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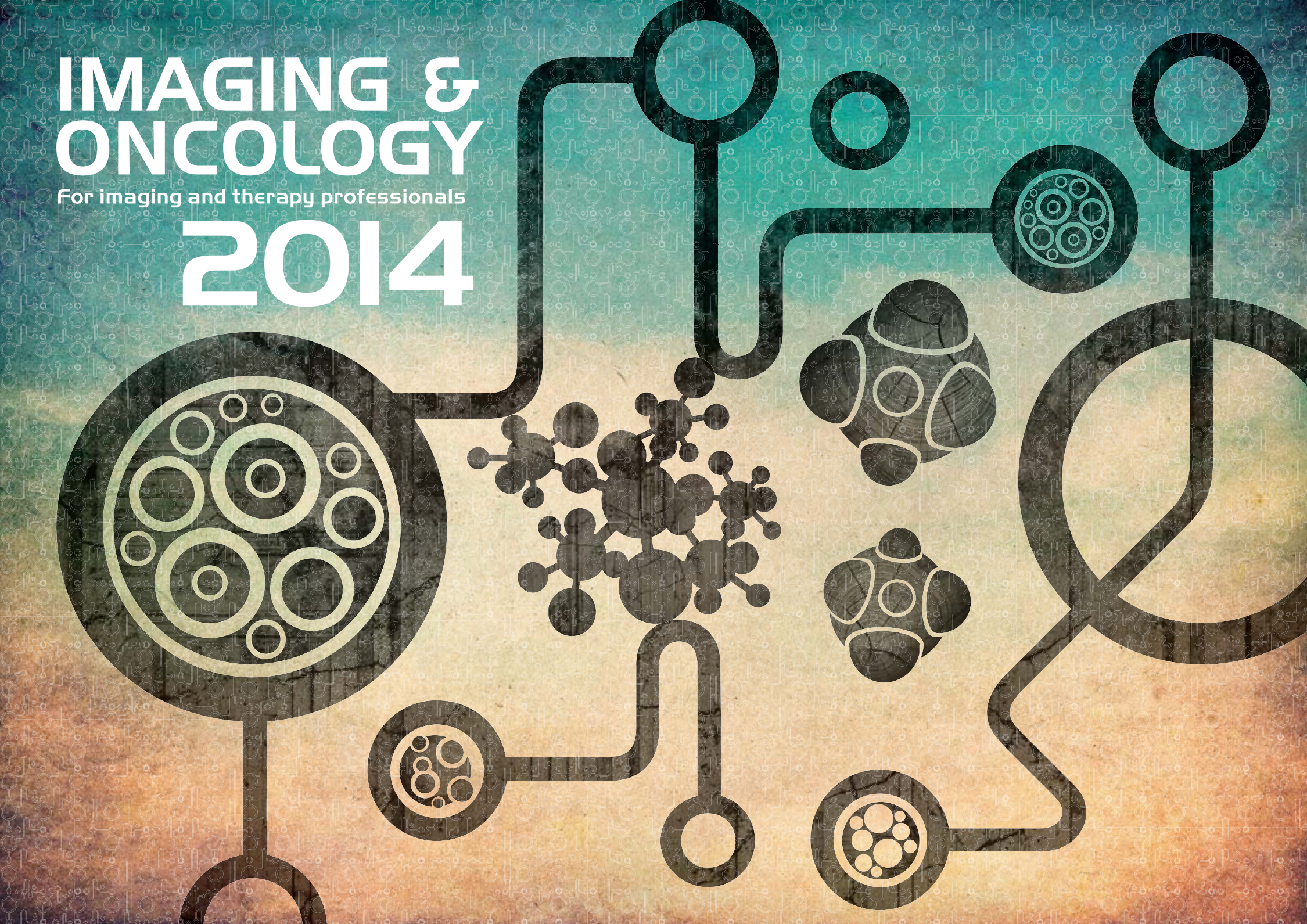
For imaging and therapy professionals

2014



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EDITORIAL

Imaging & Oncology this year features many papers focused on change and team-working. I suspect you are not surprised because these themes are inextricably linked in our professions. Without doubt, their importance will continue to be paramount for some time to come. After all, new technology in healthcare works well only if driven by a cohesive, flexible and focused team. Otherwise, its potential may never be realised. A static model of healthcare delivery is not an option when the diseases and populations that we diagnose and treat continue to change. Even if the Government were to promise endless resources (after all, there is an election coming...) we in imaging and oncology services would still be in constant flux.

In this issue Iain Robertson talks about how it is time more radiographers took on interventional roles, in order to help fill the gap left by the chronic shortage of interventional radiologists in the United Kingdom (UK). Numbers of radiographers performing invasive tasks are growing, but rather too slowly. Jancis Kinsman explains why independent prescribing of medications by radiographers is the way forward and it is hard to find an argument against her reasoning. Presently, the Society and College of Radiographers is preparing its case for radiographer independent prescribing, so this article comes at a timely moment. Naomi Lavan and Charles Gillham discuss breast brachytherapy and why more collaborative studies involving clinical trials are required before implementation. Further papers in this issue explore methods of sonographically measuring abdominal aortic aneurysms, changes faced by staff in hybrid imaging departments, and the importance of the radiology report.

Not all examples of change and team-working featured here involve just humans. Greg Slabaugh provides a very interesting and balanced insight into the uses of Computer Aided Detection software. Human and computer 'team-working' increases detection rates and can, in some circumstances, remove the need for a second human reader.

Finally, this edition offers two articles concerned very much with the humanistic element of cancer treatment. Numbers of older people and people living alone are growing in the UK and these comprise a significant proportion of those affected by cancer. Evidence indicates that patients who enjoy good support from family and friends are more likely to do better for longer. We as professionals, need to be mindful of this and have strategies in place to aid patients who have little or no such support.

I welcome your comments on this year's collection. Please feel free to email me at *hazeledwards@sor.org*

HAZEL EDWARDS

FOREWORD

Welcome to the 10th edition of *Imaging & Oncology*, a publication that set out in 2005, to challenge our traditional way of working, to pose difficult questions and to imagine how the world of imaging and oncology could and/or should look!

As President I am both delighted and honoured to follow in the tradition of writing the foreword to this prestigious publication, and as part of the preparation, I read through some of the previous editions. I thought, here we have an historic timeline of our aims and objectives over the last nine years. And it is quite fascinating.

Looking at the articles, we're able to catalogue just how much, or little, progress we have made over the last decade. Whether or not those aspirations and expectations were actually realised.

PACS in every trust was an aspiration and now it's impossible to deliver our services without it. Tick that box.

Image guided radiotherapy was in its infancy and look at it now! And PET/CT was heralded and the potential cost benefits described...but has it really reached its full potential?

Rapid access to our services, balancing capacity and demand, has been achieved somewhat, although, having met the national targets, we are still struggling with ever increasing demand. Confirmation I suppose, that the rest of the world of healthcare acknowledges that imaging and oncology is utterly indispensable.

Healthcare delivery has been slammed into a financial wall and we are often accused of being too expensive and subsequently tasked with finding more cost effective ways of working. But haven't we always strived to do that? If there is a belief that we have only recently entered the age of 'innovation' and 'transformation', we need only take a quick look back at these issues to realise that we have always been innovative and are constantly developing and transforming our services and technologies to improve the care for our patients.

I have enjoyed this special opportunity as President, to observe excellent practice right across the UK. From simple changes in approach to practice and service delivery, to the most complex technological changes, there is one common aim: to be better at what we do so we can make it better for our patients. Nothing terribly complicated in that, but the pressures that we are faced with sometimes prevent us from finding the most obvious solutions and I often ask myself, are we trying too hard?

Well, if you take the time to read through this year's issue, you will find that all is not lost! You may not agree with everything you read; you may be inspired or you may dismiss it as 'balderdash'. In any case, this journal will make you think: about your practice, your service, your relationship with your colleagues and your patients. And that, quite simply, is what we set out to achieve with this year's *Imaging & Oncology*. Enjoy!

PAM BLACK,
PRESIDENT OF
THE SOCIETY AND COLLEGE
OF RADIOGRAPHERS

TRAINING IN INTERVENTIONAL RADIOLOGY: FACING THE REAL CHALLENGES

IAIN ROBERTSON

Interventional radiology became a subspecialty of clinical radiology in 2010. The benefit of achieving subspecialty status is a clearer identity for IR and includes the ability to develop a more focused training curriculum to produce a better defined workforce.

Interventional radiology (IR) has been incredibly successful. The subspecialty has grown over a 40 year period, from contributing to a small number of specialist clinical areas to being a key component of many areas of acute and elective hospital care (figure 1). In the last 20 years, growth has really accelerated driven by a global move to minimal access techniques and improvements in medical device technology. In particular, vascular treatment has undergone a massive change towards endovascular intervention, and techniques in interventional oncology and renal access have developed into high volume specialities.

Training in IR has been slower to evolve and until relatively recently, was largely delivered as part of diagnostic radiology. Much of the focus in the past few years has been on internal issues such as funding, defining the new IR curriculum and responding to changes in other specialist areas. Far greater external challenges are facing IR in the near future. Training exists to develop the future workforce and support service delivery. Training must be able to accommodate anticipated changes in demand, workforce and the hospital environment, therefore training must be flexible and responsive. With this in mind it may be that we need to rethink substantially both our current training and service models.

CURRENT TRAINING PATHWAY IN IR

Until 2010, the model of training in IR was a five year training period in clinical radiology, which was adapted locally to allow exposure to interventional techniques and procedures as the trainee wished. A relatively small number of trainees aspiring to 'highly specialist' practice would continue training via fellowships for a further period of one to two years. This model worked well in terms of flexibility, but meant that training was variable and it was not possible to plan the IR workforce.

Under the new training pathway, a trainee entering IR subspecialty training will be committing to a six year training period. The initial three years focus on developing core diagnostic competencies with a final three years of IR training. All IR subspecialist trainees must complete the Fellowship of the Royal College of Radiologists (FRCR) examination, including all elements of diagnostic radiology. Interventional radiology training is based on satisfactory progression through training assessments, supported by evidence from a logbook of practical experience, which are then reviewed by the RCR Annual Review of Competence Progression panel. At completion, successful candidates are awarded FRCR with a certificate of completion of training (CCT) in clinical radiology with Interventional Radiology sub-specialisation.

The curriculum describes three levels of training in IR procedural skills: core, level 1 and level 2. All three levels share a common format of knowledge, skills, behaviours and illustrative common presentations. It is not possible for every trainee to become skilled in every area in the curriculum. In essence, a trainee should be able to do everything in core level, most in level 1 and a few in level 2, depending on their specialist area.

Although the curriculum has only been in existence from 2010, there have already been changes to the format and content. These largely reflect the growing clinical commitments of interventional radiologists. Future changes are likely to build on this foundation and include basic surgical skills such as suture techniques and basic access skills.

THE FIRST FEW YEARS FACING INTERNAL CHALLENGES: FUNDING, CURRICULUM AND PATHWAY

The 2010 subspecialty curriculum increased the standard training pathway by one year, without identifying additional funding. Therefore, while nationally the pathway had changed, local centres


Under the new training pathway, a trainee entering IR subspecialty training will be committing to a six year training period.

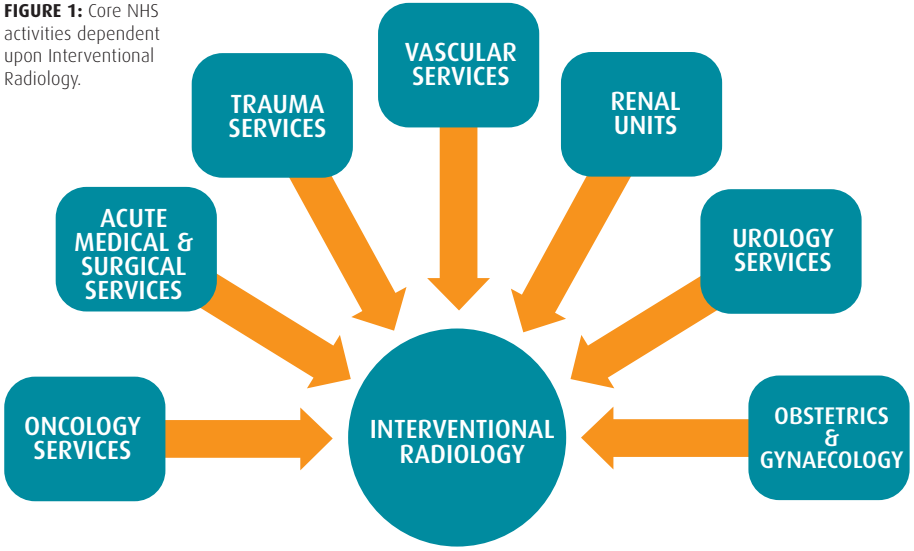


FIGURE 1: Core NHS activities dependent upon Interventional Radiology.

varied in their ability to find funding to support the additional year of training. This change has happened at the same time as a major squeeze in overall funding for medical training, with many clinical areas outside radiology experiencing reductions in their training numbers. This has made the fight for local funding particularly intense and in some areas it remains unresolved. Considerable work and focus at national and local level, by both the British Society of Interventional Radiologists (BSIR) and RCR, has developed the evidence base for further expansion in funding for IR and hopefully this situation should improve over time.

The construction of the current subspecialist pathway does pose two potential issues related to the crossover at year three into subspecialist training. The initial three year period of 'non-interventional' training may dissuade some trainees from considering IR and as most subspecialty posts are advertised within their own deanery (at end of Year 3) it is possible for an aspiring interventional radiologist to fail to gain the one or two places for six year training. In reality, most training scenes support and encourage trainees to become involved in IR earlier, however as IR develops a clear identity, there will be an increasing number of trainees who enter radiology purely to do intervention.

Could one solution be to allow entry to IR training in year one? There are two common arguments put forward against this idea – firstly trainees often think they want to do IR at entry but change their minds and secondly they/we need a period to determine if they are suitable for a practical specialty such as IR. However, while these arguments may have been true in the past, the increased profile of IR should now allow trainees to make an appropriate selection at year one. A proactive approach to improving the opportunities to learn about IR as a potential career is key; the BSIR have hosted a 'foundation' day for medical students and foundation doctors and introduced a society membership category for this group.

The complexity of interventional procedures has increased and the need for detailed knowledge of alternative techniques and clinical management continues to increase. The likelihood is that there will be a need for increasing clinical work from interventional radiologists. Similarly, the knowledge demands for diagnostic radiologists are ever increasing. In the future, it may not be possible to deliver both a full diagnostic training and a full interventional training programme in six years. Without doubt, diagnostic skills are invaluable to interventional radiologists, however, priority should be placed on providing the necessary clinical and technical skills.

EXTERNAL CHALLENGES: DEMAND, WORKFORCE AND THE CHANGING HOSPITAL ENVIRONMENT

The cost of the extraordinary success of IR techniques is a crisis of capacity prompted largely by a workforce shortage. Until sub-specialisation, there was no separate planning for the IR workforce and both services and the workforce to support them developed organically. In 2012, using a service model based on a 1:5 rota across England for the provision of 24/7 services for haemorrhage control and nephrostomy, the Centre for Workforce Intelligence (NHS England)[1] has estimated a shortage of more than 200 interventional radiologists (figure 2). Similar shortages are present in the Celtic nations.

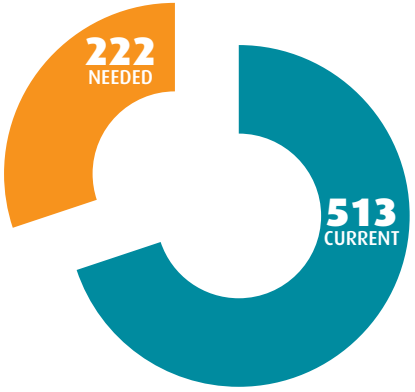
While we may be struggling at present to cope with existing demand this is highly likely to increase. Healthcare faces a major challenge in supporting an ageing population. The combination of minimally invasive procedures, local anaesthesia and low morbidity means IR is particularly suited to delivering care for this expanding patient group.

Demographic changes do not only apply to the ageing patient. IR may be a relatively young subspecialty but its own medical workforce is ageing. The first wave of early adopters are now beginning to retire and IR is moving from only accruing staff, to experiencing its first wave of retirement. This change will increase markedly over the next 10 years; in 2011 only 6% of the IR workforce was over 55, but by 2021 this will exceed 20%.

Expansion of IR training numbers is now starting to come through, but even with this expansion a workforce gap will be present (figure 3, page 10). It seems likely to be an unwinnable challenge

> The cost of the extraordinary success of IR techniques is a crisis of capacity.

FIGURE 2: The workforce gap for a 1:5 acute rota for interventional radiologists[1].



to cope with increasing demand from the ageing population and an ageing workforce, with the same service and workforce model.

The hospital environment has also changed significantly over the last 40 years and is moving again towards a separation between complex therapy delivered in highly specialist inpatient centres and less specialist care delivered locally. The need for 24/7 care means hospitals simply work differently now with much less reliance on traditional medical and surgical teams. Staff are often working between several units and continuity of inpatient management requires careful attention. The current drive is to reduce in-patient stay and the use of day case procedures is very much the norm.

In the past, IR effectively devolved much of the pre- and post-intervention care and management of patients to other clinical teams, but this will become increasingly more difficult. The previous teams will simply no longer exist and in any case, more of the patients will be day cases with an interventional radiologist's name at the head of the bed. This is not a bad thing and reflects the maturation of the subspecialty but will mean changes to training and practice. At present, a focus for many IR teams has been developing clinics to ensure appropriate consent. This will not be enough for the future. We will need to ensure not only that training equips our teams with suitable clinical skills, but also that we have a model of care that will allow us to respond to the requirement for more involvement in day case and inpatient care.

The training curricula of other specialities have also evolved. Some specialities have seen major adoption of interventional techniques that have radically altered the way they are delivered. In vascular practice, over a relatively short period, surgical techniques in some areas have been largely replaced by endovascular techniques. Recently, vascular surgery became a separate speciality with a new training pathway and curriculum. The vascular surgery curriculum had always included endovascular experience, albeit delivered variably. However, the development of the new curriculum makes the training requirements much more structured and explicit. Delivery of this training component has been a challenge and within IR has provoked much internal debate. In reality, we cannot demand that every image-guided treatment remains exclusively in the domain of IR. As the 'miniaturisation of medicine' continues we will face similar positions from other specialities. In the interests of patients, we all need to ensure that by co-operative development, procedures are available in a timely fashion from competently trained personnel.

FACING THE CHALLENGES

Training exists to develop the future workforce for service delivery. Workforce planning and service delivery models to support access to IR are still relatively under-developed, but important initial

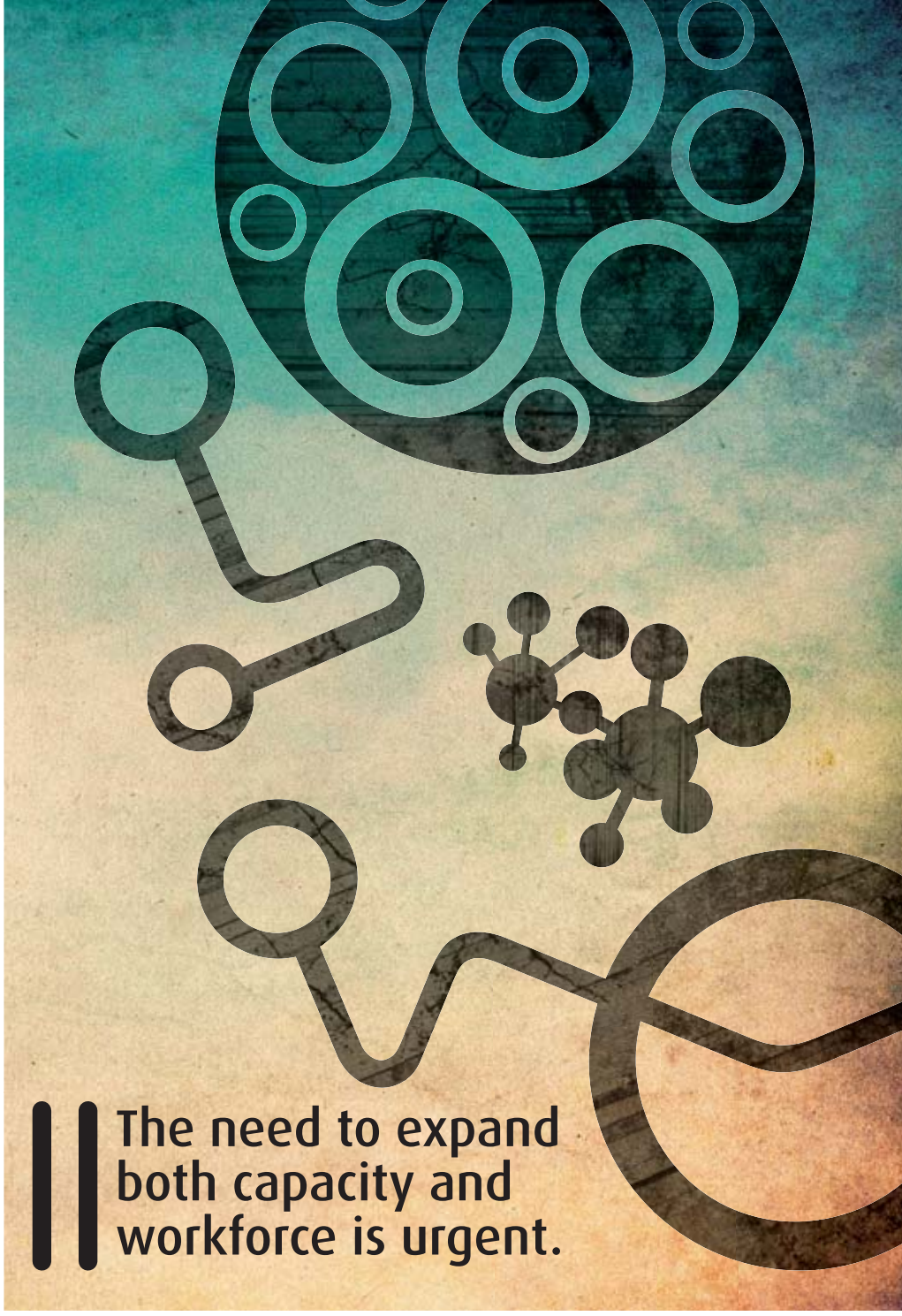
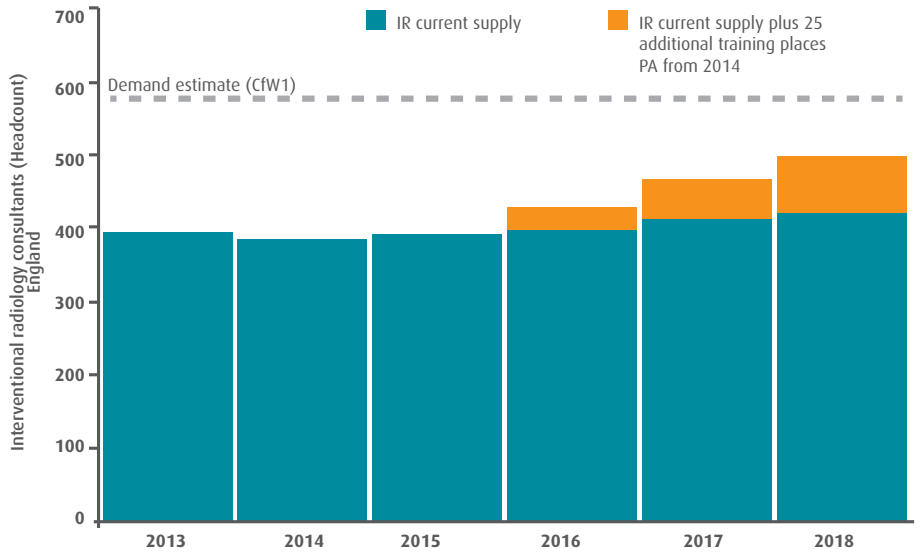


FIGURE 3: The proposed IR training expansion and workforce gap.



steps have been made by the RCR and BSIR[2]. The challenges of demand, workforce and service change mean that we are very unlikely to be able to deliver sustainable services in IR using the same workforce and service model. The need to expand both capacity and workforce is both urgent and increasing, as interventional radiologists will perform a greater clinical role for the reasons outlined earlier.

