales MRI Radiographer, Derriford , Plymouth

Christine gave an informative and in depth talk on the Role of MRI in both the Prostate and the Rectum and explained how to improved detection and characterisation for each organ to aid diagnoses. She also covered how the MRI results can affect treatment choices: which include active surveillance (watch and waiting), radical surgery, radiotherapy, hormones or palliative care, which gave a great overview of the patient pathway and understanding to the MRI role within this.

Feedback - Informative, good content, excellent slides Well presented, excellent planning scans

MSK MRI OF THE WRIST FOOT, ANKLE

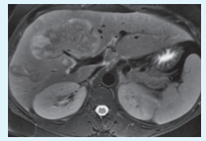
Dr Tishi Ninan, Consultant Radiologist ABMU Health Board, Swansea

Dr Ninan brought a good selection of interesting cases on the wrist covering instability, Kienboch disease and triangular cartilage. On the ankle he covered tendonitis, AVN trauma and evaluation of lateral ligament complex. And Dr Ninan also went though some very interesting cases.

Feedback - good responses to questions, informative

MRI CARDIAC

Janine Sparkes MRI Supt & Bamrr President, Neath Port Talbot



Janine gave a good overview of cardiac plans and how to achieve the angles the cardiologist require. Her top tips on achieving the correct plans were excellent and then some interesting case studies and pathologies would shared with the group with a Q&A session. Following on Janine gave a talk on liver pathologies and demonstrated the complexity of MRI of the Liver and why imaging has to be varied for each diagnosis and case.

Feedback - Interesting, pathology interesting Great pathology images

MRI FEMALE PELVIS

Paola Griffiths Supt Research Radiographer Swansea University, Bamrr Course Co-ordinator

Paola covered the Female pelvis and went through scanningplanes, sequences and pathologies, in the Endometrial/Uterus, Cervical and Ovary. Clear graphics on angulations depending on Uterus position helped the delegates to understand what the radiologist need from them. Cine of the pelvis floor and DWI were discussed as topics that are coming in to main stream Imaging.

Feedback - Easy to understand, excellent, good interaction

PAEDS AND GA'S, NOTHING STRAIGHT FORWARD

Carolyn Graham Clinical Specialist Radiographer, Londonderry and Past President of Bamrr

Lynn had an in depth talk about the challenges of imaging Paediatrics in MRI. She covered in image optimisation in relation to age progression. Lynn focused on the brain and spine, and covered the important of changing parameters and protocols to suit sizes and situations.

Also discussed were various different techniques i.e.

- Feed+Sleep for neonates
- Sedation+Anaesthesia 6 months –6 years
- IV contrast, sound reduction
- Ear Protection for Neonates
- 3T and tissues contrast

And Lynn then finished on relevantpathologies and interestingcases for the group to comment on.

Feedback - Excellent, very useful

MRI CONTRAST AGENTS

Janice St John Matthews, Senior Lecturer University of West England

Janice gave an excellent interactive session which after lunch ensured delegates remained focussed and didn't suffer from a "post lunch slump". The use of Turning-Point software handsets enabled the delegates to answer questions live on the PowerPoint affording them the opportunity to engage with the material being presented.

Janice covered the types of composition of MR Contrast Agents and discussed the importance of checking the patient's renal function and the ways this can be ascertained so as to reduce NSFrisk. She finished her session by giving learners some self-directed reading which could fit into their CPD portfolio activities.

Feedback - Great interaction, good information, encouraged to read more information regarding contrast.

The delegates finished the two days, well feed and watered and hopefully took away the key points back to their units. It is envisaged that course attendees will return to their departments with increased appreciation of MRI theory and technique and that they will share this information with colleagues and junior staff through their post-course CPD activities.

BAMRR plans to run this course again in 2015 and also hope to re-introduce the successful BAMRR 'Introduction to MRI'. This is aimed at trainee MRI radiographers to help sign-post them on their learning journey.

MRI NEURO CASES STUDIES

Dr John Morlese, Consultant Neuro Radiologist University Hospital Leicester

Dr Morlese gave an excellent talk on Neuro MRI with some interesting case studies and guess the pathology which all the delegates enjoyed as we slowly got more information to pieces together the diagnosis's.

