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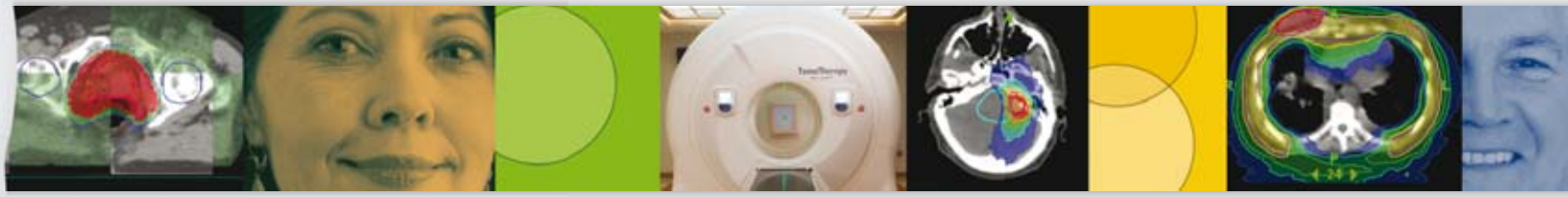

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Leading by example

Taking over last autumn from Professor Audrey Paterson as the Editor of *Imaging & Oncology* was one of the high points of my year. I could not wait to manage and influence a publication of which I had been a fan since its inception. However, I did wonder what on earth I would do if no-one would write for me. Audrey had, for five years, produced a superb collection of top drawer manuscripts, but I'm not Audrey. Certainly the contemporary nature of the publication meant that I had no papers to 'inherit' for this year's issue. And most professionals in healthcare would agree that their working environment is getting busier, which naturally means that 'non-essential' activity is more likely to be sacrificed. The prospect of my writing ten articles by fictitious authors passed through my mind and suddenly I regretted my new editorial role...

Eight months on and my fears were unfounded, for here is a fascinating collection of articles written by some of our best experts in their field. Some focus on cutting-edge scientific breakthroughs and technical innovations, some on educational dilemmas and issues relating to sustainable service delivery, and others consider ethical dimensions which affect our professions. At first glance, this eclectic mix may appear to have little in common other than that each contains high quality information. However, look closer and you will see that all these authors are leading, either with their practice, their ideas, or both. They have considered the future and have bold messages for our imaging and oncology community. This, of course, lies at the heart of why they wanted to write for this issue.

I am certain that some of the predictions and recommendations contained in these pages will contribute to shaping future services in the UK. And that managers and shapers of our professions will consider some of these concepts, perhaps modify them further, but then apply them within their own setting, ultimately for the good of the patient.

If you enjoy this year's issue of *Imaging & Oncology* as much as I have, then you will be very satisfied indeed. To use an old cliché, it really does contain something to interest everyone regardless of their specialty, and, arguably, this is because of the marvellous contributions from our medical and non-medical colleagues. I sincerely hope this publication continues to be a forum for such collaboration.

Please let me know your opinion of this year's collection since only then can I deliver more of what interests you next year. I look forward to hearing your suggestions for improvement and also for future topics.

Hazel Edwards

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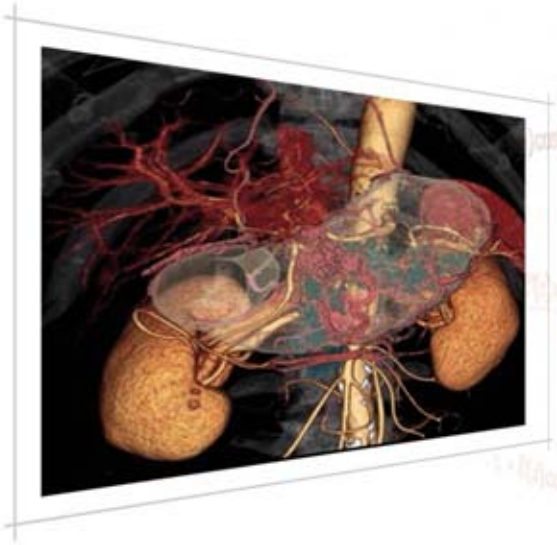

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FOREWORD

You must be the change you want to see in the world*

As the Society and College of Radiographers celebrates its 90th anniversary, I would like to welcome you to the 2010 edition of Imaging and Oncology, our annual publication which showcases important perspectives on current and emerging practice and technology.

The imaging and oncology workforce currently faces many demands and it is not easy to find the time to carry out research or to write for publication. Despite this, the authors within this edition have risen to the challenge and have found time for innovation and reflection in order to produce the high quality articles we are proud to publish.

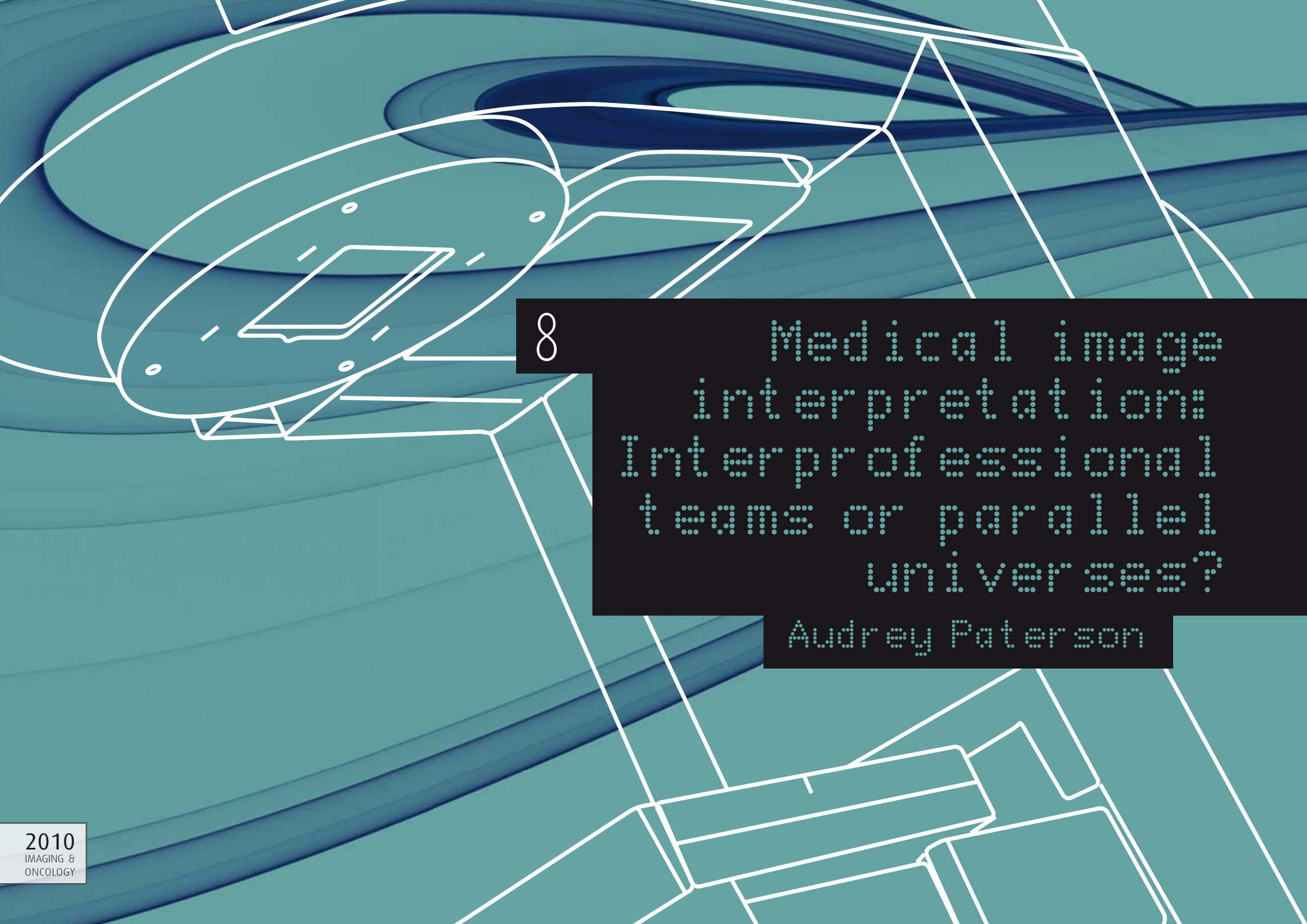
The dissemination of research and the fostering of professional debate through publication are vital, increasing the evidence-base for practice and enabling effective practice development. Providing a critical outlet for research, debate and reflection is essential to the future success of imaging and oncology services and the professions that provide them. Crucially, too, it brings benefits for our patients and clients.

Like all of the professions involved in delivering imaging and oncology services, my own profession of radiography is a clinical, patient focussed profession that is technologically driven and led. For me, the beauty of being part of such a profession is that radiographers are intuitive learners who are good at adapting to and adopting new ways of working. We relish exploring the capabilities and clinical applications of new technologies and equipment and, almost instinctively, know to maximise the benefits for our patients. I am sure this is not unique to radiography and applies equally to the other professions in imaging and oncology. For me, a career in radiography is most definitely a journey, constantly moving, constantly changing and constantly challenging – I'm sure this is equally true for my colleague professionals!

I hope that you enjoy reading this edition of Imaging and Oncology and that you find within its pages something that reaches out to you, sparks your interest and adds to your journey in the world of imaging and oncology or, indeed, as a user of imaging and oncology services.

Gill Dolbear
President
The Society and College of Radiographers

*Mahatma Gandhi



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Medical image interpretation: Interprofessional teams or parallel universes?

Audrey Paterson

2010
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Who is best placed to interpret medical images? This is the question which has, once again, raised its head in medical circles. Here, Audrey Paterson examines why and when radiography reporting came about, why it has been a success and why it is more vital than ever that it continues and develops.

In the beginning

Radiographers and radiologists have inhabited the same world for well over a hundred years and, throughout that time, role demarcation has been a concern, especially in the context of reporting[1, 2]. The parallels between the early history of imaging with x-rays and the most recent decades are uncanny. In the very beginning, there was little distinction between the non-medical and medical 'user' of the new technology, but as the 20th century progressed a firm line was drawn; medical image interpretation or reporting became the preserve of the medical profession and the emerging discipline of clinical radiology, while radiographers were the group that undertook the imaging examinations[3]. Parallel universes were established most firmly in 1925 when the Articles of Association of The Society of Radiographers were changed to prohibit reporting by its non-medically qualified members[4].

From the mid 1920s until the early 1970s, any form of 'image interpretation' by a radiographer was frowned upon very strongly and may well have led to action against the radiographer concerned. However, from the beginning of the 1970s, the unspeakable began to be voiced[5] and the unimaginable began to become the reality as radiographers took on reporting roles, supported by hard-pressed clinical radiologists[6]. Working together, the two professions were able to find effective solutions to almost insurmountable service delivery problems.

Now in the early decades of the 21st century, radiologists seem once again to be arguing that medical image interpretation is a medical role and is not safe in the hands of radiographers. Indeed, The Royal College of Radiologists recently published guidance to that effect although, possibly, it exempts reporting on ultrasound and breast screening examinations[7]. If healthcare providers and clinical departments were to give credence to this guidance, interprofessional team working and patients would be the casualty.

Ultrasound: pioneer of interprofessional team working in radiology

The widespread and rapid adoption of ultrasound imaging in the late 1960s/ early 1970s was probably the first reporting bastion to fall; and, probably, the first example of true interprofessional team working within the clinical imaging world. Medical physicists, radiographers, obstetricians and a handful of radiologists embraced the technology, working together to develop its use and applicability to healthcare. In the UK at least, the role of non-medical as well as medical team members in relation to reporting the studies appears to have evolved and grown without challenge and, today, it is accepted that the individual carrying out the dynamic study should provide the report. Indeed, this is considered best practice in the UK, supported by a truly interprofessional team approach that supports and encourages consultation with team and other clinical colleagues where findings are challenging.

> The unspeakable began to be voiced and the unimaginable began to become reality

Red dots and reporting radiographers

In the 1980s, so called 'red dot' reporting systems emerged[8]. Such systems were designed to assist in the diagnostic process at a time when reporting of radiographic examinations by radiographers was still not accepted and radiologists were unable to provide timely reports because of their overall clinical workload. That such systems are still widespread is testimony to their success. Part of that success is likely to be the interprofessional team working that developed between radiographers and accident and emergency medical and nursing staff – radiographers were frequently asked to explain why they had placed a red dot on an image as the doctor or nurse managing the patient could find neither trauma nor pathology to correspond with the red dot signal. Equally, radiographers were consulted when there was no red dot and the managing clinicians, doctors or nurses, believed they had seen relevant trauma or pathology. It can be argued that this is how care should be delivered – a team of relevant healthcare professionals pooling their knowledge and resources to individualise the care given, to make it as seamless as possible and, most importantly, to ensure it is as accurate, effective and efficient as possible. Another example, then, of radiographers working as interprofessional team members – outside of the clinical imaging department.

Reporting radiographers

As the 1980s gave way to the 1990s, the pressure on clinical imaging departments grew apace and reporting was the casualty. More and more imaging was carried out, but a sizeable proportion of this was unreported, reported too late to be of value in managing the patient, or transferred to become the responsibility of staff outside of the clinical imaging team. On the reporting front, the Audit Commission report of 1995 painted a picture that was little short of dismal[9]. It begged the question as to how a service dedicated to providing radio-diagnostic support for patients and clinical services could have reached such a point. Of course, the report was not all bad, and it highlighted the contribution that reporting radiographers were making to the overall workload, recommending that the practice be exploited further. A small number of centres had already begun to develop radiographers to take on some of the reporting load, underpinned by university-based postgraduate education programmes[10]. The Audit Commission report gave further impetus to the practice and radiographer reporting began to grow considerably.

Today, radiographer reporting in the UK is widespread, with reporting radiographers evident across the spectrum of medical imaging. Successive reviews of role development in radiography have shown inexorable growth in the number of reporting radiographers, the number of departments employing reporting radiographers, and the range of examinations on which radiographers provide reports. The most recent survey conducted in early 2008 showed radiographers to be reporting independently in 20 separate areas of practice and, in the 108 responding centres, there were 588 reporting radiographers[11]. Extrapolating conservatively from this figure, the number of reporting radiographers at the beginning of 2008 is likely to have been in excess of 1200 and, two years on, in the order of 1500–1800.

Why reporting radiographers?

It needs to be recognised that the growth in radiographer reporting was not as a result of radiographers declaring independence and teaching themselves. Rather, it was the outcome of several factors:

- Leadership and vision by the professional bodies;
- Leadership by innovating radiologists working in partnership with pioneering radiographers;
- Radiography's move at the end of the 1980s to being an all-graduate profession;
- In the mid 1980s, the end of the legal impediment placed on radiographers that had hampered their role in the interpretation and reporting of medical imaging examinations;
- The explosion in demand for more and more complex imaging examinations, and the growth in interventional, image-guided procedures;
- The need to address serious shortfalls in service delivery, notably the failure to produce reports in time to influence patient management, or at all.

All of the above were significant drivers that influenced the development and growth of radiographer reporting, but a key factor that delivered radiographer reporting was, without doubt, interprofessional team working – radiologists, radiographers and other clinical colleagues working together to devise and deliver high quality, patient-focused solutions to reporting and other problems faced by clinical imaging services.

Medical image interpretation: a multiprofessional activity

There are now a sizeable number of professionals, medical and non-medical, that undertake some medical image interpretation. They span a variety of medical specialties, nursing and midwifery practitioners, healthcare scientists and practitioners, and allied health professionals. Of these, the bulk of medical image interpretation or reporting in the UK is carried out by clinical radiologists, with radiographers contributing a growing proportion. In March 2007, the contribution of radiographers was reported to be in the order of 16 per cent[12] and this proportion is likely to have grown, since as the same study showed almost 10 per cent of examinations to be unreported.

Radiographers produce reports of comparable quality and accuracy to their consultant radiologist colleagues

Medical image interpretation is a complex clinical skill, underpinned by an extensive knowledge base. For patients and referrers to be assured of consistent and high standard reports, the outcome standard (the quality and accuracy of the report, and the timely contribution it makes to patient management) must be identical regardless of the profession or specialty of the reporter. It should also be the same in those circumstances where the responsibility has been transferred out from the clinical imaging department, for example, to the advanced practice nurse or trainee specialist registrar in the accident and emergency department or on the intensive care unit. However, provided the required outcome standard can be delivered consistently, the input and process of developing the necessary knowledge and skills may and does vary. Across the various professions and specialties engaged in medical image interpretation, the effect of differing education and development pathways on the outcome standard is not known as, generally, there are very few published research studies or practice audits. The exception is radiographer reporting. Perhaps due to the controversy that has historically been attached to the concept of reporting radiographers, a small body of audit and research literature has been produced over the past 20 years[13-15]. This shows that, in their defined scopes of reporting practice, radiographers produce reports of comparable quality and accuracy to their consultant

radiologist colleagues. Collectively, too, the advent of radiographer reporting has significantly increased the volume of reports produced and the timeliness, or turn-around times, of the reports provided[16].

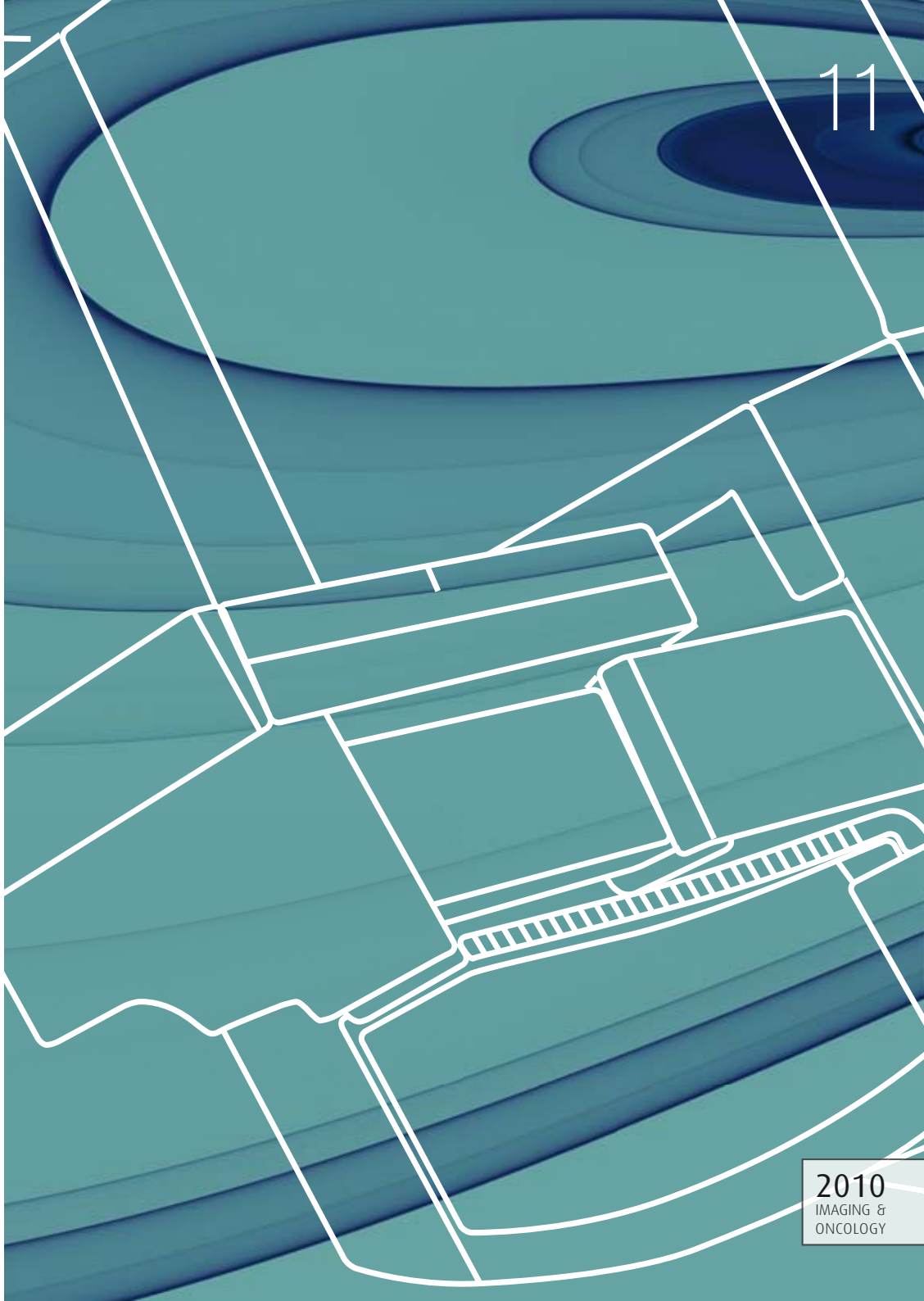
Is it surprising that radiographers in their specific scopes of reporting practice are able to demonstrate accuracy, sensitivity and specificity rates concordant with that of consultant radiologists, given the differing education and development pathways of radiographers and radiologists? Of course, some traditionalists will argue that the audit and research is flawed and, without a medical education, it is impossible for a non-medical healthcare professional to interpret medical images. This is the recently expressed view of The Royal College of Radiologists although it expresses this view only in relation to radiographers and not to the other non-medical professions who undertake medical image interpretation and reporting as part of their roles[7].

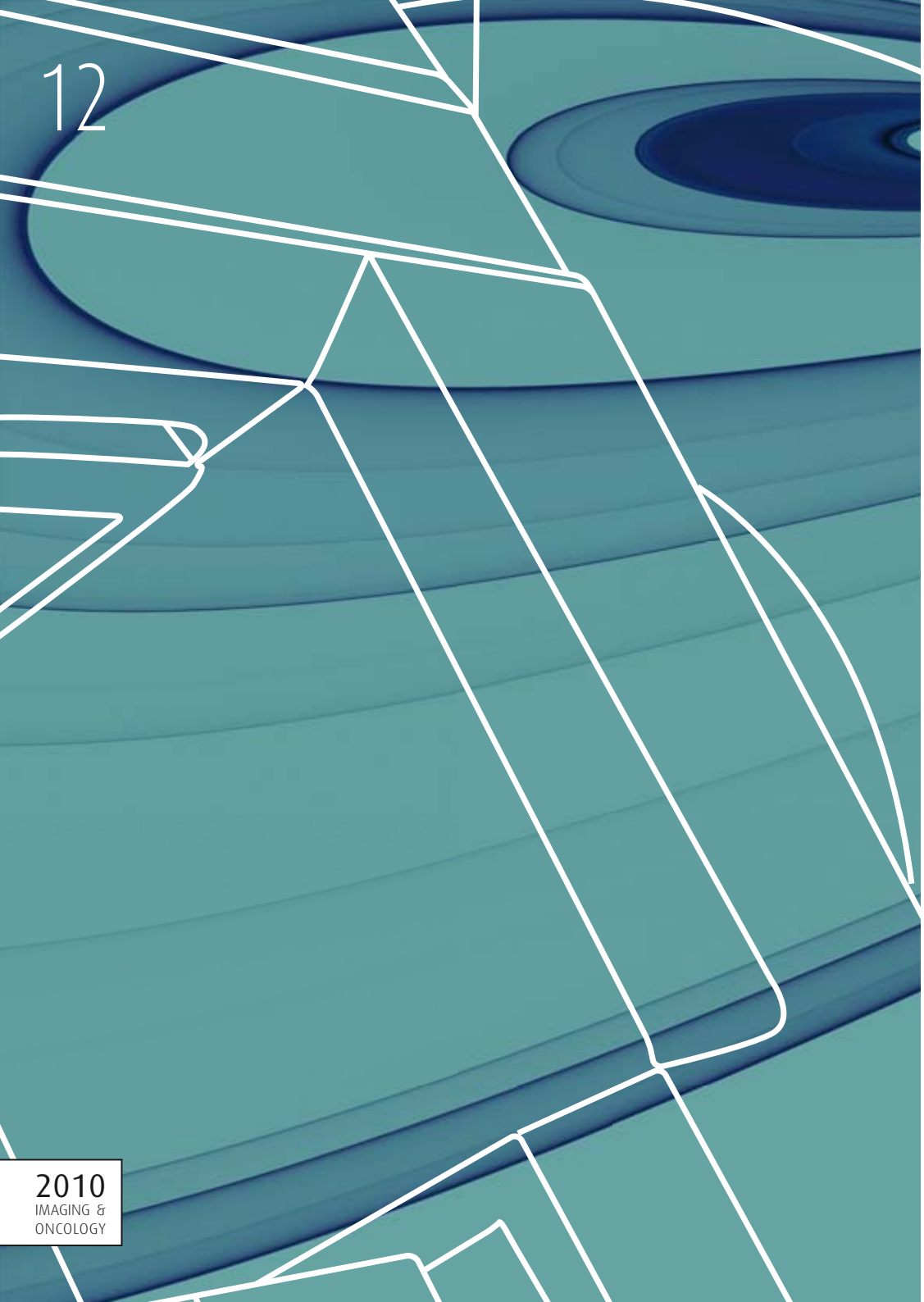
In 2010, the argument that particular roles may only be undertaken by those with a particular initial education and training is one that does not stand up to scrutiny, and many of the historical demarcations between professions have become permeable or blurred. Classic examples are podiatric surgeons – podiatrists with additional education and training carrying out a range of surgical procedures once ascribed to medically qualified surgeons only, and nurse prescribers who prescribe independently from a defined formulary. Neither of these groups received a medical education and training, yet they are recognised as appropriately educated and trained, and competent in these 'new' roles.

Education and training factors

It is clear that, in relation to medical image interpretation, radiographers and radiologists differ in their initial education and training. But, in terms of learning to interpret medical images and produce reports, their respective initial education and development pathways will give each group different strengths and different weaknesses. Radiographers about to learn to report in a defined area of practice will already have in-depth knowledge of imaging science, anatomy including radiographic anatomy, and physiology. They will also have acquired knowledge and experience of the presenting clinical signs and symptoms of trauma and pathology, and the relevance of presenting patients' clinical histories and other imaging or laboratory investigations. Participation in abnormality signalling systems will have trained them to systematically evaluate image appearances, and developed further their knowledge of trauma and pathology.

New trainees in radiology will have very little of the education, training and experience of radiographers and will be at a disadvantage in that regard. A further disadvantage for the radiology trainees is that reporting is just one (very important) part of their overall education and development to become fully qualified clinical radiologists. And, compared to reporting radiographers, trainee radiologists must learn reporting across the spectrum of clinical radiology practice. Their advantages are, of course, their medical education and training.





These similarities and differences are akin to those between medically qualified individuals and podiatrists undertaking podiatric surgery; they have dissimilar initial education and development pathways, but must acquire equivalent knowledge, skills and competences to be able to carry out the surgical practice they hold in common. Perhaps the one difference between the world of podiatric surgery and radiological reporting is that, almost from the beginning, the relevant professional bodies overcame their differences to work together. When approached in the mid 1990s to work collaboratively on radiographer reporting, The Royal College of Radiologists declined, preferring to keep the matter under observation from a position of independence.

So where are we heading?

It is difficult to see how The Royal College of Radiologists' views on reporting by radiographers[7] and The Society and College of Radiographers[17] challenge to those views will assist in delivering today's and tomorrow's clinical radiology services. Certainly, patients and referrers dependent on clinical radiology services will not welcome disagreement between the professions of radiology and radiography at national level.

Service delivery of the future is moving inexorably to a 24/7 delivery model, and not before time. Of course, this has always been the case for the radiography or the 'image acquisition' part of the service for urgent and emergency cases, and for well over 20 years radiographers have been assisting in the associated diagnostic process through red dot signalling systems[8], now being replaced gradually by initial written reports[18]. But, for patients to receive high quality, seamless care with minimal or no waiting, comprehensive clinical radiology services are required, at least on a 12/7 basis if not for even greater parts of each day; and for diagnostic procedures those services need to develop a culture that ensures the report is the important end point. That the report must be accurate and assist in the effective management of the patient is essential – but, really, who provides the report should be based on proven (and sustained) competence rather than profession.