Even allowing for a successful expansion of this part of the workforce, it seems unlikely that this will be able to support the demand for acute and elective intervention. While we may share some elements of interventional radiology with other specialities in the future this is unlikely to deliver a sustainable overall service.

Future services in IR should be planned with broader teams. Traditional roles and responsibilities should evolve and IR will need to make much better use of team members. While some IR departments have used extended role practitioners, particularly in vascular access techniques, in most centres we lag far behind other surgical specialities in their use. A recent survey scoping advanced practice in IR assessed the frequency, training and obstacles to advanced practice[3]. Just over 50% of respondents had extended role practitioners either undertaking vascular access or diagnostic procedures such as venography, fistulograms or angiograms. Training in over 90% of departments was in-house and supported by either interventional radiologists or other advanced practitioners. Notably, the commonest reasons cited by departments that did not have extended role practitioners were lack of funding and support from management.

Advanced practice in IR should provide a far greater contribution to the provision of services, but needs greater leadership to develop further. In order to make this happen we will need to describe

Training for advanced practitioners needs to be promoted and planned nationally.

a new model of service delivery and training for both radiologists and advanced practitioners. In particular, practice and training for advanced practitioners needs to be promoted and planned nationally, and led by the appropriate professional organisations. There is an opportunity for advanced practice to make greater contributions to procedural care, patient management and follow-up. Further development of national competency based qualifications in advanced practice in interventional techniques would bring better recognition and better flexibility for this group. Greater leadership and recognition of their integral role would help remove the apparent obstacles from management regarding funding and support.

Interventional radiology has already made an invaluable contribution to improving outcomes for patients. The need to provide 24/7 services, increasing demand and changes to the hospital environment, are significant challenges. Sustaining and developing IR in the future requires us to think beyond traditional boundaries, roles and responsibilities. Improving the profile of IR amongst trainees and medical students, and expansion of the medical workforce, will go some way to closing the gap. However, this will not be enough. Greater development of the advanced practitioner workforce should be a key focus for future service planning and delivery.

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About the Author
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IS THERE A CASE FOR ABANDONING OUTER WALL TO OUTER WALL MEASUREMENT OF AORTIC DIAMETER USING ULTRASOUND?

TIM HARTSHORNE

Ultrasonic diameter measurement of the abdominal aorta is considered a simple and reliable non-invasive investigation.

INTRODUCTION

There had been relatively little academic interest related to the performance of aortic ultrasound imaging until the introduction of the National Health Service Abdominal Aortic Aneurysm Screening Programme (NAAASP) approximately five years ago. The NAAASP[1] is now fully implemented in England and men in their 65th year are invited for aortic aneurysm screening. The NAAASP uses the inner wall to inner wall (ITI) measurement technique in comparison to most imaging departments that use the outer wall to outer wall (OTO) method for the measurement of aortic diameter. There is potential for confusion which may well impact on clinical management and decision-making now that two methods of aortic measurement are in use in England. In the Swedish aneurysm screening programme, the aorta is measured using a third method: from leading edge to leading edge (LELE). The aim of this article is to explain the reasons for adopting different methods of measurement and to consider whether the OTO method should be abandoned in favour of the ITI or LELE technique.

ABDOMINAL AORTIC ANEURYSMS

Abdominal aortic aneurysms (AAA) typically occur in older men (>60 years of age) and rupture is fatal in the majority of cases (>50%). Despite evidence that the prevalence of aortic aneurysms is decreasing, approximately 3000-4000 men die each year from ruptured AAA in England and Wales[2,3]. The majority of AAAs are asymptomatic and remain undetected until the point of rupture. If a large AAA is detected, it is possible to repair it by open or endovascular surgery. Ultrasound is the established method of screening for AAA as it is quick, accurate, safe, repeatable, inexpensive and well-tolerated by the individual.

Evidence for the effectiveness of population screening to detect AAAs is based on randomised controlled trials such as the Multicentre Aneurysm Screening Study (MASS)[4]. MASS provided level 1 evidence that screening for AAA is cost effective with aneurysm-related mortality reduced by nearly 50% over the 10 year period after initial invitation to screening[5].

MEASUREMENT METHODS AND ANEURYSM STUDIES

The ultrasonic measurement of abdominal aortic diameter is performed by accurate positioning of on-screen electronic callipers. Three different measurement methods are used routinely to measure aortic diameter as described in the introduction (figure 1). Each of these techniques will result in a different diameter for any given aorta. The OTO method will provide the largest diameter and ITI the smallest. It is also widely accepted that ultrasound tends to underestimate aortic diameter compared to computed tomographic imaging (CT).

The OTO technique is an established method of measuring aortic diameter and is used by many imaging and radiology departments. It most closely correlates with CT diameter measurements. It was also the measurement method used by the UK Small Aneurysm Trial (UKSAT)[6], a multicentre randomised trial which found no overall survival benefit in offering open elective repair for AAAs measuring less than 5.5cm in diameter. Most vascular surgeons in the UK base the management of small AAAs on the outcome of this study and survey small aneurysms (3.0-5.4cm diameter) until they reach the 5.5cm threshold when elective repair may be considered.

In contrast, MASS used the ITI method of measuring aortic diameter with patients also referred for potential aneurysm repair at a diameter of ≥ 5.5cm. NAAASP is predicated on the results of the MASS trial and therefore uses the ITI method for measuring aortic diameter.

The third method, LELE, is used in Sweden as it is claimed this method has a theoretical advantage based on ultrasound physics over the two other methods[7].

In clinical practice outside of NAAASP there has been no overall consensus as to which of the three methods is more reproducible, or indeed if one should be adopted as a national standard for aortic

FIGURE 1: Diagram to indicate the measurement positions for the three diameter techniques. OTO; measured from downward pointing arrow to upward pointing arrow. ITI; measured from upward pointing chevron to downward pointing chevron. LELE; measured from downward pointing arrow to downward pointing chevron.

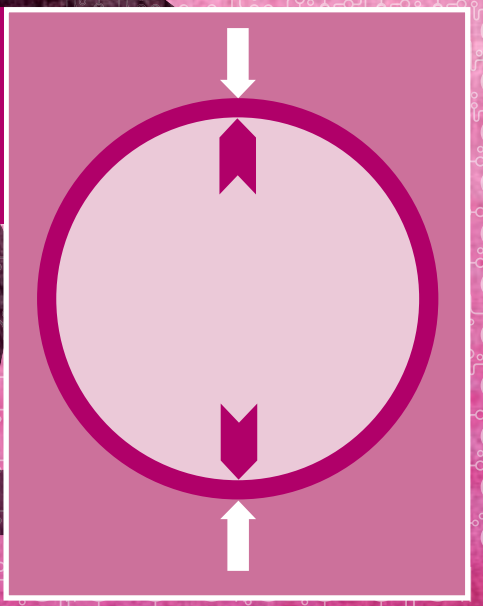
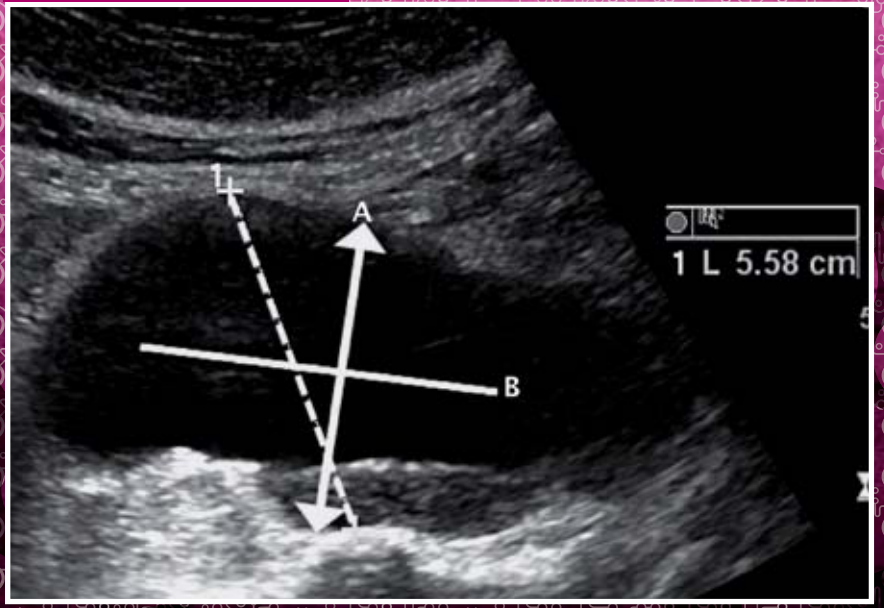


FIGURE 2: Significant over-estimation of aortic diameter by an inexperienced operator is demonstrated in this longitudinal image of an aneurysm. The dashed line between the callipers represents an oblique line of measurement (5.6cm) that could result in this patient being referred for treatment. Line A represents the correct line of measurement, taken perpendicular to the axis of the aorta at its widest point, indicated by line B.



There has been no overall consensus as to which of the three methods is more reproducible.

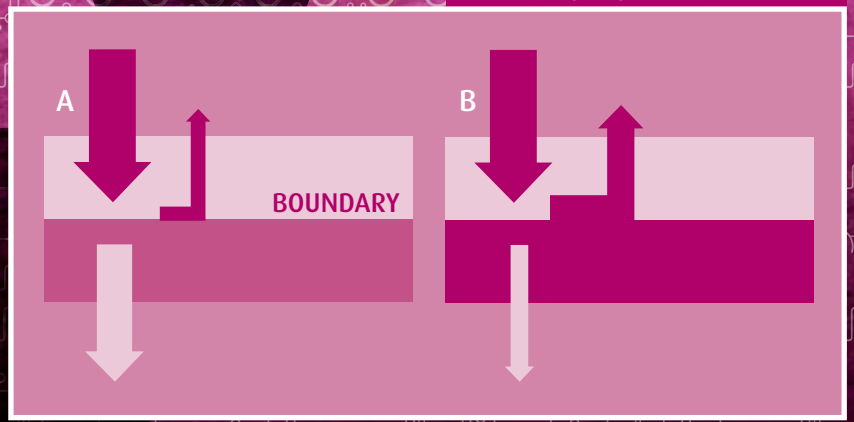


FIGURE 3: The shaded rectangles represent tissues with different acoustic impedance. (A): There is a small difference in acoustic impedance between the two materials and a relatively small proportion of the ultrasound is reflected at the boundary between the tissues (small angled arrow). (B): There is a marked difference in the acoustic impedance between two materials and a strong ultrasound reflection occurs at the tissue boundary (large angled arrow).

measurement. To examine this question it is important to consider two points. Firstly, evidence for the accuracy and reproducibility of each method and secondly, the scanning workforce and how this has changed with the introduction of AAA screening programmes.

ACCURACY, REPRODUCIBILITY AND THE SCANNING WORKFORCE

An important aspect of any measurement relates to its accuracy and reproducibility. Accurate ultrasound measurement of the abdominal aorta will be highly dependent on the skill and expertise of the operator. A recent systematic review of studies reporting the repeatability and reproducibility of ultrasound measurements of aortic diameter was conducted by Beales et al[8]. They found several studies reporting intra- and inter-observer reproducibility coefficients for the measurement of the antero-posterior aortic diameter of less than 5mm, irrespective of the of the method of ultrasound measurement used. In contrast, they found some studies reporting poor intra- and inter-observer reproducibility (>5mm) and they concluded that formal training and standard operating procedures with failsafe and quality control are vital components for aortic measurement and aneurysm screening programmes. The NAAASP has set standards for the limits of reproducibility within 5mm and has implemented a strict quality assurance programme. A similar review and critical analysis by Long et al[9] found that there is a wide range of practice with either ultrasound or CT, and they also concluded that a common methodology for AAA measurement is necessary. Importantly, they stated that reports and publications should indicate the method of measurement including plane of imaging and calliper position.

How might these statements relate to the measurement of abdominal aorta diameter in England? Firstly, until recently aneurysms were predominantly measured using the OTO technique, by a highly trained sonographer workforce as part of their general clinical workload. In England we are now in a transition period, where a significant proportion of aortic scans are being performed as part of the NAAASP. For AAA screening programmes it is not cost-effective to use highly experienced sonographers and instead screening technicians are utilised. The technicians must pass a focused university course on aortic scanning. They require a measurement technique that is reliable, reproducible, easy to teach and importantly, easy to review for quality assurance purposes, in line with the recommendations of Beales et al[8].

Secondly, all diameter measurements of the aorta should follow a standardised protocol. Adopting this approach will help to ensure that measurement variability is kept to a minimum (<5mm). The plane and axis of measurement should be consistent, avoiding errors due to obliquity as shown in figure 2. The diameter measurement technique should also be stated clearly within the report.

EVIDENCE FOR THE REPRODUCIBILITY OF OTO, ITI OR LELE MEASUREMENTS

Do any of the three measurement methods offer better reliability and reproducibility and are any of these techniques easier to teach? There is relatively little evidence to support the use of a specific method and few studies have examined the imaging performance of screening technicians. However, there is some evidence that both ITI and LELE methods are more reproducible than the OTO method with

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> It is not cost-effective to use highly experienced sonographers and instead screening technicians are utilised.

less intra- and inter-observer variability, particularly when measurements are performed by screening technicians. To understand why this may be the case we need to consider how ultrasound produces an image of the aorta.

Ultrasound scanners produce high quality images of anatomy, due to reflection and scattering of ultrasound from tissues and organs within the body. It is important to remember that an ultrasound image of an aortic aneurysm is not a 'picture' of the aneurysm, but a representation of the reflection and scattering of ultrasound waves within the tissue. The reflections are caused by changes in acoustic impedance (dependent on speed of sound and density) at tissue boundaries such as arterial wall and blood. In particular, strong reflections are produced at boundaries between tissues that have large differences in acoustic impedance (so called impedance mismatch) and these areas are displayed as bright boundaries or echoes on the monitor (figure 3)[10]. This phenomenon means that it is usually easier to see exactly where the inner arterial wall/blood boundary is compared to the outer arterial wall/surrounding soft tissue boundary. In other words, there is normally a larger impedance mismatch between blood in the aortic lumen and the inner aortic wall than the posterior outer aortic wall and surrounding peri-aortic tissue as shown in figure 4a. The result is greater confidence for the placement of the measurement calliper at the inner posterior aortic wall boundary. The boundary between thrombus, when it is present, and inner aortic wall, is also easier to identify (figure 4b). This would therefore suggest that both ITI and LELE techniques should result in less variability and better reproducibility for measurement of aortic diameter. There is some evidence to support this.

A study comparing the performance of aortic screening technicians and vascular scientists, measuring the diameter of 60 aortas (range 1.3cm-7.0cm) by both ITI and OTO methods, found that the ITI method was significantly more reproducible[11]. This was particularly the case for the screening technicians, which is highly relevant as they form the bulk of an AAA screening workforce. Many of the technicians in the study had no ultrasound experience prior to training as a screener. Screening technicians also commented that the inner wall is consistently easier to identify. The study by Gürtelschmid et al compared all three ultrasound measurement methods and found that LELE was the most reproducible method, with OTO being the least reproducible[7].

In both studies, ITI and LELE underestimated aortic diameter compared to OTO. It is estimated that the

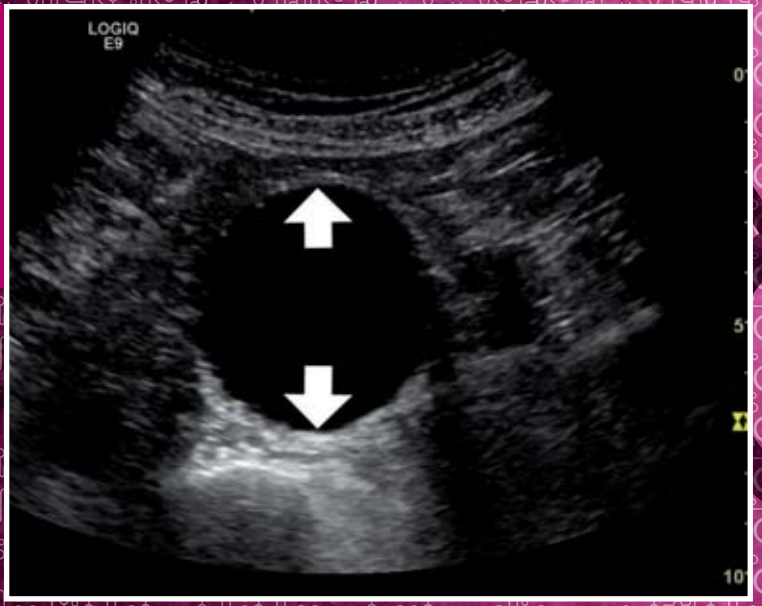

FIGURE 4A: A transverse image of an abdominal aortic aneurysm demonstrates a clearly defined boundary between aortic lumen and the inner-anterior and inner-posterior aortic walls (arrows).

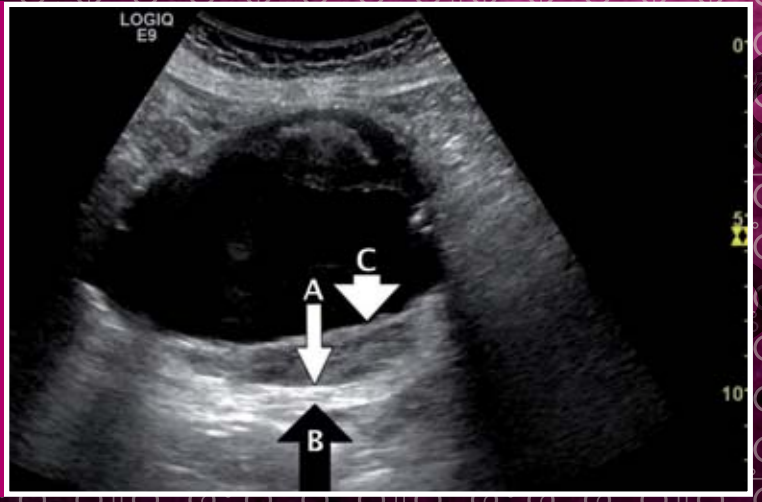

FIGURE 4B: A longitudinal ultrasound image of an aneurysm containing significant posterior thrombus. Arrow (A) marks the boundary between the thrombus and inner aortic wall. This boundary is easier to define than the outer aortic wall, which is in the vicinity of the black arrow (B). Arrow (C) demonstrates the boundary between the aortic lumen and thrombus.

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LELE and ITI techniques underestimate aortic diameter compared to OTO, by approximately 2mm and 3-4mm respectively[7,11,12]. It is no surprise that this has raised concern amongst clinicians that aneurysms may rupture whilst undergoing surveillance using the ITI method. A 5.5cm AAA reported using the ITI method may measure approximately 5.8-5.9cm by the OTO method, which is well into the size range for an increased risk of rupture, as suggested by the outcome of UKSAT[6].

However, it is important to consider a number of points. Firstly, the ITI method was used in the MASS trial that has demonstrated a significant reduction in aneurysm-related mortality with screening and aneurysm surveillance. Secondly, it could be argued that UKSAT provides evidence of when not to operate, rather than when it is essential to do so. Thirdly, given that the ITI technique is reliable, even if there is accumulated evidence that surveillance AAAs in the 5.2-5.4cm diameter range are rupturing using ITI criteria, it would be possible to change the threshold for potential treatment, for instance, referral at an aortic diameter of 5.2cm ITI. Currently there is no evidence that this is happening, but the NAAASP is keeping this under close review. This would simply represent a change of threshold, whilst maintaining a technique that is reliable, repeatable and easily taught. A similar concern has been raised for entering patients into AAA surveillance as patients are enrolled at a diameter of 3cm ITI. This would equate to approximately 3.3-3.4cm by the OTO method.

Currently, there is concern that some men with aortas in the 2.5-2.9cm diameter range measured by the ITI method may develop AAAs in later life with the risk of rupture. However, as the accumulation of AAA screening data improves understanding of AAA progression over time, one strategy may involve inviting men with aortas in this range for a further screening scan in 5-10 years at the age of 70-75.