Feedback - New techniques, ASL, perfusion excellent and relevant, clear explanations.

MRI RESEARCH OVERVIEW

Celia O'Meara UCLH London and Bamrr Secretary

Celia gave an talk to round off the 2 days to direct the delegates to research and new areas of Development. DWI, Perfusion, ASL, HypoxiaT2*, Extra-cellular VolumeT1 Mapping, Blood flow Spectroscopy and hyperpolarised gases where all introduced as well as Celia experience with the UK first Pet MRI.

Feedback Food for thought for the future

London
4th and 5th July 2014

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DELEGATES OVERALL FEEDBACK

Wonderful 2 days, filled with variety of lectures, really enjoyed.

Excellent course, venue, food and lectures

Excellent course, maybe run in a variety of locations nationally

Brilliant, Thank you

Interesting and relevant

Excellent venue and food

Very Informative lecturers

Very good

DELEGATES SUGGESTIONS FOR FUTURE TOPICS

MRI Spine

MRI Breast

More details on safety and MHRA

More Interactive

More Case Studies

Handouts and lecture materials

Evaluation of Carbon Fibre for use in MRI Radiotherapy Treatment Planning

Louise Jordan[1], BSc; Jill McKenna[1], MSc; Pete Thelwall[2], PhD
[1] Newcastle Hospitals; [2] Newcastle University. Contact: louise.jordan@nuth.nhs.uk

Aim

As the benefits of utilising MRI in radiotherapy are being recognised, this experiment will aim to determine the suitability of using readily available carbon fibre couch tops and accessories in MRI. These couch tops and accessories contain no ferromagnetic materials and are currently used in CT to accurately reproduce patient position which is essential in precise radiotherapy planning and treatment.

Background

•Contemporary radiotherapy treatments such as conformal (CRT) and intensity-modulated (IMRT) enable accurate delivery of high dose radiation to irregular target volumes. Well defined target volumes are therefore essential to prevent geographical miss of the tumour and to spare surrounding healthy tissue and organs at risk.

Pre-treatment CT

•Pre-treatment CT imaging is used to identify the radiation target volumes, with Hounsfield Units on CT data providing the electron density of tissues needed for dose calculation.

Pre-treatment MRI

•Pre-treatment MRI provides excellent spatial and contrast resolution enabling improved localisation of soft tissue anatomy. High resolution MR images may be used to facilitate accurate delineation of clinical target volumes and adjacent organs at risk.[1]

MR and CT 'Fusion'

•Co-registration of pre-treatment MR and CT imaging is an effective method of gaining a combination of improved soft tissue target delineation, geometric accuracy and electron density information.[2]

Patient Positioning

•To achieve an acceptable registration, it is imperative that the patient position be replicated on both CT and MRI planning scans.[2]
•As precise treatment depends upon meticulous patient positioning, utilising the same couch top in MRI and CT planning (and subsequent therapy), could facilitate reproducible patient positions.

Dedicated Couch Top and Accessories – Designed for Radiotherapy

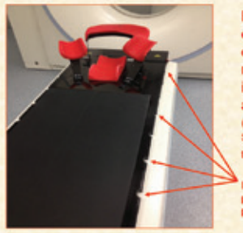


Figure 1. carbon fibre flat couch top and removable immobilisation accessory, (CIVCO Medical Solutions, Reeuwijk, the Netherlands). Indexing referencing points used to record patient position

Carbon fibre is the material of choice for the manufacture of couch tops and accessories used in radiotherapy treatment and planning, due to its high tensile strength, rigidity, lightweight properties, and low radiation beam attenuation (deflection of less than 5 mm is required to be compliant with the AAPM TG-66 guideline*). Clinical implementation of current radiotherapy treatments is associated with the availability of such radio-translucent devices.[3] Although the couch top and accessories do not contain any ferromagnetic materials, carbon fibre is an electrically conducting material and, according to Faraday's law, could produce eddy currents when placed in the MRI scanner. The potential heating effects may render carbon fibre couch tops and accessories unsuitable for use in MRI.