Over the past few years, clinical radiology departments have risen to the challenge of referral to treatment targets very successfully, especially in delivering the imaging required. They have been less successful in delivering imaging and reports, and it is difficult to see how excellent, timely reporting can be delivered without reporting radiographers being part of the solution. Yet further challenges lay ahead for clinical radiology departments, not least the provision of adequate, equitable interventional services. Progress toward this aim will be very slow or impossible, if radiologists do not share the reporting load with properly trained reporting radiographers.

2010 going forwards

The need for effective interprofessional team working is now well documented in relation to healthcare delivery and is seen as being a critical factor in delivering safe services. Strong interprofessional teams focus on delivering the care patients

require to high outcome standards rather than role demarcations and outmoded hierarchies and working practices. There are excellent examples of such working in clinical departments across the UK and such practice should become the norm. The challenge for both radiologists and radiographers is to recognise that interprofessional team working with respect and competence at the core is the way to deliver comprehensive, high quality, safe services. There is no room for parallel universes in delivering the clinical imaging services of the future.

Professor Audrey Paterson is director of professional policy at the Society and College of Radiographers.

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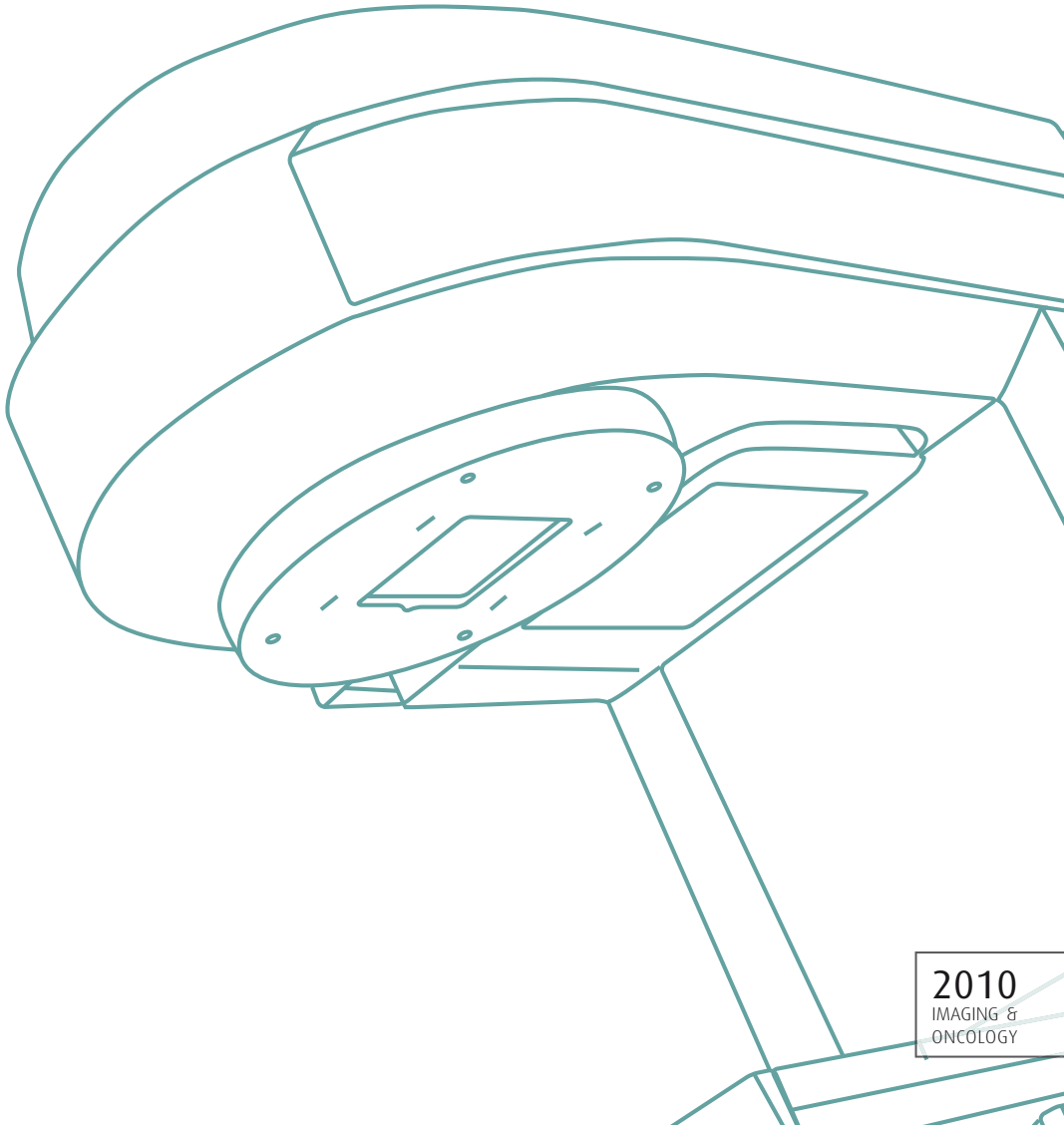

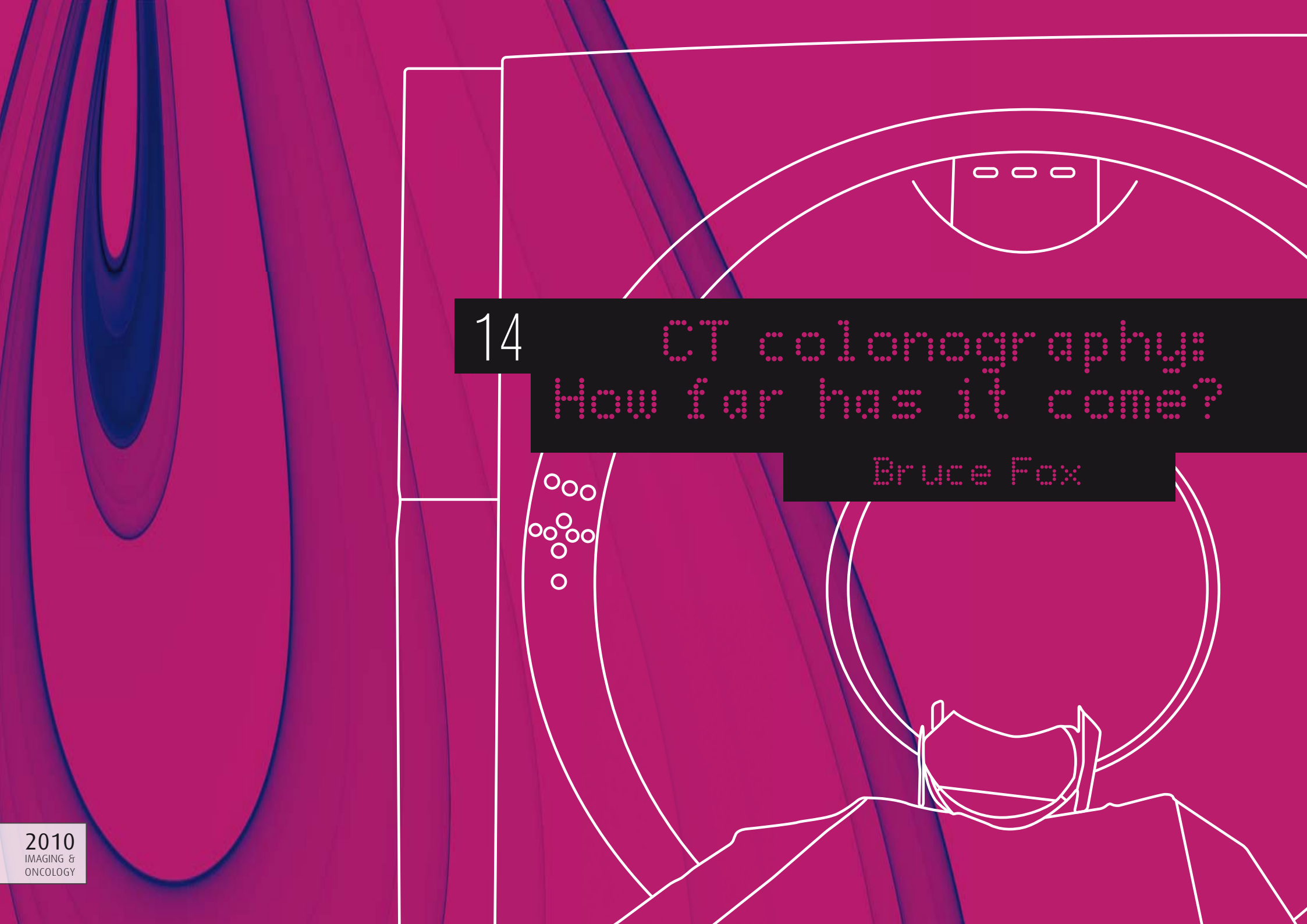

14 CT colonography: How far has it come?

Bruce Fox

2010
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CT colonography, also known as virtual colonoscopy, has come a long way since its introduction over 16 years ago. But what of its future? And how will this technique further develop in the UK?

Just how far?

It would seem that it has come far enough to be the investigation of choice for the President of the United States of America. At the beginning of March 2010, President Obama had his first routine medical examination as Commander-in-Chief and received a CT colonography (CTC or virtual colonoscopy). This was seen in America as a controversial step, firstly, because American physicians would usually see optical colonoscopy as a superior method of screening and diagnosing suspected colonic disease and secondly, because Medicare, the social insurance programme administered by the American government, has yet to sanction coverage of colonic screening of the older population with CTC. It seems likely that both of these are going to change in the near future.

Since its introduction in 1994[1], CTC has undergone a period of significant development, much of which has been driven by advances in technology. These improvements have resulted in considerably improved sensitivity. This is reflected in the most recent statement from the American Cancer Society (ACS) and American College of Radiology (ACR)[2]: *"CT colonography (virtual colonoscopy) is one of the newly recommended screening tests. In 2003, independent assessments by the ACS and the US Multisociety Task Force on Colorectal Cancer judged that there was insufficient evidence to support CT colonography. Recent data from the ACR Imaging Network trial 6664 and other large trials provided supporting evidence that the per-patient sensitivity for detecting polyps 10mm and larger was 90 per cent or greater... 'In terms of detection of colon cancer and advanced neoplasia, which is the primary goal of screening for colorectal cancer and adenomatous polyps, recent data suggest [CT colonography] is comparable to optical colonoscopy for the detection of cancer and polyps of significant size when state-of-the-art techniques are applied.'"*

In its infancy, back in the 1990s, very few centres within the UK were performing CTC. However, by 2004, as recorded in a UK National Survey[3], this had already grown to a third of radiology departments. Now, with this recognised and achievable improved sensitivity, in 2010 almost all hospitals that have access to multi-slice CT are routinely performing some CTC (Figure 1).

This escalation of its use has come as a result of not only its increased accuracy, but also its reliability, reproducibility and acceptability. All of which have led to CTC gaining recognition for its use from both the National Institute for Health and Clinical Excellence (NICE)[4] and the American Cancer Society (ACS)[5].

CTC today

To appreciate the current status of CTC, it is necessary to understand how it has developed as a technique and how it is now being performed, as both of these factors are vital in determining its current accuracy, acceptability, deliverability and, ultimately, its appropriateness as an investigation.

CTC is usually performed as a two-stage examination of the abdomen/colon with full colonic gaseous distension, obtaining prone and supine datasets[6]. These two views allow any liquid or solid residue to move, working on the principle that polyps and cancers cannot[7] (Figure 2). This movement also optimises the gaseous distension of the entire colon. The technique can be modified to a supine and decubitus view if the patient is immobile.

It seems highly likely within the very near future that the barium enema may disappear altogether.

There are two main factors that determine the ease and therefore ultimate accuracy with which the reader can review the colonic findings. These are the degree of distension and presence of stool residue.

It is now well recognised that the administration of gas (ideally carbon dioxide, as this is rapidly reabsorbed after the procedure) is best performed using a mechanised insufflator[8] rather than manually. It has also been found, by using this controlled reproducible method, that this reduces patient discomfort and therefore increases the likelihood of positive patient experience[8].

The presence of stool within the colon decreases the ability of the reader to detect or distinguish significant colonic pathology. This can be managed in a number of ways and cleansing the colon is the most obvious solution. There are various laxatives available and the most effective seem to be the osmotic laxatives, as they result in liquid residue that will easily move between the prone and supine datasets.

Frequently this still leaves some stool contamination that can decrease the sensitivity of investigation[9], but the problem can be improved by tagging the stool in advance of the procedure with a positive oral contrast agent, ie Gastrografin[6] (Figure 3).

However, it is well known within the colonic screening population that full colonic cleansing decreases patient acceptance and subsequent uptake into the screening programme[10,11]. Various modifications have been attempted to overcome this problem, some have tried prospectively to tag all the stool and not cleanse the colon[12]. Whilst this significantly reduced discomfort and side effects, including sleep disturbance, without significantly decreasing sensitivity for polyp and cancer detection, the improvement in patient willingness to repeat the procedure was not found to be statistically significant when compared to full cleansing. Electronic cleansing has also been used as an alternative, again tagging the stool, but digitally removing the residue, and whilst it seemed to be sufficient for detecting larger polyps (1cm and above) and cancer, it still resulted in an increase in diarrhoea[13]. With the current advised preparation of an osmotic laxative with stool tagging[6] it has been found that patients have a significant preference for CTC compared to optical colonoscopy[14,15].

Another important consideration, when deciding whether this investigation should be rolled out for widespread use, is its safety. It has been shown that with the technique described above, even with significant colonic distension with carbon dioxide and the use of smooth muscle relaxants (eg hyoscine-N-butylbromide), there is no significant cardiovascular effect, whilst colonoscopy is frequently associated with cardiovascular effects that are related to the sedation[16]. A national survey published in 2006 of over 17,000 examinations found a potentially serious adverse event in 0.08 per cent of symptomatic patients[17]. This figure is comparable to the most recent figures of diagnostic optical colonoscopy and related predominantly to perforation.

Accuracy and opportunities

CTC has now become a reliable and reproducible examination, but its success is reliant on its accuracy. This accuracy is ultimately dependent on the ability of the reader to detect and interpret the abnormalities. It is now well recognised that, as with any technique, specific training is the key to optimising reader performance[18]; the American and European societies of GI radiology now have well organised training programmes with this specific goal[6]. As with barium enemas, double reading of studies is also likely to increase detection rates[19], but this may not be practical, as studies are time-consuming to read and there is currently a shortage of trained readers. A solution to this may be the introduction of non radiologists to read the examinations, provided they have the same dedicated training.

Pilot studies have already been performed, looking at radiographers[20], demonstrating that their performance at detecting cancer is excellent. The performance of the readers can be further enhanced by the addition of specific software called 'computer-aided detection' (CAD). This software looks specifically at focal colonic wall thickening, assigning it a different colour to the remaining colon (figure 4). The use of the software has been found to improve the performance of inexperienced readers[21]. It can also reduce reading time when used concurrently[22]. When looking at the current use of CAD there seems to be a residual scepticism of the technology and a tendency to ignore some of the CAD findings that subsequently prove to be significant. This was most apparent in cases of large irregular polyps[23]. When looking at the use of CAD in the screening population, it may raise the cost of the examination but the detection rate is increased. Therefore, the net result is a more cost effective and efficacious screening programme[24].

With the current excellent performance and patient acceptability there are now serious implications for the use of the barium enema. Many studies over the last few years have looked at the sensitivity of the barium enema for detecting colonic polyps and cancer. They frequently report diagnosis rates of around 85 per cent for colon cancer[25], 45-50 per cent for polyps over 1cm and 30-40 per cent for polyps over 6mm. This compares with up to 100 per cent, 80-90 per cent and 70-80 per cent respectively for CTC[26, 27]. There is no doubt that CTC has superior sensitivity to that of the barium enema. As the availability of optical colonoscopy increases, the use of the barium enema in everyday practice has significantly declined. Many departments are now performing only a handful of examinations each week, largely for incomplete optical colonoscopies. This has created an environment within which it is difficult to maintain skills and almost impossible to train radiologists and radiographers. Coupled with that, the most experienced fluoroscopy staff are gradually retiring. It is already apparent in the literature that the sensitivity and specificity of the barium enema is in an inexorable decline[25, 27]. It seems highly likely within the very near future that the barium enema may disappear altogether.

The road ahead

Within the UK, CTC is still finding its place. The developments described above are now allowing it to stand alongside optical colonoscopy in the investigation of colonic pathology. Some departments now routinely use CTC[3], most frequently for the completion of incomplete colonoscopy (Figure 5), in patients with a failed barium enema and as an alternative to the barium enema in frail or immobile patients.

Increasingly, CTC is used to evaluate the colon and stage rectal lesions found at rigid sigmoidoscopy. The next major step however, already taken in the United States[2], is the move into the screening population. At the time of writing, the results from the SIGGAR 1 trial are unpublished, but it seems likely from meeting abstracts that the results will further emphasise the potential role of CTC in the primary diagnosis of cancer within the screening population.

For CTC to enter into the screening population, its risk profile has to be acceptable. The detection rates and patient acceptability make this a viable option. However, what has still to be considered is the radiation burden that CTC carries. Conventional CT is the largest contributor to the medical induced ionising radiation exposure. Recent publications have raised public awareness of the risks associated with CT[28], suggesting

Figure1

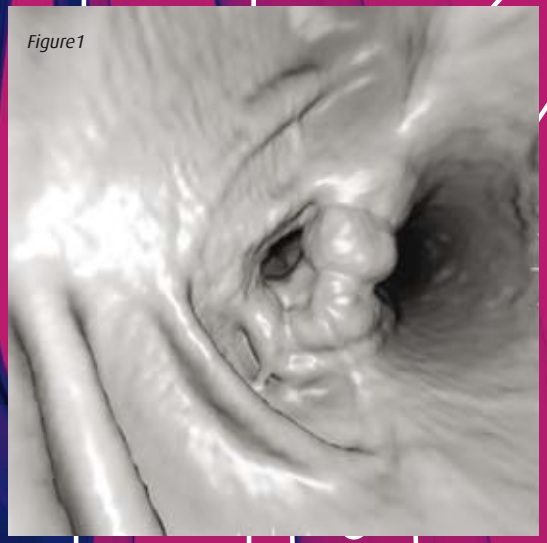

Figure 2

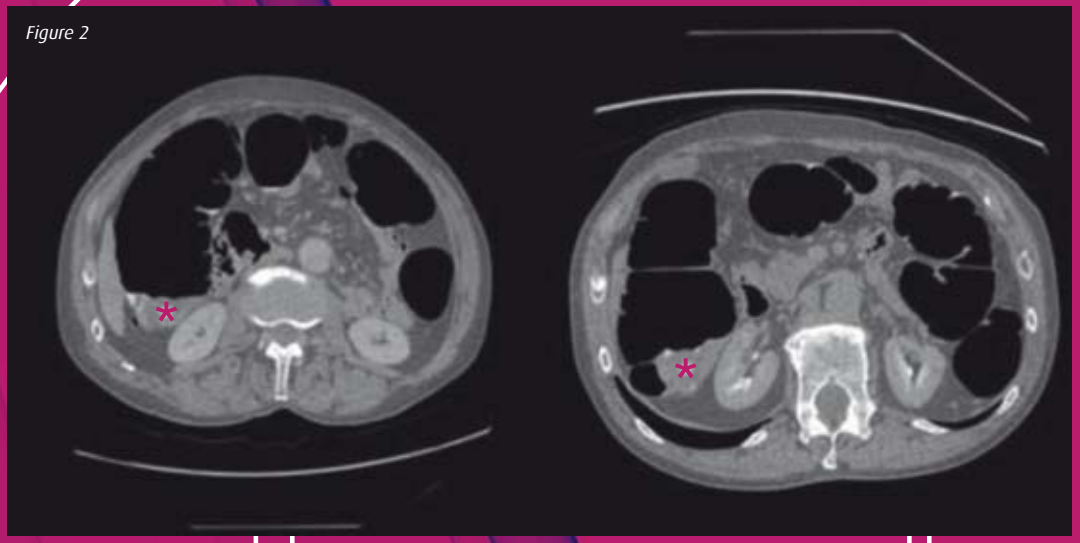

Figure 3

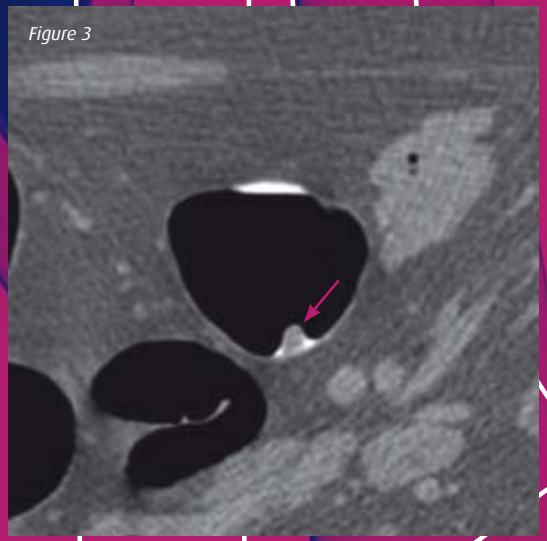

Figure 1: A virtual colonoscopy view of an annular caecal carcinoma.

Figure 2: A supine and prone image showing the immobile ascending colon cancer (asterisk)

Figure 3: A small transverse colon polyp outlined by positive colonic contrast.

that a 40-year-old undergoing CT coronary angiography would have an estimated one in 270 chance of developing cancer (one in 600 in males). This article suggested that for 20-year-old patients the risk approximately doubles.

Radiologists involved in CTC have been aware of the high levels of radiation associated with the thin sections necessary for diagnostic studies and have already made significant improvements in reducing the dose[29]. Routine barium enema has a radiation burden of about 10 mSv compared with standard CTC doses of 23 mSV. However, the dose of the CTC can be reduced to 5.7 mSv using low dose techniques[30]. Putting this in context for the general public, the average UK annual dose from natural radiation is 2 mSv, 8 mSv if you live in Cornwall. With the further development of improved dose modulation techniques and flat plate technology, the CTC radiation dose will reduce even further.

Although there have been significant developments in MR colonography, they have not reached the advanced stage of CTC, but the absence of ionising radiation makes this a very attractive proposition for the future.

One of the challenges within the screening population arises from the CTC's sensitivity, ie what to confidently report. The overcalling of small lesions, where CTC's specificity is lower, will potentially subject otherwise well patients to the risk of unnecessary colonoscopy and increase the overall cost of the screening programme. For this reason, the consensus is that only polyps of 6mm and above should be reported[31].

A second challenge, within the screening population, is dealing with the extra colonic findings, many of which will be of no significance[32,33]. Up to 6 per cent of patients (9 per cent in the elderly age group) will need potentially expensive further investigation. Clearly a significant number of these findings will, however, be important. In a series of over 10,000 asymptomatic screened patients, one in 300 had an unsuspected extra colonic cancer and finding these tumours early was shown to be of financial benefit[34]. Financially CTC for screening remains a viable option.

It seems almost certain that CTC will continue to go from strength to strength, replacing the barium enema and increasingly challenging colonoscopy as the investigation of choice for symptomatic colonic pathology and the screening population. The test now for the radiology community is how to cope with this potential explosion of examinations with the limited resources of CT scanner access, appropriately trained radiographers and radiologists.

Who knows, perhaps the lead of President Obama will effect further change within the UK?

Bruce Fox is a consultant GI radiologist based in Derriford Hospital, Plymouth. He is peninsula head for the Postgraduate School of Radiology, and is radiology adviser for the development of NICE colonic surveillance guidelines.

Figure 4: A small colonic polyp highlighted in blue by the CAD system

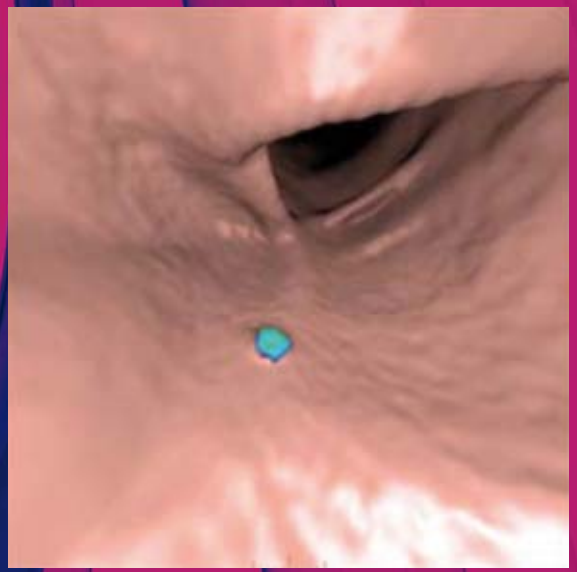

Figure 5: A CTC image for an incomplete optical colonscopy because of a stenotic recto-sigmoid tumour (image a) and a second tumour found in the caecum (image b shown with arrows. The rectosigmoid tumour is marked with an asterisk).

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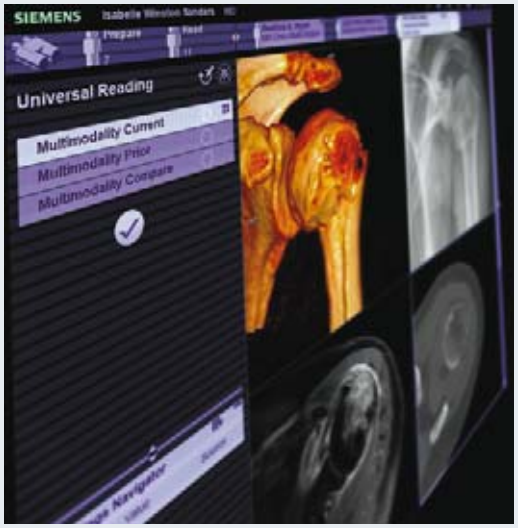

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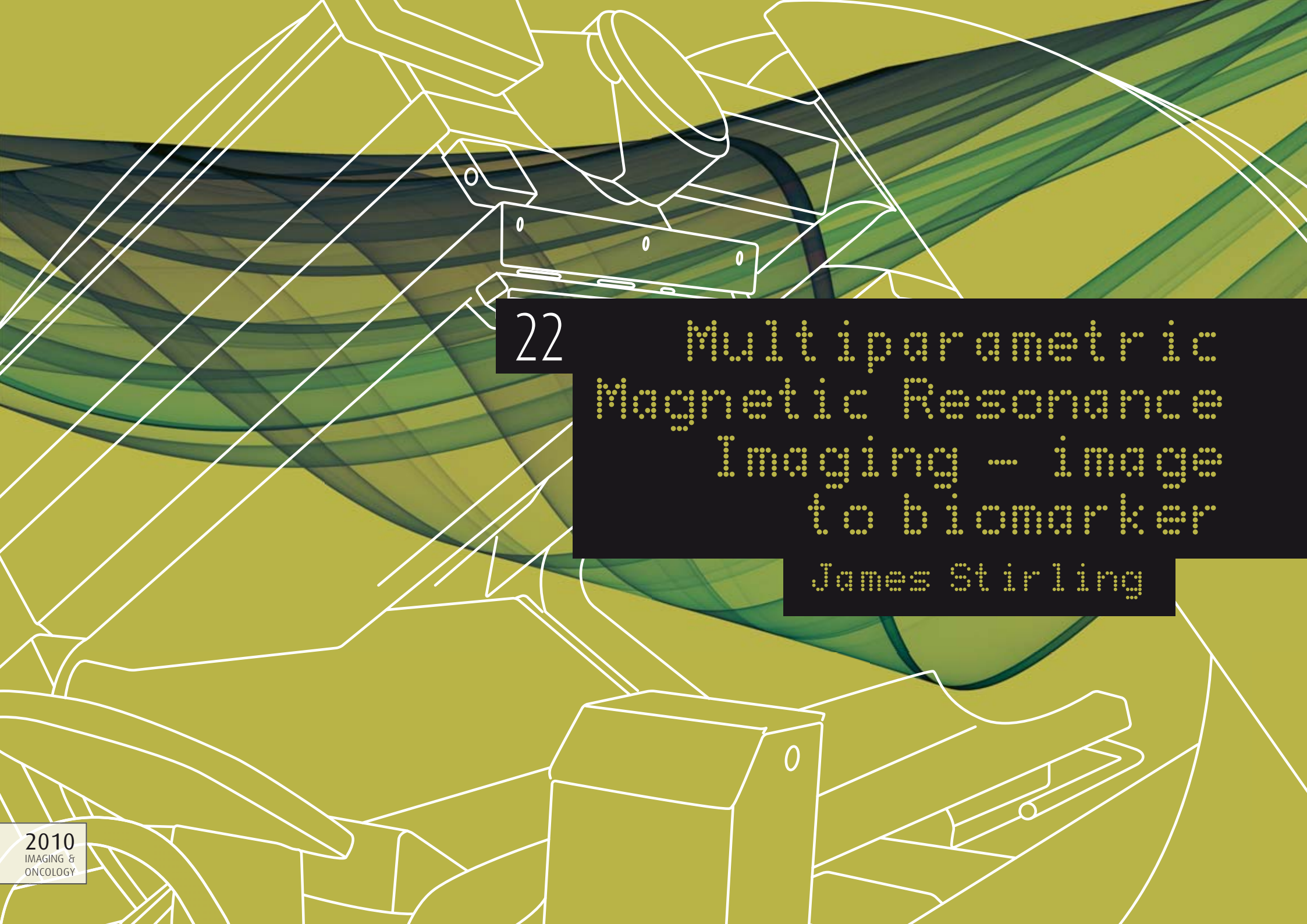


22

Multiparametric Magnetic Resonance Imaging – image to biomarker

James Stirling

2010
IMAGING &
ONCOLOGY

How can MRI be used in the early prediction of therapy response and drug development? And what challenges will arise as multi-parametric MRI is adopted across the wider clinical arena?