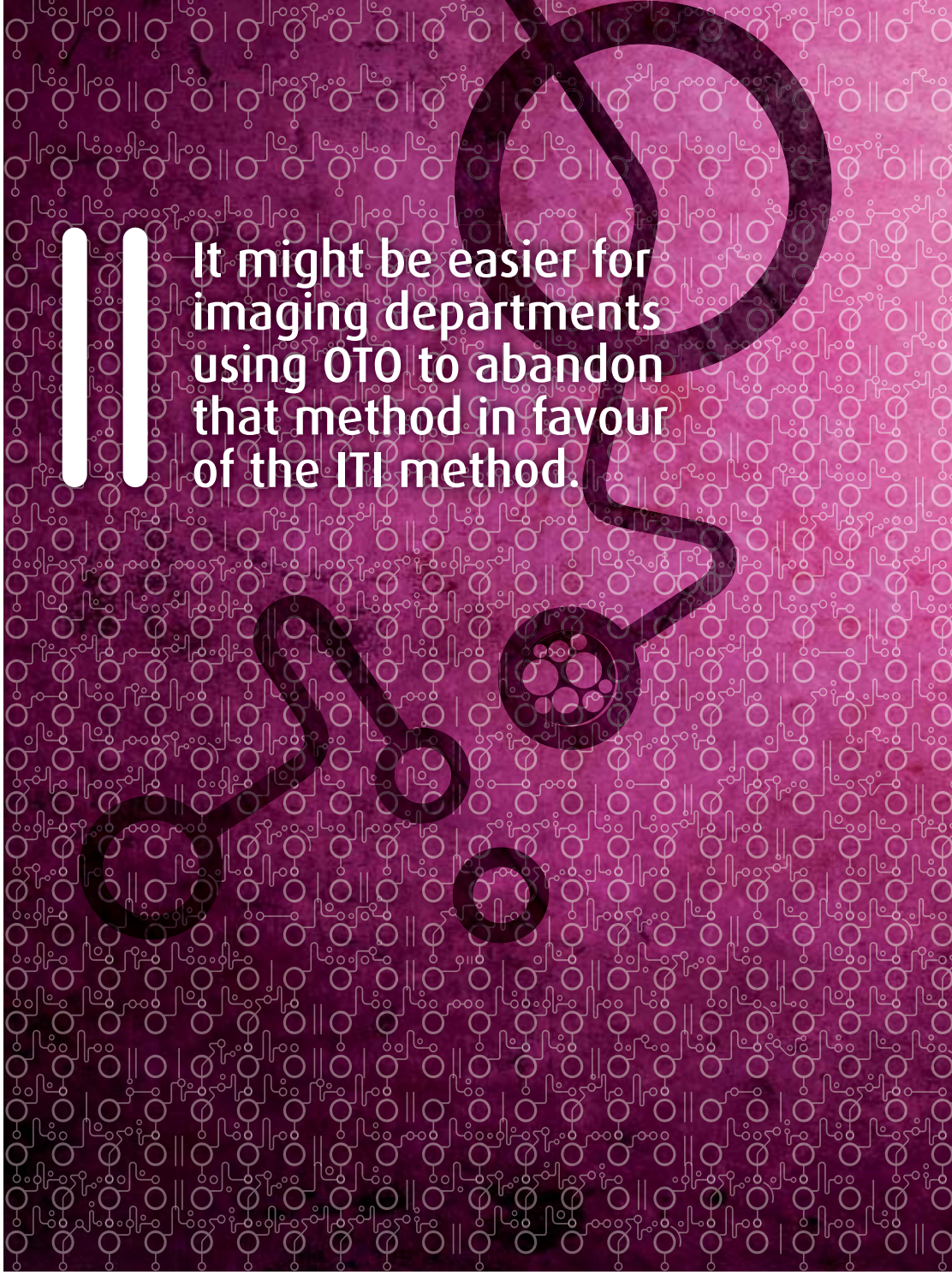
THE FUTURE

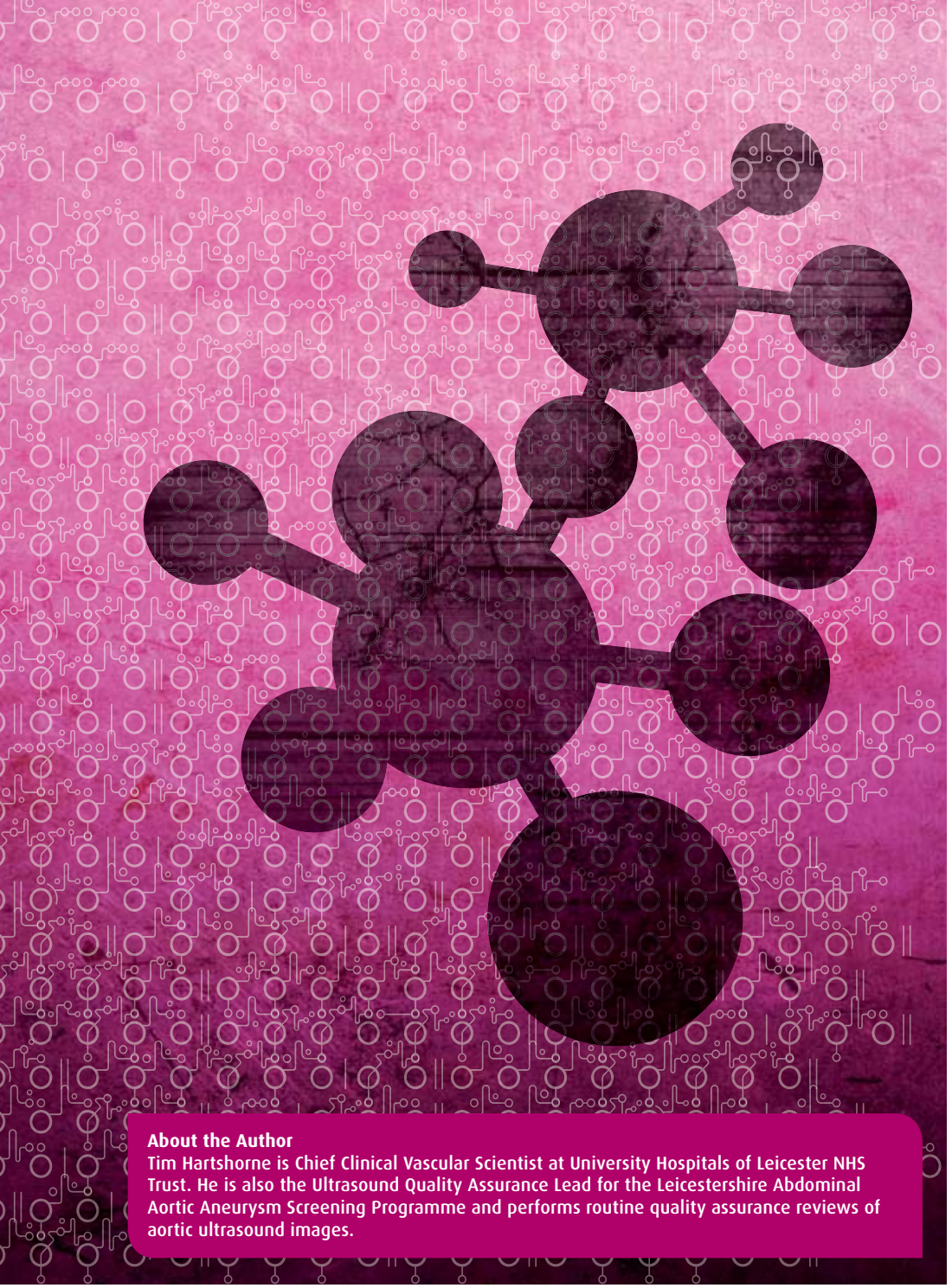
It seems illogical to be simultaneously using two different methods of measuring abdominal aortic diameter in England. The NAAASP is fully implemented and it would be difficult to re-train the screening workforce to measure OTO aortic diameter; there is also some evidence that screeners find this method less reproducible. More and more aneurysms will be detected by screening and this will provide the majority of the operative workload for vascular surgeons in the future. If the ITI thresholds for enrolment into screening and treatment are wrong they can be re-adjusted based on accumulated evidence from NAAASP, which is currently collecting large amounts of data related to AAAs.

Alternatively, it might be easier for imaging departments using OTO to abandon that method in favour of the ITI method, thus harmonising the ultrasound measurement of aortic diameter in England. Given that the LELE method is used only in Sweden it is unlikely to be adopted elsewhere unless there is convincing evidence that it offers significantly superior reproducibility.

CONCLUSION

On the face of it, it would seem logical to measure aortic diameter from outer wall to outer wall, similar to CT scanning, but it is important to consider the physical nature of ultrasound and how this relates to imaging of the aorta. For AAA screening programmes, low variability with high levels of reproducibility are fundamental requirements. The absolute diameter of the aorta is unchanged whatever





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measurement method is used. If more studies continue to suggest that the OTO method is the least reproducible method of measuring the aorta, particularly when performed by screening technicians, imaging departments should consider adopting the ITI technique as this is already embedded within AAA screening. Additionally, it is important that clinicians are aware that different measurement methods are currently in use. There may be a case for organisations such as the Vascular Society or National Institute for Health and Care Excellence to issue recommendations. Until such a time it should be a mandatory requirement that all reports of aortic diameter specify which measurement technique has been used to avoid confusion.

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COMPUTER-AIDED DETECTION: FROM EMERGENCE TO UBIQUITY

GREG SLABAUGH

Use of computer-aided detection (CAD) has seen considerable growth in radiologic practice since the first commercial system was cleared for clinical use by the United States Food and Drug Administration (FDA) in the late 1990s for breast mammography.

Since the 1990s, there has been a proliferation of CAD systems developed for different clinical workflows. This trend is likely to continue as CAD widens its reach, and its performance improves with each successive software generation. This article provides a summary of the role of CAD, a brief history, and future directions, with computed tomography (CT) colonography as an exemplifying clinical application.

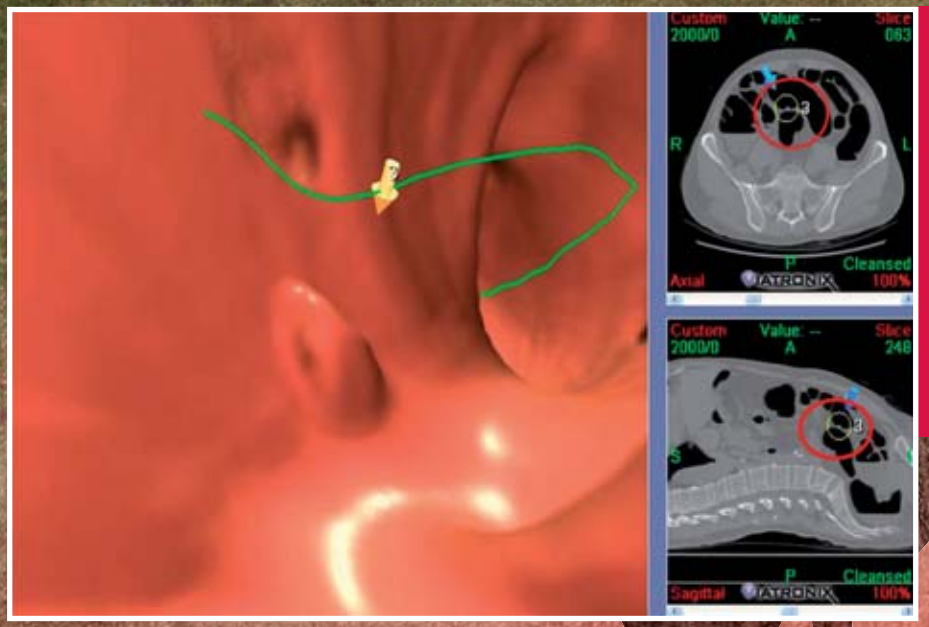
Fundamental to radiology is the interpretation of medical images to provide a diagnosis. As in any human endeavour, this involves an inherent risk of error. Unfortunately, diagnostic errors in radiologic interpretation are all too common, with rates up to 30% for patients harbouring abnormalities[1]. The reader may experience stress or guilt if an important finding that could adversely affect a patient is missed[2].

Errors can be categorised as perceptual or cognitive. A perceptual error is one in which an abnormality is present in the image, but the reader somehow fails to 'see' it, despite the abnormality being evident in retrospect. Perceptual errors can result from reader fatigue, distraction and variable conspicuity of an abnormality. Cognitive errors occur when the reader sees, but makes a wrong judgement about a radiologic finding. It has been estimated that 70% of errors in radiologic image interpretation are perceptual, whilst the remaining 30% are cognitive[1].

To reduce errors, strategies such as double reading[3] have been proposed, where an image is reviewed by two human readers and a policy is applied to resolve inconsistencies (such as forming a consensus opinion). Whilst effective at improving detection, double reading is labour intensive and therefore its practice is limited. As an alternative, CAD applies automated pattern recognition software to identify suspicious areas in an image. CAD produces a set of visual marks that are overlaid on the image to draw the reader's attention; examples are shown in figure 1. In this way, CAD can assist the reader in detecting abnormalities that may have been missed on a single read. The use of software, rather than a second human reader, has the potential to provide an increase in detection rates without significantly increasing demand on staff[4].

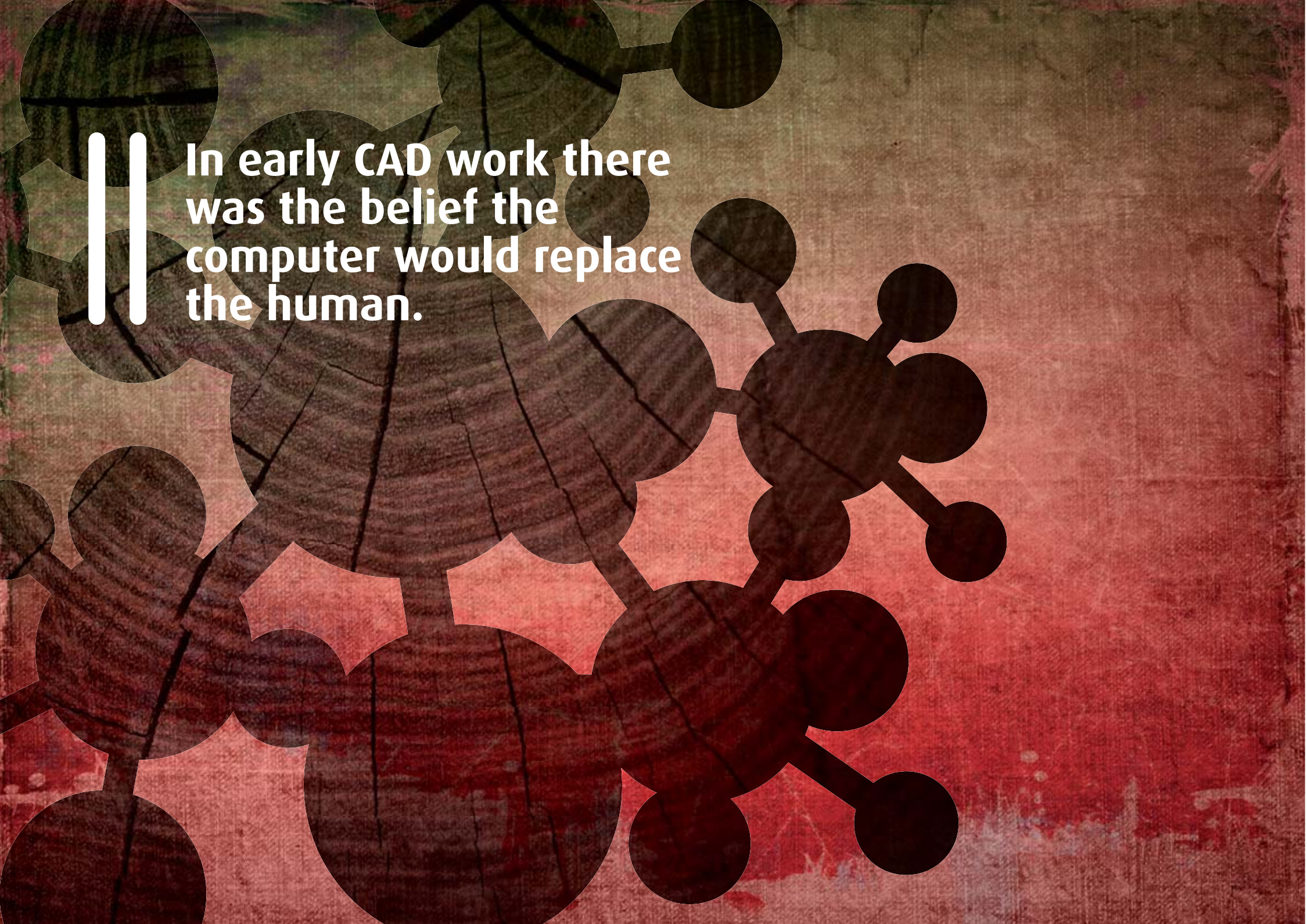
CAD HISTORY

CAD has its origins in the study of radiologic errors. In 1948, Stanford University radiologist L Henry Garland rather shockingly raised the issue of radiologic misinterpretation in his presidential address to the Radiological Society of North America annual congress[5]. This 'call to arms' laid the groundwork for quantifying reader performance through objective measures, and research into improving image interpretation. Following the invention of the integrated circuit in the late 1950s, early investigations into the use of computers in the automated quantitative analysis of medical images began in the 1960s. In this early CAD work, there was the belief the computer would replace the human reader. However, due to limitations of the computing hardware[6], difficulty with digitisation of images, and high standards required for clinical use, success was limited[7]. By the 1980s, CAD research instead took the view that the computer could assist the human reader to provide a more accurate diagnosis, which is the prevailing opinion today.
The CAD field had a watershed moment in 1998 when the US FDA cleared for clinical use, the first commercial CAD system, produced by R2 Technology, for the detection of breast lesions in mammography. Following this, CAD grew rapidly, expanding into larger sets of clinical problems, whilst additional commercial CAD products became available. Today a variety of CAD systems



FIGURES 1A (LEFT) AND 1B (BOTTOM LEFT): Example implementations of CAD marks. In (a), a colon CAD system detected a sessile polyp, and a CAD mark is presented to reader by rendering an arrow overlaid on a 3D endoluminal visualisation of the colonic surface. In (b), a lung CAD system identifies suspicious regions in a CT image of the lungs, presenting the reader with a list of CAD findings to examine.
Note that CAD is differentiated from computer-aided diagnosis (CADx), which extends the computer analysis to characterise a finding (eg, provide a probability of malignancy).

70% of errors in radiologic image interpretation are perceptual.


In early CAD work there was the belief the computer would replace the human.

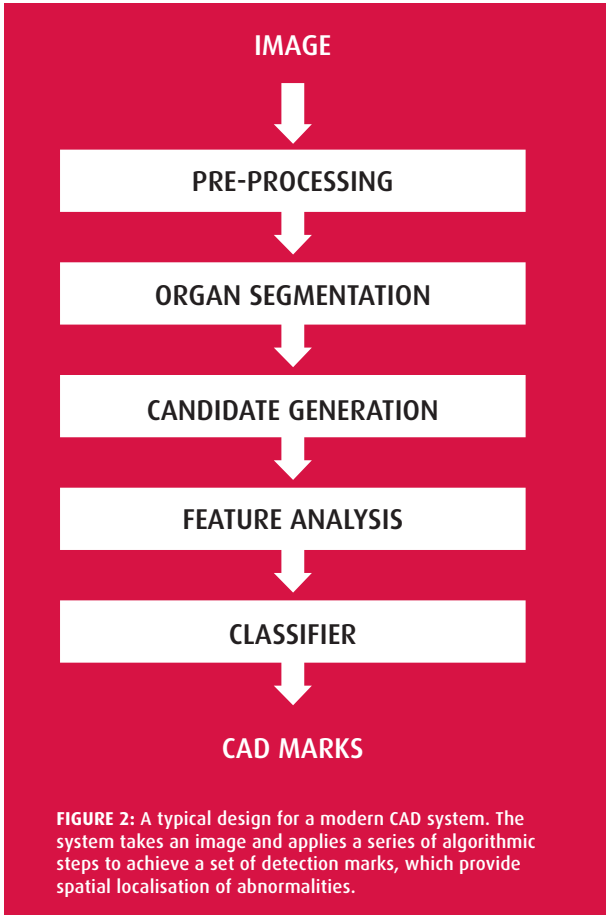


FIGURE 2: A typical design for a modern CAD system. The system takes an image and applies a series of algorithmic steps to achieve a set of detection marks, which provide spatial localisation of abnormalities.

exist, spanning an ever-increasing array of clinical workflows, organs, and imaging modalities.

HOW CAD WORKS

A standard algorithmic design of a modern CAD system is presented in figure 2. CAD may first apply image pre-processing, for example, image denoising or in the case of CT colonography, electronic cleansing of faecal material. Next, a segmentation algorithm is applied to localise the organ of interest in the image. A candidate generation step provides an initial detection of suspected abnormalities, such as lesions. Candidate generation is designed to be highly sensitive, so that it identifies as many lesions as possible, but may include non-lesions as well. Feature analysis extracts mathematical descriptors of each candidate region. Good features are those that discriminate between lesions and non-lesions, and are often based on features human readers themselves use to disambiguate true lesions from pseudo-lesions. Finally, each candidate and their set of features are classified using a supervised machine learning algorithm designed to filter out the non-lesion candidates. Those that pass through the classifier produce the final set of CAD marks, which are superimposed on the image to provide a prompt to the clinical reader, highlighting the suspicious region.

CAD is often applied in screening applications; common examples include breast mammography, lung nodule screening and CT colonography. CT colonography for example produces a large number of images (often more than 1000 2D axial images per patient) that must be carefully analysed by the clinical reader. This application is ideal for CAD, as it involves a large quantity of data, coupled with a relatively low prevalence of non-diminutive (6mm or larger) lesions in a screening population; a scenario which lends itself to reader fatigue.

A typical implementation of CAD will employ it as a second reader. In this mode, the reader will first read the image without any assistance from CAD, and take note of all findings. Once complete, CAD is activated and each mark is reviewed by the reader. Often CAD as second reader is likened to a 'spell checker' in a word processing program, helping the user avoid making mistakes after they've provided input. Alternatively, in a concurrent read, the reader reviews the image simultaneously with the CAD marks superimposed. Yet another approach is CAD as first reader, where the human reader reviews only the marks produced by the CAD system. First reader and concurrent reader modes are not favoured in clinical practice. In a concurrent read, the reader may overly focus on the CAD prompts at the expense of the rest of the image, resulting in an unwanted automation bias. CAD as first reader may limit the sensitivity of detection, as any abnormalities missed by the CAD system will be unrecoverable by the human reader.

PERFORMANCE

The performance of CAD is usually characterised using one of two methods: stand-alone testing and reader studies. In a stand-alone test, the performance of CAD is evaluated using a test dataset that is independent of the dataset used to develop the CAD system, and contains a set of known abnormalities that have already been previously identified. In CT colonography, these known abnormalities are often established through verification with optical colonoscopy and linked to CT images. The sensitivity (percentage of correct identifications) is often plotted as a function of the number of false positives. Stand-alone studies are useful for characterising CAD algorithm performance independent of the clinical reader and, because these studies can be fully automated, provide a fast way for CAD system designers to test if modifications are beneficial when working on algorithmic changes.

However, the true purpose of CAD is to assist the clinical reader. A reader study determines if CAD is beneficial to human interpretation. Standard practice is to perform a multiple reader, multiple case (MRMC) study, where a pool of readers evaluate a set of cases, both with and without CAD as second reader. The performance of the readers is captured in receiver operating characteristic curves[8]; the area under the curve (AUC) providing an overall measure. Effective CAD systems show an increase in reader performance when CAD is used, ie a CAD gain in AUC.

Some of the early reader studies demonstrated that CAD does not have to be perfect to provide a benefit to the reader. As long as the CAD finds abnormalities (true positives) that are missed by the reader, it can help the reader improve their sensitivity, by drawing their attention to abnormalities that would have otherwise been overlooked. Numerous studies have shown that on average, human readers detect more anomalies using CAD than without CAD. The advantage of using CAD, however, varies based on the reader experience. Particularly less experienced readers have more to gain by using CAD, and studies by teams such as Mang et al[9] have shown CAD can help these readers approach the skill of an expert reader in detection. However, larger

powered studies have shown expert readers can also benefit from CAD[10] In another study from 2010, a CT colonography CAD system detected 15 polyps 6mm or greater in size that were missed by an expert reader, including four large (10mm or greater) polyps that were found at subsequent optical colonoscopy[11]. Example true positive CAD marks from this system are shown in figures 3(a) and (b). Indeed, many readers rely on CAD in their routine clinical practice and find it an indispensable tool[12].

LIMITATIONS

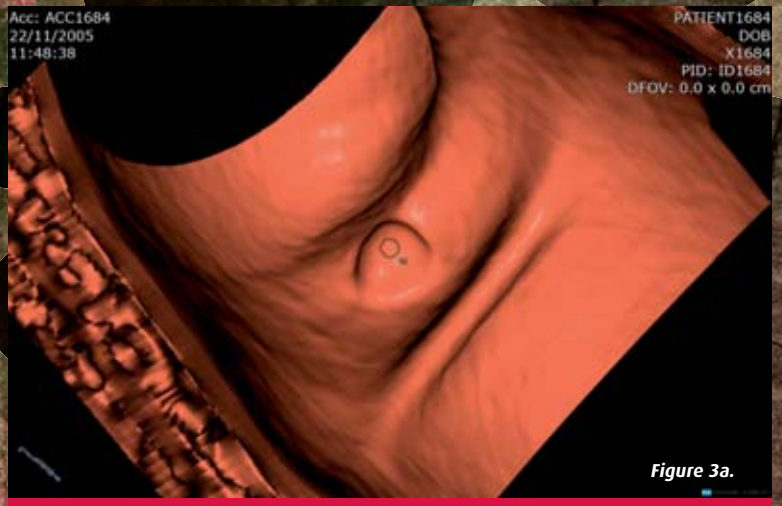
Whilst CAD helps readers find more abnormalities, CAD produces false positive detections as well. These false positives must be dismissed by the reader, otherwise they may lead to recalling the patient or additional workup. In CT colonography, CAD false positives are typically produced by residual stool, the ileocecal valve, thick haustral folds and the rectal catheter. Examples are shown in figures 3 (c) and (d). Some of these false positives, such as the rectal catheter, are easily recognised by the clinical reader, however, others may be more difficult to dismiss.

Indeed, many studies show that CAD helps readers increase their sensitivity in detection, but at the price of a loss of specificity (due to CAD false positives that are not dismissed). The benefit of increased sensitivity must be weighed against any potential loss in specificity in the clinical application. Recently, having reviewed the use of CAD in community practice in seven US states from 1998 to 2006, Fenton et al sparked debate by questioning whether CAD was truly effective in detection of breast cancer[13]. Whilst this study was disputed due to its statistical approach, interpretation of results[14], and focus on outdated film-screen technology and dated CAD systems[12], it did raise key questions about proper deployment of CAD in clinical practice. It also highlighted the fact that CAD is a moving target, evolving with clinical practice (eg film-screen to digital in mammography).

There are other limitations of CAD. Often it is difficult to compare the performance of different CAD systems, even those designed for the same clinical application, since a universally agreed set of test images is unavailable. Related to this, CAD performance can vary based on the quality of the images to which it is applied. Despite advances in image analysis and pattern recognition, CAD does miss abnormalities, ie produces false negatives. For example, in CT colonography, CAD detects roughly 90-95% of a patient's polyps[10,15] (which is similar to an expert reader's performance). However, this means 5-10% of polyps are not detected with CAD. If a CAD false negative coincides with a reader false negative, then the abnormality goes undetected, resulting in a potentially dangerous situation for the patient. Another limitation of CAD is the reader's time spent reviewing CAD marks. If the CAD system generates numerous false positives, they can be time consuming and tedious for the reader to dismiss.

THE FUTURE OF CAD

Despite these issues, CAD has a very bright future. Currently, commercial CAD systems are available for numerous clinical applications, including breast mammography (x-ray and magnetic



FIGURES 3A, B AND C: Example detections in CT colonography; CAD prompts are displayed as circles superimposed on 3D endoluminal renderings. Figure (a) shows a true positive detection of a sessile polyp, while (b) shows multiple detections of a true positive. Figure (c) shows a multiple false positive due to the ileocecal valve, and (d) shows a false positive resulting from a thick fold.