*AAPM-TG-66 guidelines specify < 5 mm in range of 60 cm in z-axis with a patient load of 136 kg

Materials & Method

•Images were acquired from a water filled tub that contained a box made of either carbon fibre or PVC, (figures 2a and 2b)
•Both boxes were 15cm square, 10cm deep
•The carbon fibre material is the same as used to construct CT planning and treatment couch tops and accessories.

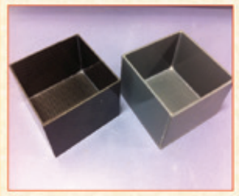


Figure 2a. Boxes made of carbon fibre (left) and plastic (right)

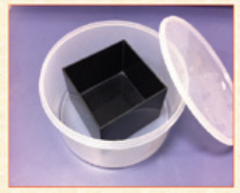


Figure 2b. Each box was placed in a plastic tub, filled with water and sealed

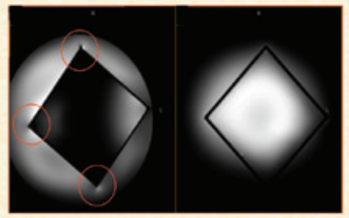
•A 3T Intera Achieva MRI scanner (Philips, Eindhoven, The Netherlands) was employed
•The body coil was used for transmit, a 6-channel cardiac coil was used for receive

Imaging Parameters

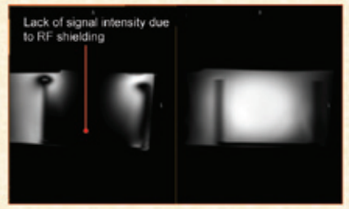
Spin Echo sequence with TR=3000ms TE=8.3ms NEX=1 FOV=300x300mm Matrix Size=192x192
•Providing a homogeneous B1 field is present, the parameters used will produce a proton density weighted image, displaying uniform signal from the water

Results

•Figures 3a and 3b show the differences between the carbon fibre box (left) and the plastic box (right)
•The image of the plastic box (right) displays high signal intensity from the water as is expected with PD imaging in a homogeneous B1 field
•In comparison there is an inhomogeneous signal within, and to some extent, outside of the carbon fibre box caused by an inhomogeneous B1 field
•There is some evidence of B1 field focusing at the edges of the carbon fibre box (circled)



Figures 3a (above) and 3b (below). PD-weighted images of carbon fibre box (left) and plastic box (right)



Discussion

Faraday Cage

A Faraday cage acts as a conductive barrier against radiofrequency (RF) waves. In this experiment, the carbon fibre box acts as a Faraday cage causing RF shielding, and thus the B1 magnetic field is perturbed inside and near the box.

Specific Absorption Rate

The rate at which RF energy is deposited in tissue is expressed as the specific absorption rate (SAR) with limits applied in accordance with requirements defined in IEC60601-2-33[4]. In this experiment there is evidence of B1 field focusing at the edges of the carbon fibre box (circled on figure 3a). These so called "hot-spots" indicate an increased deposition of RF energy which has potential SAR implications. The inhomogeneous B1 field may also interfere with the scanner's ability to perform correct pre-scan power calibration.For instance a 270° rather than 90° pulse that has the same net effect as all of the magnetisation in the transverse plane may be generated, which could potentially lead to RF heating of the carbon fibre.

Conclusion

This experiment has proven carbon fibres are sufficiently conductive to act as a Faraday cage. At the very least RF shielding artefact occurs due to the lower effective tip angle in some places. In addition, inhomogeneous excitation causes hot spots due to increased RF energy deposition. This increase in RF results in greater SAR levels which may pose a risk to the subjects in the scanner.

Carbon fibre is not a suitable material to be used in MRI scanning due to B1 inhomogeneity, potential RF heating and SAR implications. PVC couch tops are a potential health and safety hazard being heavy and cumbersome to handle. An alternative strong yet lightweight, non-conducting material is required for construction of flat top couches and accessories for use in MRI radiotherapy planning.

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