Introduction

Magnetic Resonance Imaging (MRI) is maturing into a very powerful imaging tool for cancer. It can be used to improve the understanding of the biological effects of therapy, predicting response early after initiating therapy, for monitoring the effects of radiation, and to understand the mechanisms of action of novel drugs by imaging different physical parameters which act as biomarkers.

This article discusses why it is needed and how it can help with the early prediction of therapy response and drug development. In particular the focus will be on the challenges involved as multi-parametric MRI is disseminated into the wider clinical environment.

Today, the main imaging tool to evaluate therapy response is the evaluation of anatomical images by the application of size criteria such as RECIST (Response Evaluation Criteria in Solid Tumours)[1]. Even though RECIST is widely used, many lesions' measurements are hard to reproduce and some lesions cannot be measured at all. Therefore, there is increasing acknowledgement that morphological evaluations have significant limitations[2].

Recently, the evaluation focus has broadened to include 'functional' imaging techniques that depict physiological and cellular processes within tumours and tissues as quantitative values in parametric imaging maps. These functional imaging techniques have been used in the clinic with increasing frequency. Multi-parametric imaging is an extension to this approach involving multiple functional imaging techniques. The multi-parametric approach has been shown to be useful as a method for predicting the outcome of therapy, and imaging can be used as a biomarker. Imaging biomarkers relate images and the quantitative or semi-quantitative parameters they give to biological or pharmacological processes which are harder to monitor. This makes them ideal to evaluate novel drugs in early development. A variety of quantitative imaging techniques are being pursued in the clinic, including functional MRI, perfusion CT, a number of nuclear medicine imaging probes (notably 18FDG-PET), and microbubble enhanced ultrasound. Examples of clinically-deployed MRI functional imaging techniques and the biological properties that they depict are given in Table 1.

Biological property on which imaging is based	Pathophysiological correlates	Commonly derived quantitative imaging parameters/ biomarkers	Functional Imaging Technique
Diffusivity of water	Tissue architecture: Cell density, extracellular space tortuosity, gland formation, cell membrane integrity, necrosis	· Apparent diffusion coefficient (ADC)	**Diffusion-weighted MRI (DW-MRI)** [24-28]
Contrast medium uptake rate in tissues, which is influenced by: **· Perfusion & transfer rates** **· Extra-cellular volume** **· Plasma volume fraction**	Vessel density Vascular permeability Perfusion Tissue cell fraction Plasma volume	· Initial area under gadolinium curve (IAUGC) · Transfer and rate constants (K^{trans}, k_{ep}) · Leakage space fraction (v_e) · Fractional plasma volume (v_p)	**Dynamic contrast enhanced MRI (DCE-MRI)** [29-31]
Blood volume and blood flow	· Vessel density · Blood flow · Tumour grade · Vessel diameter	· Relative blood volume/flow (rBV/rBF) · Mean transit times (MTT) · Vessel size index	**Dynamic susceptibility contrast MRI (DSC-MRI)** [32]
Cell membrane turnover/energetics and replacement of normal tissues	· Tumour grade · Proliferation index	· Quantified ratios of metabolites including choline, creatine, lipids, citrate, lactate and others depending on echo time	**1H-MR spectroscopic imaging (1H-MRSI)** [33-34]
Deoxyhaemoglobin shows higher relaxivity than oxyhaemoglobin. Measurement also reflect blood volume, perfusion and Intrinsic composition of tissues	· Ferromagnetic properties of tissues · Level of tissue oxygenation	· Intrinsic tissue relaxation rate ($R_2^* = 1/T_2^*$)	**Blood oxygenation level dependent (BOLD) or intrinsic susceptibility weighted (ISW) MRI [35-36]**

Table 1 Summary of biological properties, pathophysiological correlates, the quantitative parameters derived and their functional imaging techniques

Multi-functional imaging as a combined approach has come from the technological progress within many imaging modalities such as SPECT-CT and PET-CT and the soon to be available PET-MRI. There are new techniques within each modality, such as software that enables the fusion of different parametric images, derivation of quantitative biologically-relevant biomarker data that can be co-registered with anatomical images, and bioinformatics that allows integration of quantitative imaging parameters with other biological data such as serum cytokines, circulating cells and tissue genomic and protein expressions. New bioinformatics approaches where gene and protein signatures are matched to imaging findings are sometimes known as radiogenomics. Figure 1 shows a multi-parametric biomarker paradigm that depicts the different modalities and how MRI is placed within these different approaches.

Tumour phenotype characteristics and multifunctional MRI

Hanahan and Weinberg[3], and Gatenby and Gillies[4] have proposed that metabolic reprogramming enables cancers to overcome or circumvent microenvironmental barriers to uncontrolled proliferation (Figure 2). These characteristics must be present in order to sustain growth and include:

- Insensitivity to anti-growth signals
- Evasion of programmed cell death (apoptosis)
- Self-sufficient growth signals
- Limitless replication potential (immortalisation)
- Sustained angiogenesis
- Invasion and metastasis
- Invasion of anoikis-cell death signals mediated by loss of cell–extracellular matrix contact
- Increased glucose consumption through increased glycolysis
- Resistance to acidity-mediated toxicity

> Multi-functional MRI has been shown to be a very robust method of accessing the effects of novel drug regimes on tumours

MRI can map non-invasively many cancer characteristics such as increased tumour cell density, abnormal vascularity, metastasis, cell death and the consequences of altered metabolism (Figure 2). With multi-parametric MRI it is possible to create a unique multi-faceted phenotypic view of the tumour. Many of these biological features are key anti-cancer targets[5] so MRI is being used in drug development trials to observe changes over

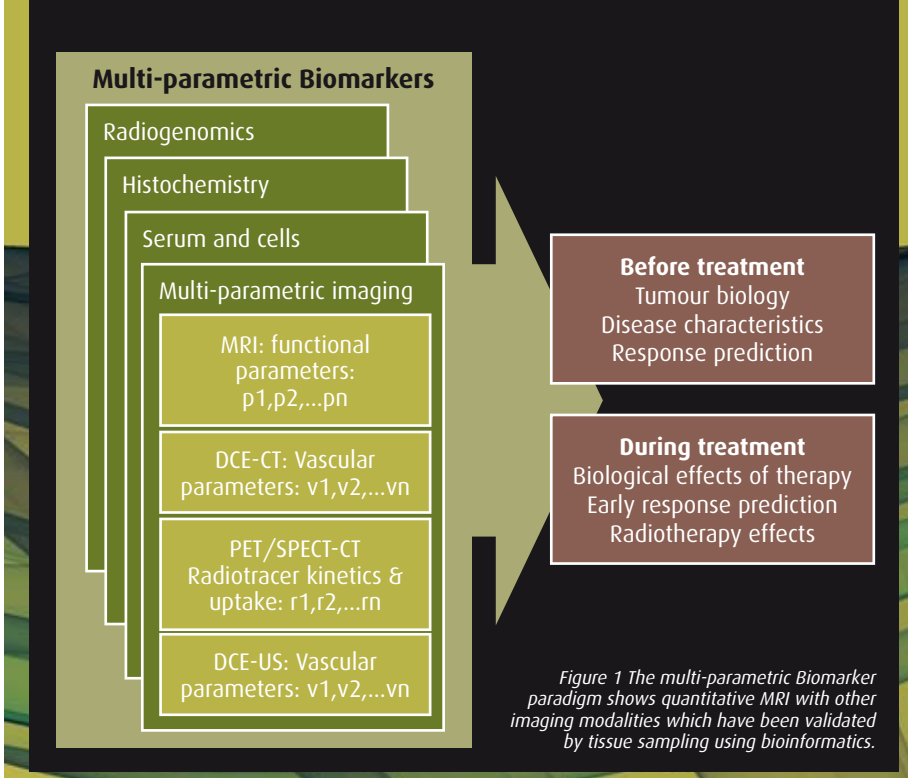


Figure 1 The multi-parametric Biomarker paradigm shows quantitative MRI with other imaging modalities which have been validated by tissue sampling using bioinformatics.

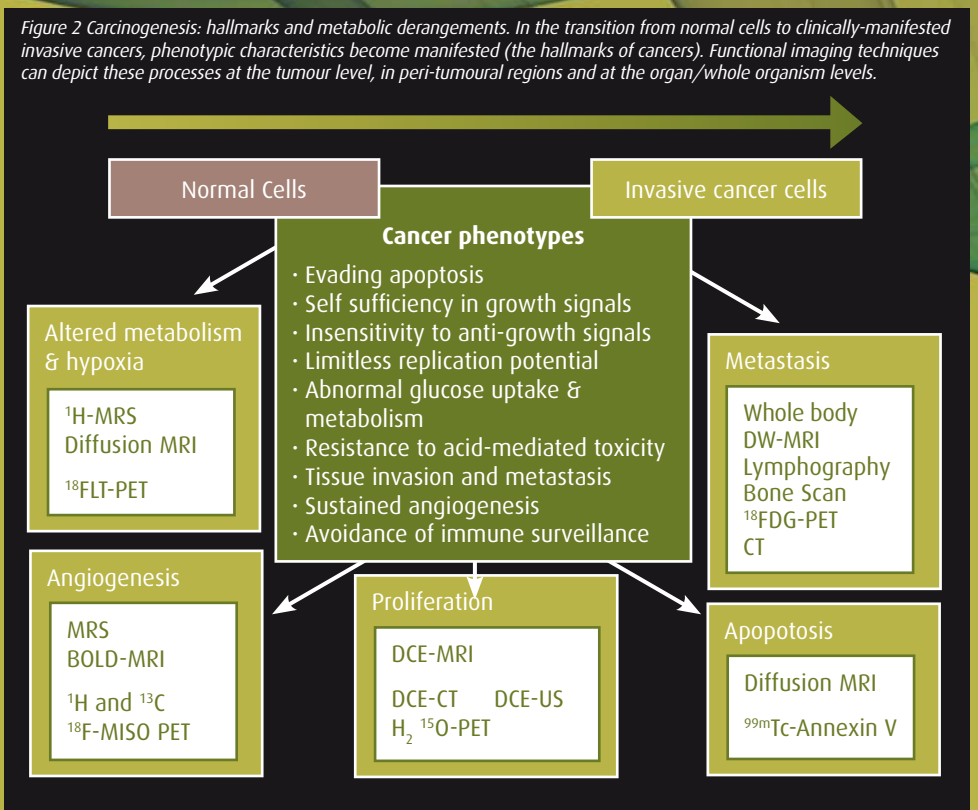
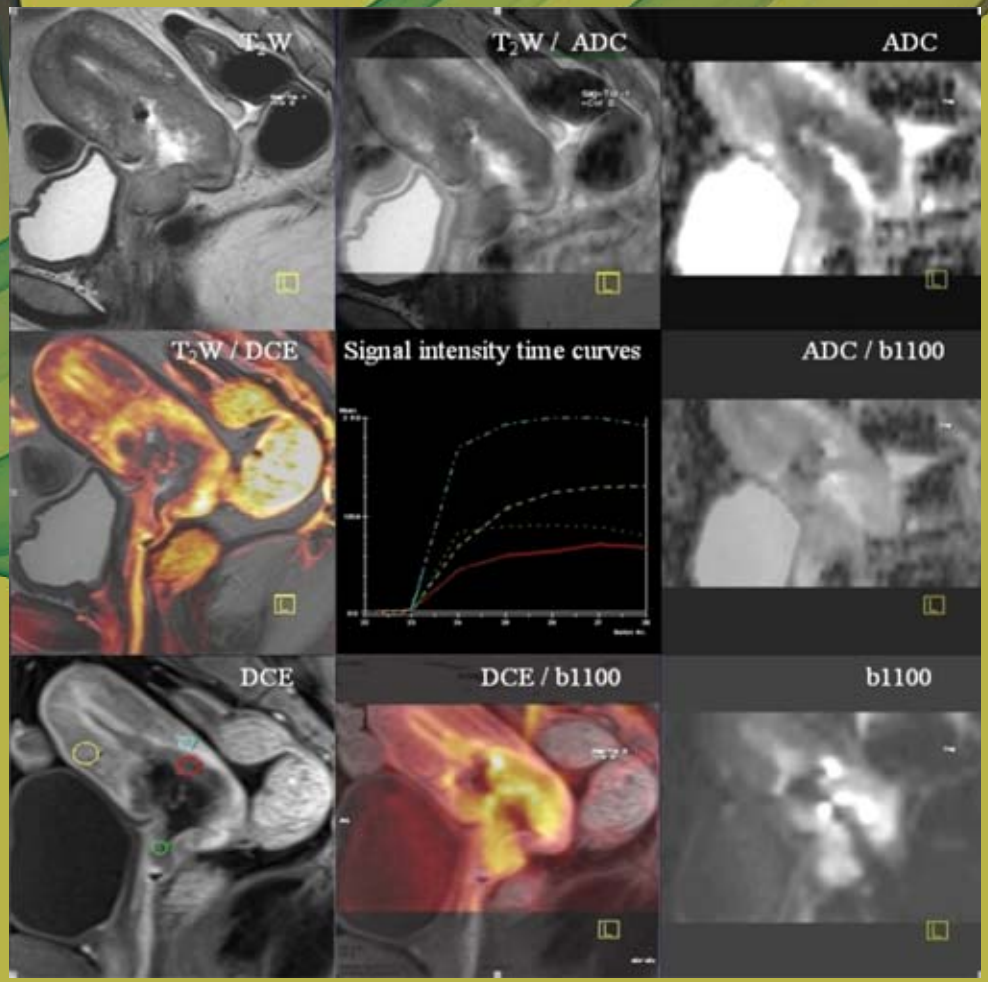


Figure 2 Carcinogenesis: hallmarks and metabolic derangements. In the transition from normal cells to clinically-manifested invasive cancers, phenotypic characteristics become manifested (the hallmarks of cancers). Functional imaging techniques can depict these processes at the tumour level, in peri-tumoural regions and at the organ/whole organism levels.

Figure 3 Fusion imaging of T2 weighted, DCE, and DW Imaging. A 31-year-old patient with a large T2b carcinoma of the cervix with metastatic envolvement of the right internal iliac and hypogastric lymph nodes. Row 1 (left to right): T2 weighted (T2W), Fused T2W/ADC, ADC image. Row 2 (left to right): Fused T2W/early post-contrast image, signal intensity-time curves, fused ADC/b1100 image. Row 3 (left to right): Early post-contrast image with ROIs for the signal intensity-time curves, fused early post contrast/b1100 image, and b1100 image. The tumour has restricted diffusion which indicates high cellularity as seen in the ADC images but there are area differences in the vascularity as shown on the early post-contrast image. The hypovascular region (red region) is likely to be hypoxic suggesting a more aggressive tumour.



time during novel therapy regimes. Recent research has shown that functional imaging depictions, including heterogeneity of contrast enhancement, do reflect underlying gene expression patterns in a number of cancer types[6-12]. In the clinical field, multifunctional assessments are used for disease characterisation in various parts of the body, including the brain[13, 14], the parotid gland[15] and prostate gland[16-18]. When these techniques are used and assessed together, the results can sometime be discordant for a whole tumour or certain areas within it (Figure 3). Neither the clinical importance, nor the biological processes involved within these discordant areas are fully understood.

Drug development role and early prediction of therapy response

Multi-functional MRI is being used increasingly in drug development. Individual techniques have been used for a number of years to monitor the effects of novel therapies on the micro-environment of tumours; many studies have looked at drug action only on one parameter such as vascularity or, more recently, cellularity, using DCE-MRI or DWI respectively. Multi-functional MRI brings many of these techniques together to show the different effects of a new therapy in terms of demonstrating mechanism of action in humans and for predicting outcomes to treatment.

Drug development

There have been significant advances recently into the understanding of the molecular and genetic pathways controlling cellular function, and with that understanding novel targeted therapies have emerged. Biomarkers are essential to the drug development process because they confirm mechanism of action of drugs in vivo. Imaging biomarkers are a part of this development process. They are used by the drug developers to help make 'go-no-go' decisions at an early stage on whether to carry on developing a given drug or not, so as to be able to give priority to the most promising compounds or approaches. In this paradigm, it is not always possible to predict all the changes that may occur in humans when a new drug is given because of complex interactions between drug-tumour-host.

Multi-functional MRI has been shown to be a very robust method of accessing the effects of novel drug regimes on tumours, helping to unravel multiple processes that may be occurring. Multi-functional MRI uses no ionising radiations and so can be performed at multiple time points during therapy. Batchelor et al[19] looked at recurrent glioblastomas treated with cediranib, an orally-active multi-tyrosine kinase receptor inhibitor of vascular endothelial growth factor (VEGF) receptors. The authors brought together a number of functional MRI parameters in this observational study. They looked at contrast-enhanced tumour volume, vessel size index, microvessel permeability (transfer constant), extracellular leakage space, water diffusivity and diffusion tensor imaging. After treatment the blood-brain-barrier of the brain was seen to normalise within days with reductions in microvessel permeability, extracellular leakage space and water diffusivity (Figure 4).

Interestingly, it was noted that after these encouraging early changes, things began to alter in unexpected ways. In particular, the enhancing tumour volume started to increase despite persistent reductions in vascular permeability (ie the drug was still working)

suggesting that the molecular pathway of continued tumour growth did not involve VEGF[20]. Figure 4 shows a similar effect after bevacizumab in a patient with glioblastoma. Furthermore, it was noted by Batchelor et al that apparent diffusion coefficient (ADC) values also decreased with therapy. If cells were being killed by this therapy then ADC values should have increased[21]. The explanation for decreases in ADC values is that cediranib decreases the tumour water content. Reductions in the microvessel permeability and extracellular leakage space values give confidence for this hypothesis for reductions in ADC values noted. These findings of reduction of enhancement without cell death and indeed with tumour growth, with an intact blood-brain-barrier breakdown induced by antiangiogenic therapy, have been termed 'pseudoresponse'[22].

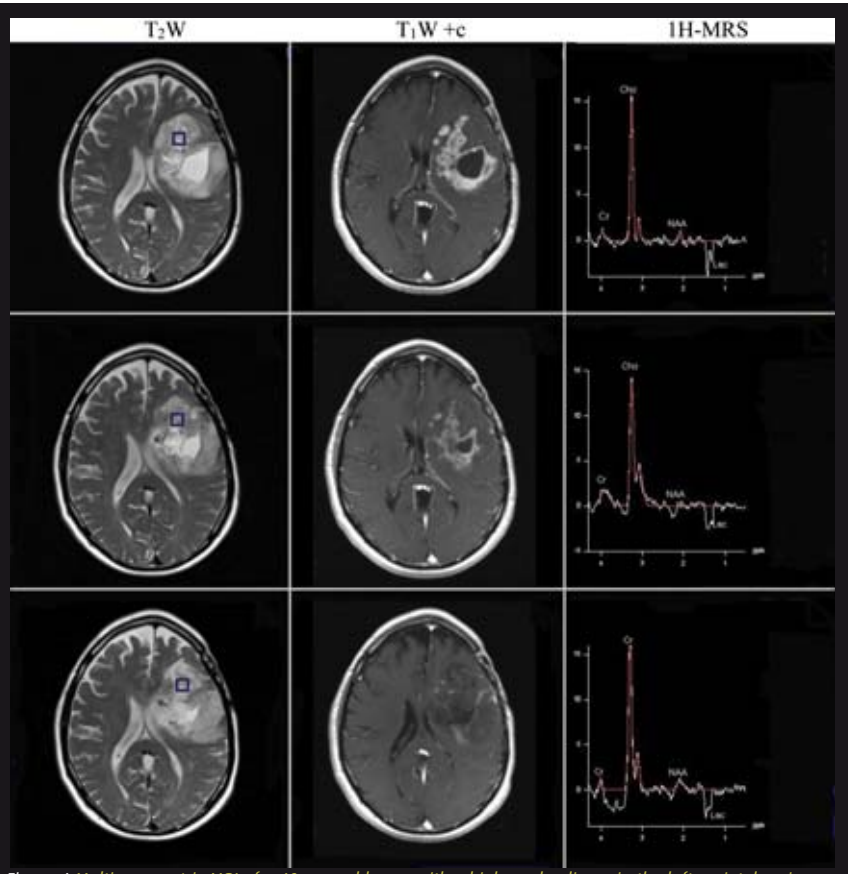


Figure 4 Multi-parametric MRI of a 40-year-old man with a high grade glioma in the left parietal region, after anti-VEGF antibody therapy. ***Row 1:*** *pre-bevacizumab. The T2 shows a large tumour with necrotic regions (blue square shows spectroscopy voxel). The T1 post-contrast image shows areas within the tumour where the blood-brain-barrier has broken down. The 1H-MRSI (TE=135ms) spectrum demonstrates a large choline (cho) peak which correlates with hypercellularity, a reduced N-acetylaspartate (NAA) peak showing that neurons have been destroyed or displaced, and an inverted lactate acid (Lac) peak indicating anaerobic glycolysis.* ***Row 2:*** *14 days post-bevacizumab. This shows a slight reduction in size and post-contrast enhancement which indicates that the permeability has been reduced but the spectrum has remained constant illustrating that there has been no cell death. This effect is termed "pseudoresponse".* ***Row 3*** *12 weeks post-bevacizumab. The tumour has increased in size and thickness by growing into the area of necrosis. There is again a reduction in permeability (normalization of the blood-brain-barrier). The spectrum has not changed, indicating non-response to therapy.*

The multi-parametric approach is important for predicting potential clinical benefits of therapy

Predicting therapy benefit

A good recent example of early prediction of therapy outcome is the work published by Sorensen et al who used quantitative multi-functional MRI biomarkers to see if indices of vascular normalisation could predict the survival of patients with recurrent glioblastoma multiforme treated with cediranib[23]. They showed that changes in transfer constant, microvessel blood volume and circulating collagen levels acquired one day after the first dose of cediranib correlated with progression-free and overall survival. Importantly, the correlative power was greatest when these biomarkers were combined into a composite index. Both examples quoted above (Sorensen et al[23] and Batchelor et al[19]) show that the multifunctional approach is useful not only for confirming mechanism of action of a drug in humans, but also for understanding its effect on the microenvironment of tumours (tumour-host interaction). Furthermore, the multi-parametric approach is important for predicting potential clinical benefits of therapy.

Future dimensions and conclusions

Multi-functional MRI will be used increasingly both in research and clinical imaging. Like all advancements, a lot of work needs to be done to improve techniques and this will require a world-wide effort. If multi-parametric imaging is to reach its full potential as a diagnostic tool and as a biomarker for drug development, more work needs to be done in terms of standardisation of measurements, analysis and display. Standardisation would help equipment manufacturers develop better measurement methods for data acquisition and to create sophisticated, user-friendly software for post-processing. At the moment there is also no explicit guidance, or frameworks for such new imaging approaches to move from the research field to clinical validation. The Radiological Society of North America has started a new group, the 'Quantitative Imaging Biomarker Alliance' which has recognised this challenge. This is a very exciting and growing area of imaging which will certainly have a significant impact on many areas of diagnosis and therapy.

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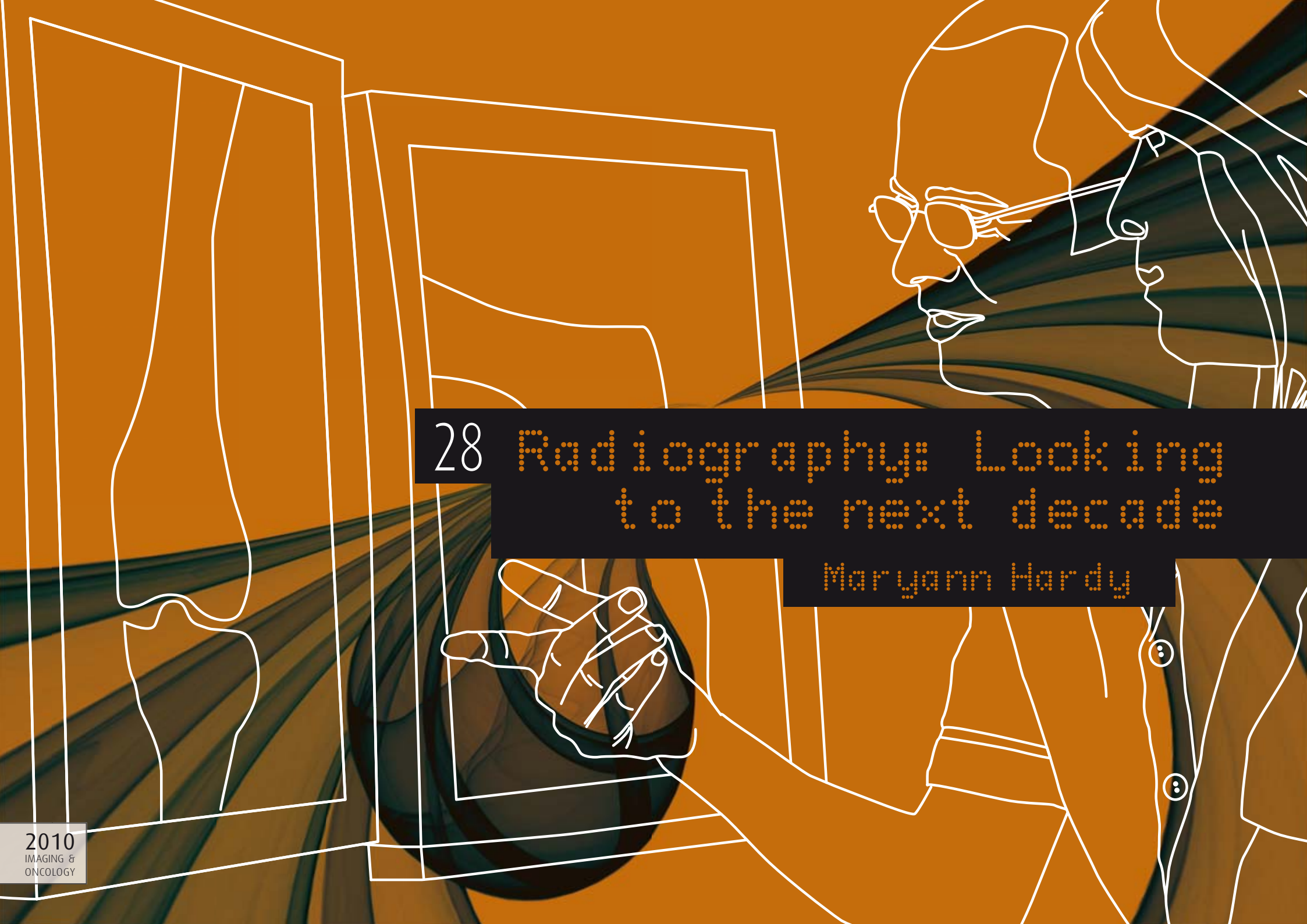


28 Radiography: Looking to the next decade

Maryann Hardy

That the future is unknown is an axiom. But one thing is certain: The future of imaging will demand the radiography profession and its educators to think innovatively, and open its mind to new ways of working. This may be a challenge, but the rewards will be greater career advancement, higher job satisfaction and, of course, high quality care and imaging services for patients.