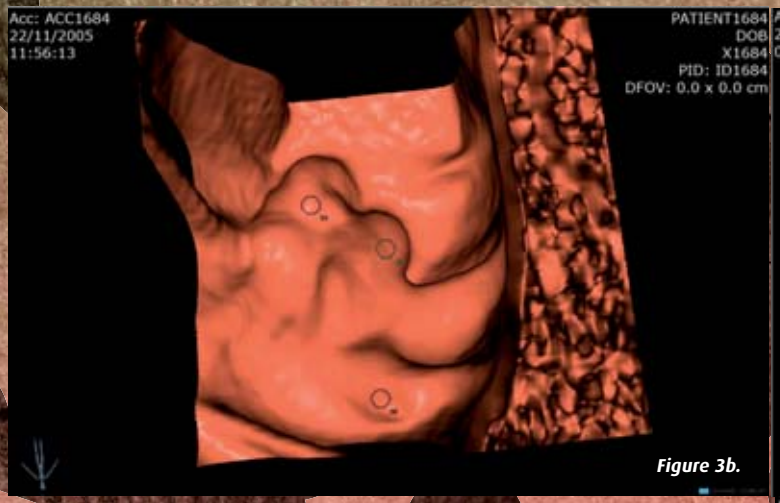


Figure 3b.

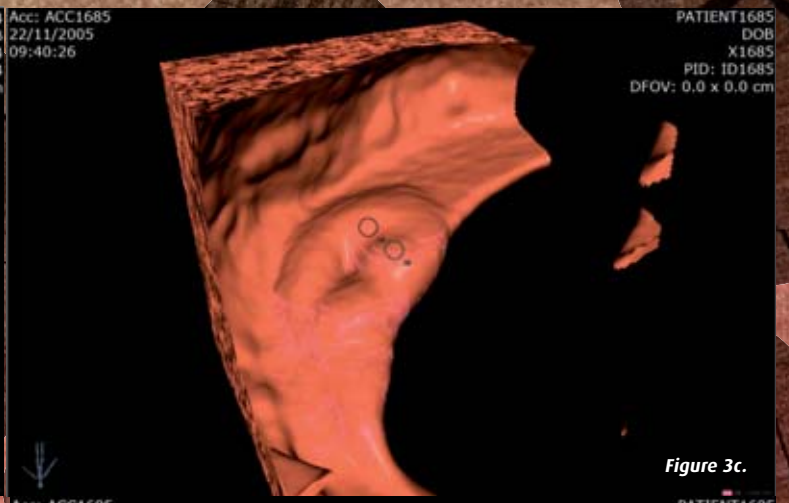


Figure 3c.

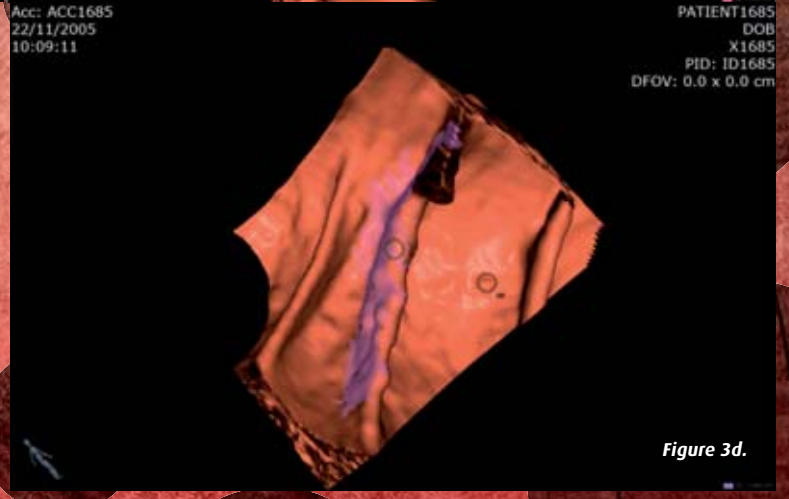
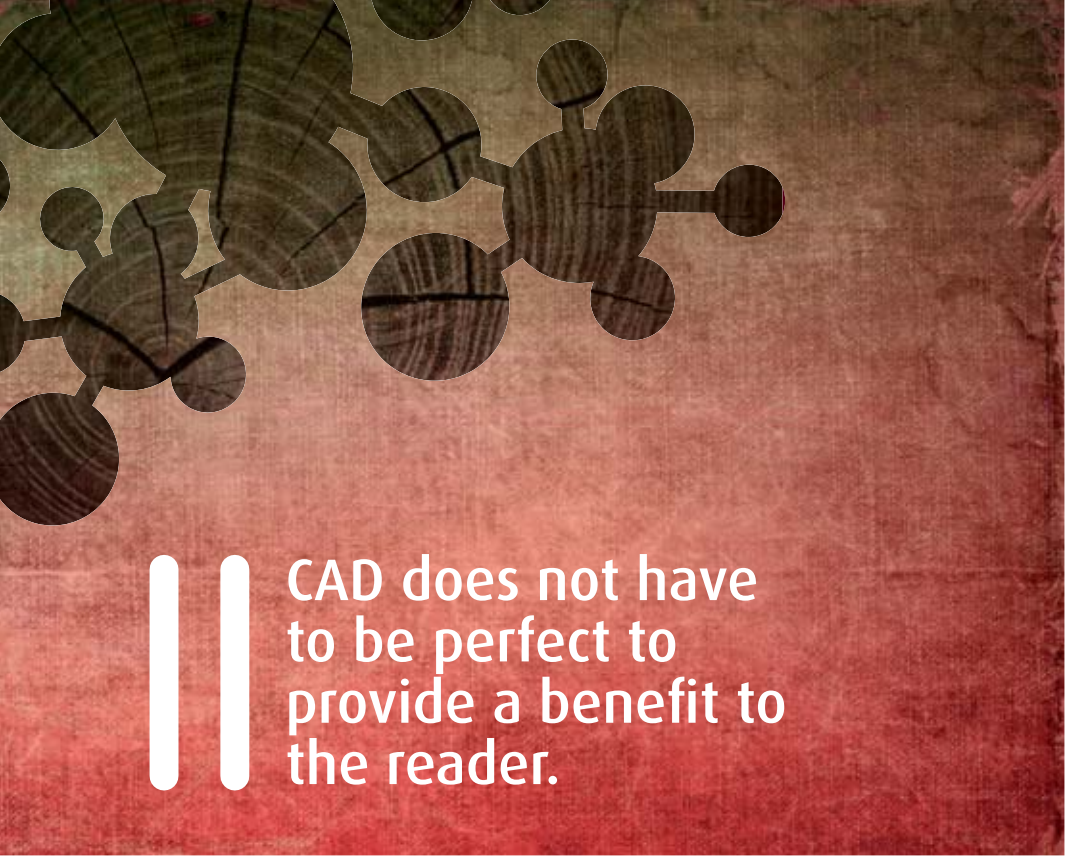


Figure 3d.



> CAD does not have to be perfect to provide a benefit to the reader.

resonance imaging (MRI)), detection of polyps in CT colonography, screening for lung cancer with CT images, and prostate lesion detection using MRI. The scope of CAD will continue to expand, to different imaging modalities and organs. Whilst the regulatory environment for CAD devices is complex, particularly in the USA, 16 years after the first FDA clearance for a commercial CAD system there is precedent as well as established guidelines for CAD devices. Companies will continue to have success in commercialising their CAD solutions, and market adoption will grow, particularly in newer areas such as bone, liver and prostate[16].

Advances in image analysis and machine learning in this new era of 'big data' will produce more sensitive CAD systems that generate fewer false positives. Meanwhile, imaging technology will continue to improve, providing higher fidelity images, as well as new modalities for which CAD systems will be developed. Standardisation of clinical workflows and patient preparation will reduce variation in datasets, making it easier to develop robust CAD solutions. As CAD systems mature, they will go beyond pure detection to additionally provide a diagnosis, such as a computerised grading of lesions to assist in the clinical workflow. Through the use of registration techniques, software will enable longitudinal studies of abnormalities as well as cross-modality integration.

CAD is now proven technology in a number of important clinical applications. Undoubtedly CAD will continue to widen its reach into new clinical workflows. Readers are ideally situated to help by experimentally validating CAD through clinical trials and adopting approved CAD systems into routine clinical practice.

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Steven Short (PACS/RIS Manager, Alder Hey and Liverpool Womens); Andrew Robson (Carestream); Stephen Thomasson (Project Manager, Aintree); Anita McClean (RIS and Deputy PACS Manager, Aintree); Bonnie O'Sullivan (PACS/RIS Manager, Walton); Jon Kingan (Carestream); Lynn Anslow (PACS/RIS Manager, St Helens and Knowsley) Gareth James (PACS/RIS Manager, Warrington); Sharron Dyce (PACS Manager, Royal Liverpool University Hospital); Rose McHugh (PACS/RIS Manager, Clatterbridge); Fiona Hayes (Merseyside); Stephen McGeorge (RIS Manager, Royal Liverpool University Hospital); Steve Sparks and Mark Smalley (Carestream)

The Cheshire and Merseyside Consortium, made up of eleven trusts, has chosen Carestream to supply its CARESTREAM Vue PACS v11 as a managed service.

Peter Rowlands, Consultant Radiologist at Royal Liverpool University Hospital explained the background: 'Cheshire and Merseyside's an unusual area. There are multiple trusts in a small geographic area with a number of specialist hospitals, so it's always been a challenge to have patients moving around between hospitals. There's currently around a million and a half exams a year across the consortium with more and more studies being done; each study has more data in it, so the amount of data being transferred increases. More of our people now work across different sites and to support that activity and make it easier for images to be acquired in one site and reported on another were high priorities for us.'

Peter Rowlands, Consultant Radiologist

PACS Manager at Royal Liverpool University Hospital, Sharron Dyce was part of the procurement team: 'I think the biggest achievement was bringing eleven trusts together and keeping them together right through to deployment. We've been live over six months and we're already realising the benefits of image sharing across the community.'

'In the procurement process you aim to get the most cost effective, as well as the most feature rich system to meet the needs of each trust,' went on Sharron. 'Carestream had a lot of advanced features such as CT reconstruction already standard within their system where others didn't.'

Sharron also recognised the benefits of having a direct relationship with the system supplier. 'Under the Local Service Provider arrangements there was always a middle man,' said Sharron. 'From a manager/administrator point of view I can go directly to Carestream and immediately be in touch with an engineer who can help me straight away.'

Sharron Dyce, PACS Manager

Now that the new PACS is in operation, what clinical benefits have Peter Rowlands and the radiology team across Cheshire and Merseyside seen? 'When we're reporting we have access to previous studies which means we can report the scan there and then, and that's a big advantage for radiologists,' he said. 'We're also seeing a lot of the annoyances of the previous situation, particularly with image transfer, disappearing. It's a very popular system.'

MULTI-DISCIPLINARY MEETINGS

'Multi-disciplinary meetings are also much easier to facilitate now. Previously, two or three days before a meeting, all of the images had to be imported, which was very time consuming, so that's a big advantage. Recently we've also had a pilot scheme with registrars reporting out of hours work for two hospitals and this would not have been possible in the previous PACS situation,' continued Peter.

'Our aim is to take visible light or endoscopic images and incorporate those in PACS so that the patient folder has all of the images whether they're visible light, pathology, x-ray or MR.'

Concerning multi-disciplinary meetings, Sharron received a positive message from a Consultant Oncologist at Clatterbridge: 'what a difference the region-wide PACS makes to us. When patients cross between the specialist small hospitals and the large hospitals, the PACS system makes management so much easier, whether it is in our clinics, in MDTs or when I ring a colleague in a different hospital and we can both view images and discuss management.'

How does Sharron Dyce assess the new PACS from a management perspective? 'We've installed a more complex, more robust system, with a primary PACS store and a backup PACS store,' she said. 'We've now got a global worklist which is also a data base and a vendor neutral archive which is the central storage for the trust. Comparing the previous national contract to our managed service with Carestream I think we're probably paying 40% less than we were, so there's massive savings there.'

CARESTREAM VUE MOTION

And what of future developments? Sharron Dyce explained: 'As a trust we went from transferring about 250 studies a week to importing about 180 a week and that will probably reduce to about 100 imports a week. That of course will allow image transfer teams to do other things than import studies from Cheshire and Merseyside, as they are now available on the global worklist.'

'In order to bring other places on stream such as Wales and the Wirral, we're looking at installing something called the Carestream Agent into sites that need to see Cheshire and Merseyside images and where we need to see their images, so that will be another step forward in data sharing. There's also a zero footprint client called Carestream Vue Motion which is a very simple viewer which will be the next step. Once we've got the global worklist available on the Vue Motion client that will be the first port of call for all clinicians. They'll see the image, a report and, if they need any advanced viewing, they can launch the full client from within Vue Motion.'

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THE RADIOLOGY REPORT: A VOICE FROM THE DARK

ADAM WALLIS, PAUL MCCOUBRIE

The radiology report is the lasting written documentation of a radiological investigation or procedure. Reports serve many functions other than just communicating the clinical findings of the radiological study or procedure. They may also be used for teaching, patient education, audit and quality improvement, research, billing purposes and are, of course, a lasting medico-legal document.

INTRODUCTION

The first documented report was written well over a century ago[1] by William Morton, a neurologist describing an abdominal radiograph. Many early reports were terse statements simply informing clinicians that 'radiographs are available for viewing in the x-ray room'[2]. Despite the huge technological advances the report changed very little for decades.

Recent exponential increases in number, variety and complexity of radiographic examinations have led to a great demand on resources. Widespread use of picture-archiving and communication systems (PACS) has resulted in fewer in-person consultations[3]. In this modern era of teleradiology, reports and images travel across the globe through cyberspace. As technology-based solutions become the commonplace, reports risk becoming commoditised; this risks losing the all important focus on clinical utility. Some PACS systems now even have an in-built 'chat' system – heaven forbid we should have to pick up the 'phone or even go to see a colleague in person, we can now just message each other!

Despite this, all professionals producing reports on investigations or procedures have a duty of care to do this to the best of their ability. We have to provide our clinicians with helpful, accurate and clear reports. And this should be done in a timely and cost-effective manner. If we don't do this, we are doing a disservice to our patients and our employers. Increasingly, monopoly provider status is not guaranteed; image acquisition and/or reporting can and will be outsourced in this competitive financial climate.

It goes without saying that there are many important aspects of the radiology report. One reason that articles of this nature stir up controversy is because this is a hugely subjective topic. Each report is a culmination of years of teaching and personal experience, but surprisingly little formal teaching. There is no such thing as a perfect report nor is there any real right or wrong way to go about writing a report. There are many qualitative studies of reporting, although few have produced categorical guidance. This article does not lay down absolute rules, but rather highlights what we believe are the most important points to consider.

CONCISE

Most would agree on the importance of being concise. Reports that are short are more likely to be read – clinicians faced with a long report may merely skip to the conclusion. But it is more complex than that. Reports that are punchy and concise are easier to understand. Short sentences, simple grammar and minimal jargon are key features to achieve this. It is easy to write a long report but much harder to write a short one. The secret to a short report is knowing what to leave out. This is more difficult than it sounds. It takes experience, particularly a deep understanding of the clinical context and the likely impact of the report in an individual's management.

There is a balance to be struck however and our hearts sink when we read reports such as 'clear' for a chest radiograph or 'no metastases' for an ultrasound of the abdomen. Clinicians expect a professional written and thoughtful response to their clinical question (assuming a clinical question is provided). It is difficult to be certain that much thought has gone into

Reporting can and will be outsourced in this competitive financial climate.

reviewing a complex study if the report is only two words in length. The needs of the referring clinician vary. The best way to be sure is to ask them what they want from a report. It is doubtful that they would be happy with a single word, and could even perceive that similar shortcuts were taken when looking at the images – many clinicians will doubt a particular feature was examined if not especially mentioned[4].

HOW TO AVOID THE RADIOLOGICAL HEDGE

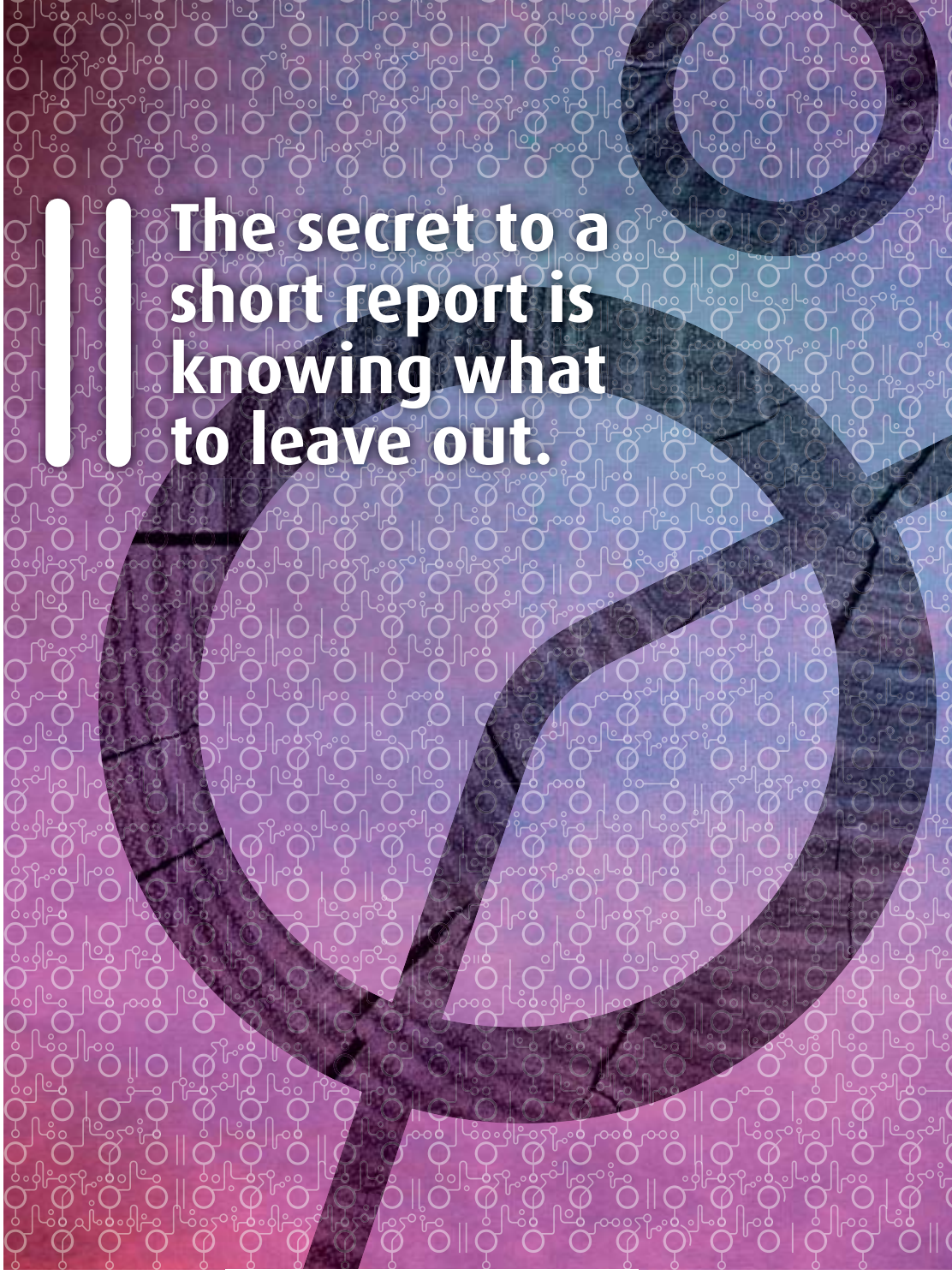
As previously stated, the radiology report is a lasting medico-legal document. Most malpractice lawsuits cite poor communication as a causative factor[5] and often the cause is a lack of commitment on the part of the radiologist. The radiological 'hedge' should generally be avoided. Of course we recognise that no radiological investigation is 100% sensitive or specific, but reporting requires the use of clinical judgement and acumen to arrive at a clinical opinion, rather than bailing at the first sign of commitment and complexity. In some cases a study will be of poor technical quality, in which case say so. If in doubt, using the first person can imply consideration and thought. If it is an honest answer to state: "I am uncertain as to the importance of this" then say so. Do not however, use obscure language to write an ambiguous and therefore meaningless report.

Consider the end-user of the report – the referring clinician and what they should infer from the report. A case in point was the general practitioner who was faced with a new patient who had moved into the region, clasping a CT report from A N other hospital stating:"There may be a possible 4.5mm nodule at the right lung base though this may be a vessel, it is difficult to be certain, perhaps follow-up should be considered". As far as reports go, this is next to useless. Whilst not advocating confrontation or diatribe, these issues should be raised at discrepancy meetings. Debate on poor reports encourages us all to improve our reporting standards. If you are not taking part in these discussions, then perhaps you are part of the problem.

Maybe in years to come, as more emphasis is placed on reporting standards, initiatives such as the Radiology Events and Discrepancies (READ) by the Royal College of Radiologists (RCR) will include errors arising due to poor reporting. We have discussed comprehensively, hedge terminology and ways to avoid the hedge[6]. A key question to ask is 'what is the take home message that the referring clinician has after reading my report?'. Spend some time reading your reports and asking this question, ensuring that where possible you avoid hedging.

HOW MUCH STRUCTURE IS ENOUGH?

A structured approach rather than rambling prose conveys clarity of thought. Surveys of clinicians and also radiologists, suggest a preference towards structured reporting rather than prose text. Recent guidance by the European Society of Radiology suggests the format of clinical referral, technique, findings, conclusion and advice[7]. A logical structure provides a strong foundation for a concise and clear report[8,9,10]. Hospital clinicians[11] and family doctors[12] appreciate a well-structured report.



Structured reports are divided into meaningful organised sections. The Radiological Society of North America (RSNA) report initiative aims to improve reporting practices through the development of clear and consistent report templates[13]. The structured layout includes information on the indication, comparison and technique, as well as a description of what should be essential components within the findings and an area to enter free text. This technique may be more time efficient and allow automated integration of other factors such as measurement, technical information and key images.

Structured reporting can be taken a step further by only allowing the use of a specific vocabulary: a lexicon of accepted terms. Such a step would prevent hedging and report ambiguity as the radiologists would have to use specific terms. Structured reports may potentially synchronise better with electronic patient records and certainly make data collection for audit and research easier.

And yet for all its potential benefits, structured reporting has yet to take off. Possible barriers include the necessary training and a concern that extra time to complete the reports would impact negatively on workflow and productivity. However, the perceived constraint that we would have to work within the framework of these reports is a key hurdle. Many of us are precious about how we report and do have a sense of ownership over how we do it. The fact of the matter is that we don't like losing our ability to write freely. How much structure is enough? Perhaps a full lexicon is taking things too far for many, but a structured approach, using paragraphs and headings to break up prose and improve readability, is favoured.

USE VOICE RECOGNITION WISELY

Speech or voice recognition (VR) is a valuable tool now in use in the majority of UK radiology departments. VR reduces the overall time to produce a report compared with using a transcription service[14]. However, this can come at the price of increase in time due to checking[15] and there is a tendency for errors in inexperienced hands. Always proofread your reports!

It is all too easy for simple errors to creep into reports, with potentially important consequences for the patient. Words such as 'asymmetric' can easily become 'symmetric', the word 'no' is easily missed such that 'no metastases' becomes 'metastases' and so on. For this reason, consider phrasing findings in the positive, with pertinent negatives. 'Normal pulmonary arteries with no PE' is hard to mis-transcribe. Clinicians have also noted that when proofreading, reporters do not always look at the images again, which can lead to grammatically and semantically correct reports, but left-right errors can still be present[16].

Reports are a reflection of the individual. Simple grammatical mistakes thus tend to make the individual look rather foolish. Unlike mistakes in medical notes that can become 'buried' beneath others, these will be there for the pleasure of others for many years to come. Take pride in the accuracy of your words, always read carefully and have zero tolerance for grammatical errors. Table 1 gives excerpts from verified reports which all make the reporter look rather careless.

> Reports are a reflection of the individual.