A decade of change: 2000-2009

In the 2005 issue of 'Imaging & Oncology', Adrian Thomas dared to take a look into the future and debate the 'Role of the Radiologist in 2010'[1]. He concluded that imaging will be increasingly central to clinical medicine and argued that attachment to structures (and practices) of the past was unnecessarily limiting. He encouraged radiologists to have open minds and support innovative solutions to ensure that the increasing demands for medical imaging are met. But what about the role of the radiographer? This article discusses the challenges that could be waiting for the radiography profession in the next decade and explores their implications for service delivery.

The last decade has, without doubt, been a period of immense change for radiographers in the UK. Agenda for Change (AfC)[2] and the implementation of the four tier structure, now referred to as the Career Progression Framework[3] promised to recognise and appropriately reward radiographers for new and existing roles and responsibilities, taking account of additional knowledge and skills acquired to meet new role expectations.

However, despite the publication of AfC banding criteria and sample job descriptions, the mapping of existing radiographer grades to new AfC bands was not consistently applied across Trusts, particularly in relation to Bands 6 and 7, and created much professional anxiety nationally. In addition, while many Trusts have been happy to invest in assistant practitioner roles to enhance the imaging workforce (1st tier), few have appointed radiographers to consultant positions (4th tier)[4].

Despite the grading inconsistencies, radiographer roles have continued to expand rapidly within all aspects of medical imaging and across modalities. Some authors have argued that this rapid expansion in roles and responsibilities was a direct result of the shortage of radiologists experienced in the early 2000s.

However, the Healthcare Commission Report *An Improving Picture?* (2007)[5] disagrees with this, as radiographer role extension has been greatest in larger departments where there are relatively more radiologists and fewer radiographers, and not in departments where radiologist numbers are small in relation to radiographers. Consequently, while radiologist shortages may have been a contributory factor, it would appear that increasing sub-specialisation within radiology[6] and changing government and public expectations of high-quality health service provision were the real driving force for change.

Indeed, the government publication *A health service for all talent: Developing the NHS workforce* (2000)[7] encouraged the development of new skills and the acceptance of new roles that operated outside traditional boundaries thereby "maximising the contribution of all staff to patient care and doing away with barriers which say only doctors or nurses can provide particular types of care". As a result, the last decade has seen radiographers embrace the opportunities available to them and adopt new ways of working, many of which have been evaluated, audited, researched and published in order to provide a clear evidence base for practice developments[8-16].

Yet, despite all the external drivers for change and increasing research evidence base demonstrating the success of new radiographer roles, tension still exists within some imaging departments, and across the radiology-radiography professions as a whole, as to whether limits should now be placed on radiographer role development[17]. Nowhere is this more hotly debated than in relation to radiographer image reporting.

Image reporting: A synergy of professional talents

Diagnostic imaging services rely on the synergy of talents of two complementary professions – radiology and radiography. While the boundaries between these professions are blurring in order to optimise service delivery and meet service demands, this has created some professional anxiety as to who should undertake what role. Government documents would lead us to believe that professional background is of little consequence as long as the role is undertaken by a suitably competent and qualified health professional at an appropriate time in the patient pathway. However, while radiology colleagues generally remain supportive of radiographer role extension, there exists some disgruntlement with regard to the extent and range of radiographer reporting.

The formal reporting of radiographs by radiographers in the UK began around 15 years ago and on the whole is considered to be a huge success. While this time was synonymous with a shortage of radiologists, we have already noted that this was not the sole driver for the onset of radiographer role expansion or introduction of radiographer reporting services. Consequently, the predicted increase in the number of radiologists employed within the NHS over the next decade should not restrict the continued development of radiographer reporting services, particularly when we consider that the predicted demand for consultant radiologists may not reflect actual service demand due to reasons of affordability, technology and impact of changes in skills mix[18].

The expectations of imaging services have moved on since the introduction of radiographer reporting. And, with a wider range of examinations requested, a greater number of interventional procedures performed and an increasing expectation for shorter examination report turnaround times[19], radiographer image reporting (along with other role extension responsibilities) is an essential component of most modern imaging departments, supporting the delivery of efficient and cost-effective services.

Indeed, it could be argued that further development of radiographer reporting services is preferable and more cost-effective than the current outsourcing of imaging examinations to private UK and overseas consortia, a practice which has a number of reported risks and associated quality assurance issues[20-22].

Consequently, it is likely that the next decade will see radiographer reporting services continue to expand across modalities to meet service needs. However, the delivery of radiographer reporting services are likely to change as reporting services appropriate to a weekday 9-5 service are no longer appropriate in the age of 24/7 healthcare. Flexible radiographer reporting needs to be planned in partnership with radiology reporting rotas to optimise service provision. There may also be a greater role for non-reporting radiographers with respect to the triage of radiographic examinations in terms of urgency of report and, of course, further developments in the clinical application of computer-aided diagnosis (CAD) may yet offer new ways of working[23,24].

All of these radiographer role developments could support expansion, diversification or greater specialisation of radiologist roles and this returns us to the question posed by Thomas[1] as to whether "the best 'home' for a specialist radiologist is within the radiology department or integrated within a specialist clinical team".

Whatever the future, the key to continued successful imaging services is partnership between radiology and radiography, with mutual respect and recognition for the skills and contribution of each profession. Essential to this is the development of new ways of working that involve greater communication and sharing of examination workloads within the imaging team, whether they be related to clinical sessions or image reports, rather than differentiation of work lists. However, to support this ideal we may need to look at new models of service delivery.

New models of service delivery

Current service delivery targets in the UK are focused on reducing patient waiting lists and ultimately the time from referral to treatment (the 18 week patient pathway). However, with demand for imaging services escalating both in terms of referrals and out-of-hours accessibility, current initiatives will struggle to maintain service efficiencies without attracting significant additional financial costs unless changes in operational service delivery are implemented. One suggestion is to extend the working day and increase the number of assistant practitioners working across imaging modalities, adopting a model similar to that in nursing where relatively large numbers of nursing assistants are employed routinely and supervised by ward or outpatient nurses.

Currently, in the UK, many out-of-hours imaging services (periods outside of 9am-5pm Monday to Friday or 8am-8pm where an extended day is worked) are provided on an on-call or overtime basis. These services are costly in terms of finance, but can also create occupational tension and stress when regular or prolonged on-call responsibility, or excessive overtime shifts, impact on work-life balance.

Expanding the availability of imaging service provision and implementing a radiographer shift system supported by a greater number of assistant practitioners (similar to the nursing model) could increase imaging department productivity while providing greater cost-efficiency savings in terms of image acquisition.

However, such service developments would need to be supported by changes to image reporting procedures to ensure imaging informs patient management appropriately and at a suitable time in the patient pathway. Again, this could be an opportunity for further expansion of radiographer roles and responsibilities including greater opportunity for cross-modality working, broadening of radiographer reporting services, and development of supervisory management skills in relation to the work of assistant practitioner teams.

However, if significant changes are envisaged for the operation of imaging departments and the contribution of the radiographers to service provision, it is perhaps time to also look at changes in professional education that may be necessary to support successful reconfiguration of imaging services.

Radiography education – the future of the profession

While changes in clinical practice over the last decade have been rapid for practitioners, the same changes have generated a huge demand for higher level education to support practice developments. In addition, the last decade has seen an explosion in the contracted number of student radiographers which in turn has impacted on both universities and clinical departments as they work together to maintain the quality of pre-registration clinical education.

Despite this, radiography educators have responded well to the educational demands of the profession and a whole range of courses are now available to support practice developments. However, if new ways of working and further expansion of radiographer roles are to continue, academic colleagues need to work with clinical service leaders to map service development needs and educational demands to ensure their aims are congruous.

An important factor to review when considering future radiography workforce models is the changing demographic of student radiographers and their expectations of radiography as a career. The last decade has seen a move away from student radiographers being the stereotypical 18-year-old female attending university straight from school. Today, radiography cohorts are a diverse mix of ethnicity, gender, age and prior occupational qualifications/experience. In addition, many students have family

responsibilities, and all of these need taking into account when planning educational programmes and career pathways.

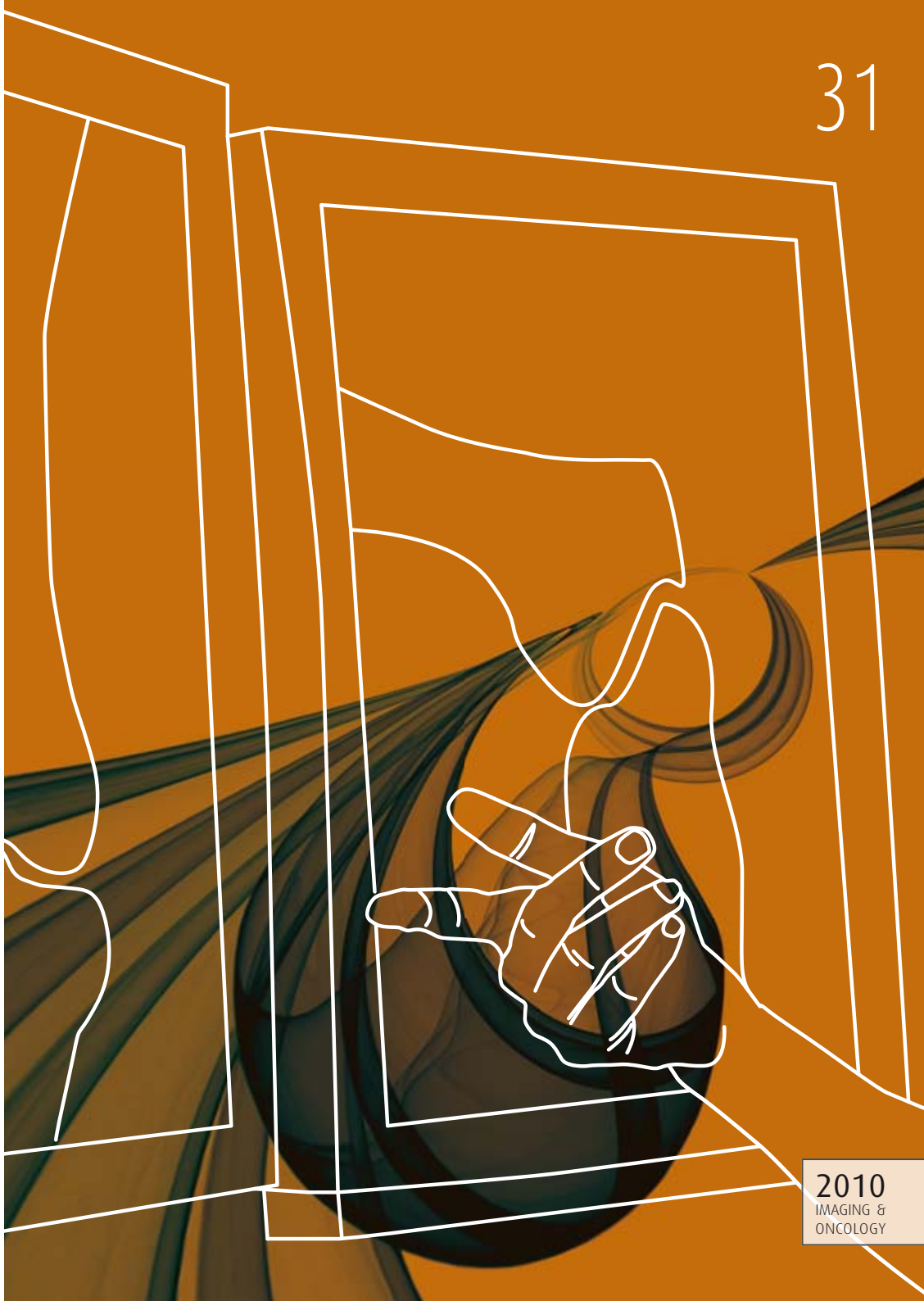
The traditional three-year, full-time undergraduate radiography degree programme may no longer meet the needs of potential radiography students and could be seen to discriminate against specific societal groups who are unable to commit to full-time education. Part-time degree programmes are being explored by universities but as yet, provision is limited. It could be argued that co-ordinating clinical and academic education for part-time students while assuring the maintenance of developing competencies is difficult. But this should not prevent the introduction of part-time programmes if a need exists. Similarly, for students who already have a degree or comparative healthcare qualification, should a greater number of shorter 'fast track' radiography programmes be developed? An argument against this is the lack of curriculum time to educate students on all aspects of diagnostic imaging. This then poses the question – do we have to?

A suggestion that has been around for some time is the introduction of single modality pre-registration qualifications (eg, ultrasound; CT; MRI; conventional imaging). However, while such awards may respond to immediate skills shortages, they may limit flexibility in working practices in the future. An alternative may be to introduce dual qualification awards. Many 'old timers' will remember the College of Radiographers' dual award for radiographers qualifying in both diagnostic and therapeutic radiography. However, the issue today is the breadth of diagnostic imaging modalities available.

All pre-registration courses aim to provide some experience in each imaging modality, but there is insufficient time for students to develop the depth of knowledge required to practice autonomously in any modality or specialist branch of imaging practice beyond perhaps conventional radiographic imaging. Dual qualification pre-registration programmes could be developed in line with projected clinical demand for imaging examinations with clinical education being streamlined to permit the development of clinical competencies within specific clinical areas (eg conventional imaging and CT; conventional imaging and mammography etc).

The adoption of such an approach would create a workforce designed to meet projected clinical demand. In addition, postgraduate education could be tailored towards higher level skills development appropriate to advancing practice boundaries and service innovation. However, due consideration also needs to be given to the development and maintenance of the expertise, skills and knowledge of academic radiographers.

It is recognised that the next decade will see a large number of radiography educators nearing retirement age and thought needs to be given to future academic recruitment. It may no longer be appropriate to disengage professional education from professional practice, with educators isolated from clinical practice within universities, particularly when professional developments are rapidly changing the role of radiographer. Clinical-academic roles have been promoted by the Department of Health to support



More radiographers will need to engage with research and the development of the evidence base

the development of research competencies among clinicians[25]. However, it could be argued that similar partnerships should be explored with respect to educational delivery to ensure that subject expertise informs teaching. This will be essential if new educational models are to be developed.

If changes in education are not considered in light of workforce demands and changing student demographics, then we risk delivering programmes with expanding content with respect to the variety of imaging modalities and practices, but diluting the depth of student learning. Consequently, if this scenario becomes reality, the next decade may see the implementation of a formal pre-registration (or preceptorship) period (usually of one year duration) during which clinical orientation and development of clinical competencies are developed in a supervised environment.

The Department of Health has already put forward a preceptorship framework for nursing to be introduced during 2010[26] and it is possible that such a scheme, if successful, could be an expectation for all newly qualified healthcare professionals in the future. Many departments may argue that this is happening informally already. However, a nationally agreed preceptorship framework will ensure appropriate support for all newly qualified staff in developing competencies appropriate to their first post and will permit the identification and discussion of future learning needs in relation to their planned career direction. However, for individuals to be able to identify and plan specific career pathways, there needs to be greater clarity in the career development and progression process, particularly with regard to senior clinical leadership roles.

Succession planning, clinical leadership and the consultant radiographer

For many radiographers commencing their clinical career, an aspiration may be to achieve advanced practitioner or consultant radiographer status within a specific area of practice. However, the engagement of clinical departments nationally with respect to appointing staff to these roles varies, and it has been stated that a number of advanced practitioners and consultant radiographers have been appointed by virtue of personal qualities rather than the recognised need to appoint to such a role as part of strategic service development and planning[4].

Part of the problem, particularly in relation to consultant practice, is that despite the clearly defined four domains of practice, some departments and imaging managers remain unclear as to how these transpose to a clinical role and therefore, what a consultant radiographer would contribute to service delivery. Another barrier to the wider introduction of consultant radiographer roles is the lack of support among some radiologists for senior autonomous clinical leadership among radiographers. Perhaps it is the term ‘consultant’ that causes concern or the fact that blurring of role boundaries becomes more conspicuous at higher levels of clinical responsibility and practice. As a result of these and many other locally identified barriers, consultant radiographer roles have rarely been considered within strategic planning or imaging service business

models as ways forward in improving service delivery.

So are consultant radiographers destined to face extinction in the future? This is unlikely, but neither should we expect a rapid growth in numbers. Work has begun to evaluate consultant radiographer roles in terms of service provision and cost effectiveness and this evidence should support expansion in numbers.

However, further work also needs to be undertaken to apply the non-medical consultant role ideals to actual clinical roles in order to provide clarity to their application. One important step that is essential for professional recognition and autonomy is the appointment of consultant radiographers (or a representative of consultant radiographers) to the strategic clinical management group for imaging services within hospital Trusts, alongside the radiology clinical lead, to ensure that radiographers have a voice to inform clinical developments and service planning. In this way, radiology and radiography will truly be seen as partner professions at all levels, both with valuable contributions to make to the successful provision of imaging services.

Conclusion

Radiography is a dynamic profession and during the next decade will build upon the professional developments to date and expand on these further in order to meet government and patient expectations of successful imaging services.

However, financial restrictions will require innovative thinking with regards to optimising staff contribution to service provision and radiographers must be open to new ways of working to meet service demands. The coming decade may also be one of constructing and consolidating partnerships between different clinical professional groups and also between clinical and educational institutions in order to support new and innovative ways of working across the sector.

In addition, more radiographers will need to engage with research and the development of the evidence base to support practice change. Without these, barriers to professional development at local level will continue to prevent the implementation of a rewarding and far reaching career framework and limit the cost-effectiveness of radiographer led service improvements.

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Body MRI in paediatric oncology: Challenges and clinical applications

Luisa Disini
Kieran McHugh

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IMAGING &
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MRI is becoming an increasingly important modality in paediatric imaging. The clinical applications are many, but what are the considerations and challenges?

Introduction

Cross sectional imaging is essential for the diagnosis and management of the oncology patient, including children. A variety of complementary modalities are available and the imaging algorithm is tailored to the relevant clinical and therapeutic questions at different stages of the management process.

The same modalities as in adult imaging are used, but physiological and anatomical differences in children necessitate different approaches in paediatric oncologic imaging. Ultrasound, for example, allows better visualisation of structures due to their smaller size and lack of fat in children, making it a readily available modality for studying the abdomen and retroperitoneum[1]. Children also are less cooperative during most imaging procedures, but in recent years compliance in CT imaging has become less of an issue as a result of developments in ultrafast image acquisition with newer multidetector CT scanners.

Overall, survival rates for children's cancers have improved remarkably over the past few decades such that more than 70 per cent of children now survive their cancer[2]. However, the radiation burden from repeated CT scans for tumour surveillance has an unknown long-term impact on these children. As radiation protection is a key component in the decision pathway for imaging all children, MRI is an increasingly important modality and, as with other cross-sectional imaging techniques, there are general considerations for body MRI in children.

This article focuses on these adjustments as well as those specific to MRI. The current applications of MRI in paediatric oncology, supported with case studies, and a brief discussion of emerging MRI applications in tumour evaluation are discussed.

General considerations in paediatric body MRI

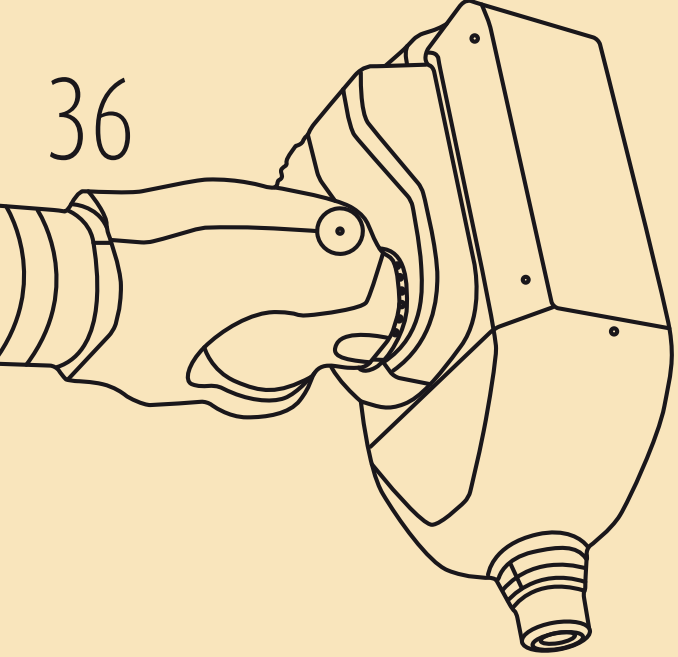
Obtaining useful images from MRI involves a trade off between the signal to noise ratio, acquisition duration, spatial and temporal resolution, and this is further complicated in paediatric body MRI by the smaller size of the structures to be imaged. Other practical challenges include strategies for improved compliance, concerns about gadolinium contrast agents and compensation for physiologic motion artefacts. Consequently, the optimum image quality in the shortest scan time is provided by the radiologist working in partnership with the MRI radiographer to select the optimum pulse sequences from those available.

Image resolution for such small anatomical structures is optimised by choosing the smallest available multi channel coil providing optimal coverage of the region of interest. For instance, a head or shoulder adult coil may be used to image the abdomen of infants and newborns. Furthermore, the field of view, matrix, slice thickness, and slice spacing parameters need to be tailored to the specific demands of the clinical situation[1]. In general, the field of view should be kept small and should not exceed the length of the coil[3].

> With novel and cross boundary working there was a potential to increase patient throughput

The longer scan time and the need to lie still for a prolonged period makes compliance an issue in children and so MRI often requires sedation or general anaesthesia in younger children[4]. Infants below six months are usually scanned during natural sleep after a normal feed, often best after a period of sleep deprivation. In older patients the requirement for deep sedation or general anaesthesia is determined on a case by case basis, requiring anaesthetists and specially trained nurses with adequate cardio respiratory monitoring equipment. If sedation is not required with the older child, investing time for strategies to decrease patient anxiety is recommended. Examples include a pre-visit to the scanner, use of play therapy, as well as audio and video entertainment at the time of the scan. Educational websites such as Medikidz (www.medikidz.com) can also be useful.

As in adult imaging, contrast optimisation is achieved with intravenous gadolinium chelates to delineate enhancing lesions. Although hypersensitive reactions to gadolinium-based contrast agents are much rarer than with the iodine-based contrast agents used in CT imaging, there may be an appreciable risk of nephrogenic systemic fibrosis in young patients with renal failure[5]. Therefore, high risk patients with a low glomerular filtration rate need to be identified. In this situation, a careful discussion with the clinical team is important to determine the balance of benefit pf a contrast-enhanced study taking into account the level of renal function. In the current absence of an alternative suitable contrast agent, those whose renal function is too poor may be offered a non contrast MRI scan. Other considerations include the emerging evidence of gadolinium deposition in the growing bone and cartilage[6]. A stable gadolinium chelate such as gadoteric acid (Dotarem), with no reported cases of nephrogenic systemic fibrosis, is currently the preferred contrast agent in several institutions.



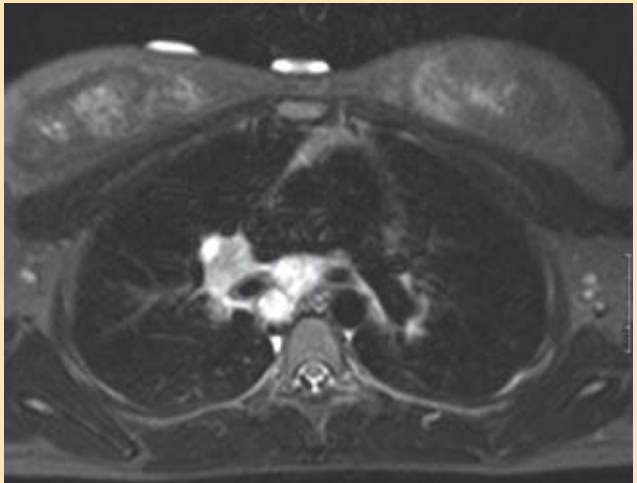


Figure 1 T2 weighted axial image with fat suppression. Right hilar and subcarinal mediastinal lymphadenopathy as high signal lesions. The adenopathy here was secondary to metastatic renal cell carcinoma in an adolescent girl. CT is normally used to detect or exclude mediastinal adenopathy but this example shows that MRI can be useful in this context also.

Figure 2a
T1 weighted sagittal image.

To compensate for motion artefact due to rapid respiratory, cardiovascular and gastrointestinal motion in children, specific protocols have been developed. One particular solution involves the reduction of acquisition time with faster imaging sequences, such as those acquired during a few seconds of breath-holding, consequently minimising respiratory motion. For example, 3-dimensional T1 weighted spoiled gradient echo imaging (3D spoiled GRE) is a fast sequence with excellent contrast characteristics suitable for breath-holding[3]. This can be achieved in the awake and cooperative child or under a general anaesthetic. In other instances where conditions for breath holding are not met, sequences allowing for free breathing or respiratory gating are used. Respiratory gating acquires an image slice at the same phase of respiration, triggered by chest wall motion[7]. Proton density and T2 weighted sequences, for example, may use respiratory triggering and sample only the MRI signal during the end expiratory phase. Other strategies include cardiac gating for diagnostic images of the chest, such as with the half-Fourier single shot acquisition sequence (HASTE)[3]. Attenuation of bowel peristalsis, a noticeable artefact on T2 weighted imaging, is achieved through pharmacological means such as hyoscine butylbromide (Buscopan)[1].

These respiratory motion artefacts are seen as smearing in the direction of the rise and fall of the chest and abdomen in the axial plane, caused by high signal coming from the fat component of the anterior chest and abdominal wall. Consequently, it is an issue with chest and abdominal but not pelvis and appendicular MRI. Another strategy to overcome this problem is through minimisation with homogeneous fat suppression using specific sequences such as T1 or T2 weighted images with fat suppression. T1 weighted images with fat suppression also have the added advantage of not requiring any motion compensation and therefore allowing image acquisition during free breathing[3]. In addition, respiratory artefacts from the body wall fat tissue are minimised by the homogeneous suppression of fat by the Short Tau Inversion Recovery sequence (STIR).

Current applications in paediatric oncology

Indications for MRI in paediatric oncology include the initial tumour diagnosis, differential diagnosis, staging and pre-operative imaging together with follow up imaging to assess response to treatment and post-operative imaging for residual tumour, recurrence and metastasis[8]. MRI in children was initially used almost exclusively for neurological applications[9]. In recent years, due to its excellent soft tissue contrast and superior multiplanar capabilities, MRI body imaging has made an impact on diagnostic algorithms by contributing to the reduction of the radiation burden in children. It has been successful in paediatric oncology for the evaluation of abdominal, pelvic, musculoskeletal tumours as well as imaging of the chest for determining the extent of mediastinal masses[1] (Figure 1). MRI has limitations for studying the lung parenchyma where low-dose chest CT is the imaging modality of choice for detecting, excluding and monitoring pulmonary metastases.

There is no universally applicable MRI paediatric body imaging protocol. A wide variety of protocols are now available due to developments in scanner hardware and pulse sequences and they are optimised to address a number of clinical questions. Most protocols, however, include T1 and T2 weighted, T1 post contrast, and fat saturated sequences. This maximises the excellent anatomical delineation provided by T1 and T2 imaging with the additional detection of fluid or oedema from the latter. Contrast enhancement of tissue is detected with fat suppressed T1 weighted images after

Figure 2b
STIR coronal image. Well defined geographic shaped areas of necrotic marrow in a leukaemic patient with ischaemic necrosis secondary to steroid intake

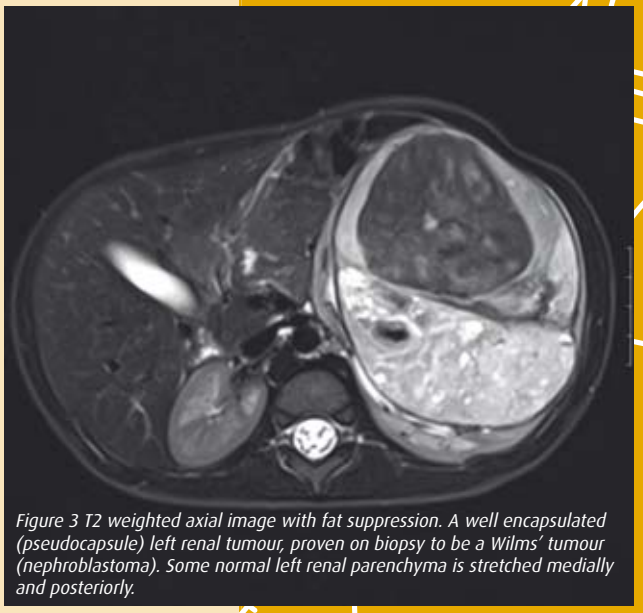


Figure 3 T2 weighted axial image with fat suppression. A well encapsulated (pseudocapsule) left renal tumour, proven on biopsy to be a Wilms' tumour (nephroblastoma). Some normal left renal parenchyma is stretched medially and posteriorly.

gadolinium enhancement. Fat suppression with STIR is considered the work-horse of MRI for its superior ability to detect fluid or oedema. In musculoskeletal imaging fat suppression with STIR enhances the contrast between bone marrow and intramedullary conditions such as oedema, infection or neoplastic disease (Figure 2a & b).

Other sequences include three dimensional T2 weighted sequences which provide high resolution images of the pancreatico-biliary tree and the urinary tract with respiratory triggering[3]. Balanced steady state free precession sequences are GRE sequences which allow a quick and reliable overview with little motion artefact but have restrictions for lesion detection[8]. Finally, 3D spoiled GRE post contrast images can accurately delineate lesions with a weak signal against enhancing vessels and surrounding tissues, consequently allowing certain tumours to have a relative lack of contrast enhancement[3].

Children have a different spectrum of disease compared to adults. The most common entities encountered in clinical practice include tumours involving the retroperitoneal organs (notably the kidneys and adrenal glands) (Figure 3), intraperitoneal liver, mesenteric and pelvic genital tumours, while primary bone tumours are more common than metastatic bone disease. A detailed MRI description of these tumours is beyond the scope of this article but it is noteworthy that many of the tumour and tumour-like lesions in the paediatric population have similar imaging appearances to those in adults, particularly the mesenteric and genital tumours. However, although paediatric tumours generally return a high signal on T2 weighted images and enhance with gadolinium, some may return an intermediate or relatively low signal on T2 weighted images and may enhance poorly, in contrast to many adult tumours. This is exemplified by the small

Figure 4 T1 weighted axial post contrast with gadolinium image . A left infrarenal neuroblastoma showing a relative lack of contrast enhancement compared to the spleen and right kidney.

round cell tumours in infants and young children such as neuroblastoma, nephroblastoma (Wilms' tumour) and rhabdomyosarcoma. Neuroblastoma, for example, shows very little enhancement following gadolinium administration, particularly following chemotherapy (Figure 4). This tumour can be demonstrated with the 3D spoiled GRE post contrast sequence by producing a negative contrast appearance[3]. Apparent diffusion coefficient maps with diffusion weighted imaging (DWI) have also recently shown these highly cellular neoplastic lesions rather conspicuously[10]. Thus, tumour cellularity with DWI may one day become an invaluable tool in the analysis of paediatric tumours[11].

The future of MRI in paediatric oncology

Whole body MRI, unlike focused regional MRI, is a total body examination typically targeting a specific component of the body, for example bone marrow. This allows whole body staging in paediatric oncology, much like PET/CT, and has recently been demonstrated to be useful for suspected bone marrow metastases or systemic skeletal disease[12,13]. MR spectroscopy has research applications in paediatric abdominal tumours for its ability to characterise tumour cell metabolites[14]. With its improved spatial and temporal resolution, 3T MRI may overcome the anatomic challenges of imaging small children but altered T1 contrast, artefacts and patient safety remain particular challenges. Work is also underway to determine the potential applications of combining whole body imaging, MR spectroscopy, or functional MRI with 3T MRI in paediatric radiology[15].

Conclusion

There is no single imaging algorithm for the analysis of tumours in children and there is no single ideal imaging modality. Body MRI, with its lack of ionising radiation, is invaluable in the paediatric oncology patient for the evaluation of posterior mediastinal, abdominal, pelvic and musculoskeletal tumours. There are several challenges associated with paediatric MRI which necessitates a collaborative approach between the radiologist and radiographer. Furthermore, there is also no ideal imaging protocol and MRI sequences are tailored to the spectrum of disease in children. Diffusion weighted imaging and whole body MRI are emerging MRI applications which may soon be incorporated into the standard imaging protocol for paediatric body tumours.

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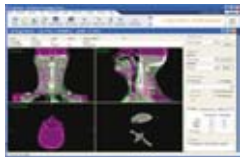

Human care makes the future possible

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40 Self-referral for imaging: It does have a future

Julie Burnage

Do the 'worried well' deserve to be demonised for seeking private imaging examinations? What is the future of self-referral imaging and the aggressive marketing techniques adopted by some private companies? Is tighter regulation the answer?

Introduction

Over the last few years there has been an increase in the number of private companies offering imaging tests to self-referring members of the public, and some of these have adopted aggressive marketing campaigns. This increase has attracted interest, concern, and implied condemnation from some professional organisations and individuals as illustrated by the recently published special feature 'Let's all jump on the bandwagon: further debate on the use of ultrasound' in the journal *Ultrasound* earlier this year[1]. The conclusion reached in the article is sound since it advocates sonographer registration and the compulsory training and regulation of all clinicians using ultrasound, regardless of professional background. Who is doing the scan and how they deal with the findings is of utmost importance since it is widely accepted that 'the greatest hazard from ultrasound is the misinterpretation of the appearances by poorly trained or undertrained operators'[2]. But, arguably, why and where a scan is performed is not as important.

However, that is not to say that scans should be available at the back of church halls or the public rooms of the local library because, aside from turning ultrasound provision into a circus, there are health and safety issues. Patients' privacy and safety may be compromised and staff may be at risk of developing work related upper limb disorders if they are expected to conduct high volume lists in inappropriate settings.

This article aims to add to the debate on 'self-referrals' and in some way 'decriminalise' both the patient – 'the worried well' – and those who offer some of the services.

Who exactly is offering these scans?

Edwards[1] states that 'In the UK those using ultrasound can be divided broadly into three groups', and goes on to describe the first group as 'core imaging specialists, including radiographers and radiologists, whose primary role is to produce and interpret images'. The second group is 'clinical specialists...midwives, physiotherapists, emergency physicians' who use ultrasound to 'enhance their diagnostic power'. The third group 'employs ultrasound in a non-medical capacity by providing 'bonding' scans for pregnant women and by inviting the asymptomatic 'worried well' of the public to pay for an ultrasound examination for reassurance'.

Forgive me for stating the obvious, but a trawl through the myriad of companies advertising such services in the UK on the internet shows that the majority of these companies are either owned or staffed by (dare I say it?) the core imaging specialists of group one and clinical specialists of group two. The very people who are lauded by Edwards in the opening paragraph are the ones who, a few sentences later, are labelled at best, as profiteers and at worst as charlatans.

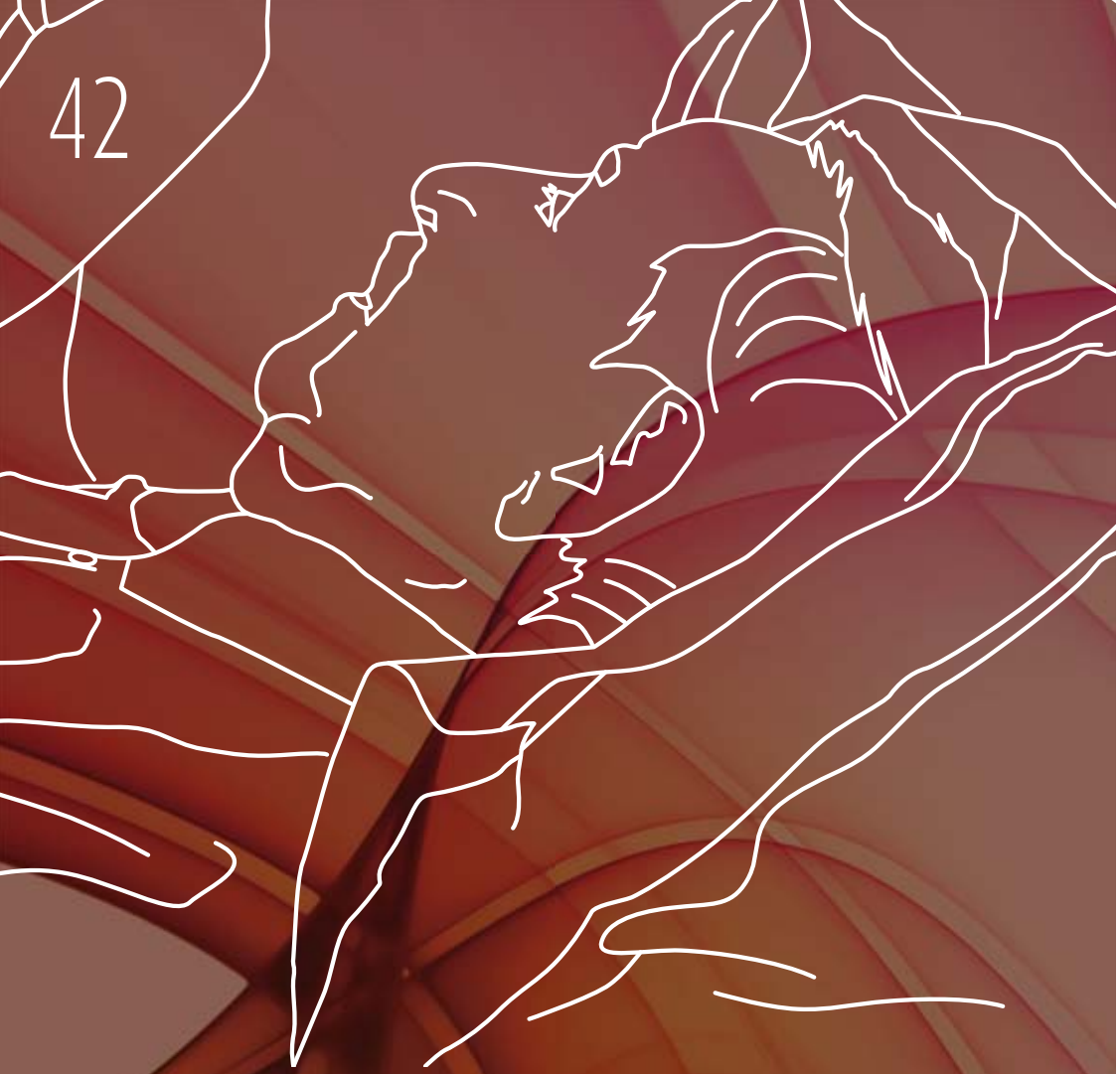
Is it any wonder that the general public is scared witless?

There have always been 'self-referrers' or the 'worried well' as they are so frequently (and in the author's opinion, disparagingly) called. Can any ultrasound practitioner reading this article say honestly that they have never scanned a patient where the clinical information has simply said 'anxious' or 'for reassurance'? Or never scanned a colleague (or themselves) without a referral? The Biblical phrase 'He that is without sin among you, let him first cast a stone...' springs to mind here. However, before I go any further, let me declare an interest:

I am a sonographer who in 1995 set up an independent ultrasound company. It was to offer an ultrasound service somewhere between the two delivery models available at the time: the National Health Service (NHS), where ultrasound was offered almost exclusively in the secondary care setting, and the private sector which catered for the insured or affluent members of the public and which offered a choice of hospitals and convenient appointment times. At first, all our patients were referred by GPs, were scanned in the primary care setting and were paid for out of the NHS budget.

However, it soon became apparent that many people would be willing to pay to have an appointment that fitted in with their lifestyle (something that the NHS was not providing) as long as the cost was not prohibitive. We now also accept self-paying and insured patients referred by clinicians and self-paying patients who self-refer.
To date, my team of experienced committed sonographers and radiologists have, between them, scanned and reported in excess of 80,000 patients for my company.

I admit, and I don't feel guilty for saying this, I pay them – they do it for the money and I do not know of anyone in groups one and two who scans patients purely for philanthropic reasons because philanthropy does not pay bills.



I do not know anyone who scans patients for philanthropic reasons

It is acknowledged that when the company was started, it was with the express intention of giving NHS patients the option of having their ultrasound scan 'closer to home'. At the time it was not deemed appropriate or feasible by the majority of imaging departments, but with the subsequent publication of the *Delivering Care Closer to Home* policy in July 2008[3] it is now expected. In addition, self-referral is becoming an accepted part of some aspects of healthcare. For example, giving patients the opportunity to access physiotherapy directly has been encouraged and endorsed by government:

"Self-referral will help both vulnerable members of society and those with busy lives by providing quicker access without the unnecessary hoop-jumping of going to see the doctor first.[4]"

The internet has a part to play in the changing face of medicine. For good or bad, it is here to stay and has empowered patients, although not always in a helpful way. Patients are more aware of health issues, tests and treatments, and are no longer afraid of questioning professionals. By giving access to information and services, the internet is the facilitator of the masses.

Less than 10 per cent of the 80,000+ patients we have scanned have been 'self-referrals'. It is difficult to give an exact number because no matter what route a patient has taken to end up lying on one of our couches, the pathway is almost identical from our perspective.

1. We are contacted: (letter, email or telephone call).
2. We triage: (not all referrals are appropriate and if the request does not fit our criteria we do not accept the business. We might be out to make a profit but not at the expense of our ethical and professional beliefs). Benefits and risks are discussed with the self-referral patient and they are encouraged to consider what they will do if their scan result is abnormal.
3. We appoint.
4. We scan (but not before making sure that the patient understands the information they have been given, the limitations of ultrasound, and gives their informed consent).
5. We discuss the findings and create and forward the report.

Self-referral patients: Mad, bad or just dangerous to know?

The term 'worried well' is used frequently and sometimes scathingly by many, but is it any wonder that the general public is scared witless?

The constant advertisements in the press and on television for vitamins, good bacteria, constipation, headaches, colds, (the list is endless) are trying to convince us that if we're not ill, we will be – unless we buy their product. There are, of course, no adverts telling us that we are fine and dandy as we are. Indeed, we are bombarded with messages about taking some responsibility for our own health and wellbeing; lose

weight, exercise, stop smoking, don't drink, don't eat, do eat, have safe sex. Every week, newspapers and magazines run terrifying articles about how some diseases do not present with any symptoms until it is too late. Given all this, why is it so wrong for a woman to arrange a scan to check her ovaries? Does that make her mad or bad when all she is doing is trying to take some responsibility?

How can being concerned about one's own health be a bad thing? Surely prevention is better (and cheaper) than cure. We are sending the general public mixed messages – if you are overweight, drink too much, smoke, do not exercise then you are almost singlehandedly going to destroy the National Health Service but on the other hand, if you try and look after yourself you will be lambasted and treated like a neurotic social pariah by some.

Arguably, the majority of patients self-refer because they do not want to waste the GP's valuable time if it turns out they are worrying needlessly. Few do it because they do not trust their GP or want to prove him/her wrong, although I have had patients request a scan because they feel their doctor is not taking their concerns seriously and, sadly, all too often, pathology has been found, which, in some instances, was serious.

A recent audit of 1000 of our patients (GP referrals) showed that 73 per cent did not need to go on to secondary care because they had a normal scan result and/or could be managed in primary care. A normal scan result is just as important as an abnormal result because, giving the right information about the result and the implications, puts the patient's mind at rest and prevents unnecessary visits to the GP. Exactly the same is true for self-referrals. What is essential however, is that the scan is undertaken by appropriately trained staff with the informed consent of the patient and that the clinical significance (or otherwise) of the result is explained to them.

Undoubtedly, a normal scan can give false reassurance but this situation applies equally to those who have self-referred as well as to those who have been referred. But by listening and talking to a patient and understanding what it is that is worrying them and why they have come for a scan, will help to focus the discussion about the results. It is important that the patient understands that having a scan (self-referred or otherwise) is not a panacea and that the person best placed to advise them is usually their clinician. A responsible and experienced sonographer will always ensure that the patient is aware of the limitations of themselves and of the modality.

So far, I have considered only the companies who provide services to patients who contact them directly, but there is another type of company – those who have aggressive marketing campaigns and who send out glossy leaflets with quotes from people who would be dead if it was not for the amazing 'life-saving' service they received. My mother receives an average of one letter a month from a particular company and for the last four months has been trying to find out who sold her name and address to them. She is not happy about this – not least because my usually sensible father has started to wonder if they should avail themselves of this service. His rationale being that this company would not be allowed to send these things to people if it was not a good idea. We, as imaging professionals, should be campaigning to stop the selling of databases to companies like this.

Interestingly, some GP surgeries seem to be capitalising on the current climate: Recently a friend received a letter from her GP offering her ovarian screening in the surgery (for a fee) by a private company who would then send the report back to the GP. Furthermore, a relative of mine had the offer of accessing self-pay abdominal aortic aneurysm screening in the GP surgery. Again, the letter came from the surgery and, on investigation, the surgery received a 'cut' of that fee. Therefore, it is rather hypocritical of some clinicians to complain about the time taken up by the 'worried well' demanding appointments to discuss the findings of their screening scan when some of them seem to be making money out of such services. Once again the Gospel of John springs to mind.

Obstetric scanning

Some private companies suggest that having a 3D scan will help you bond with your baby, the inference being that without a 3D scan you may not, which is a ridiculous concept. However, having a scan later in pregnancy with or without the 3D images, may add to the bonding experience and make what many find an already magical time even more special. Sometimes the pressures placed on those undertaking routine obstetric scanning in the NHS can rob them of the ability to see these scans as anything other than routine and that manifests itself in apparent disinterest – a comment made by many of our private patients; the excitement and wonder of their pregnancy is turned into the mundane.

Women self-refer for obstetric scans for a raft of reasons and it is therefore unwise to make sweeping statements, demonising all providers and the women themselves. There are aspects of services provided by some companies which I find distasteful. Selling packages that focus more on the teddy bear/key ring/photo frame/DVD with your choice of music, than on the scan and its findings doesn't sit well with me, but we live in a democracy where people can choose what they buy. If a woman wants her baby's first teddy to be a 'freebie' form of advertising that is up to her. If sonographers are happy to sell their skills and experience to provide entertainment, it is up to them – at the moment and in the absence of legislation.

We have women contacting us to book a 3D scan who say they are not bothered about having their baby checked because they just want the pictures and/or DVD. For us, it is not business at all costs and we do not provide services for those people, but there are companies out there who will. We have had verbal abuse because we have refused to scan to determine gender before 24 weeks 'because I don't want another girl'. We do not accept those bookings either. In reality, these requests are few and far between. The majority of our self-referral obstetric patients come to us (and I assume therefore to most other independent providers) because they cannot get what they want, or feel they need, through the NHS.

An audit of our obstetric referrals gives a glimpse of the reasons people pay privately for scans. The vast majority are for early dating and Down's syndrome screening. There are many women who have had previous miscarriages who do not want to wait until their 12 week scan to find out they have had another – worried well or someone with rampant hormones who needs to know that it is okay to get excited about their pregnancy?

At the time of writing, nuchal translucency screening is still not universally available across the UK and so people who want to make informed choices about their pregnancy are willing to pay for the privilege. Should these women be able to access this service or should their freedom of choice be ruled by their postcode?

Appointment choice is another factor, particularly for those women whose partners may not be able to attend scans with them. We have seen a marked rise in the number of armed forces personnel making appointments for scans because tours of duty mean they will not be able to share the pregnancy otherwise. Knowing that their scan will not be rushed is a major factor for people booking private appointments.

Having the time to chat and talk through what the appearances mean on the monitor is a luxury not readily available in most busy NHS departments. It is not the length of the scan that is important, but the length of the appointment.

3D scans make up only about 15 per cent of our obstetric self referrals and are not an easy way to make money, although many believe they are. Our philosophy is to ensure that patients enjoy their scan experience whilst understanding that the health and wellbeing of their baby is of paramount importance. If we get great images as well, that is a bonus. Having filtered out at the appointing stage those who have a different idea, we tend to have very few issues or complaints from customers. Equally, there have been numerous cases of potential problems being identified during these scans including polyhydramnios, oligohydramnios, intrauterine growth restriction (IUGR), vasa praevia, talipes equinovarus, facial clefting, and macroglossia.

Conclusion

The self-referral patient is here to stay and whilst we live in a democracy, people have choices. Arguably, it is simply a matter of time before self-referral becomes the norm. If we try to ban self-referral for ultrasound, the practice may be driven 'underground', which may serve to make monitoring standards even harder than it is currently.

Undoubtedly, standardised training and regulation of all those using ultrasound should be constantly and consistently monitored in both the independent and the NHS setting. We have a duty to protect the public and while imaging self-referrers remains legal, it is our duty to make it as safe as we can.

There must surely be an argument for the regulation of companies offering self-referral ultrasound services and, perhaps, legislation which demands that patients are informed of the possible dangers of ultrasound (for obstetric patients in particular) and the limitations of the technology (for all patients). Companies targeting the masses should, alongside their glowing testimonials, also give information about how many scans they have performed and the percentage of those which had serious clinical conditions uncovered. The information must be given in such a way as to enable the public to make an informed choice and the scaremongering must be stopped.

The selling of databases and use of nationwide mail shots to bombard the general public should be banned. Not only will this reduce the number of people turning up at their GP surgery with frequently useless screening results, it could help save forests by reducing the number of trees that need to be destroyed to create these unsolicited letters and leaflets. Rather than work against each other, those providing ultrasound services should accept that the 'one size fits all' approach does not work. Instead, they should come together to ensure that patients are not, in effect, punished for choosing a route that some of us might not approve of.

Julie Burnage is the director of Ultrasound Now Ltd, St Asaph, Denbighshire

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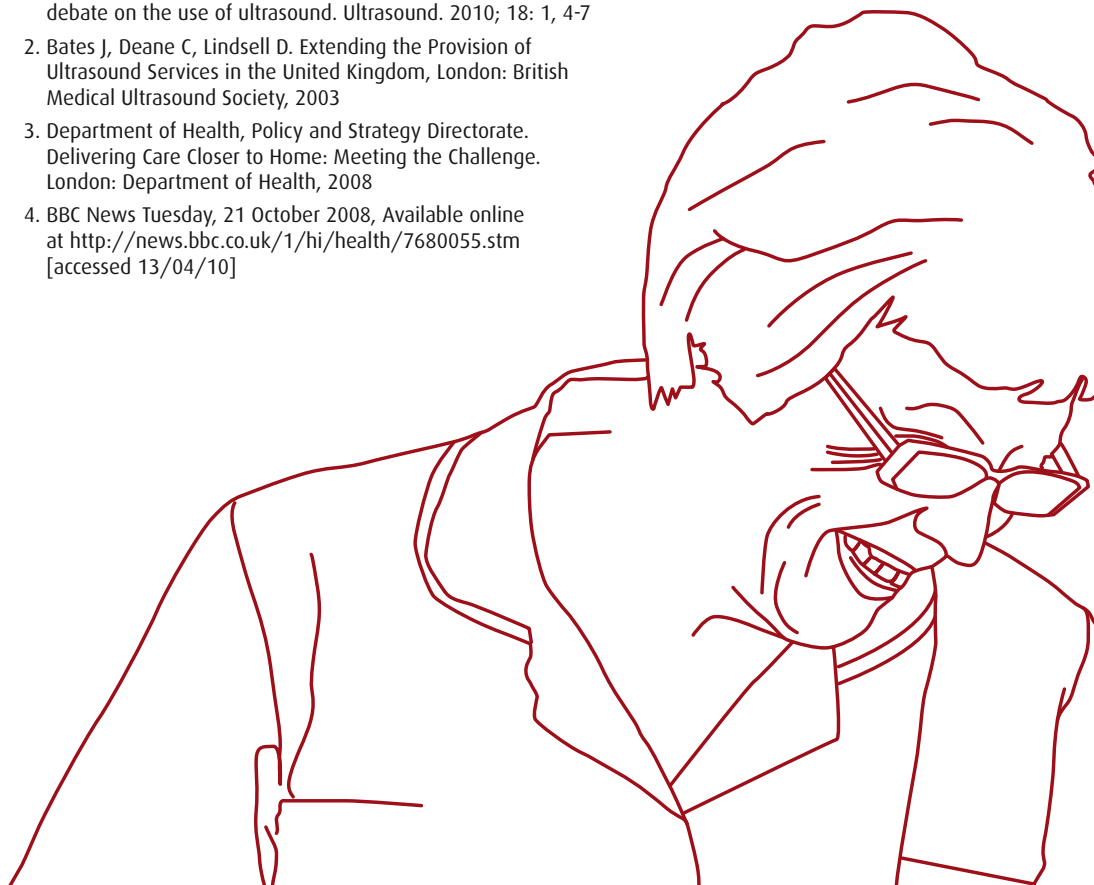

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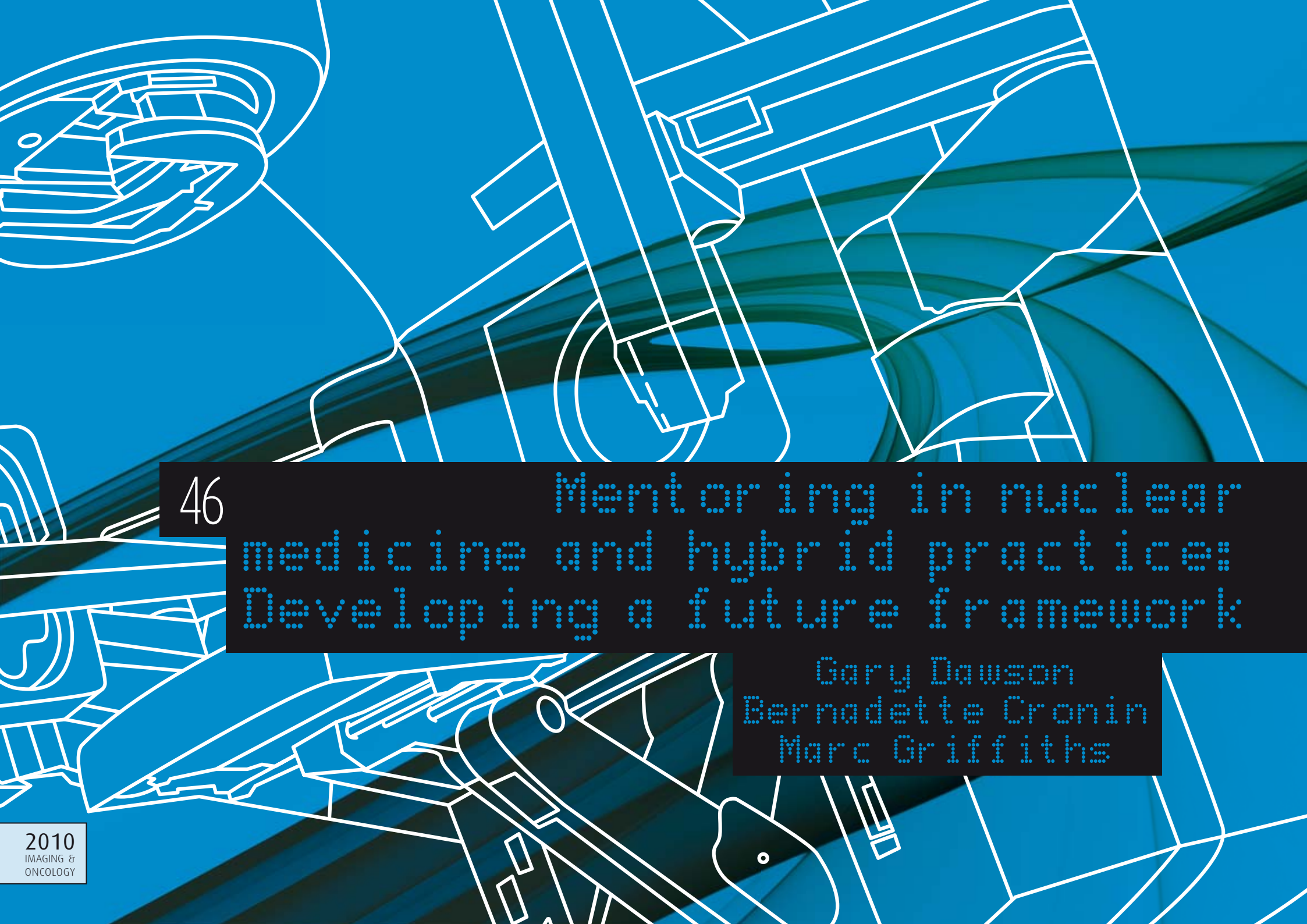

46

Mentoring in nuclear medicine and hybrid practice: Developing a future framework

Gary Dawson
Bernadette Cronin
Marc Griffiths

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Dramatic advances in nuclear medicine have been witnessed over the last 10 years. The advent of new technologies such as SPECT/CT and PET/CT has significantly influenced the working practices of the nuclear medicine practitioner. While such advances are beneficial to patient prognosis, can we be certain that the current workforce has the necessary skills to deal with such complex technological challenges?