TEACHING

Trainees need to appreciate the importance of radiology reporting skills, yet American radiology residents in 2004 received no more than one hour of didactic instruction in radiology reporting per year[17] and the figure in the UK is likely to be similar. Most clinicians and radiologists feel that training in reporting should be obligatory[4] and the publication of the above guidance, together with the aforementioned initiatives by the RSNA and also the updated RCR curriculum comes amid resurgence in the interest of the radiology report in recent years. Many UK universities offer radiographers postgraduate reporting courses and the United Kingdom Association of Sonographers (UKAS) has produced useful guidance on style and content of reports for sonographers[18]. In many centres radiographers receive excellent teaching[19].

We sincerely hope this renewed interest will be reflected in teaching this important skill to trainees, as the ability to write clearly is a skill, not an art, and is learned by practice[20]. Didactic instruction, supervised practice and the rigorous evaluation of reporting skills are necessary in any programme aimed at learning how to report. Radiology trainees generally glean information about reporting style and technique from their consultant or radiographer trainers, through informal reporting sessions. Varieties of reporting style and phraseology are assimilated and from these the trainees' own reporting style will emerge.

The RCR curriculum utilises competency-based training and workplace-based assessments. Progression is mapped to a defined curriculum and demonstrated by the achievement of core competencies. Workplace-based assessment tools have been incorporated into the new e-portfolio for assessment of radiology trainees. We have developed such a tool for reporting – The Bristol Radiology Reporting Assessment Tool (BRRAT) which aims to provide formative and summative feedback to trainees to improve radiology reporting skills[21].

CONCLUSION

Despite its inauspicious beginnings, the radiology report is increasingly recognised not only as a vital means of communication but also as an important medico-legal document. Increasing workload and extended hours exerts pressure on modern radiology departments, but this should not come at the detriment of the radiology report. Technological advances and solutions continue to be embraced to reduce these pressures by increasing productivity. Increased awareness of the importance of reporting is reflected in the initiatives on both sides of the Atlantic described above, and the increasing availability of reporting standards. Radiologist and radiographer training increasingly recognises the importance of reporting as an essential component of curricula. Radiologists and radiographers must satisfy not only the patients and referrers but also themselves to ensure the production of timely reports of the highest quality.

- Minor right pleural thickening is noted in close to the coastal and diaphragmatic pleura.
- Upper lobe shows reduced patch ground glass dusting and arteries or from previously.
- Respectively with a tiny calcified nodule is unchanged.
- Continued follow-up suggested to proximally six months if clinical indicated.
- No adds renal pathology seen.
- Marked hydronephrosis of the renal pelvis with loss of renal para time is suggesting this stent is no functional.
- Multiple low density lesions or nerve root on the liver, unchanged the previously noted a para-aortic or and the coeliac are lymph nodes have significantly reduced in size.
- Low attenuation adjacent to the later ventricle.
- The actual a tumour itself is cir slightly less then scan in the previous scan.
- Cystic lung disease consistent with LAMB.
- The hands were volumetrically acquired through the chest.

TABLE 1: Voice Recognition errors from verified report.

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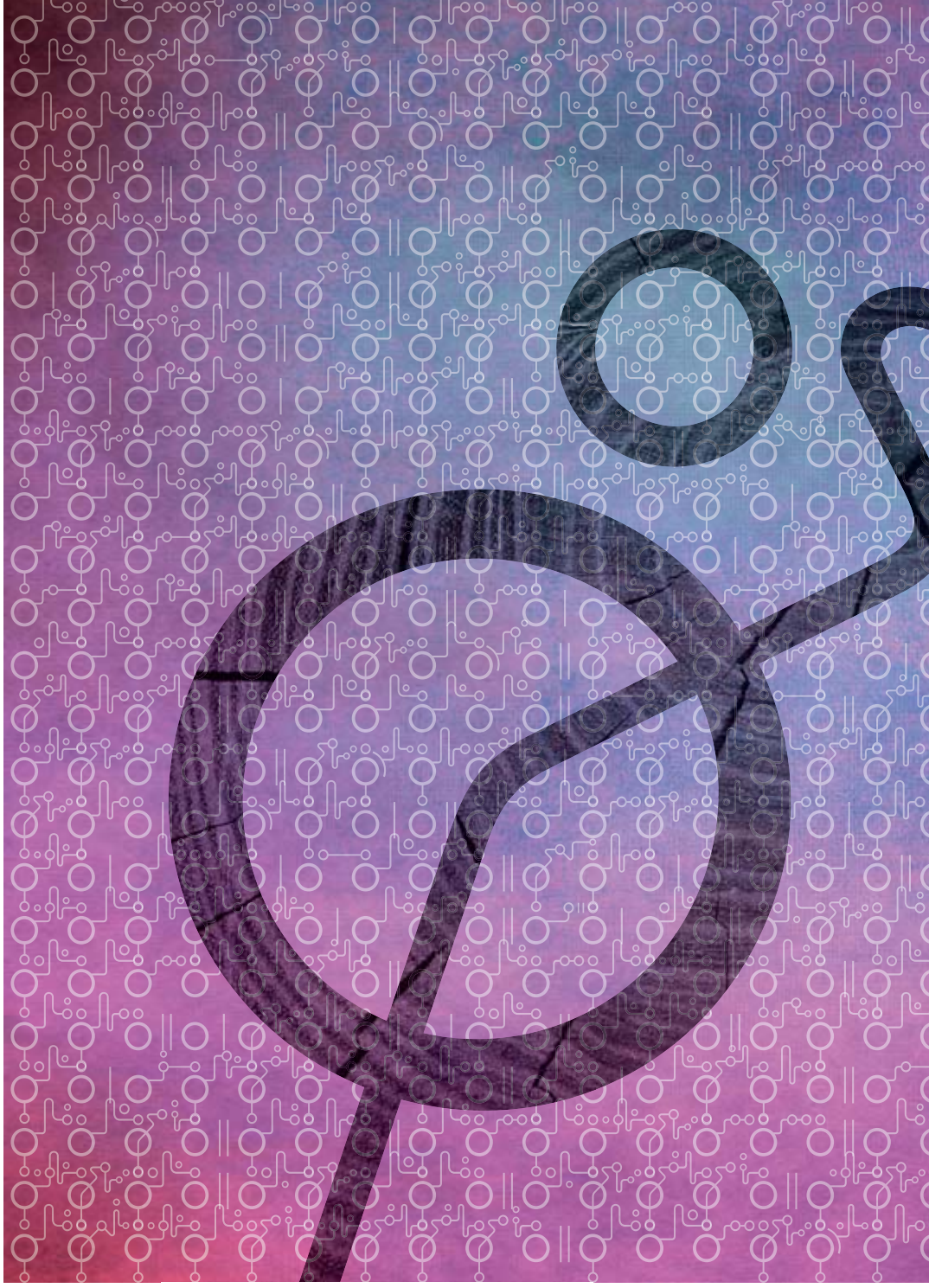

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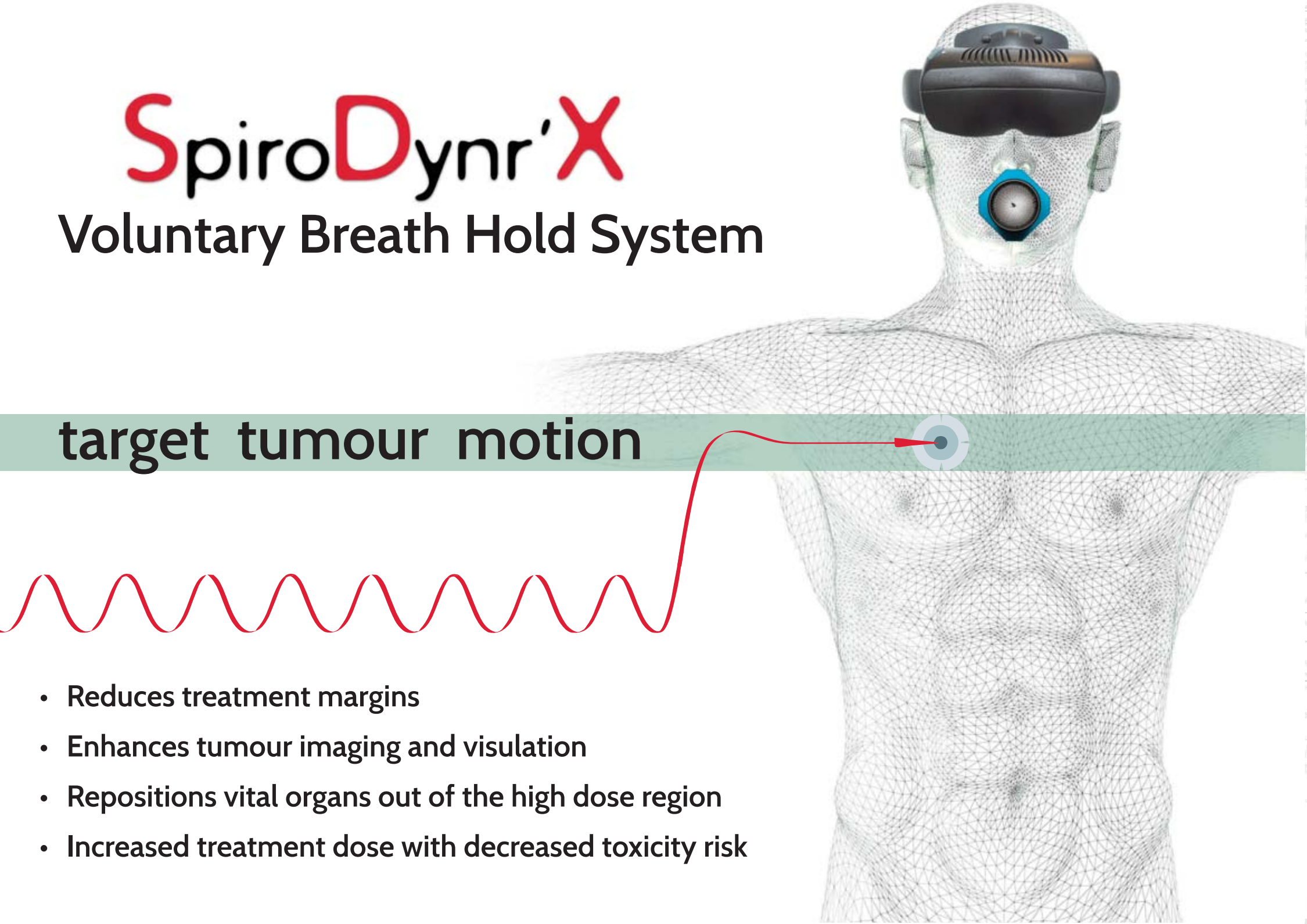

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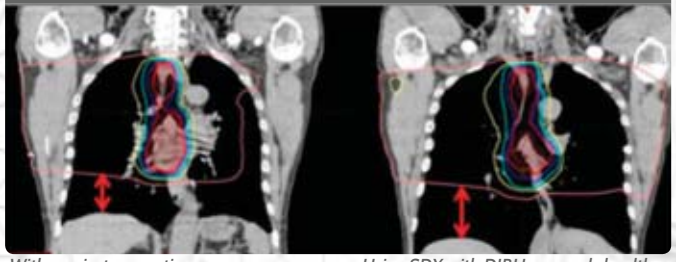
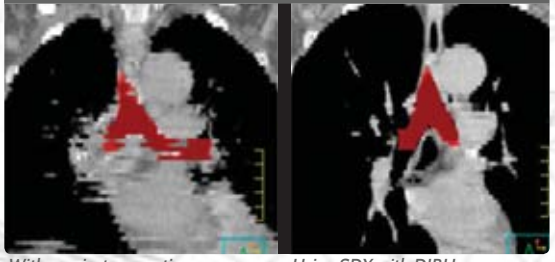


With respiratory motion

Using SDX with DIBH; expands healthy lung tissue out of the high dose region

IMAGE IMPROVEMENT



With respiratory motion

Using SDX with DIBH

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HYBRID IMAGING IN NUCLEAR MEDICINE: CREATING A PATIENT-CENTRIC APPROACH TO SERVICE DELIVERY

MARC GRIFFTHS, GARY DAWSON

Staffing a modern, hybrid imaging environment requires a skilled and competent workforce, who should have the opportunity to further develop their working practice and clinical service provision.

TECHNOLOGICAL POSITIONING

Health professionals across the world now work within an environment of flux and uncertainty, which inevitably presents new challenges for the workforce, in terms of developing new skills and knowledge[1]. This, when coupled with the need to provide high quality care, which enhances the individual patient experience[2], has resulted in a revolutionary change to the traditional role of the health professional[3]. The introduction of any new hybrid imaging system may require appropriate staff training, considerations for service redesign and patient workflow dynamics, as part of the change process.

Collectively, the term 'hybrid imaging' relates to the physical fusion of more than one diagnostic imaging tool to provide anatomical and functional information in one environment. The emergence of the hybrid imaging workforce has arisen from the developing specialist area of clinical nuclear medicine over the last decade, mainly due to the introduction of new imaging hardware and developments within current patient treatment pathways[4,5]. The ability to perform a hybrid imaging examination within a single physical environment provides clinicians with physiological and anatomical information, which may form part of the patient's initial diagnosis or evaluate their on-going response to treatments such as radiotherapy and / or chemotherapy[6,7,8]. The integration of new technology requires the modern healthcare professional to adopt a greater 'evidence based' ethos, which is innovative, promotes quality patient care, and encourages 'smart' working practices that help deliver productivity savings[9,10].

Optimisation of SPECT/CT acquisition parameters is essential to current clinical practice, in order to minimise the patient dose from the CT element of the examination and to ensure that an appropriate level of anatomical information, which is both justified and adds clinical value to the imaging procedure, is acquired. There is a necessity for clear clinical protocols and appropriate use of CT within a hybrid imaging environment, especially where the patient may have recently undergone a diagnostic quality CT examination. Such activities would appear to warrant the development of clear clinical guidelines / protocols, which can help support the healthcare professional as to the appropriate use of CT within the hybrid imaging environment in order to ensure that patient safety can be maintained at all times.

The growing use of CT within the hybrid imaging environment has placed additional pressures on nuclear medicine practitioners, particularly nuclear medicine technologists, who make up a large percentage of the workforce, as previous or recent training and experience with CT may not have been undertaken. Balancing the needs of effective service delivery, workforce development and holistic patient-centric care requires careful planning and collaboration with a range of healthcare professionals. Introducing new hardware and software technology requires appropriate social frameworks, which may include ensuring the role of the practitioner is clearly defined in order that the emerging relationship with the patient is maintained. There is a potential danger of 'patient objectification' during high technology examinations[11,12], such as hybrid imaging and the subsequent dehumanisation process that may occur. Creating an environment where workforce flexibility is present, in terms of understanding the position of new technology within the patients' journey and a greater understanding of the need to reshape the delivery of such clinical services, is paramount to the ongoing development of hybrid imaging within the modern healthcare domain.

CHANGES IN WORKING PRACTICE AS A RESULT OF INTRODUCING HYBRID IMAGING TECHNOLOGY

Introducing new hybrid imaging technology may result in an increase in examination

11

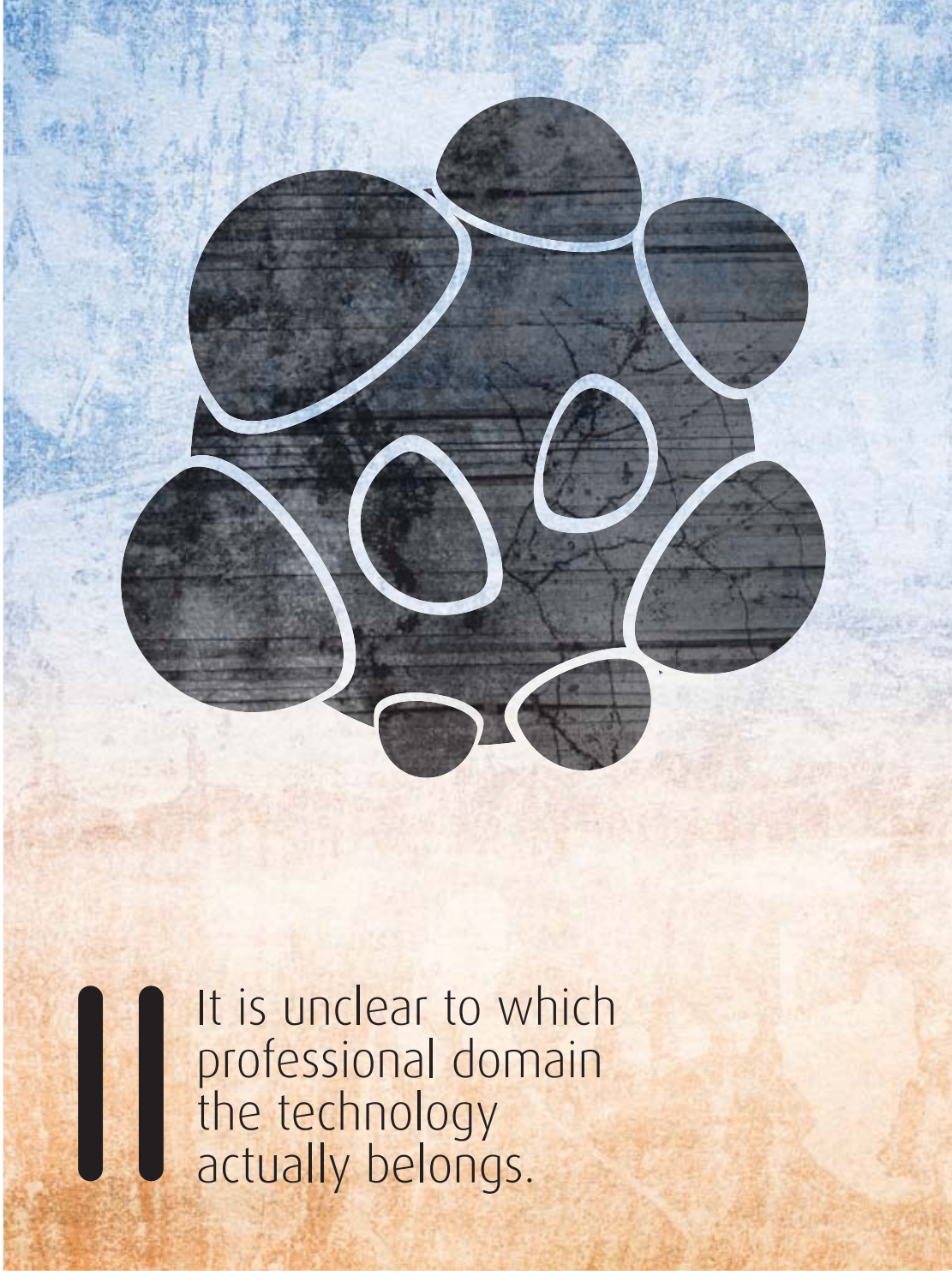
Staffing a modern, hybrid imaging environment requires a skilled and competent workforce.

referrals, requiring revisions to existing clinical protocols and the overall workflow of a nuclear medicine department. Service re-design and innovation are common themes within a modern health system and process mapping of new hybrid imaging techniques will help to establish clinical demand, capacity and overall activity levels. Such an approach is essential to ensure that a robust modelling plan for future workforce requirements is created and that the identification of core areas of service expansion (eg sentinel node imaging), role development and leadership opportunities within this emerging field of imaging are considered. Greater empowerment of Allied Health Professionals (AHPs) to deliver measurable targets is a key driver within the modern health service[13,10] and as such, AHPs are imperative to the success of such targets. Nuclear medicine, and in particular hybrid imaging, is well positioned to adopt the rapid diffusion of new technology through innovative practice, which integrates clinical, research and educational dimensions[10]. There is, however, a need to ensure that the current and future workforce, which is a mix of technologists and radiographers, is appropriately trained in order to utilise the advanced technology effectively.

New working environments require practitioners to possess new knowledge, skills and problem solving abilities, which may not have been inherent to a clinical nuclear medicine department, prior to the introduction of hybrid imaging. Examples of the requirement for new knowledge and skills specifically relating to hybrid imaging practice may include:

- Cross sectional anatomy (following the introduction of CT within Nuclear Medicine);
- Patient counselling and support skills (increase in the amount of oncology patient referrals, especially with patients who are newly diagnosed with cancer);
- Radiation protection and patient dose minimisation techniques (with the introduction of an X-ray source, additional knowledge and understanding is required with reference to the appropriate patient dosimetry and safe working practice);
- Increased decision making capabilities (identification of incidental findings on patients' images and subsequent actions);
- Establishing formal clinical supervision and mentorship within hybrid imaging;
- Service improvement and innovation (provision of a 'one stop service' whereby the patient benefits from having a physiological and anatomical investigation in one hospital visit).

Healthcare professionals are experiencing a transformation in terms of their working environment; the need for improved communication channels[14] for recording patient information and being prepared for attending to patients who are at crucial times in their lives, requires appropriate and possibly extra training. There is also the potential for patients to be overlooked as part of their examination, with the nuclear medicine practitioner instead focusing on the technology, rather than the patient. There is a risk that patients could be secondary to the actual equipment/technology, which is utilised to acquire the relevant images. The traditional approach to nuclear medicine examinations involves practitioners being



> It is unclear to which professional domain the technology actually belongs.

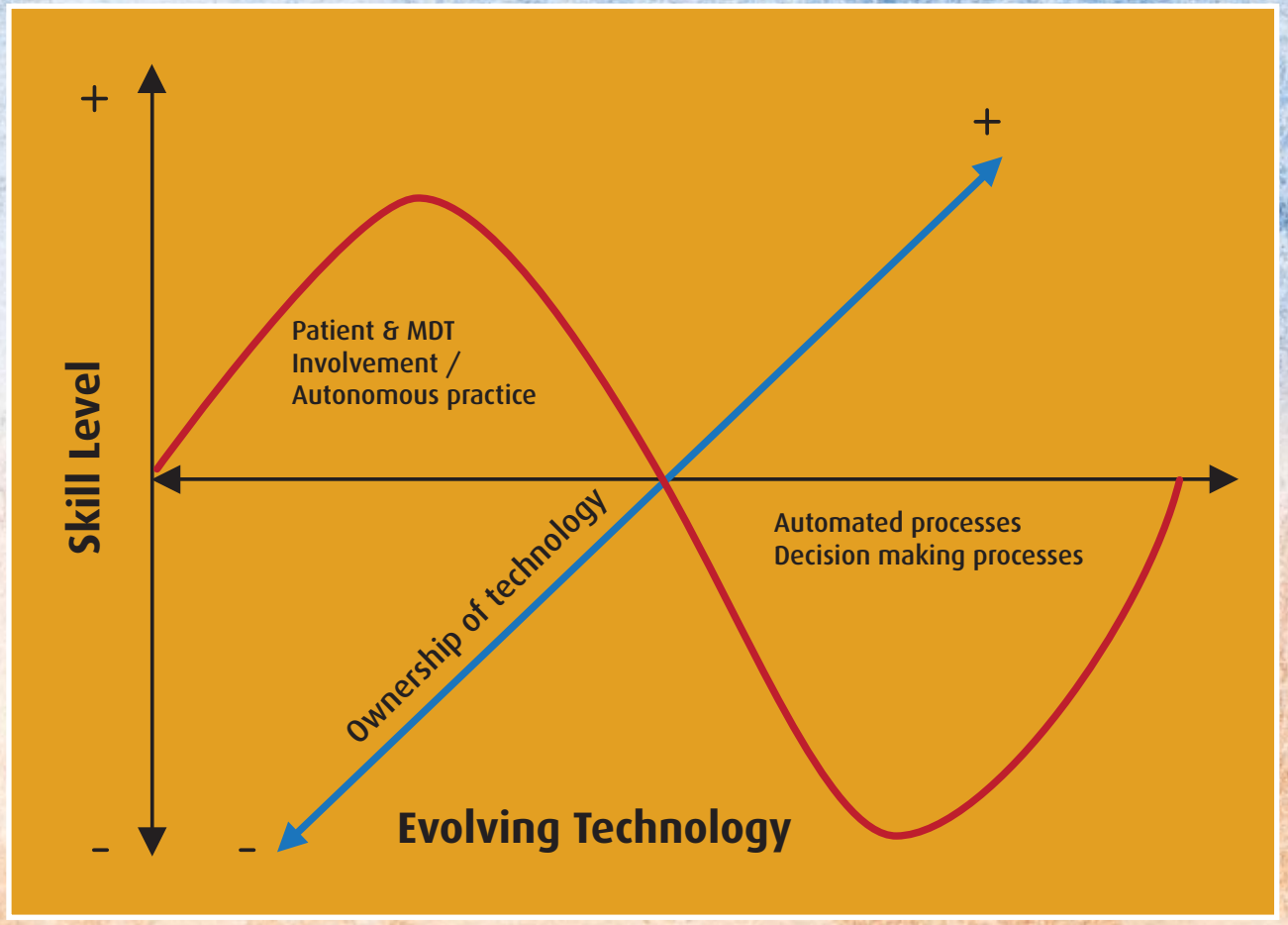
FIGURE 1: Example control console environments of hybrid imaging environments.

physically present in the same room as the patient, albeit at a distance to minimise individual radioactivity exposure. Introducing a physical barrier in the form of a control console, voice intercom, remote access controls and multiple processing units (figure 1) may reduce contact time with the patient, when compared to traditional nuclear medicine practice.

OPPORTUNITIES FOR GREATER ROLE IDENTITY AND INTER-PROFESSIONAL WORKING

The role of the nuclear medicine practitioner is evolving, with the potential for greater autonomy, decision making capabilities and increased professional recognition. However, the introduction of new technology and imaging techniques has also highlighted questions around who actually 'owns' the domain of hybrid imaging and whether a new hierarchy is emerging from within this imaging modality. A cross-section of professionals may work within a hybrid imaging environment including technologists, clinical scientists, assistant practitioners, radiographers and nurses, as identified in a professional workforce analysis publication[15]. However, it is unclear to which professional domain the technology actually belongs. Coupled with this, is the limited range of appropriate professional and educational guidelines for the development of the nuclear medicine, and more specifically, the hybrid imaging workforce in the United Kingdom. This is in contrast to countries such as North America and

FIGURE 2: Professional reorder and ripple as a result of introducing new technology.



Australia, where professional bodies, such as the Society of Nuclear Medicine Technologists Section provide clear career development pathways and clinical protocols within the field of nuclear medicine and specifically hybrid imaging[16].

TECHNO-CENTRIC USE OF TECHNOLOGY

Given the potential increased level of patient throughput within an imaging department, the process of obtaining diagnostic data may be viewed as an extremely quick process, with minimal patient contact[17]. This, when coupled with the potential organisational change to the working environment and associated challenges around the adoption of new technology[18], has contributed to the evolution of new roles and the dissolving of traditional, inflexible working practices. There is the potential for organisational barriers and a breakdown of existing social systems within communities where new technology had been introduced, and this has the potential to impact on efficiency, role identity and collaborative working.

Non-contextualisation of the effect of introducing new technologies on practitioners with traditional based social identities may prevent professional development and future social structures from developing. This may also be compounded by the inflexible nature of technology, normally driven by manufacturers as a means of maintaining consistency of patient throughput, but reducing the autonomy of the practitioner. Figure two presents a conceptual model, whereby the nuclear medicine practitioner may be in a state of 'professional ripple' when the ownership of new technology is not necessarily associated with the nuclear medicine community. Greater collaboration should be encouraged within the healthcare arena, which includes a number of professionals taking joint ownership of the new technology, in order to provide a patient-centric service. Care also needs to be taken in terms of how the new technology determines the practitioner's skill level, in terms of managing the tensions associated with automated and autonomous practice.

The challenges associated with defining a clear role for nuclear medicine practitioners working within hybrid imaging are to be expected, given the occurring technological and environmental changes. Hybrid imaging environments present a number of challenges for nuclear medicine staff who are unfamiliar with new working procedures and the need for streamlining patient workflow dynamics. This may lead to confusion and concerns around the use of new technology for a percentage of the workforce, as the shape of the professional identity within nuclear medicine begins to change. Having a clear framework for ongoing training and development of the hybrid imaging workforce is essential for future service provision. Understanding the emerging hybrid techniques and the impact on the patient's diagnosis and subsequent treatment will define the future identity of the hybrid imaging practitioner and influence pre- and post-registration education.

CREATING A PATIENT-CENTRIC APPROACH TO THE USE OF HYBRID IMAGING AND REDUCING THE POTENTIAL FOR TECHNO-CENTRIC SERVICE DELIVERY

There is opportunity for greater skill mix within hybrid imaging practice, along with the

> Nuclear medicine practitioners should use the introduction of new technology as their opportunity to reframe and restructure working practice.

requirement to further develop new skills or enhance existing skills. The need to ensure a clear evidence-based practice trajectory has been suggested by Hogg[19] as a means of providing greater understanding for nuclear medicine practitioners. Gulliver et al[20] also support the notion of a need to redefine the role of the nuclear medicine practitioner, especially given the fact that a number of new duties, such as image reporting, referring patients for additional examinations and requesting CT examinations, were once reserved only for the medical practitioner.

The flow of patients through the nuclear medicine department has changed as a result of introducing new technology[3]. It is not clear as to the level of independent practice and decision making that might be appropriate within this area of clinical practice, and further research is required. Collegiate working with other healthcare professionals is vital to the future success of hybrid imaging practice and being equipped with state of the art technology is not enough to survive as a specialist modality. The frequency of use of new technology will shape and form the new environment with members of the sub-communities engaging with each other and other professions to ensure successful integration. This fits with Barley's[21, 22] concept of reorganisation following the introduction of new technology and the need for greater appreciation of the impact that this might have on the respective workforce. Early adopters and service champions should be nurtured and promoted at every opportunity, working across a number of disciplines and creating a greater sense of collective ownership in terms of how the new hybrid imaging technology is utilised. This will require remapping existing workflows and identifying existing roles and responsibilities, to ensure learning and development is available for everyone.

The evolution of new technology within nuclear medicine has created a dilemma in balancing the training needs of the practitioner, humanising the use of the hardware and ensuring the provision of a caring role. This dilemma resonates with other professional groups, such as nursing, where a direct conflict has occurred in creating the appropriate synergy between delivering patient care and optimising the use of new technology[23,24]. Heavy workloads and multiple demands on practitioners' time are linked with work-related stress[25],

leading to reduced efficiency, anxiety and lack of time for direct patient contact[26]. There is a danger with hybrid imaging that care is now being provided in the absence of the actual patient, which is different to the traditional nuclear medicine environment. For example, the introduction of a separate control room has created a physical barrier between the health professional and patient and the use of an intercom and CCTV has further distanced the level of direct care. Unlike nursing, where all of the instrumental care[27] is typically always performed with the patient being present, nuclear medicine practitioners are conducting some of their tasks without the patient being present. This undoubtedly will create some tension within the hybrid environments and may be due in part, to the conflict of having to use the vast amounts of hardware and software, sometimes remotely in contrast to traditional nuclear medicine techniques.

Post Francis review[28] there is a greater need for a values and behaviours-based approach to the delivery of patient care and a requirement to ensure transparent levels of accountability and clear leadership within the healthcare system. There is a need for greater focus around mentorship and promotion of early adopters, to facilitate the learning of others within the hybrid imaging environment. The creation of a flexible and adaptive workforce fits with the NHS Education Outcomes Framework[29] and fosters a positive promotion of the role of the nuclear medicine practitioner. This is particularly important with regards to creating strong multiprofessional links and flat collaboration opportunities.

Encouraging the involvement of other health disciplines will further raise the profile of nuclear medicine practitioners and encourage multiprofessional working and patient-centric provision of clinical services. This model aligns with the Department of Health's[10] training approach for Allied Health Professionals, nurses, medics and scientific officers, in terms of developing the healthcare workforce, and begins to create a clear trajectory for future hybrid training and education needs within Health Education England and equivalent organisations in Scotland, Wales and Northern Ireland. Figure three (page 36) outlines the potential influences and cultural changes that have been created as a result of introducing new hybrid imaging technology within the workplace. A re-conceptualisation of professional roles will remove pre-conceived barriers to innovative ways of delivering patient services and act as a catalyst to role development[30]. This will also support future workforce requirements mapping, with a values and behaviours approach to healthcare delivery[31].

A cause and effect relationship has been created as a result of introducing new hybrid imaging technology within nuclear medicine. The introduction of new technology may act as an independent force and as a result develop a new agency and social structure[32]. The secondary effects include professional ripple and re-order, occupational shift in terms of domain ownership and potential new roles. It is imperative that the nuclear medicine workforce is able to effectively map the new knowledge and skills required to work effectively within a hybrid imaging environment, in accordance with the government's requirement for healthcare professionals to adopt new technology and further diffuse its use[10].

Collegiate working with other healthcare professionals is vital to the future success of hybrid imaging.

SUMMARY

Given the advent of new hybrid imaging technology, there is the potential for a loss of professional identity and erosion of skills and knowledge pertaining to traditional nuclear medicine practice. This in part is due to the automation of processes and systems and also the risk of technological determinism, which attempts to remove the practitioner from traditional modes of patient interaction.

There is a clear need to understand the new environment, reach out to other healthcare professionals, demystify some of the semantics between various disciplines and create an identity for hybrid imaging that will allow others to further embrace and utilise this emerging technology. This approach would not only create further access by other healthcare professions, but would also create the opportunity for expansion and acceptance of hybrid imaging in other domains that are not visible in the current pathway.

By removing traditional ways of working, nuclear medicine practitioners should themselves use the introduction of new technology as their opportunity to reframe and restructure working practice. Creating a balance between a patient-centric service delivery and being at the forefront of technological developments and advancements is challenging. A collaborative approach involving professional bodies, educators and clinical practice, facilitating the creation of competency and evidence-based practice, is a focal point to begin mapping the future role of the nuclear medicine practitioner within hybrid imaging.

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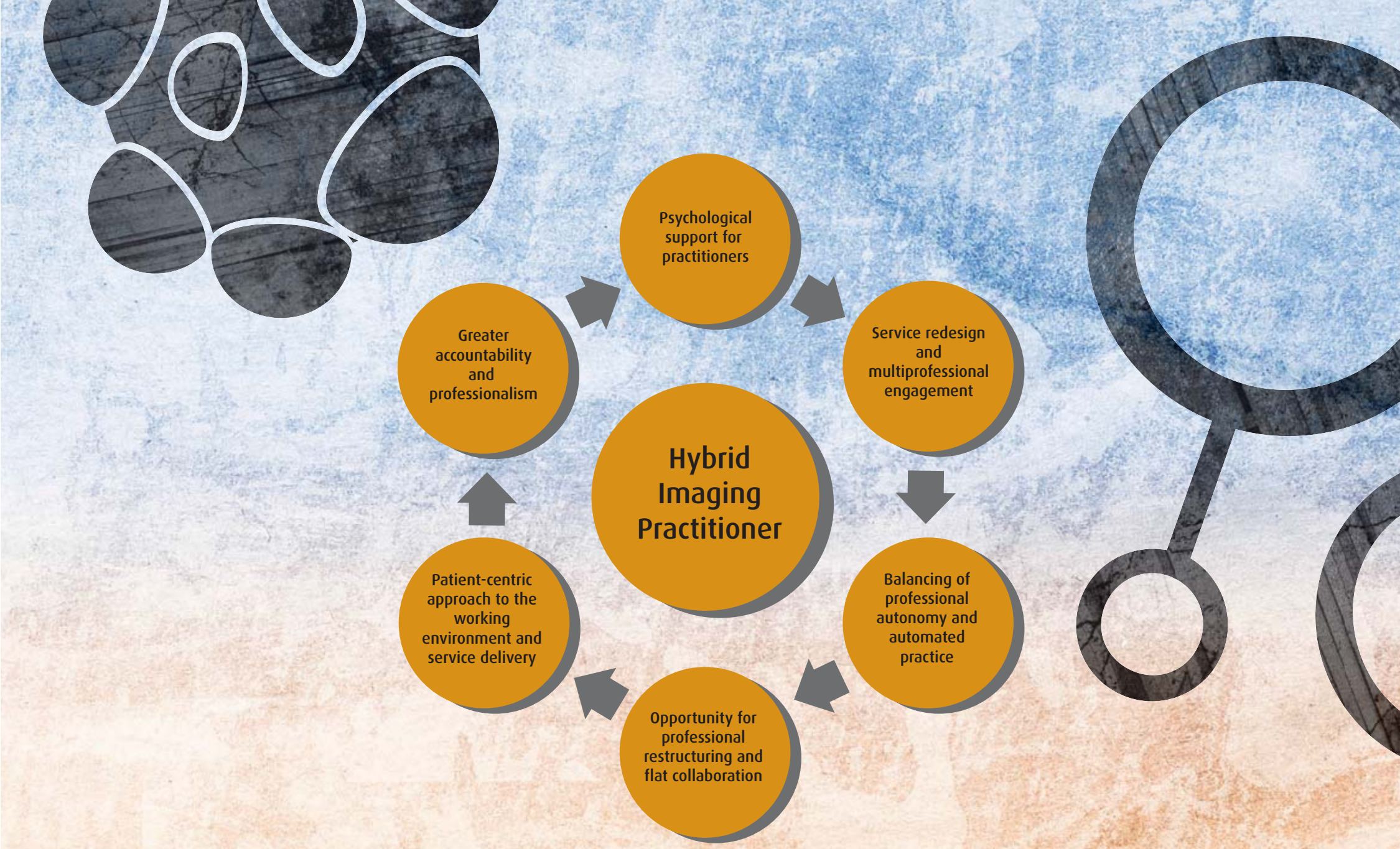

FIGURE 3: Creating a new identity within healthcare – the role of the hybrid imaging practitioner.

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WHY PRESCRIBING BY RADIOGRAPHERS IMPROVES PATIENT CARE PATHWAYS

JANCIS KINSMAN

Radiographers have been able to train as supplementary prescribers since April 2005 when non-medical prescribing was extended to include Allied Health Professionals[1].

BACKGROUND: LEGISLATION

Supplementary prescribing is described as 'a voluntary partnership between an independent prescriber and a supplementary prescriber, to implement an agreed patient-specific clinical management plan (CMP) with the patient's agreement'[2]. Prior to this, patient group directives (PGDs) were used to supply and administer a limited number of medicines to patients and this mechanism is still used widely in radiotherapy and diagnostic imaging. PGDs are written instructions that are drug specific, allowing medication to be supplied to a group of patients identified before they present for treatment. The medication that can be supplied and administered using a PGD varies depending on local Trust policy but is often quite restrictive with regard to type of drug and length of course, and the Department of Health suggests that it should be for 'one time only' supply and is not suitable for situations where multiple drugs are required to treat a patient[3].

Supplementary prescribing using a CMP facilitates a wider range of drugs to be prescribed for radiotherapy side-effects, but is generally not a suitable mechanism for the diagnostic imaging setting. However, even therapeutic radiographers are becoming increasingly frustrated by the limitations of supplementary prescribing and the desire to prescribe independently is increasing. The Society of Radiographers is currently preparing a bid to support a change in legislation to allow this.

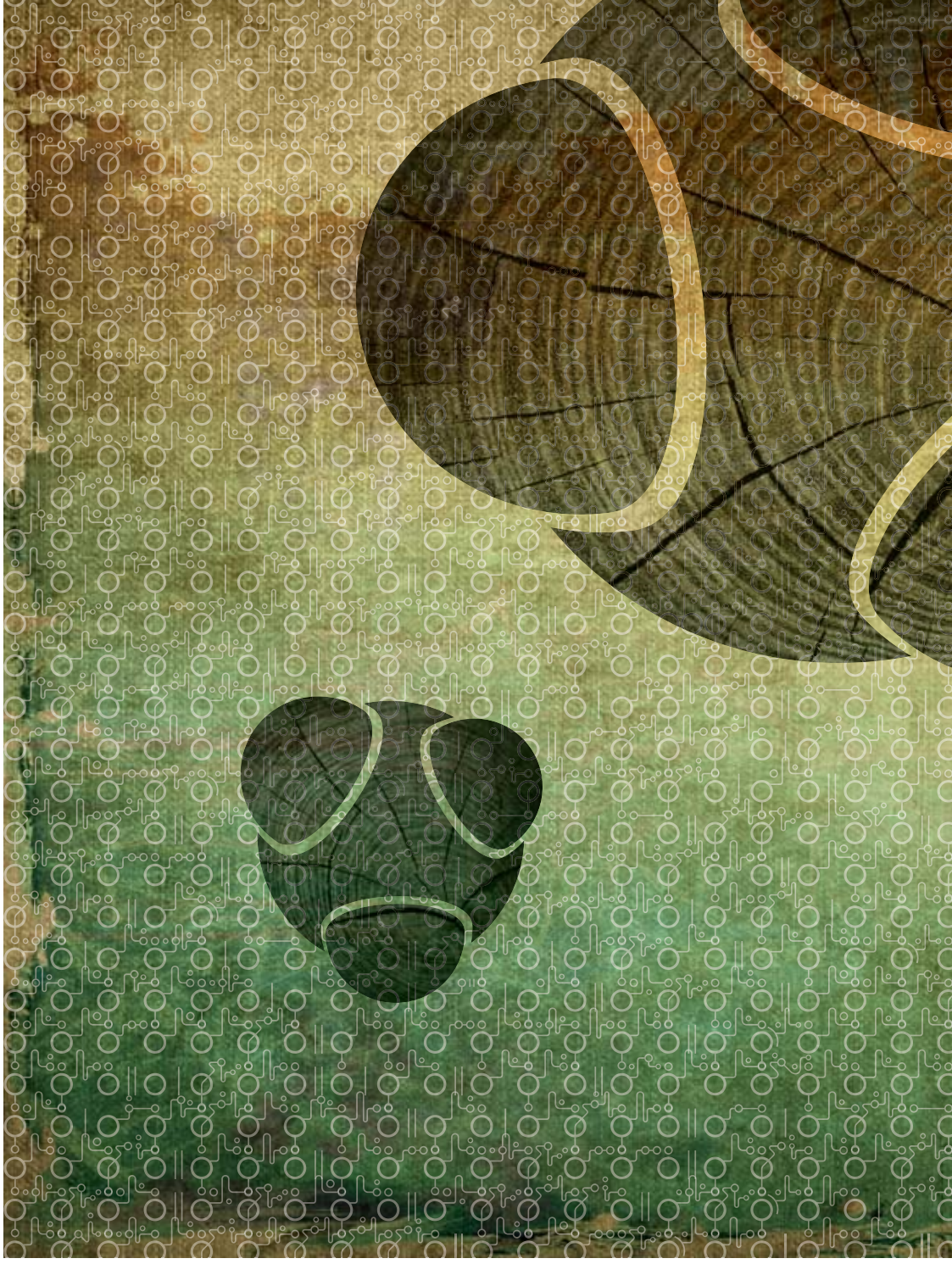
CURRENT PRACTICE

In Bristol we have a long history of radiographer involvement in the management of radiotherapy toxicities, initially using group protocols, and then PGDs and since 2006 with the addition of supplementary prescribing. To date, seven radiographers have qualified as non-medical prescribers. Some have site-specialist roles and most have many years' experience of managing radiotherapy side-effects. At the outset we were aware that supplementary prescribing was not a mechanism ideally suited to our needs, but felt that we would need to implement it and demonstrate that we could prescribe safely in order to have a means to progress towards independent prescribing. Many radiotherapy departments in the UK have implemented radiographer-led on-treatment review clinics, and have radiographers with a similar level of expertise. Increasingly, therapeutic radiographers are developing site-specific roles and areas of expert practice; not just in delivering the radiotherapy, but also as a key member of the multidisciplinary team managing the patient's care during their treatment. This may involve reviewing patients' radiotherapy and chemotherapy side-effects, as well as the symptoms of their disease. Some radiographers also prescribe chemotherapy and hormone therapy as part of their role. There are some instances when this cannot easily be achieved within the framework of supplementary prescribing, and so radiographers find themselves increasingly frustrated and restricted by the prescribing mechanism available to them.

Because supplementary prescribing is not suited to the diagnostic imaging setting, only a very small number of diagnostic radiographers have trained as non-medical prescribers, and medicines management is largely confined to administration of contrast media. There are a few exceptions, where radiographers in expert roles are using PGDs to administer a wider range of medicines, in order to streamline services for patients. For example, there is currently a consultant radiographer in the UK who works in gastrointestinal imaging and uses 14 PGDs to support the service she provides.


The Department of Health has made it clear that patient safety is of paramount importance.

> Therapeutic radiographers are becoming increasingly frustrated by the limitations of supplementary prescribing.



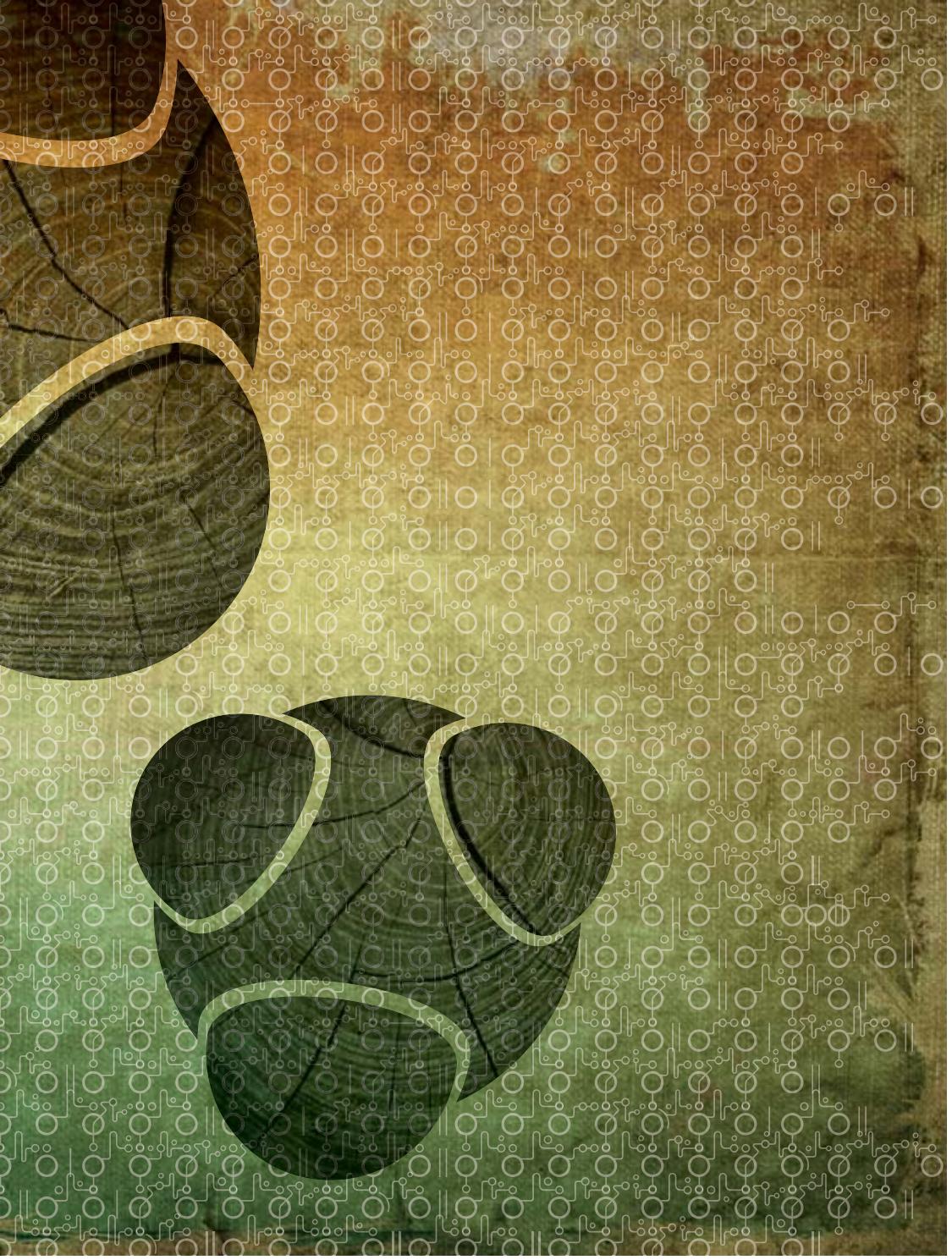
HOW DOES PRESCRIBING BY RADIOGRAPHERS BENEFIT PATIENTS/SERVICES?