Introduction

How do we ensure that our developing workforce is able to fully embrace these new technologies, and what support will we need to provide in the future to enable them to reach their full potential? Educators in various fields such as healthcare and industry are becoming increasingly aware of the ways in which individuals and organisations learn[1]. Clinical practitioners continue to develop learning styles within the workplace and areas such as preceptorship and mentorship have begun to emerge within diagnostic imaging and radiotherapy practice.

The Health Professions Council (HPC) has clearly identified the need for graduate practitioners to continue their learning and development post-qualification and the term 'life long learning' is a key principle of the Department of Health's (DH) framework for ongoing development within the National Health Service (NHS)[2]. The Knowledge and Skills Framework (KSF) also requires clinical practitioners to develop competencies within core dimensions in order to meet specific roles and responsibilities within the modern NHS[3]. It is hoped that these frameworks, combined with the recommendations in Lord Darzi's pivotal report[4] will provide the potential to increase autonomy among the nuclear medicine workforce.

The utilisation of a formal mentoring framework could be one such tool that aids the ongoing development of nuclear medicine practice. Mentoring allows individuals to discuss problems, reflect on personal strengths and weaknesses and importantly it encourages goal focus, thus enabling the individual to meet targets and overcome difficulties[5]. While the concept of mentorship is widely accepted by most healthcare professionals, the lack of a universal definition remains apparent[6]. Traditionally, the mentorship process has relied on the transfer of knowledge and wisdom from an experienced healthcare practitioner to one who is deemed to be less advanced in their practice[7-8].

In the absence of a universal definition of the mentoring process the Standing Committee on Postgraduate Medical and Dental Training[9] is often quoted and defines mentorship as: "*The process whereby an experienced, highly regarded, empathic person (the mentor), guides another individual (the mentee) in the development and re-examination of their own ideas, learning, and personal and professional development.*"

Mentorship in the healthcare setting

Within healthcare, mentorship is a term most commonly associated with nursing and midwifery[10,] and numerous mentorship programmes have been advocated[2] by the Nursing and Midwifery Council[11-13]. These frameworks have been designed to support the pre-registration student and have provided the mentor with a 'toolkit' that supports the student through their practical development[12]. The Royal College of Nursing places great importance on the value of mentoring: *"The importance of the role of the mentor and the quality of the mentorship offered in practice cannot be over-emphasised; learning experienced in the clinical setting ensures that the nurses and midwives of the future are fit for practice and purpose"*[13].

No reference is made to the importance of mentorship in the ongoing professional development of the nuclear medicine radiographer

Furthermore, these documents clearly define the role of the mentor and outline the levels of responsibility that these individuals need to consider. Indeed, since the updated 'Standards to support learning and assessment in practice'[11] only mentors who have completed an accredited mentor preparation programme from an approved Higher Education Institution are deemed suitable to 'sign off' students. Perhaps more importantly these mentors remain accountable to the Nursing and Midwifery Council for their decisions relating to an individual's ability to practice[13].

A great deal of support is also now offered to NHS doctors. The government has

supported various mentoring frameworks since the introduction of the 'NHS Plan'[14]. Ongoing development in this area has been directly linked to the DH's 'Improving Working Lives' initiative[15] which aimed to assess the level of support that was offered to various healthcare professionals. The undertaking of a number of working papers[16-17] clearly demonstrated that doctors could benefit from mentoring at all stages of their career and, as such, formal mentoring guidance was issued by the DH in 2004[18]. Similar support has also been forthcoming from the British Medical Association[19] and a number of the medical royal Colleges, including the Royal College of Surgeons[20] and the Royal College of Obstetricians and Gynaecologists[21].

Mentoring for the radiographer

While the above information demonstrates the introduction of formal mentoring frameworks for certain groups within the healthcare arena, have the same opportunities been offered to all healthcare professionals? If the answer to this is no, then how can we be sure that these professionals have the necessary skills or support to successfully meet the demands of the rapidly evolving NHS?

Clinical imaging services, including nuclear medicine practice, are under tremendous pressure from emerging technological advances and government aims to achieve a 'no wait' service[22-23]. New technology and evolving working practices in diagnostic imaging have changed extensively the skill requirements for modern radiographers[24-26]. Some of these new skills may necessitate the development of new learning styles and support strategies in order to meet the challenges of a 21st century healthcare system. Life-long learning is a strategy advocated by the DH[2, 27] and professional bodies such as the College of Radiographers (CoR) place learning and development at the core of the modern allied health professions career structure[28-29]. The use of e-learning resources to develop blended learning infrastructures may also further support future mentorship models and help identify learning styles[30].

If government targets are to be met and, more importantly, are to be sustainable, there must be full support for the clinical radiographer. Fortunately, this has been acknowledged to some extent by the recent DH paper 'A High Quality Workforce'[31] and the need to install formal mentoring frameworks for all is clearly advocated. Although support for radiographers may have been provided on an ad-hoc basis the first formal definition of mentorship for the profession is stated in the 'Clinical Supervision Framework' produced by the CoR in 2003, and is defined as *"support offered by an experienced professional nurturing and guiding the novice"*[32]. However, in the authors' experience, the 'novice' may actually be an experienced member of staff and this situation may blur the boundaries between mentorship and preceptorship roles.

The main purpose of the *Clinical Supervision Framework* document is to concentrate on the key principles of clinical supervision deemed fundamental to the monitoring of radiographic practice:

"Mentorship is concerned with making the most of 'human potential' and encouraging self-development...It relies on the active seeking out and challenging of practice concepts with either a peer or other members of the team"[32].

However, no reference is made to the importance of mentorship in the ongoing professional development of the nuclear medicine radiographer, which the authors consider vital for essential future clinical provision. The main points from the 'Clinical Supervision Framework' are further reinforced by the 'Radiography Skills Mix' paper[33], which details how mentorship, while able to complement other support mechanisms, should in essence be a stand-alone process independent of other practices. Importantly, any developed framework should be focused towards the psychological needs of the individual and should encapsulate the broader aspects of the radiographer role. In other words, mentorship should not concentrate solely on clinical practice, but should also enhance a range of applicable skills, in order to encourage the practitioner to engage in the sharing of good practice and learning within and across organisations[34].

What is the potential scope for mentorship in nuclear medicine?

According to the NHS National Workforce Project[34] the qualities of an appropriate mentor include:

- Self and behavioural awareness
- Awareness of the current climate influencing NHS decision making
- An understanding of current and future training needs
- A realistic appreciation of timescales and pressures impacting on a clinical service
- Communication competence; listening, observing, parallel processing and projecting
- Conceptual modelling and goal clarity

However, within a clinical nuclear medicine environment there does not appear to be a clear definition of who the mentor should be, or how training should be undertaken. Rapid developments in technology such as hybrid imaging are demanding greater levels of analysis, problem solving and critical evaluation of daily clinical practice[35]. Mentorship within an evolving environment is a role that should be undertaken by someone with experience, a critical understanding of the service requirements and in possession of skills to nurture the workforce. Unfortunately, within the United Kingdom research of the available literature fails to identify a transparent mentorship role within nuclear medicine practice. However, this type of development does appear within the education frameworks of other countries[36-37].

Here in the UK we need to develop and implement a robust mentorship framework specifically focused on our nuclear medicine practice, or we face being left behind by countries such as North America and Australia. A national mentorship framework is required and the University of the West of England (UWE) in Bristol has begun this process by collaborating with representatives from clinical practice and students who enrol on the nuclear medicine programme. By utilising aspects of existing mentorship frameworks from other national professional bodies and guidance from international colleagues, the remainder of this article will focus on preliminary research findings

of a student support scheme initiated as a collaborative partnership between clinical stakeholders in the NHS and UWE.

Formulating a mentorship framework

At UWE a formal method of clinical mentoring has become an integral aspect of the Nuclear Medicine Programme. The importance of this aspect of the course was highlighted during a re-validation event in 2008, after discussions around skill mix and developing the nuclear medicine workforce in order to encompass *"new ways of working"*.

In order to fully evaluate the relevance and level of required mentorship within the Nuclear Medicine Programme, an action research study was performed (Figure 1). The action research process firstly identified the traditional support methods for practitioners working in nuclear medicine and was undertaken by the academic team at UWE. This initial scoping exercise identified the following core support dimensions:

- Academic and practical day-to-day advice
- Traditional face-to-face support during academic contact
- A focus on course completion, rather than establishing a specific career pathway

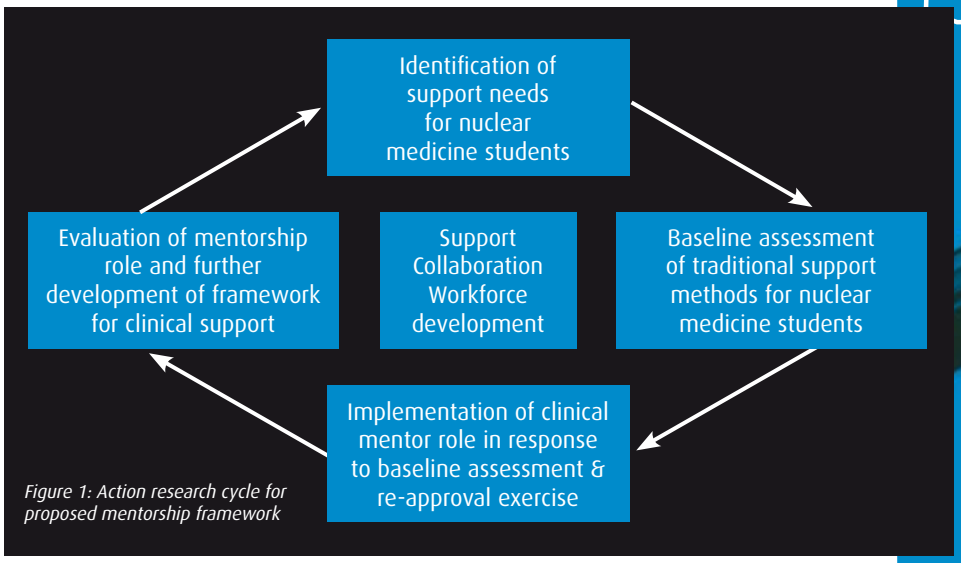
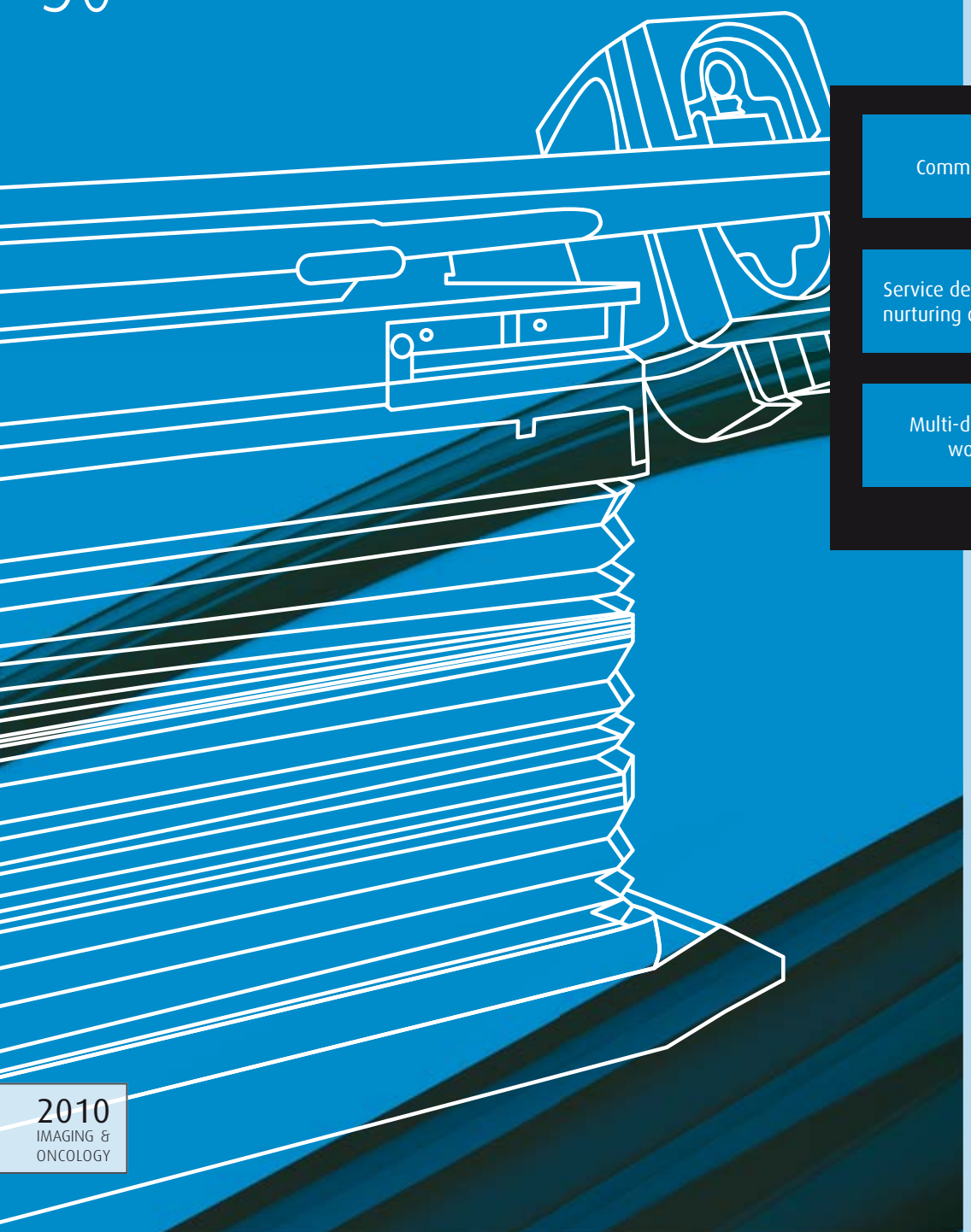


Figure 1: Action research cycle for proposed mentorship framework

The second stage of the action research process – utilising an ethnographic approach – invited clinical stakeholders to discuss and share their experiences of mentorship at a knowledge exchange (KE) study day. Ethnography was deemed appropriate for this part of the study, as it allows researchers to engage with workers from clinical practice where cultural changes have been brought about by developments in technology and technique[38]. An evaluation of cultural changes allows researchers to consider the 'lived experience' of the subject group, which in this case enabled evaluation of everyday experience. This information was gathered during the KE event, where clinical stakeholders were asked a series of questions using an interactive voting



system (Turning Point Technologies™), based upon initial discussions. The agreed core dimensions of a possible mentorship model were summarised and are indicated in Figure 2. These reflect the mentoring framework advocated by the NHS National Workforce Project[34] and have since been discussed with the current students on the Nuclear Medicine Programme.

Communication	Radiation safety & practical working	Workforce development & skills assessment
Service development & nurturing of junior staff	Networking & collaboration	Promoting an enquiring mind/questioning
Multi-disciplinary working	Research/innovation/ audit	Delegate responsibility appropriate to the mentee's ability

Figure 2: Agreed core dimensions of a potential nuclear medicine mentorship model

Following on from the KE event, an action plan was developed which encouraged the clinical stakeholders to utilise the core dimensions of the suggested mentoring framework within clinical practice. The success of this implementation was subsequently evaluated by students, through the creation of an online survey and by interviewing a representative sample of the mentors.

Evaluating the students' past and present experiences of mentorship provided the researchers with a greater understanding of their specific needs. The majority of responses appeared to link with previously identified core dimensions from the clinical stakeholders, thus highlighting an apparent consensus of opinion around the value of mentorship within nuclear medicine practice. Overall, the responses from the students were positive, with the entire cohort agreeing that mentorship was valuable and key to personal development. It was apparent that most of the cohort had not previously experienced a formal method of mentorship, even though the average qualified time was between three to five years. Specific qualitative responses included:

"It is an essential system for monitoring the development of new staff, as well as reinforcing the basic skills to the senior staff members."

"A good mentorship programme should enable the department to develop and identify the training needs of individuals. I think it's really important to have a mentor, as it will help with career progression."

In order to complete the action research cycle, a representative sample of clinical mentors were interviewed in order to explore their own personal experiences of the newly implemented role. Overall, the feedback relating to the role was positive and the qualitative comments included:

"I didn't feel I had a base to start from with regards to mentorship, even though I had previously supported students on the programme."

"I wasn't aware that I had to facilitate student assessments. I think the day also taught me to take a step back sometimes with my workforce and let them think things through for themselves, provide support where required, but facilitate rather than micro-manage."

"It's almost like creating a new sphere of responsibility within your clinical nuclear medicine department. However, the impact of mentorship on other members of staff within your department also needs to be considered, in terms of the overall department dynamics."

"Mentorship is positive and should be promoted. It should be enhanced within an educational programme and linked to the learning contract that is currently in place on the course. This will help formalise dates and times of meetings between the mentee and mentor. This will also help to identify any areas of the student's work that requires development and support and praise any aspects of good practice. It should also encourage interaction, communication and reflection on working practice."

The feedback from the interviews was also followed up by a case study review of a mentorship programme within a nuclear medicine department. A department manager provided an account of the benefits of mentorship within nuclear medicine:

Case Study: Mentoring in nuclear medicine & PET/CT

In a busy NHS where clinical demand continues to grow at a faster rate than the available resources, it is unlikely that Trusts will be able to afford, or be willing to justify, employing staff where time set aside for mentorship provides a whole or part of their job plan. Thus time, perhaps one of the most useful tools in this process, may be the most challenging resource to find, and the traditional model of a mentor-mentee relationship will need to be adapted.

Where possible, opportunity should be provided for the mentor and mentee to work together to maximise the benefits of this relationship (Figure 3). However, it should be remembered that learning is bi-directional and so although mentorship is primarily designed to develop the mentee, both participants should benefit and, as continued professional development is a requirement for all allied health professionals going forwards, it would not be unreasonable to expect individuals to contribute some of their own time to this process.

Figure 3: Example of clinical mentorship in the workplace, working together, the mentor and mentee can share good practice and develop the clinical service.

Therefore, in a busy department where the mentor and mentee may be working in separate areas, time could still be found during breaks or before and after a shift to discuss work done and learning experiences. To facilitate this arrangement, the mentee could, for example, keep a diary, which would provide a framework for discussion during these meetings. The key to achieving success in this type of environment is to develop and nominate mentors who are committed to teaching and willing to work hard. The reward being not necessarily of financial gain, but rather the knowledge that they have really made a difference by helping another professional to develop.

The future?

There may be a requirement for a blended approach of clinical supervision encapsulating mentorship and preceptorship. This role may require the collaborative involvement of higher education institutes and at UWE, trainee mentors have to attend and complete a Facilitating Learning and Assessment in Practice (FLAP) module in order to formally assess students in the clinical environment. However, a robust system is required in order to audit and assess the mentors within practice. Within the nursing profession this is monitored by the Nursing and Midwifery Council and places accountability on the clinical mentor to perform their role with an up-to-date knowledge base and relevant practical skills. The authors advocate a similar system within radiography and nuclear medicine, whereby mentors are formally accountable to the HPC.

Mentorship within nuclear medicine may also involve practitioners from other professions, such as cardiology, oncology and neurology. As skill mix becomes increasingly important within the patient's journey, there may be a requirement to include mentorship from outside the immediate nuclear medicine domain. This is particularly important as practitioners develop greater autonomy within the workplace and become more involved in decision-making processes. Figure 4 provides an example of the level of training/development that is required to utilise CT effectively within an appropriate operational framework in a hybrid environment. The increase in the number of diagnostic capable CT units within a hybrid environment requires appropriate workforce training and mentorship models.

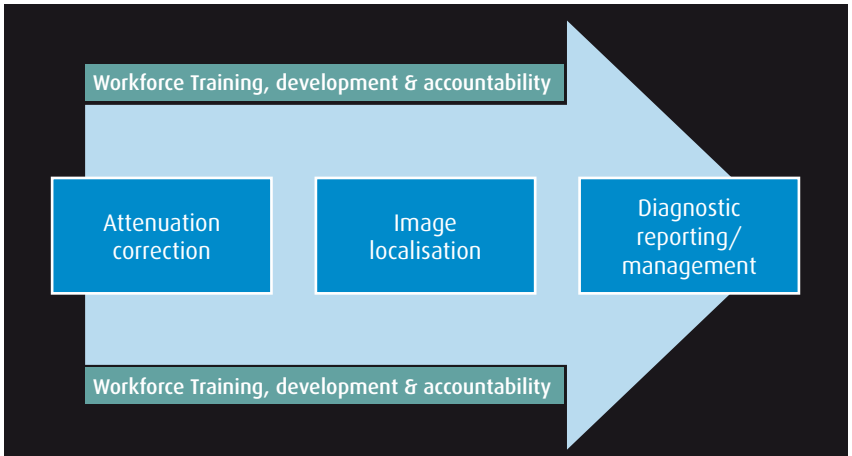


Figure 4: Potential use of CT in a hybrid environment and level of workforce development required

Conclusion

There is no doubt that well structured, good quality mentorship in a clinical environment can bring about vast benefits, not only for the mentee but also for the mentor, the organisation, the wider profession and, of course, the patients who rely on us to provide high quality care and expertise. As hybrid imaging becomes more widely available, the role of the mentor will evolve, and the knowledge and skills required to deliver this role at an appropriate level will increase. A department staffed by a mix of radiographers and nuclear medicine technologists who have entered the profession through a variety of routes presents a unique challenge. Introduction of a mentorship programme would have to be structured flexibly to ensure that the mentor was able to provide the right level of support to each mentee.

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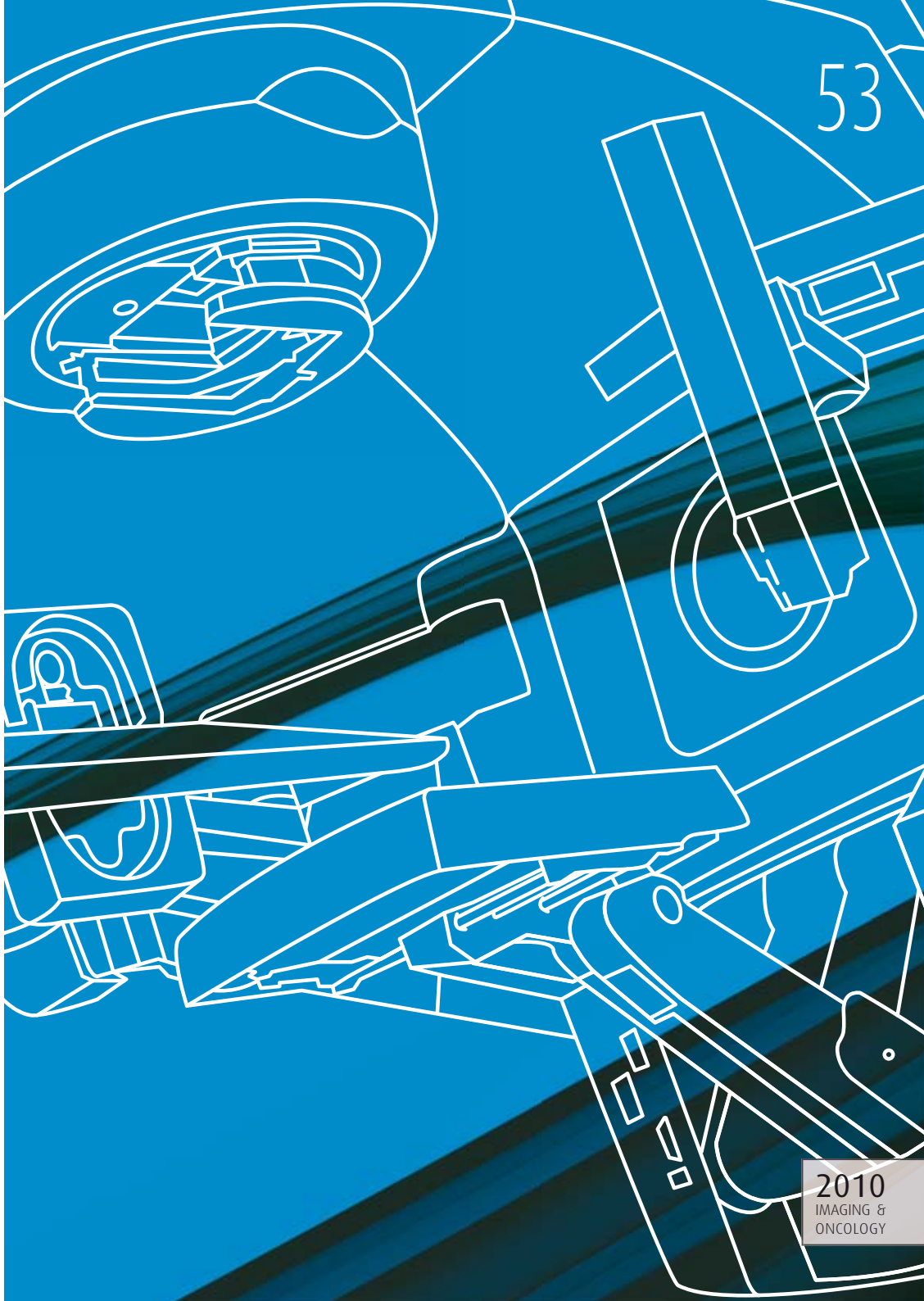

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Patient centred quality care: Radiographer led brachytherapy and novel service redesign

Lisa Punt

2010
IMAGING &
ONCOLOGY

Breaking down professional barriers and challenging traditional boundaries can lead to a novel and highly effective radiographer led service, ultimately putting the patient at the very heart of quality care.

Introduction

Innovation and modernisation have been high on the agenda for the Department of Health during the last decade. Publication of the NHS plan in July 2000 highlighted the need for financial investment and reform to ensure the UK had an NHS service fit for the 21st century[1]. The plan recognised the failings of an out of date operating system that lacked equitable care, disempowered patients, up-held 'old fashioned' demarcations between staff, and had no clear incentives or levers to improve performance[1]. It was clearly identified that, hand in hand with increased funding, new ways of working would be needed if our NHS was to become a world leader in healthcare delivery.

In 2000, the Department of Health published the *Meeting the challenge* document, which set out to identify the pivotal role allied health professions would have in implementing innovative, patient centred practice and service delivery that would ultimately improve patient outcomes[2]. The document identifies the government's recommendation for the development of consultant therapist posts, with key responsibilities to strengthen professional leadership whilst influencing service improvement.

This article describes how successful service redesign, in the form of a radiographer led vaginal vault brachytherapy service, has been implemented by a consultant radiographer. Through novel ways of working, skill-mixing and breaking down traditionally held professional boundaries there has been greater patient throughput, better equipment utilisation, improved patient continuity and improved quality of care. Other factors required for the success of this service included advanced clinical skills, strong leadership skills, and a clear service need.

The first UK radiographer led new patient clinic for adjuvant pelvic radiotherapy in endometrial cancer is now well established. However, a continued focus on service need, training and service delivery, and audit is required if the service is to be sustainable. Results of a recent evaluation audit of this service will be discussed.