The original drive for radiographers to supply and administer medications in our department was to improve safety for patients. Prior to the use of group protocols and PGDs, radiographers were assessing patients' toxicities and deciding what medication was required and then a medical doctor would 'rubber-stamp' the prescription. Due to some of the practical difficulties that we experience with supplementary prescribing and the limitations of PGDs, many review radiographers are finding that they are still having to ask a doctor to write a prescription, which causes delay for the patient and is professionally demoralising. It is also not good practice; either the doctor assesses the patient before prescribing medication, which is a duplication of effort, a waste of resources, and wastes the patient's time, or more commonly they prescribe based on the radiographer's assessment of the patient. The Department of Health has made it clear that patient safety is of paramount importance and that '..there cannot be a trade-off between safety and efficiency'[4]. Radiographer prescribing should satisfy both of these requirements, particularly if the radiographer is able to take full responsibility for the prescribing decision.

There is also a national drive to involve patients more in decision making about their treatment[4], and non-medical approaches to consultations tend to be less didactic and perhaps more inclined to take into account patient preferences. A recent patient satisfaction survey at our Trust found that most patients were happy with a radiographer-led review service and 100% of patients who responded felt that the radiographer spent enough time with them, listened to them and gave them clear information about the name and the purpose of any medication they prescribed[5]. The following quotations are examples of the responses received:

"The lady conducting my review was extremely helpful and knowledgeable. I felt at ease with her and felt like she really cared about my situation."

"The radiographer in prescribing my medication, did so with competence and good knowledge of the medication."



DISCUSSION

What is the most appropriate mechanism? The simple answer is that one mechanism may not suit every situation.

On the face of it therapeutic radiographers appear to have successfully implemented supplementary prescribing, however there are some fundamental issues with this mechanism that continue to make its use in this situation difficult, limiting and possibly inappropriate.

Supplementary prescribing was originally intended for the shared management of chronic conditions, where it was perceived that the independent prescriber and supplementary prescriber would meet with the patient to draw up a CMP based on the patient's individual needs.

Radiotherapy planning, treatment delivery and on-treatment review, are led by radiographers in many departments. Most oncologists see their patients only in a clinic at the time of diagnosis and then after treatment is completed at follow-up. Understandably, many feel that the first clinic is not the most appropriate time to draw up a CMP, and if that happens there would not normally be an opportunity for the supplementary prescriber to be present. This means that rather than the intended shared management, it is instead, a passing on of management from the oncologist to the radiographer.

The reality is that a significant number of CMPs do not get completed due to the amount of paperwork the oncologist has to complete and also because the supplementary prescriber is not present to give their input. If the CMP is not completed prior to the start of treatment, there will be limited opportunities for the radiographer and oncologist to get together to rectify this; nowhere more so than in satellite centres or departments with extended working hours. Another fundamental problem with this mechanism is that the patient's condition may change significantly between the formation of the CMP and its use, thus rendering it obsolete. Where conditions are chronic, a review period of one year may be sufficient to ensure it is up to date, but radiotherapy patients' toxicities are acute. In addition, this patient group tends to be elderly with many comorbidities that could affect prescribing decisions.

Given these difficulties, some centres will have continued with PGDs, and certainly it is a cheaper option compared to the significant investment required to train radiographers for supplementary prescribing. Perhaps this is short sighted. It is possible that we are limiting ourselves and denying our patients the best quality care. 'The preferred way for patients to receive the medicines they need is for a prescriber to provide care for an individual patient on a one to one basis'[6]. PGDs were intended for use only in situations where medication could not be supplied or administered in a timely manner on prescription. With supplementary prescribing available as an option to us, can we really say that this is the case in radiotherapy?

Supplementary prescribing requires the independent prescriber to have made the diagnosis. This is one of the fundamental barriers to using this mechanism in diagnostic imaging, as often the patient does not yet have a diagnosis. In the radiotherapy setting the diagnosis is taken to be their cancer, however this is often not the condition covered by the CMP, but rather the toxicities from their radiotherapy. For example, a specialist radiographer might assess a patient receiving

radiotherapy for cervical cancer and diagnose a urinary tract infection. Therefore, the diagnosis at this point is not cervical cancer, but rather an acute urinary tract infection. The radiographer is taking professional responsibility for that patient and should be able to prescribe accordingly, as recognised by June Crown back in 1989[7].

In diagnostic imaging, although independent prescribing will enable role extension and efficiencies of service, PGDs are likely to continue to be an appropriate mechanism for some administration of contrast media. One area where this mechanism fails is in the administration of mixed medicines. Some advanced practitioners report that they are unable to perform procedures without a radiologist present, purely because two drugs need to be administered simultaneously, which is not possible under PGD. Clearly this is an inefficient use of resources and yet the Government has stated its commitment to reducing bureaucracy and increasing efficiency[4].

WHAT OTHER BARRIERS ARE THERE TO RADIOGRAPHERS PRESCRIBING?

When radiographers were surveyed about potential barriers to prescribing they listed a lack of support from radiologists, lack of resources for implementation and scepticism about radiographers' suitability for the role[8]. Clearly, radiographers' undergraduate training does not fully equip them for prescribing of medicines and it is likely that only those who are specialists would be expected to do so. Postgraduate non-medical prescribing courses allow radiographers to gain all the knowledge and skills required and it has been our experience that when doctors understand how rigorous the training is, and particularly if they have been involved, perhaps as a mentor, they are confident that radiographers are safe to prescribe. That said, there may still be a certain amount of concern that radiographers might make prescribing decisions that are different from that which the doctor would have made. However, two doctors may also differ in their decisions, as would many autonomous health professionals, so why should a radiographer not make a judgement that is different, provided that it is based on good evidence and experience?

All professional groups who prescribe follow the same standards that are set out in the Single Competency Framework[9]. There is equity in the standards that we follow, but not in what we are able to do and this inequality is particularly evident when working in multidisciplinary teams. A good example involves a radiographer who runs a review clinic for patients with head and neck cancers. She is a supplementary prescriber and is part of a multidisciplinary team, which includes a clinical nurse specialist (CNS) who has a good understanding of head and neck cancers and the treatment pathway, but has much less experience and understanding of radiotherapy toxicities. The CNS is an independent prescriber and yet the radiographer is arguably better equipped to manage the patient's radiotherapy side effects. Inevitably, some radiographers in this situation may find that there is less incentive for the doctor to complete the necessary paperwork to allow them to prescribe when another member of the MDT can prescribe independently.

CONCLUSION

Independent prescribing could bring opportunities for service redesign in diagnostic imaging

services, but it needs the vision of managers and commissioners to first identify the potential benefits. There are some good examples of radiographers grasping the opportunity to extend their roles and improve the experience of their patients, despite the current limitations of PGDs and supplementary prescribing, but they are few and far between.

For therapeutic radiographers, independent prescribing is the natural progression to a more appropriate and robust mechanism for prescribing. It is more streamlined, is not reliant on doctors to complete paperwork, and ensures that radiographers take full responsibility for their own prescribing decisions. This is particularly appropriate as they grow into specialist and consultant roles and become experts in the management of radiotherapy toxicities.

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LUNG CANCER IN THE OLDER PERSON: IS AGE A BARRIER TO TREATMENT?

NICOLA CORNELIUS

This paper reviews the factors affecting decision making in lung cancer, the complexity of the prognostic indicators and considers if age should be a consideration in 21st century medicine.

INTRODUCTION

Macmillan Cancer Support[1] is unequivocal regarding treatment of the older person stating: "under treatment is one of a number of factors contributing to the unacceptably poor cancer survival rates among Britain's older population." This is a disturbing statement regarding the accessibility of services to a section of the population who are at increasing risk of developing cancer[2]. There is a plethora of factors influencing decision making in older patients: performance status, comorbidities, general health. It would be disconcerting to consider that age alone could be the overriding factor in determining suitability for treatment.

There is due concern that older patients may not be able to tolerate treatment and are susceptible to increased side effects. However, technological advances in the delivery of radiotherapy have changed significantly over recent decades. Treatments are better tolerated as advances in imaging have facilitated tighter margins and greater confidence in treatment delivery. The radiosensitivity of lung tissue makes this particularly pertinent in patients with lung cancer.

BACKGROUND

Lung cancer is the second most common cancer[2] for both men and women, accounting for 13% of all new cases. It is the major cause of cancer deaths, accounting for 20% of all cancer deaths and almost half of these deaths are in people aged 75 or over. Predominantly a disease of the older person, there is significant controversy surrounding the management of patients with lung cancer and particularly whether age impacts the treatment decisions. It is not clear whether age is used in decision making in lung cancer, but the use of radiotherapy certainly decreases with age[3] (figure 1). This, however, has not been correlated with stage and performance status, which will also impact on the decision to treat with radiotherapy. In the surgical context, even adjusting for stage and performance status, patients over 75 are significantly less likely to undergo resection than those under 65. Informed patient choice is an essential part of the decision making, and the patient may decide, together with family and carers, to decline treatment. Patients must be given sufficient information to make informed choice, although there is evidence that people over 75 are less likely to receive information about side effects or have a named clinical nurse specialist. This lack of support may impact on the decisions the patients make regarding their treatment[4].

In 2012 the Department of Health surveyed oncologists and found that, in identical patients with no comorbidities and good social support, patients in their 80s were 28% less likely to receive intensive treatment than identical patients in their 70s[4]. In the clinical situation, this could not be replicated as performance status and comorbidities would also be taken into consideration, obscuring the impact of age as a single entity. However, the survey does indicate that chronological age may have an impact on treatment decisions made by oncologists. Decisions based solely on age would contravene the Equality Act[5], which was expanded in 2012 to include public sector organisations, including Cancer Services. The presence of comorbidities, stage at presentation and performance will impact upon treatment decisions and the impact of age will be less obvious.

AN 'ELDERLY' POPULATION

A key factor within the analysis of treatment for patients with lung cancer is the definition of the term elderly. The National Institute of Health and Care Excellence (NICE) in its lung cancer guidelines[3] uses over 80 as a descriptor for the elderly, but this is not a universally adopted

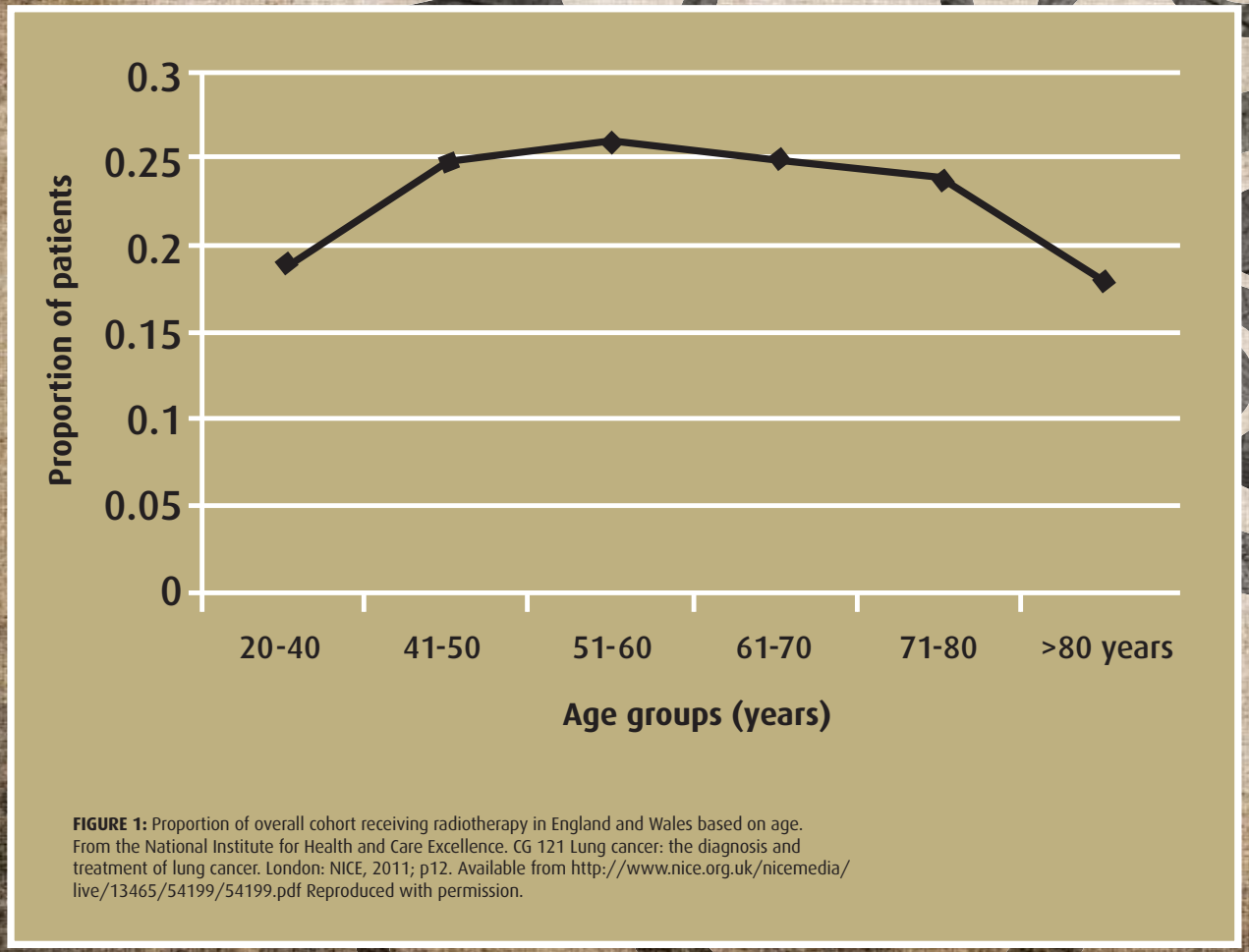
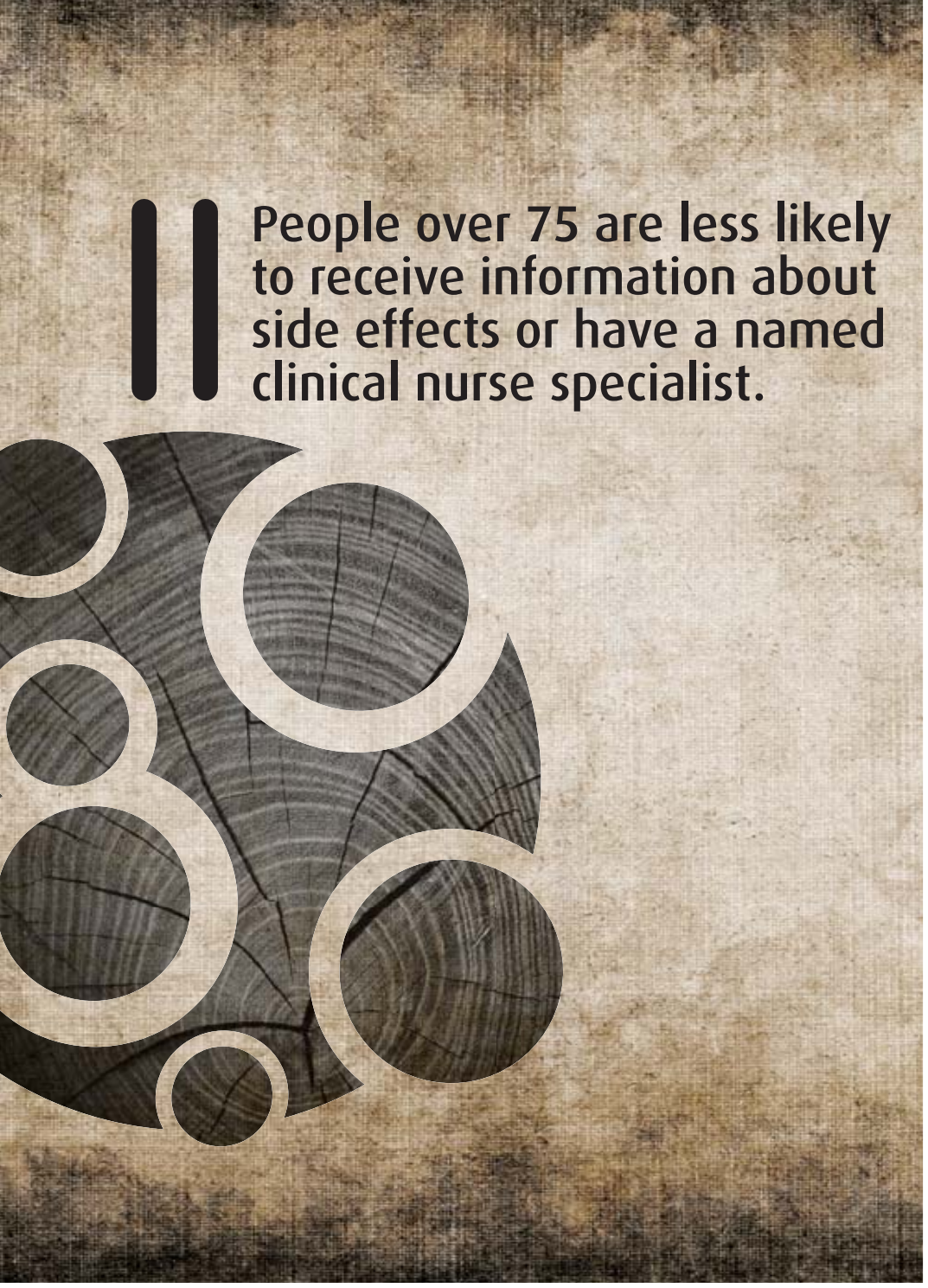


FIGURE 1: Proportion of overall cohort receiving radiotherapy in England and Wales based on age. From the National Institute for Health and Care Excellence. CG 121 Lung cancer: the diagnosis and treatment of lung cancer. London: NICE, 2011; p12. Available from http://www.nice.org.uk/nicemedia/live/13465/54199/54199.pdf Reproduced with permission.



term. The World Health Organisation identifies 65 as the accepted criterion for the older person. Alternatively, Orimo et al[6] advocated the use of the terms 'early elderly' for the people aged between 65 and 75 and 'late elderly' for those over 75. However, these terms still do not adequately describe the over 65 population because chronological age is not directly associated with performance status; there can be no generalisation on this concept as one 65 year old may be may be significantly more active than a peer with mobility issues.

Pertinently, NICE[3] identifies that more than 40% of patients aged over 80 have performance status 3-4, which has greater significance on the decision to treat than age alone. Comorbidities increase with age[7]; the probability of patients presenting with co-existing medical and physiological problems means the definition of ideal treatment remains elusive. Furthermore, ageing is associated with a decrease in functional status and body mass[8] which are inextricably linked with wellbeing and compromised ability to tolerate cancer treatments. Multiple symptoms such as pain and fatigue become more prominent as the body's cancer burden increases and further impact the functional status of the patient[9].

Age is not the significant issue in the patient with advancing disease. The overall performance of the patient must be assessed accurately. Even in the context of advancing disease, the risk of under treating patients remains significant.

The prognostic impact of age and comorbidity is controversial. The view that older patients do not do well after cancer treatment can be a self-fulfilling prophecy, as a consequence of cautious approaches to their management. Wetle[10] defined age as a risk factor for inadequate treatment, purporting that treatment decisions were based on chronological age, and routinely in clinical correspondence age is the first information given, ie 'This 58 year old gentleman presents with....'. This is further compounded by misconceptions regarding life expectancy, quality of life, lack of interest/fear of treatment by the patients themselves and a paucity of evidence regarding treatment options for older patients.

TREATMENT OPTIONS: EARLY STAGE DISEASE

In the 2011 guidelines for lung cancer, NICE advocates radical radiotherapy for patients with stage I, II or III non-small cell lung carcinoma (NSCLC) and performance status 0 or 1[3]. Critically, the limiting factor is that the disease can be encompassed in a radiotherapy treatment volume without undue risk of normal tissue damage. Modern techniques, including 3D conformal treatments and image guidance radiotherapy, facilitate small margins and hence the sparing of normal tissues and a reduction in the risk of radiation pneumonitis quantified through dose volume histogram. Thus, radical radiotherapy is accessible to patients with larger volume disease because the dose to normal tissues is better visualised/assessed and manipulated to minimise the risk of radiation induced morbidity.

The high ablative doses used in stereotactic body radiotherapy (SBRT) improves survival in the older person[11], with local control rates exceeding 90% and low treatment related toxicity. For the

Elekta's Versa HD™ System Sets New Standard of Radiotherapy for Cancer Patients Worldwide

During a live global event on March 1, Elekta announced the launch of Versa HD™, an advanced linear accelerator system designed to improve patient care and treat a broader spectrum of cancers. Featuring highly conformal beam shaping and tumour targeting, Versa HD also introduces new capabilities designed to maximize health care system resources and deliver highly sophisticated therapies without compromising treatment times. Elekta has achieved CE Marking, allowing European medical centers to employ Versa HD for their patients with cancer.

Versatility to deliver better treatments to more patients

Versa HD gives clinicians the flexibility to deliver conventional therapies to treat a wide range of tumours throughout the body, while also enabling treatment of highly complex cancers that require extreme targeting precision. As an integrated treatment system, Versa HD offers the versatility to address today's growing cancer management challenges.

"In Versa HD, we incorporated technologies that would provide an immediate impact to patient health and quality of life," says Elekta's President and CEO, Tomas Puusepp. "Versa HD represents another market-leading innovation from Elekta, and reflects the best thinking of Elekta's technical experts and our clinical partners."

Integrated with Elekta's Agility™ 160-leaf multileaf collimator (MLC), Versa HD provides ultra-precise beam shaping – critical for maximizing the dose to the target while also sparing surrounding healthy tissues. Importantly, this high targeting accuracy is available over a large field-of-view, permitting delivery of high-definition (HD) beams to a wide spectrum of complex targets. Historically, high-definition beam shaping often was mechanically limited to only small target therapies. Versa HD with Agility overcomes this challenge, now empowering clinicians to deliver extremely precise beam contouring for both small and large targets.

Unprecedented combination of High Dose Rate delivery and rapid MLC leaf speed

Capable of delivering radiation doses three times faster than previous Elekta linear accelerators, Versa HD harnesses the ultra-fast leaf speeds of Agility MLC. With this groundbreaking combination, clinicians can now – for the first time – fully exploit higher dose rate delivery, potentially enabling even greater capabilities for sophisticated therapies, including stereotactic radiosurgery (SRS), stereotactic radiotherapy (SRT) and volumetric modulated arc therapy (VMAT).

Versa HD™ is not available for sale or distribution in all markets.

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few patients who present with early stage NSCLC, SBRT is a good option irrespective of age.

Combined chemotherapy/radiotherapy and surgery are the mainstay treatments for early stage lung cancer. Many trials into the management of patients with lung cancer, specifically exclude patients over the age of 65, and extrapolation of the data may not be representative, leaving the indications for treatment less robust. However, whilst toxicity may be more pronounced, there is evidence which suggests that outcomes in older patients mirror results for younger patients[8]. NICE recommends that more research is undertaken in this area.