Radiographer led Vaginal Vault Brachytherapy (BT) service: Background

Vaginal vault BT is predominantly used in the adjuvant setting for treatment of endometrial cancer[3]. It may be used in conjunction with external beam radiotherapy, offering a boost to the top of the vaginal vault or alone to minimise the risk of recurrence within the vault for those women with low-intermediate risk endometrial cancer[4]. The planning process involves vaginal examination to assess the capacity of the vagina followed by a sizing procedure, using dummy tubes, to measure the vaginal length and diameter of treatment tube required. Historically, this procedure – together with the treatment process, consent and follow-up – was undertaken by a clinical oncologist.

Service need: new ways of working?

In the early days of developing a radiographer led service for vaginal vault BT the driving force behind role development and skill mix changes was a need to improve equipment utilisation and reduce inpatient stays. At the time, low dose rate BT equipment was in general use and the treatment procedure involved overnight admission due to the 10-12 hour treatment times. Treatment days were limited to the two days when oncologists were available to plan and deliver the BT, thus limiting the patient throughput and increasing waiting times. In order to optimise treatment it was clear that with novel and cross boundary working there was a potential to increase patient throughput and reshape service delivery.

Following initial consultation with the local lead clinical oncologist, a competency programme was designed, to evidence expert practice and role development in this field of practice. The clinical education programme included patient consent, vaginal examination, brachytherapy procedure and on-treatment review.

With novel and cross boundary working there was potential to increase patient throughput

Training was undertaken with the supervision of the local clinical oncologist whilst academic learning was evidenced through a work-based module in gynaecological oncology. This module was supported by the multi-professional team within gynaecological oncology and accredited by Sheffield Hallam University. Partnership with higher educational institutions provides essential support in developing work-based or role dependent education programmes and through a portfolio of evidence is able to demonstrate breadth and depth of learning. Reflective practice is also a key skill associated with high levels of clinical reasoning and autonomous practice[5].

With training complete, the entire treatment pathway from consent through to discharge is now undertaken by a radiographer (Figure 1).

Figure 1: Patient pathway for vaginal vault brachytherapy

The benefits of service development

The implementation of a radiographer led service allowed flexibility within the system and increased the number of available appointments. Patients were offered the choice to attend for treatment at 8am, which meant that the procedure could be carried out as a day case, reducing the number of overnight admissions and allowing more treatments to be undertaken each week. With the advent of high dose rate (HDR) equipment in 2005, the service has continued to be radiographer led as an outpatient service. HDR BT is given in three sessions, as opposed to the two sessions previously used with low dose rate BT. This, allied to a general increase in patient numbers, has resulted in up to nine patients requiring treatment in any one week. Availability of the radiographer led clinic has meant that the workload could be managed easily without increasing patient treatment waiting times. Continuity for the patient has also been improved with implementation of this pathway.

Novel practice

Installation of the HDR unit also brought with it the need to consider and implement further role development. With this new equipment it was now possible to consider implementing image guided brachytherapy (IGBT), which in 2005 was recommended by the European Brachytherapy Society as the way forward in the treatment of cervical cancer. This three dimensional, image based, conformal treatment planning results in an improved dose to tumour target while reducing the dose to organs at risk. Pötter et al in 2007[6] published a seminal paper reporting a three-year pelvic control rate of 96 per cent for tumours 2-5cm and 90 per cent for tumours greater than 5cm. These figures, together with a 2 per cent incidence of grade 3-4 toxicity for bladder and bowel, were impressive. The benefits of combining interstitial and intracavity BT for patients with insufficient response and/or unfavourable topography following External Beam Radiotherapy (EBRT), also improves tumour coverage[7] and achieves excellent local control rates[8].

To facilitate implementation of this complex treatment technique, the use of different skills mix within the current team was required to ensure optimal cost-effectiveness of the new IGBT service. One potential area for further radiographer role development is the management of patients with endometrial cancer requiring consideration of adjuvant radiotherapy.

Development of a radiographer led clinic for adjuvant radiotherapy (RT) in endometrial cancer

In July 2008, the UK's first radiographer led clinic was established to manage women for consideration of adjuvant radiotherapy for endometrial cancer. All women diagnosed with an epithelial endometrial cancer at this trust are now seen by the consultant radiographer following discussion at a multidisciplinary meeting. The process is shown in Figure 2. The initial consultation with the consultant radiographer involves:

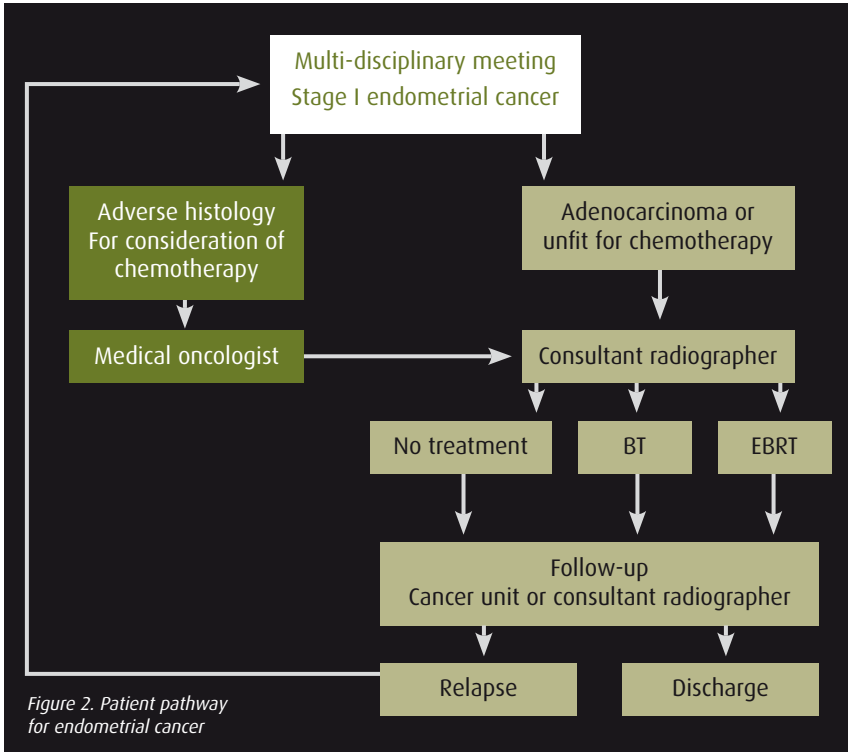


Figure 2. Patient pathway for endometrial cancer

Full history. Details of social history, past medical history, performance status, drug history and presenting symptoms are taken.

Assessment of pre-existing contraindications to pelvic radiotherapy. Evidence suggests that the risk of long-term, serious permanent damage to the bowel and bladder following pelvic radiotherapy is significantly increased in patients with pre-existing bowel and bladder problems[9]. Knowledge of such contraindications will allow the patient to be fully informed about the potential risk of developing late effects from the treatment and may influence their choice of treatment.

Discussion of histological findings. Provision of detailed information regarding histology findings to include disease stage, grade, lymphovascular space status and cell type are discussed together with risk of relapse.

Discussion of treatment options. The patient is fully informed of the treatment options

for adjuvant radiotherapy, including the potential benefits and complications relating to their stage of disease, histology, contraindications and preferences.
Options for discussion include:

- Active surveillance (AS): The patient will undergo regular follow-up with radiotherapy reserved for potential relapse within the pelvis.
- Brachytherapy (BT): Reduces the risk of vaginal recurrence to less than 5 per cent[10]. EBRT may be reserved for potential relapse within the pelvis.
- EBRT: Reduces the risk of pelvic recurrence (vaginal and nodal) to less than 5 per cent[10].

Current evidence suggests that for intermediate risk or high risk early-stage endometrial cancer adjuvant EBRT cannot be recommended with the aim of improving overall survival[11]. The patient faced with a treatment choice will often need support and time to make a decision regarding treatment that they feel comfortable with.

Consent

Appropriate written information and patient specific risks associated with treatment are discussed and documented.

Planning and treatment review

If the patient proceeds with EBRT they will be reviewed during their treatment course by the consultant radiographer with management of acute toxicity as appropriate. Those women proceeding to brachytherapy alone will be managed within the radiographer led clinic with vaginal sizing, planning from standard plans and treatment being carried out by either the consultant radiographer or the advanced practitioner in gynaecological oncology.

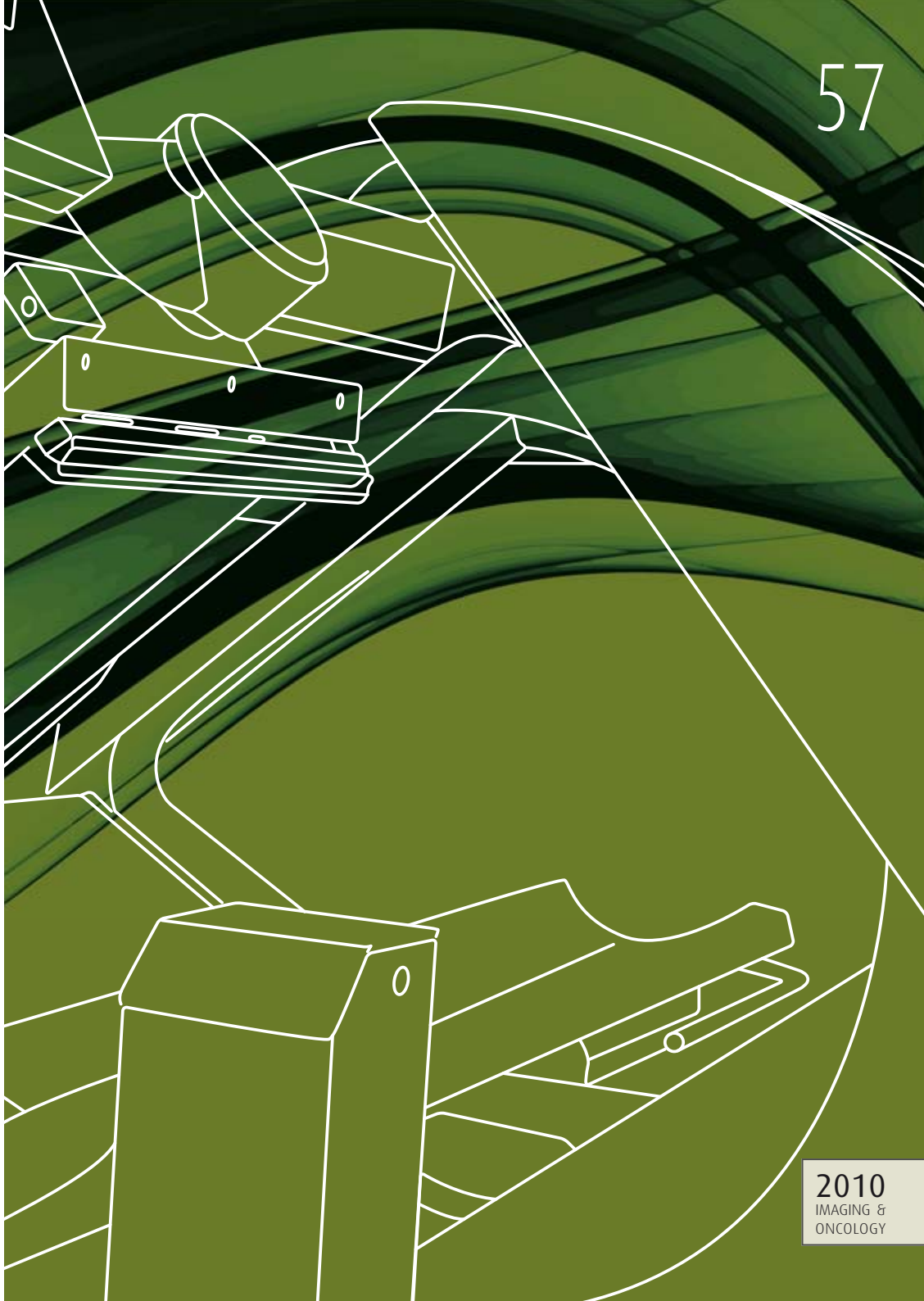
Those women who choose to have active surveillance will be monitored closely by the consultant radiographer (or local surgeon if referred from a cancer unit) for five years.

Evaluation

With the implementation of this novel radiographer led patient service for the treatment of stage 1 endometrial cancer, evaluation is important to consider the impact of change on the quality of service delivery. To evaluate this new service, a retrospective audit of one aspect – the quality of recorded consent within new patient letters – was undertaken; methodology and results are described in the next section. This was a repeat of a previous audit undertaken by the oncology doctors to look at quality of consent by consultant oncologists and registrars. Further evaluation of efficacy of skill mix change on patient treatment management is required.

Method

All women with a stage 1 endometrial cancer who had been seen in the new patient clinic by the consultant radiographer between July 2008 and September 2009 were identified using the hospital patient information system. New patient letters were reviewed on the electronic patient records system. Comparison was then made



to a previous audit undertaken by the oncology doctors between July 2006 and June 2007.

Audit standards

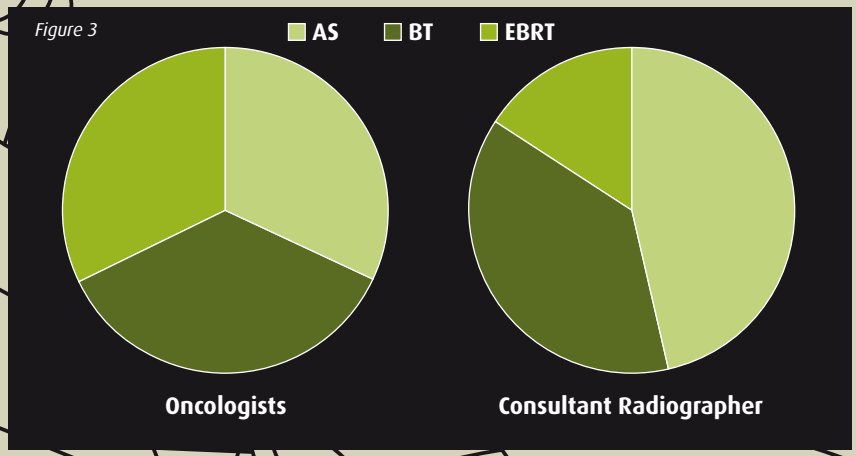
1. Record of three treatment options discussed: 100 per cent
2. Risk of bladder and bowel toxicity assessed: 100 per cent
3. Record of discussion of treatment related late side effects: 100 per cent

Results

Between July 2006 and June 2007, 22 new patients were seen by the oncologists and between 2008 and 2009, 26 new patients were seen by the consultant radiographer. Results for the standards relating to documented evidence that treatment options were discussed, risk of late toxicity and risk factors identified are shown below. Treatment choice (Figure 3) was evenly distributed between the three treatment options in those patients seen by the oncology doctors (AS-32%, BT-36%, EBRT-32%). However, in the patients seen by the consultant radiographer (AS-46%, BT-38%, EBRT-16%), fewer women opted for EBRT (16% v 32%). This may reflect the interpretation of the preliminary results of the PORTEC II study[12]. This study was the first randomised trial comparing the efficacy of vaginal vault brachytherapy and EBRT to determine which treatment provides optimal local control with best quality of life. The conclusions from the study were that vaginal BT is effective in preventing vaginal recurrence, and whilst there was a slight but significantly increased pelvic failure in this group compared to the EBRT arm, distant metastases, overall survival and relapse-free survival were similar in both groups.

	Treatment options discussed	Late side effects recorded	Risk factors recorded
Consultant oncologist	93 per cent (13/14)	100 per cent (14/14)	**93 per cent (13/14)**
Oncology registrar	38 per cent (3/8)	63 per cent (5/8)	**63 per cent (5/8)**
Consultant radiographer	96 per cent (25/26)	100 per cent (26/26)	**96 per cent (25/26)**

Figure 3



Discussion

The quality of documented consent in the consultant radiographer letters was comparable to that by the consultant oncologists. Oncology registrars performed less well and this is most likely due to the learning curve of junior registrars who were audited during the evaluation. Education and training of registrars must remain a priority in areas of clinical practice in order to prevent deskilling, especially as these practices are now managed by different professional groups. A training and assessment programme has therefore been implemented by the consultant radiographer for all registrars during their six month clinical placement rotation with the team, both in the new patient clinic and the brachytherapy clinic.

This audit has demonstrated that the quality of consent information and advice women are now receiving is comparable to that given by consultant oncologists. This shows that redesign of the patient pathway has facilitated the most appropriate and cost-effective use of medical skills for undertaking complex treatments. It has also led to the successful development of a radiographer led service for endometrial cancer patients that includes leading the development of education and training programmes for oncology registrars and leading service development and research activity, whilst offering a high-quality clinical service. A follow-on prospective study of patient satisfaction will be undertaken in the near future.

The quality of documented consent in the consultant radiographer letters was comparable to that by the consultant oncologists

Conclusions

The allied health professions play a fundamental part in the patient pathway and with developed clinical skills are in an ideal position to positively influence patient outcomes and to shape the future of the NHS. Those who choose to take on leadership roles and challenge traditional boundaries of working should harness the skills of those around them, ensuring at all times a level of integrity, transparency and inclusiveness that leads to the highest possible level of service delivery. At my cancer centre there are now two consultant therapeutic radiographers, the second working in the field of neuro-oncology. Both roles have been created and developed as a direct response to service need, with the remodelling around both site-specific areas increasing patient throughput, increasing equipment utilisation, improving patient continuity and facilitating valuable research. Such initiatives are essential if the NHS is to continue to deliver sustainable, high-quality services.

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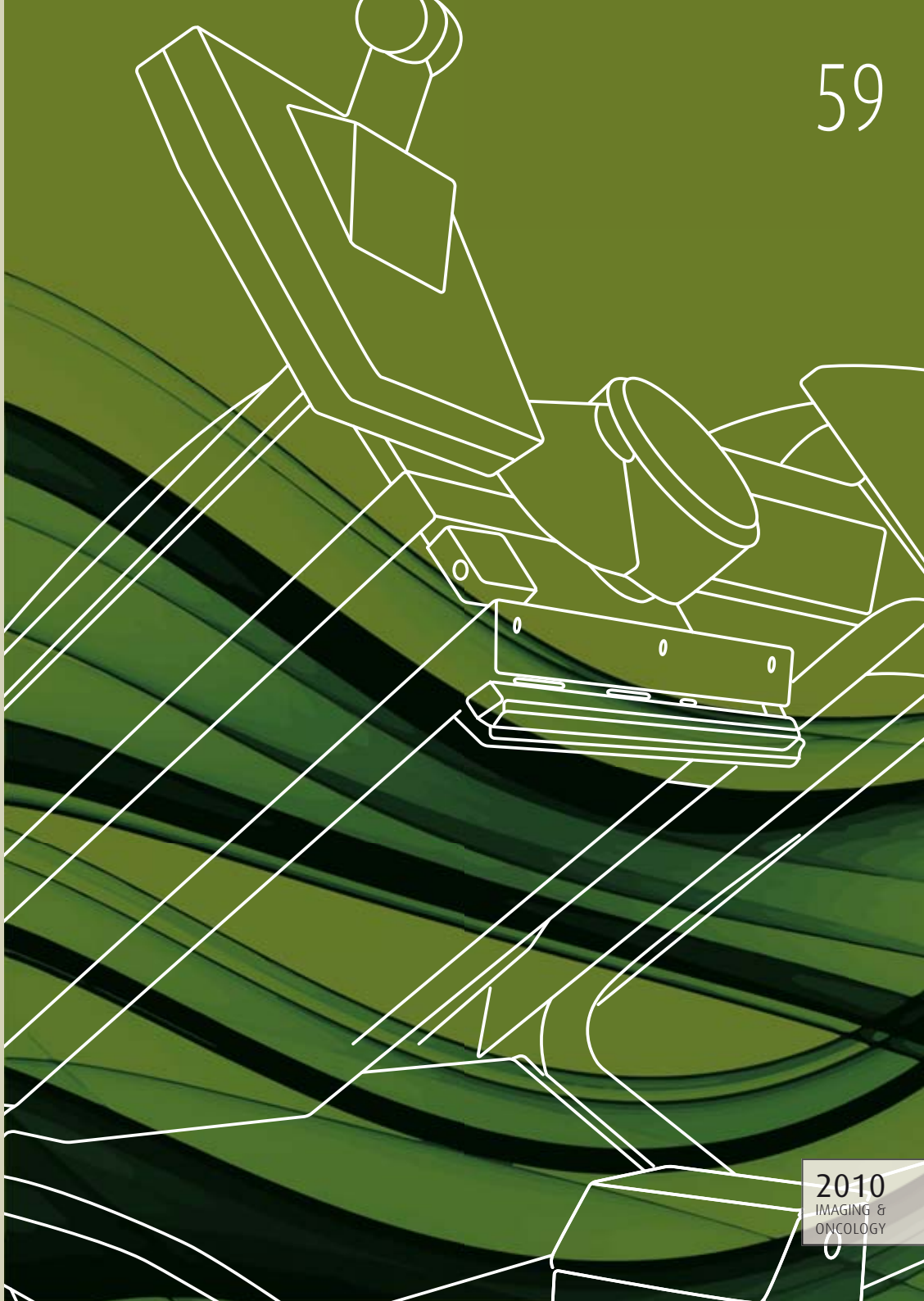

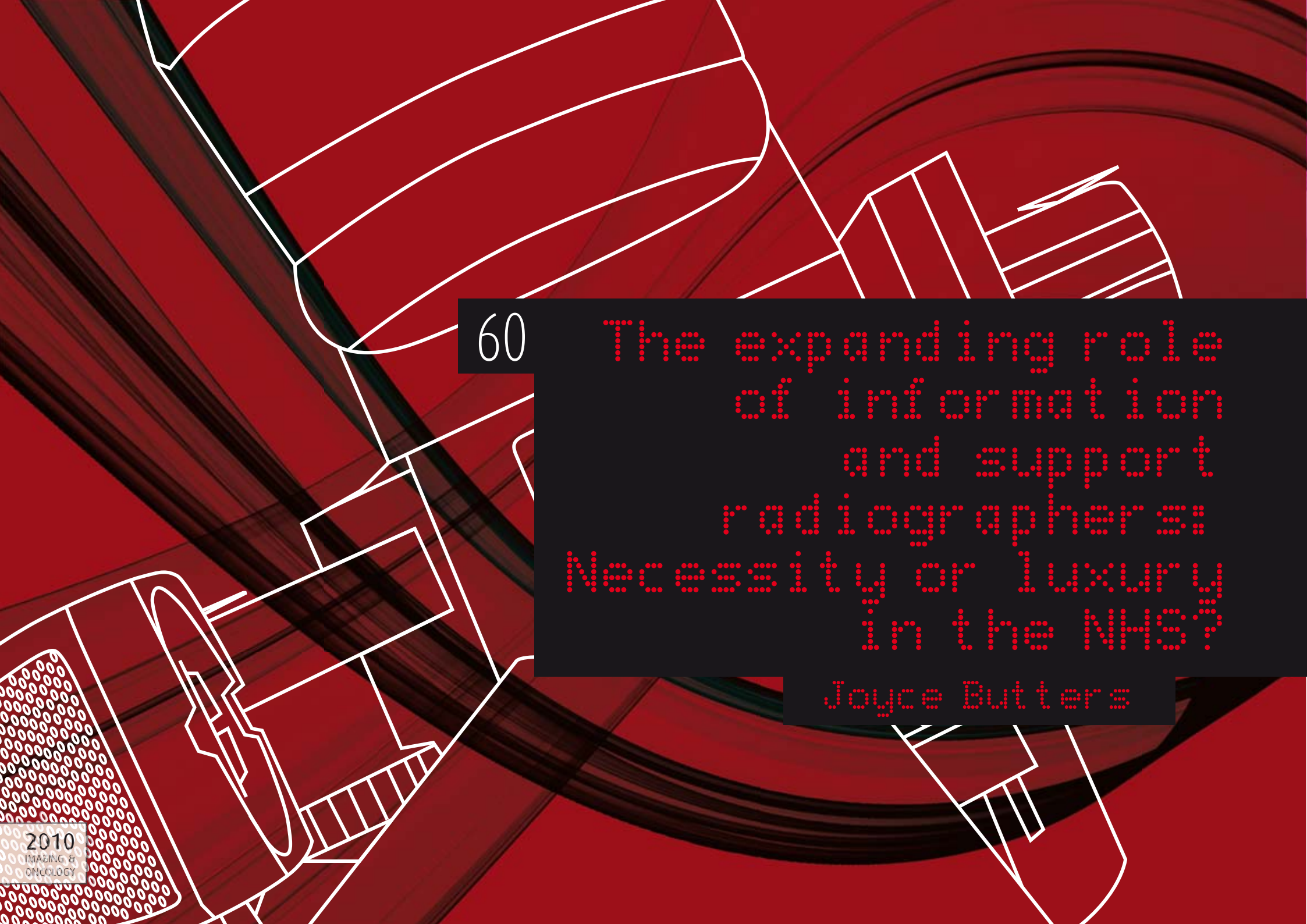
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The expanding role of information and support radiographers: Necessity or luxury in the NHS?
Joyce Butters
2010
IMAGING & ONCOLOGY

What are information and support radiographers and just how valuable are they to their patients and colleagues?

Introduction

Radiotherapy departments aim to provide a responsive, patient-centred service. Some centres have information and support radiographers (ISR) to provide additional help for patients. These posts are funded commonly by either the Macmillan Cancer Support charity or by National Health Service (NHS) trusts themselves. The ISR role – Macmillan funded or not – is not evident in all NHS radiotherapy departments. Perhaps those radiotherapy managers without ISRs view them as a luxury, whilst maybe those with ISRs consider them essential to services. As an ISR, I will define my role and then let the reader decide whether I should be viewed as a necessity or luxury within today's NHS. I will describe my role as a Macmillan ISR, as ISRs in different trusts will have slightly different approaches.

The Cancer Reform Strategy highlighted that a top priority is a need to achieve coordinated and integrated care for cancer patients[1]. For this to happen, developing the role of therapeutic radiographers is essential. Role development is not new and has been aided by the introduction of the career progression framework. Arguably, to provide information and support is a basic, integral skill of all radiographers, so is it necessary to develop this skill further? Or is it a luxury and therefore a waste of precious resources?

When was the ISR post established?

The Macmillan organisation believes passionately in patient-centred care and to achieve this, working with the NHS, they have provided resources for many professional roles including ISRs. Macmillan funds the post for three years and then it is anticipated that the trust will fund the role permanently although the Macmillan title is retained. The first Macmillan nurses were appointed in 1975[2]. Since then, Macmillan has diversified and developed the skills of other professional groups, including therapeutic radiographers. The first Macmillan ISR post was established in 1991 and currently there are more than 40, at least half of which are Macmillan[3, 4].

The Macmillan ISR post at Velindre Cancer Centre

My post as Macmillan ISR, which began in 2002 at Velindre Cancer Centre, provides a service for patients receiving radiotherapy within the South East Wales Cancer Network, which has a population of one and a half million. I have diplomas in therapeutic and diagnostic radiography. I am also a British Association of Counselling and Psychotherapy (BACP) accredited counsellor.

My responsibilities include the development and application of a high quality and integrated research-based support service for patients receiving radiotherapy and I am a resource within the SE Wales Cancer Network for providing expert knowledge to support the multi-disciplinary teams. My remit is to:

- Provide clear and consistent pre and post treatment information and support, as an independent practitioner, to any Velindre NHS Trust patient receiving radiotherapy[5].
- Support through advice, advocacy and counselling, patients and their families from diagnosis to completion of treatment with particular reference to the implications of the condition and treatment.
- Develop and maintain a multidisciplinary service to patients receiving radiotherapy in conjunction with nursing staff, lead clinicians and other healthcare professionals.
- Provide education and advice on all aspects of radiotherapy to multidisciplinary groups both in hospital and community environments.
- Assist in the induction of new staff from all disciplines based in the hospital, incorporating teaching and learning principles into professional practice.
- Communicate and liaise with other disciplines within the trust and in the community ensuring provision of an integrated and coordinated service to patients.

> Three quarters of people experience anxiety as a result of their cancer but less than half receive information, advice, support or treatment for this

Referrals are mostly informal and from therapeutic radiographers, but also self-referrals or referrals from other hospital employees are accepted. These are documented to enable audit of the service. A mutually convenient time is made for me to see the patient, ensuring they can relax knowing I have the time to spend with them. Inevitably, a practical question about their disease and treatment will reveal emotional difficulties underlying the patient's ability to cope. Methods to manage these anxieties are discussed and implemented if appropriate.

I work integratively as a BACP accredited counsellor. It is important to establish rapport, using empathy, congruence, and by being non-judgmental. Then I can begin to apply

relevant models of counselling. This raises the patient's awareness, in a relatively short time, of their values and beliefs which enables them to transform their thoughts, feelings and behaviour. This can have a profound and positive effect on their lives and of those around them, even though they have cancer. In fact, nearly half of people with cancer say the emotional aspects of cancer are the most difficult to manage[6]. I feel it is relevant for my counselling expertise to be used for this service to help ensure that cancer patients benefit from the expansion and development of psychological therapies[1].

So is an ISR a necessity or luxury?

A necessity is defined as a pressing need, want or desire. A luxury is something relatively expensive adding to pleasure or comfort but not indispensible[7]. I believe the ISR role is most definitely a necessity, but to answer this question we need to look at the evidence. In light of the lack of evidence surrounding the Macmillan ISR post, in 2003 the role and service provision was evaluated through a national audit (unpublished)[8].

A questionnaire was piloted in Maidstone and 13 centres took part. The aim of the audit was to identify whether Macmillan ISRs made a difference to patients and colleagues and, if so, how. In 2004 and 2006 patients, clinicians and other health professionals at Velindre were invited to complete the same questionnaire in order to evaluate our information and support service.

All audits showed that overall the patients were very complimentary about the service, expressing gratitude for the level of support provided as well as the information. One said: *"Myself and my wife found the help invaluable and would not have managed throughout my treatment if it was not for her [ISR]."*

Clinicians felt that the service improved patient understanding of cancer and its treatments. Radiographers' responses showed that they felt the best aspects of the Macmillan ISR service fell into five categories. These were the provision of time, availability, counselling, holistic care, and information and advice. One radiographer observed: *"She provides holistic care for the patients and is well informed to deal with most situations, be they emotional, psychological, financial or social."*

Feedback from other staff groups included nurses, allied health professionals and community palliative care teams. Their responses could be categorised into six groups:

1. Information and support before, during and aftercare of radiotherapy
2. Ease of contact and approachability
3. Liaison
4. Multi-disciplinary input
5. Counselling
6. Educational resource

In particular, staff commended the information provided on recent treatment developments, which they felt was accurate and easily understood[9]. Having a named person fostered good relationships with patients. They were easy to contact, available at all stages of the patient's journey, and provided holistic care thus creating a flexible, user-friendly service. One participant commented: *"Having a person in the department who is around and easily contacted [is good]. A person who is not just a voice on the telephone. Someone who is friendly and always available to give advice."*

The role was seen as bridging gaps between services, for example by providing a useful link between the hospice and community teams. *"The Macmillan ISR gives a lot of extra advice, eg benefits and social security due to a lack of social worker on site"* [sic], *"A 'can-do' person."*

The Macmillan ISRs were seen as a valuable educational resource for patients and staff, not just verbally but also in the production of patient information leaflets and policies[9]. Overall, the service was considered excellent, and was valued by patients and staff alike.

Improved communications and the experience of patients having radiotherapy

All categories suggested that services in trusts with no ISRs may improve if some were appointed. The specific expertise provided by the senior experienced therapeutic radiographer in this role seems to be recognised by professionals, patients and carers alike. While this promotes high-quality care, these professionals are in short supply and employing them in this role will take them from the 'shop floor' of treatment. With the rapid advancement of technical innovations in treatment units, therapeutic radiographers may have a greater choice of role development in the future. Those more holistically-minded may want a greater role in patient care. Becoming a Macmillan ISR may provide that opportunity. Retention of these experienced staff will help to ensure patients have a seamless package of care at our cancer centres[8].

Audits of the Macmillan ISR role at Velindre Cancer Centre in 2004 and 2006 concluded that it improved communication and the experience of patients having radiotherapy. Almost all patient comments were complimentary, however one patient said "I do not remember meeting you" (I had given him advice and support over the phone to give up smoking). Another thought "the service deserves better accommodation" (my first room was tiny). And another found the Macmillan ISR "difficult to contact" (I now have an answerphone).

During the two years between these audits the role was further developed with an increased emphasis on education, clearer feedback for clinicians and other support staff, and improved communication with other disciplines. Furthermore, patients are now informed of the service at the beginning of their radiotherapy pathway.

It is pleasing and reassuring to see that future therapeutic radiographers are very aware of the value of this role in a radiotherapy department. Data collated from a final year Cardiff University radiotherapy student's dissertation in 2008 concluded 'availability of resources and support from staff, whilst they are constantly improving, still show room for development'. The study recommended continued financial support from the government, more specialised staff and raising awareness amongst radiographers of the vital role of ISRs in supporting the service[10].

The role of the ISR at Velindre Cancer Centre has expanded within the confines of being a lone worker. The main expansions have been:

- The emotional support to patients and family as an accredited counsellor. To have this service provided at the time of need has made a huge difference to people as waiting for referrals to specialist services when in crisis makes the intervention too late. Timely intervention of the ISR also helps the patient cope with their treatment and this in turn makes it easier for staff to manage the patient.

- Site specific written radiotherapy information which helps with issues around informed consent and compliance. Producing this to Plain English standards has helped patient understanding of what radiotherapy will mean for them[11, 12, 13]. This is important as up to three quarters of the population may have reading and comprehension difficulties, which can affect understanding[9].

- Open evenings. These are multi-disciplinary and held once a month with radiographers, specialist nurses, volunteers and patients who have experienced radiotherapy. These evenings can help to relieve anxiety for patients and their families who are waiting for their treatment to start. They are informal and friendly which give an excellent first impression of the department and so help to allay fears[14].

- Distress thermometer. This is a psychosocial assessment tool which is helpful for discovering what is worrying a patient. These issues can then be addressed more quickly[15, 16].

- Student learning. A collaboration between the university, the radiotherapy department, patients and carers to help students gain empathy.

- The requirements of disabled people and information for patients with learning disability. This is an area where more work needs to be done[17] and the ISR is best placed to tackle this issue.

Cancer patients' experiences indicate a lack of generic information on subjects such as finances, diet, complementary therapies, psychological support, body image, support groups and family history risks[1]. The ISR can refer to or direct these patients to relevant areas. In particular, ISRs need to recognise and assess psychological needs as there is much evidence which demonstrates the efficacy of psychosocial support in reducing anxiety and improving quality of life in cancer patients[18].

Many readers may be unaware that people living with cancer may, as a consequence, develop organic brain syndromes, anxiety disorders, psychotic illness, psychosexual difficulties, alcohol and drug related problems, personality disorders, and may deliberately self harm[19]. Patients and carers found to have significant levels of psychological distress should be offered prompt referral to services able to provide specialist psychological care[19]. Three quarters of people experience anxiety as a result of their cancer but less than half receive information, advice, support or treatment for this[6].

Current ISRs feel the necessities of the post are autonomy, support from management and Macmillan, empathy, knowing one's limitations, patience, diplomacy, staff support, training, crisis management and advanced communication skills. The luxuries are time, flexibility, and the freedom to be innovative by pooling ideas with colleagues. Amongst my personal luxuries I can also include huge job satisfaction.

Some may ask 'is holistic care the responsibility of the radiotherapy department?' Think of the effect of a patient choosing not to put on their heating in order to be able to afford the cost of petrol to travel for treatment. They become cold, their immune system may be compromised, and side effects may worsen, making it harder to cope[20]. Caring for this patient is the responsibility of therapeutic radiographers, so holistic care must count.

No ISR? You are not supplying patients with the help and support they need

Should patients view ISRs as a necessity or luxury?

These snapshots of examples of interventions may further help to answer this question. Consider how these patients might have coped without my interventions.

Practical support

- A patient with a brain tumour was increasingly frustrated at his speech impairment. When talking to him and his wife (a GP who was in tears) their relationship was breaking down. A referral to see a speech therapist the next day greatly boosted his confidence, and he was happier and more relaxed about his treatment. This improved his relationship with his wife so her quality of life improved significantly.

- Many out-patients have a long way to travel. Since I have been in post they are now able to access Macmillan grants for financial help with travel expenses.

Emotional support

- Parents (where the father had a brain tumour) were anxious about how to explain to their child about dad's condition. This couple was concerned they had lost control of their eight year old son's behaviour. They had not spoken to him about his dad's illness, but had told their older children. They did not realise he may be reacting to the tension and secrets in the house. Discussion around how best to proceed was invaluable for them, and their little boy returned to the loving child he used to be.

- A patient who was very passive with her family and in her workplace had great anxiety about returning to work after cancer treatment. Counselling on self-esteem and assertiveness gave her the confidence she needed to return to work and change her family dynamics for the better. She said: *"I should have done this years ago, cancer is one of the best things to happen to me".*

- A patient with endometrial cancer with vaginismus was not able to contemplate brachytherapy. Letting her talk about her fears and her past experiences and helping her to leave them in the past enabled her to tolerate the procedure. She could not believe what a difference just talking had made saying, *"You have brought me in from the cold".*

- A gentleman with prostate cancer was experiencing side effects from hormone treatment. He was crying all the time, felt he was weak and was losing his masculinity. This was having a profound effect on his family relationships. Talking this through and challenging his belief that men should not cry was life changing for him. He became more relaxed and enjoyed hugs for the first time ever from his family.

- A claustrophobic patient was having panic attacks when wearing her treatment mask. Explaining panic response, teaching relaxation and mentally reframing the mask as her 'friend' helped her to manage her treatment much to her great delight and relief.

Multidisciplinary team work

- A community nurse wanted reassurance about a patient's skin reaction and came to the department to have an explanation of radiotherapy. This inspired her to arrange a teaching session about radiotherapy for her peers. I made new contacts and they now have a 'link' person for advice about radiotherapy.

- Team work with radiographers and especially the review radiographer team is vital to make my job possible. They are now confident to question patients a little deeper knowing that if there is anything they can't address they can refer to the information and support service for further help. This ensures a seamless service for the patients.

Information and support has always been an integral part of any radiographer's role. With the development of more complicated techniques, the battle of waiting times and targets in under-resourced departments, and longer working days, finding time with patients on a one-to-one basis is increasingly difficult for therapeutic radiographers. This is where the ISR can be invaluable. Scheduling time to use their highly developed communication skills enabling patients to talk through their difficulties has such an impact on their well being even if nothing physical can be done. As Butler et al state: "the topic that seemed closest to most participants' hearts was the psychosocial, social and spiritual aspects of living with cancer".[21] Therapeutic radiographers are at the heart of cancer treatments and, as they meet patients attending for weeks of radiotherapy, who best to extend their current skills and specialise in this role?

Conclusion

This is a very exciting and pertinent post for any radiotherapy department. As a Macmillan ISR, I am proud to be an ambassador for this charity and to be an allied health professional for the NHS, striving to do my best for patients and colleagues. Having an experienced radiographer in this post, instead of working on the machines, may be viewed as a luxury for the department. However, the difference this person can make to the quality of life of people living with cancer makes it an absolute necessity in my opinion. Picture a radiotherapy service with an ISR and one without. If your department does not have at least one ISR, arguably you are not supplying your patients with the necessary help and support they undoubtedly need.

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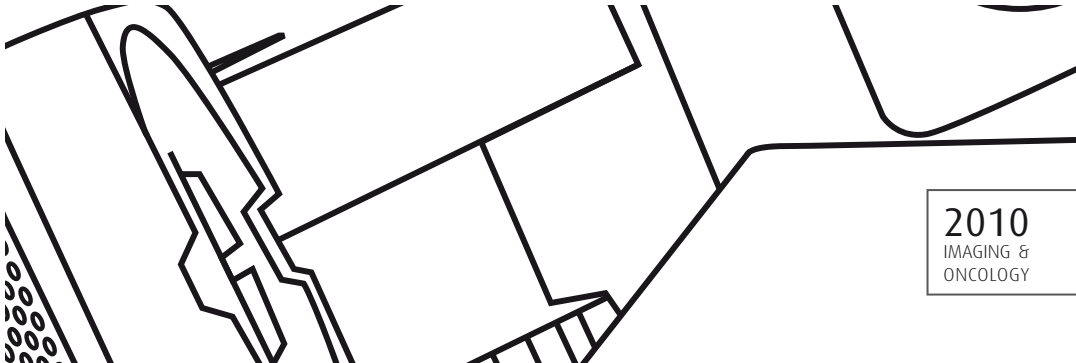

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Radiotherapy: The workforce imperative

Tim Cooper

The workforce issues facing radiotherapy are not insurmountable. A great deal of work is currently under way to find short, medium and long term solutions to ongoing issues. But perhaps the greatest test is facilitating a shift in mindset so that those delivering the service are able to approach challenges differently.

The urban myth

Delivering a world class radiotherapy service requires development of both capacity and quality. Building quality within the service requires widespread implementation of advanced technology, such as Intensity Modulated Radiotherapy (IMRT) and Image Guided Radiotherapy (IGRT) to allow clinicians to deliver the best outcomes for patients. The focus on capacity supports timely access and equitable availability for all patients. Achieving this requires us to address the longstanding challenge within radiotherapy: the workforce.

There is currently an urban myth within the world of radiotherapy; workforce shortage has been a problem for so long that it is now a problem that cannot be solved. Further, that as demand continues to increase and we are expected to expand our capacity to match, it is only going to get worse...and then to deliver IMRT could be the final straw...

We obviously recognise why this has happened, but nationally, the radiotherapy programme has so much momentum at present that engagement in finding solutions is higher than ever. Additionally, the focus is now on resolution of the problem in order to ensure that services are sustainable in both the short-term and also the longer term. Clearly, workforce capacity is a problem, and is recognised by the Cancer Programme Board to be one of the biggest risks to developing world class radiotherapy.

Just because others have tried to address the problem does not mean they did not succeed; just because the problem is still visible does not mean the previous work was in vain. Our solutions will build on previous work and have flexibility to respond to the changing radiotherapy agenda.

National Strategy

The National Radiotherapy Implementation Group (NRIG) has tasked its workforce subgroup with leading on creating a sustainable workforce. The terms of reference are clear:

- This sub-group will promote expansion, development, education and training of the multiprofessional radiotherapy workforce.
- It will collate the multiple tools and strategies to be employed in supporting workforce development.
- The overall aim is to develop a fully trained workforce and also to provide training for research.

Many Strategic Health Authorities (SHAs) have shared their workforce plans with the Department of Health. Ensuring these plans are consistent with capacity and delivery models in each area will be a key requirement of a robust workforce plan. Demonstrating joined up thinking in both our approach and actions is vital as the different bodies come together to develop and sustain solutions.

There are a number of key issues which need to be considered:

Radiography

Much has been made of the gap in the newly qualified workforce. Both recruitment and retention are recognised as key indicators of a sustainable workforce. Attrition rates of 35 per cent are unacceptably high. This is a significant issue, but not the most pressing. We should be able to manage this area, albeit with short-term solutions such as increasing commissions and increasing the number of intakes, until the national strategy accomplishes its aims.

We are now also aware that ensuring the development of a sufficient number of band 7 and 8 practitioners (and similar roles in radiotherapy physics) within the current workforce is equally important; they will lead service expansion and implementation of advanced technology. Development of higher band posts is also likely to aid expansion and retention of the senior workforce. We must also ensure that succession planning is sufficiently robust to fill the gaps they leave when planning our increased capacity. With the increasing expectation of satellite radiotherapy services, this will become a growing challenge in the future.

Radiotherapy physics

Development of the radiotherapy physics workforce has different training implications. Trainees receive much of their training within the radiotherapy physics service. Capacity within the services to meet the training need will remain a challenge in the years to come.

As we develop and expand our IMRT service (at least one centre in every network should be providing a comprehensive IMRT service by 2012) we recognise that the bulk of the IMRT challenge will fall to the radiotherapy physics and dosimetry teams. Developing early solutions to these workforce challenges will be key to the success of the IMRT programme.

Clinical oncologists

The National Radiotherapy Advisory Group report has stated that a significant proportion of routine work could be delivered by appropriately trained non-medical advanced/consultant practitioners who have the necessary knowledge and skills[1]. This will free consultant medical staff to focus on the remaining more complex clinical work such as developing the IMRT service. Continuing the development of a structure to support this (eg implementing the Career Progression Framework, formerly known as the four tier structure, in therapeutic radiography) is vital to its success. A number of work streams are taking place that will influence the development of the workforce model.

Developing solutions

We have already begun to publish some of the learning from the four tier pilot sites. This has begun with the Society and College of Radiographers' document 'Policy into Practice'[2]. There are already a number of tools for the assistant practitioner role, and more encouragement and direction, along with better signposting to services managers from the professional bodies to support their wider uptake, will be helpful.

Whilst local fora exist for discussion with those commissioning and providing education and training for the radiotherapy workforce, little opportunity exists nationally to explore solutions and share thinking. The National Cancer Action Team has therefore begun a series of national workshops to develop this engagement. We have made a commitment to continue this into the future.

The first workshops began with Higher Education Institution (HEI) leads and managers from the four tier pilot sites. These were successful and gave a number of structured actions for development. A further workshop in March this year was open to all radiotherapy managers, all HEI leads along with invites to SHA workforce and cancer leads. The focus of the meeting was on the (newly) qualified workforce and how to maximise the development of this vital resource. At the time of writing, early indications suggest this was a most productive and innovative forum.

Within radiotherapy physics, 'Modernising Scientific Careers' (the new career framework for the profession) was developed during 2009. Our intention was to hold back work with radiotherapy physics during this process to avoid mismatch of programmes. We are now clearer on the direction of Modernising Scientific Careers and have therefore been able to begin; and 2010 will see the leading of this work with radiotherapy physics in the same way as with the therapeutic radiographers.

During 2010, we expect to begin to integrate these scientific and radiographic groups. The solutions to our workforce issues and clinical delivery do not rest within professional boundaries – but work across them.

Dosimetrists are a key element of our workforce, especially as we develop the national IMRT programme. We recognise that there is not a single national training programme or qualification. This leads to two problems: Firstly that mobility of the workforce is limited. If you are unable to demonstrate a level of learning, a new employer will be uncertain of your competencies and therefore of the level of your ability. Secondly, recruitment into a profession that is not recognised through a structured training route or qualification will remain a challenge.

In response, we have developed a national dosimetry early implementation training programme. With an intake planned for spring 2010, this will work with a small number of radiotherapy physics services in the early implementation phase to develop the curriculum and the education process. It is anticipated that this will become the platform for a long overdue national training programme.

Staffing models

Looking at skills mix in its wider context is part of the strategic vision. Defining skills mix in terms of whole time equivalent staff within each professional group (however well intentioned) leads to silo working and limited service development. If we consider our overall staffing resource to be set as a fixed number in each professional group (three of this group, two of that and one of these); role expansion and development is constrained as established posts and budgets are now fixed. Instead, we should consider the workforce requirement as a whole, and based around competencies rather than job roles. This enhanced flexibility will be vital as we move forwards.

With current staffing guidance limited to individual professional groups, the focus becomes achieving the number rather than delivering the task. Cases for increased resources then focus on appointing posts rather than the benefit to the care pathway. Forward thinking services should consider their staffing resource as a single entity. Within this, there will always be a number of tasks that can only be undertaken by oncologist/physicist/radiographer, but many tasks are much broader and many professionals are equally well-equipped to undertake them; we should be looking for the best placed person at that time.

Working beyond boundaries extends to other areas too. Appropriate use of administrative staff to undertake admin duties has two benefits. Firstly they are a more cost-effective resource, but secondly (and arguably more importantly) administrative tasks are a skill best left to those who are trained to do them since they are likely to do them more efficiently and more effectively. In turn, this gives our clinical workforce greater capacity for clinical delivery – sounds sensible and yet rarely is this carried out to its full effect.

Tough times ahead

As the NHS enters arguably its worst financial period during the coming months, negotiating for a fixed staffing establishment will be increasingly difficult. Arguing for investment in radiotherapy will require commissioners to (further) disinvest in other areas. The benefits of doing this must be not only clear, but also unequivocal.

Setting staffing within the Darzi QIPP (quality, innovation, productivity and prevention) framework will be more effective, and certainly more likely to engage commissioners' attention. Demonstrating value and pathway improvements derived from the QIPP framework will be key to securing scarce resources.

Identifying links from staffing establishment to the expected growth in radiotherapy activity would demonstrate whole service vision and planning.

Commissioning exemplars

The National Cancer Action Team has funded a number of commissioning exemplar projects to support thinking and modelling in challenging areas. One key project is within the Lancashire and South Cumbria Cancer Network (LSCCN) which is investigating opportunities around modelling its radiotherapy workforce. The project is looking to remodel the radiotherapy workforce in LSCCN to support capacity expansion including the development of satellite radiotherapy units.

Commissioning exemplars (there are currently four commissioning exemplar projects in radiotherapy) have been created and developed so that one area leads on a topic of wider importance, and publishes both the learning and methodology to support others and maximise benefits. The outcome of this project is expected to be published by late summer 2010.

From the LSCCN Commissioning Exemplar project proposal.

Workforce – recruitment & retention-have been highlighted as a major risk to development of radiotherapy services particularly recruitment to satellite units which are being planned in what are perceived to be less attractive recruitment areas. Affordability/costs of satellite development vs expansion at the cancer centre has also been highlighted as a concern

Building on existing cancer workforce planning project currently taking place on a Northwest footprint this proposal seeks to establish the workforce implications and opportunities associated with the establishment of satellite radiotherapy facilities in Lancashire and South Cumbria. It is suggested that innovative role creation may address issues of recruitment and retention and may offer opportunities to address perceived cost differentials of satellite units.

Identification of the training and education requirements associated with the development of satellite radiotherapy units and overall expansion offers an opportunity to influence training and education commissions in a timely way to better match availability of skilled staff to service development

Innovation

The radiotherapy profession has a good track record in challenge and innovation. However, in order to tackle long standing problems, we need to be prepared to continue to do things differently; to look at the same problem and to think different thoughts. It sometimes requires us to be brave and bold in an attempt to develop something new.

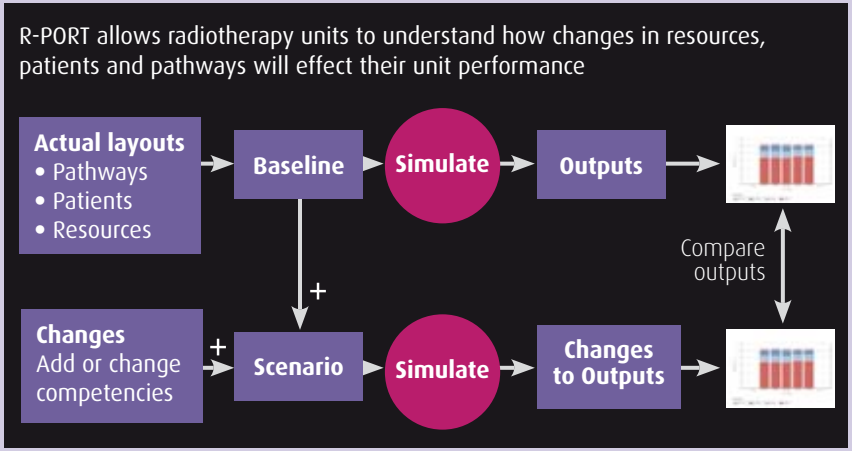
As an example of this: should the assistant practitioner role be limited to a ceiling of Band 4? With enhanced competencies and developed skill set, and a significant number of existing Band 4 practitioners, the service may well be able to support one or two Band 5s, acting not as a supervisor to the Band 4s, but in an enhanced role.

Role enhancement and skills development must not be limited to one staff group. As we expand our radiotherapy capacity, and develop an extended delivery capability, our workforce must have the opportunity for development and higher achievement.

R-PORT

R-PORT is the tool that the National Cancer Action Team has developed to support service modelling and planning. Importantly, R-PORT is based on competencies derived from Skills for Health[3]. When modelling, R-PORT looks for the best placed person at the appropriate point with the defined competencies to do the task – it has no idea of their job title – just the benefit they can make to the pathway. Using R-PORT will allow us to reconsider new ways of working and examine the value added to the clinical pathway.

This type of wider evidence-based analysis is more likely to capture the engagement of those who have access to the resources; they too will require evidence to reinforce the decision they have made.



VERT

VERT (virtual environment radiotherapy training) is an excellent tool and a great opportunity for training our workforce. We must also use this asset more creatively as part of our workforce solution by maintaining the skills and enhancing the ability of our workforce. VERT is not just a training tool for students, but also a valuable tool to promote and maintain the skills and confidence of our newly qualified workforce.

Higher Education Institutions (HEIs)

In the current method of working, HEIs compete with each other for enrolled numbers in each programme. This level of competition is important as it maintains high education standards by challenging HEIs to be competitive and innovative in both curriculum design and course content. It does mean, however, that some courses may become non-viable if multiple HEIs are competing in the same limited pool. Instead, it may be that one HEI running a programme on behalf of a number of institutions could attract a higher number of trainees and secure a wider curriculum base. The competition model also restricts access to advanced practice courses and post-qualification training where geographical access (time away from base) is also an important uptake issue. New models for education commissioning should be examined.

We need to think creatively about those parts of our workforce that are currently considered lost to attrition. Many people fail to complete the full accredited training programme. This may not mean that radiotherapy is the wrong career choice for them, or that their skill set is not valuable. Those that are unable to complete a chosen academic qualification in one area may be perfect candidates for roles in other parts of the service. This is not completely new thinking, but recognising the signs early is vital; and proactively managing this group is important. Left to a last resort at an exit interview is unlikely to be helpful or productive.

Raising the profile

Improving our workforce will require the public profile of radiotherapy to be raised both in the health economy and within the wider public world. Our staff and our patients are our greatest advocates. Ensuring that our workforce of the future has proactively chosen radiotherapy because they already knew and understood what the profession represented may help to support sustainable recruitment.

Conclusion

There is already a significant amount of guidance published to support workforce issues. As an example, below are a list of those available from the Society and College of Radiographers. The Royal College of Radiologists and the Institute of Physics and Engineering in Medicine have also produced supporting guidance and documents. Additional guidance is helpful, but it must be targeted appropriately. Importantly, we must better signpost what exists already.

Developing a longer term resolution to radiotherapy workforce issues requires us to generate our own local solutions with network and national support. Nationally developed tools will support improvements locally. Implementing a series of actions that are relevant regionally will be both sustainable and responsive.

Breaking the urban myth requires us to accept that workforce planning will remain a challenge for a long time to come. This must be seen as a natural product of a professionally directed service that is enhancing both its service quality and service quantity. If we assume an instant solution is possible, it must presuppose a degree of inertia in the service, such that the problem will stand still long enough to be fixed. And therein lies our dilemma. Developing world class radiotherapy relies on a service in constant evolution. Talk of resolving the workforce problem must be replaced with expectations of iterative solutions within a longer term framework of successful delivery.

Existing SCoR Guidance

Staffing Guidance

- Radiotherapy moving forward: Delivering new radiography staffing models in response to the Cancer Reform Strategy: SCoR 2009
- The Role of the Community Liaison Expert Radiographer Practitioner: Guidance for Radiotherapy and Imaging Service Managers and Commissioners: SCoR 2009
- Positioning Therapeutic Radiographers within Cancer Services: Delivering Patient-Centred Care, SCoR 2006
- Radiographic Staffing: Short Term Guidance: 2005 Benchmark for Standard Core Functions within Radiotherapy, SCoR 2005

Education, Learning and Development

- Improving Student Retention: Guidelines and Good Practice, SCoR. 2009
- Learning and Development Framework for Clinical Imaging and Oncology, SCoR 2008
- A Framework for Professional Leadership in Clinical Imaging and Radiotherapy & Oncology Services. SCoR 2005
- A Strategy for Continuing Professional Development. SCoR 2003
- Protected Study Time - Guidance for Radiographers, Managers and Union Representatives. SCoR 2009

Implementing the Career Progression Framework

- Implementing Radiography Career Progression: Guidance for Managers. SCoR 2005
- The Scope of Practice of Assistant Practitioners in Radiotherapy. SCoR 2007
- Developing the business case for consultant radiographers: SCoR 2003
- Consultant Radiographers: Succession Planning. SCoR 2009
- Implementing the career framework in radiotherapy – policy into practice. SCoR 2009

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