LATE STAGE DISEASE

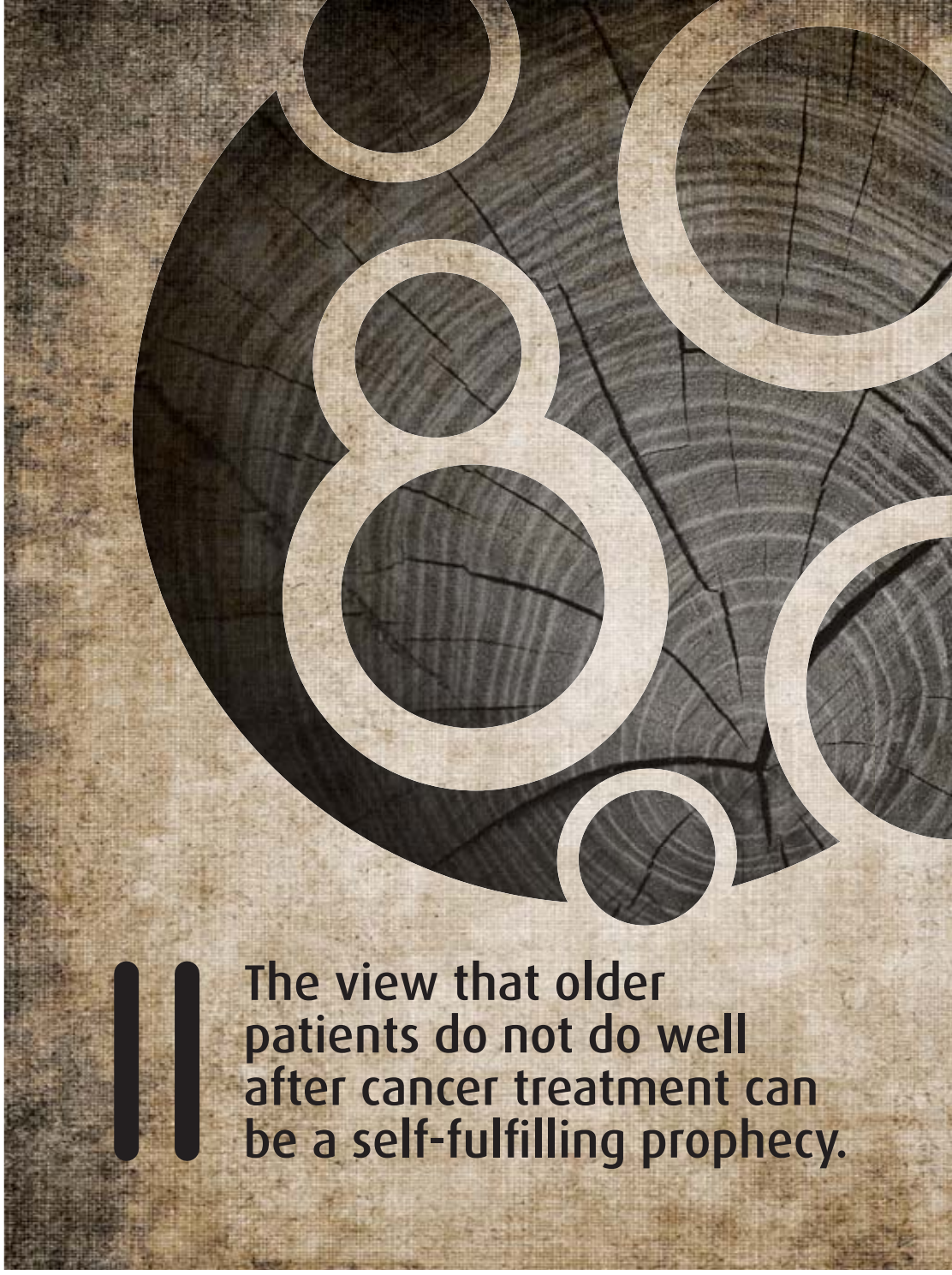
Over recent decades there has been significant progress in the treatment of advanced disease[12]. Even in a disease with poor prognosis, the use of conformal radiotherapy techniques has been associated with a two month improved survival in older patients with NSCLC. Anticipated decrease in toxicity was not demonstrated when using complex techniques, indicating that the improved survival was through tumour control, rather than reduced normal tissue dose[13]. Where accurate assessment of the patient can be determined, complex radiotherapy techniques are appropriate and can result in improved survival for this group of patients.

Significant advances are being made in the palliative arena in the management of patients with lung cancer. The probability of patients having comorbidities, eg cardiovascular disease, increases with age[3] however, it is only the presence of more than one comorbidity that results in poorer prognosis[7]. The significance of quality of life must be recognised and patients' fears and expectations can have a significant impact on this[14]. Alleviating debilitating symptoms of advanced lung cancer, including dyspnoea, bone pain, haemoptysis and anorexia are indicators for treatment. However, again patient selection, performance status and comorbidities must be prioritised as it has been identified that only 26% of patients receiving radiotherapy in the final two weeks before death had improved symptoms or stabilisation of symptoms[15]. This emphasised the lack of evidence for palliation of symptoms, however there is a lack of research regarding the efficacy of radiotherapy in the terminal phase and almost none pertaining to the older patient.

Hypofractionation with one or two treatments may be indicated for patients with poor performance status and no treatment should also be given due consideration. However, even in patients with poor performance status and advanced disease, there can still be a role for high dose palliation.

CONCLUSION

In the 21st century the concept of 'elderly patient' cannot alone, be a basis for treatment decisions. The presence of adverse prognostic indicators is a determinant in the appropriateness of treatment regimes. Radiotherapy techniques allow aggressive treatment in patients with comorbidities and advanced age. Careful evaluation of the overall status of the patient and respect of their wishes and expectations must be the primary determinants of treatment decisions.



> The view that older patients do not do well after cancer treatment can be a self-fulfilling prophecy.

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BREAST BRACHYTHERAPY: A NEW STANDARD OF CARE IN EARLY STAGE BREAST CANCER?

NAOMI LAVAN, CHARLES GILLHAM

The use of brachytherapy in breast cancer management is well established both as a boost technique and as a means of delivering accelerated partial-breast irradiation (APBI).

With over 20 years follow-up, breast conserving surgery (BCS) in combination with whole breast irradiation (WBI) has provided comparable clinical outcomes to mastectomy for women with early-stage breast cancer and has become the standard of care for most women[1]. The addition of WBI to BCS results in reduced in-breast tumour recurrence and confers a breast cancer mortality benefit[1]. Furthermore, prospective randomised trials have demonstrated enhanced local control in most women following BCT when, in addition to WBI, the tumour bed is boosted to a higher dose[2]. Evidence that the majority of in-breast tumour recurrence occur within a limited radius of the tumour bed has been further developed with the advent of APBI.

BREAST BRACHYTHERAPY AS A BOOST TECHNIQUE

Historically, the predominant use of brachytherapy in breast cancer treatment was as a method of delivering a boost to the tumour bed with an additional margin after BCT and WBI. In the seminal EORTC 22881/1882 trial[2], women with negative surgical margins were randomised to a boost or no boost. Boost technique was at the discretion of the treating physician, but options included 16Gy delivered by either electrons or tangential photon fields, or interstitial Ir192 implants at a dose rate of 0.5Gy/ hour. This trial confirmed improved local control with the addition of a boost, albeit with modest increase in post-treatment fibrosis[2]. With the wider availability of electron-based therapy there has been some decline in the use of brachytherapy in this setting. However, arguably interstitial brachytherapy remains the preferred boost technique for deep seated tumours in women with larger breast size, as the technique spares more of the superficial normal breast tissue and deeper structures such as the chest wall, lung and heart[3].

BREAST BRACHYTHERAPY TECHNIQUES

APBI is a technique that aims to treat only the lumpectomy site with an additional margin of 1-2cm and not the entire conserved breast. APBI can be delivered by a variety of techniques; brachytherapy, intraoperative radiotherapy (IORT) and external beam radiotherapy (EBRT). In brachytherapy-based techniques the delivery of higher doses per fraction to a smaller volume of tissue allows treatment to be completed in a shorter period of time. There is now a wealth of experience in using brachytherapy as means of delivering APBI. A variety of techniques exist including multicatheter interstitial brachytherapy and balloon-based modalities[4].

Multicatheter interstitial brachytherapy (MIB) has the longest follow-up of all brachytherapy techniques in this setting. It was initially developed in the setting of boost delivery following WBI EBRT. This modality involves the insertion of flexible after-loading catheters into the region of interest within the breast. Insertion can be free-hand or template-based. Catheter placement distances are predetermined. Both high dose rate (HDR) and low dose rate (LDR) brachytherapy has been used. HDR confers an advantage over LDR as it is an outpatient treatment. Conversely LDR requires a two to five day inpatient admission. The accepted dose for HDR MIB is 34Gy in ten fractions twice daily, each fraction delivered at least six hours apart to allow for normal tissue recovery. MIB necessitates a significant amount of skill on the part of the treating clinician in order to deliver high quality treatments.

Other brachytherapy-based techniques were developed due to these technical challenges that were perceived to be potentially limiting its widespread use. These included single- and multi-lumen balloon-based techniques. The devices consist of a balloon attached to a catheter that is

Recently published results from two RCTs have added to the uncertainty surrounding the adoption of APBI.

inflated to the volume required to fill the surgical cavity. The catheters are then after-loaded with Ir192 HDR sources. Placement can occur post-operatively under ultrasound guidance or, perhaps controversially, peri-operatively at the time of lumpectomy. The multi-lumen varieties allow greater flexibility in treatment planning due to the availability of additional source positions compared to the single-lumen catheters.

Other non brachytherapy-based APBI techniques in use include 3D conformal EBRT and electronic brachytherapy systems employed in IORT but these are beyond the scope of this review.

EVIDENCE FOR APBI

A team based at William Beaumont Hospital, Troy, Michigan recently published twelve-year outcomes of a matched-pair analysis comparing interstitial brachytherapy and WBI. They reported equivalent outcomes for local control (3.8% vs. 5%, p=0.4), regional recurrence, disease free survival, cause specific survival and overall survival in their cohort of 199 women[5]. Similarly encouraging results have been published from other retrospective series. However, a lack of phase III trial data remains with only a single randomised control trial (RCT) from Hungary, reporting equivalent five year local control (4.7% APBI vs 3.4% WBI) and excellent cosmetic results[6]. However, the study has subsequently been criticised as being underpowered.

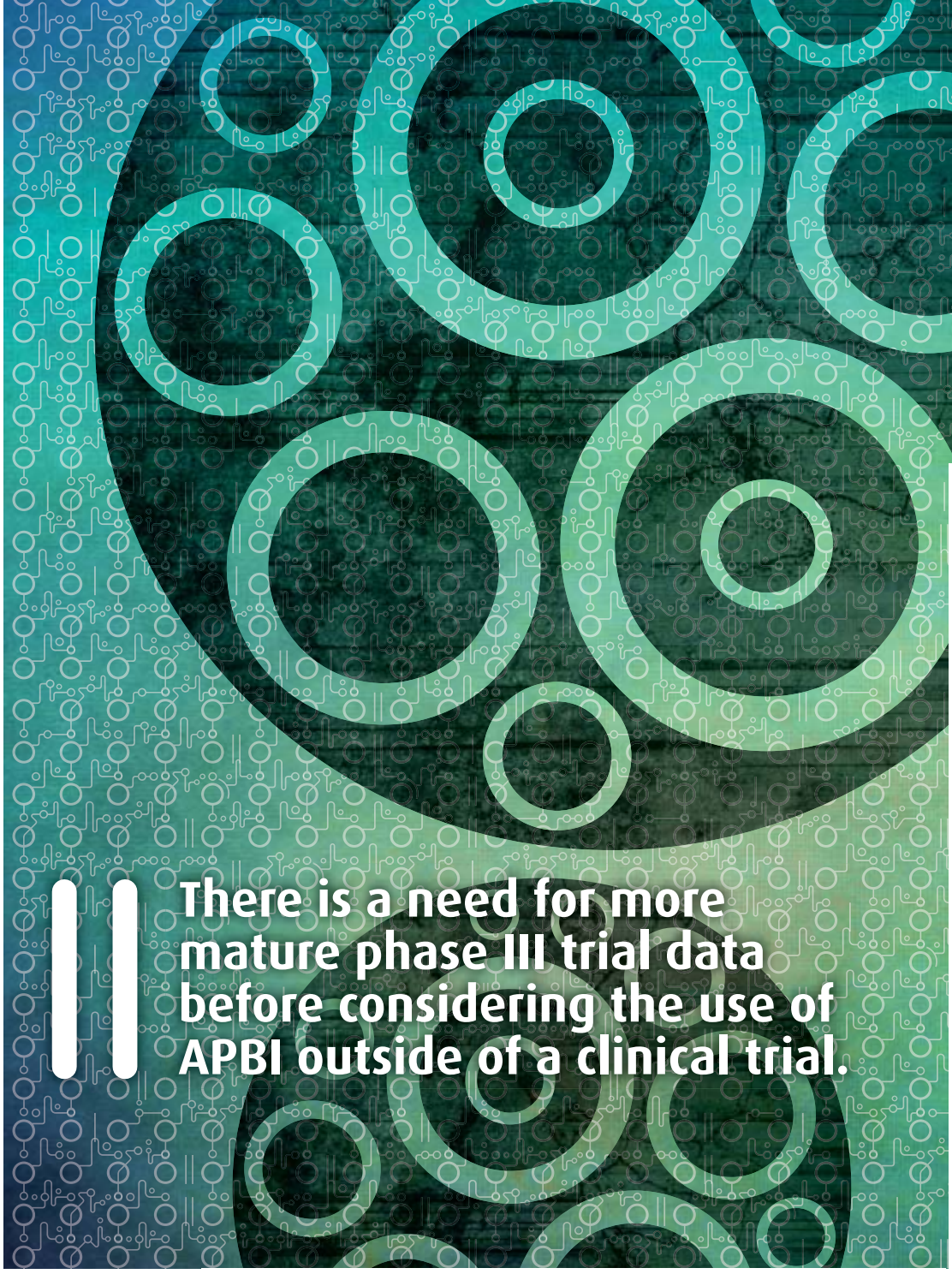
Valachis et al published a meta-analysis of three eligible trials including a pooled total of 1140 patients[7]. They showed a statistically significant increase in local and axillary recurrences (pooled OR 2.150, p=0.001, pooled OR 3.43, p<0.0001 respectively) following APBI. This meta-analysis has also been criticised for including two older trials predating the introduction of clinical guidance on patients considered suitable for APBI.

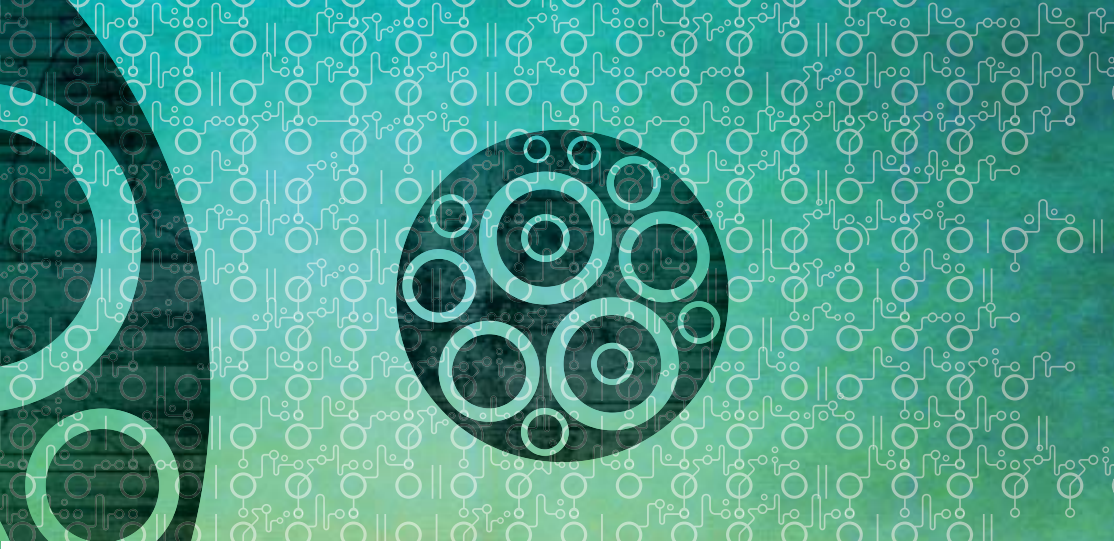
Though utilising different APBI techniques, recently published results from two RCTs have added to the uncertainty surrounding the adoption of APBI into general practice. The RAPID trial (randomised trial of accelerated partial breast irradiation) compared EBRT APBI to standard WBI. The APBI dose was 38.5Gy in ten fractions twice daily; considered equivalent to the HDR-BT prescriptions previously published in the APBI setting[8]. A statistically significantly adverse cosmetic outcome at three years was found following a planned interim analysis.

The TARGIT-A trial (a randomised trial comparing targeted intraoperative radiotherapy versus whole breast radiotherapy), a non-inferiority phase III RCT, randomised 996 patients to standard EBRT or IORT. With four years follow-up, in-breast tumour recurrence was reported to be 3.3% in the trial arm and 1.3% in the standard arm. Though this absolute difference of 2% fell within the pre-determined non-inferiority boundary of 2.5%, longer follow-up is required to further elucidate this risk of tumour recurrence[9].

CURRENT STATE OF PLAY

Brachytherapy as a method of boost delivery post-BCT has been largely superseded by photon- and electron-based techniques. Going forward, a current RTOG[1] randomised trial is exploring the non-inferiority of photon-based hypofractionated WBI and concurrent boost compared to sequential boost and WBI[10].





There is clearly a need for more mature phase III trial data before considering the use of APBI outside of a clinical trial. In addition to RAPID and TARGIT, randomised controlled trials either actively or closed to accrual include NSABP B-39/ RTOG-0413, GEC-ESTRO IMPORT-LOW and ELIOT trials.

With increasing cancer incidence, the economic impact of cancer care is an important consideration. Previously published analyses have not identified a cost benefit in favour of brachytherapy-based APBI compared to standard WBI[11,12]. Importantly, the UK START trial that assessed hypofractionation in the setting of BCT has allowed the previously standard five week course of WBI EBRT to be truncated to three weeks. This fractionation schedule already reduces the number of treatments for patients, thereby alleviating some of the burden on already stretched departments. Importantly, unlike APBI the safety and efficacy of this fractionation schedule has been confirmed with the recent publication of ten year follow-up data[13].

CONCLUSION

APBI is undoubtedly an attractive treatment paradigm but only if proven to result in similar outcomes for women when compared to whole breast irradiation. It will be a number of years before interim results are available from the aforementioned trials and even at that stage five year data will still be regarded as immature in the setting of early stage breast cancer. It is unlikely, therefore, that our current standard of breast conserving surgery and whole breast irradiation will be changing in the near future.

FOOTNOTE

(1.) RTOG – The Radiation Therapy Oncology Group is a collaborative group in North America, funded by the National Cancer Institute.

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THE IMPACT OF LONELINESS: A CONSEQUENCE OF CANCER AND ITS TREATMENT

LESLEY SMITH

When Macmillan Cancer Support launched their 'Not Alone' campaign in 2013, the television advertisement showing a man on his own with a doctor, being told he has cancer, and being unable to take in any other information, then collapsing outside, struck a chord with many people.

The psychological and social impact of a cancer diagnosis is immediate and significant[1]. It is well recognised that the majority of people will need a support network, including friends and family, professionals, charities and volunteers, to help them cope. However, one in four people diagnosed with cancer in the UK lack the support of family or friends during their treatment and recovery[2]. For people who are already socially isolated or lonely, finding enough of the right kind of support will be particularly problematic. The importance of addressing social isolation and loneliness is being recognised increasingly by health and social care professionals because research is showing its adverse impact on mortality[3,4]. This has been shown specifically in cancer survival. Kroenke et al[5] suggested that women who were most socially isolated before they were diagnosed with breast cancer, were twice as likely to die from the disease as women with the strongest social network. Similarly, another study led by Lutgendorf[6] found that women with ovarian cancer who had the most supportive social relationships lived for at least a year longer on average than those without support.

Loneliness and isolation affect a greater proportion of cancer patients than might be expected, and with increasing cancer diagnoses and increasing survival, the number of people in the UK living with cancer who are isolated and/or lonely is only going to grow from the current estimate of 400,000[9]. Health and social service policy makers and service providers will need to take account of these trends as well as the changing demographics of increasing numbers of single-person households, which went up 0.7 million to 7.7 million from 2001 to 2011[7]. Carers of cancer patients are also affected – 14% reported feeling isolated in a recent survey[8].

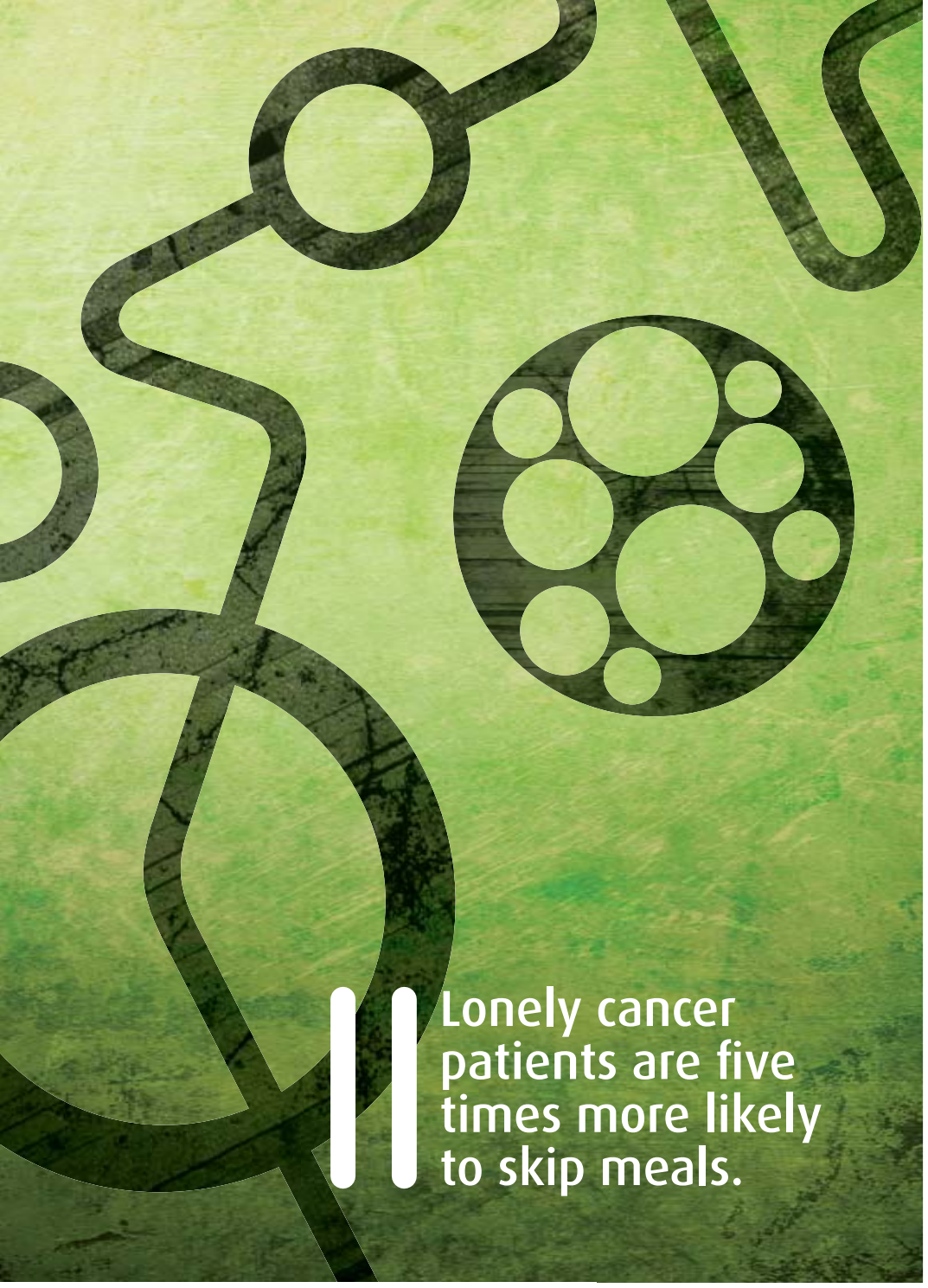
Research carried out by Ipsos Mori for Macmillan Cancer Support showed that feeling lonely is having a detrimental impact on the lives of people living with cancer[9]. Comparing the experiences of cancer patients who say they feel lonely since their diagnosis (or more lonely than they did before) with those who aren't, lonely cancer patients are:

- Eight times more likely to eat a poor diet (45% vs. 6%);
- Five times more likely to skip meals (38% vs. 7%);
- Three times more likely to drink more alcohol than they usually do (22% vs. 7%);
- Almost five times more likely to have not left the house for days (66% vs. 14%);
- Almost three times more likely to have problems sleeping (76% vs. 27%).

Cancer care teams often meet patients who are at risk of not completing their course of treatment due to lack of support. A survey of health professionals[2] found that 53% say patients have decided to skip treatment altogether because they have no support from family or friends and over 90% of professionals have treated cancer patients who do not have any support at all from family or friends – 60% have seen patients in this situation in the month prior to the survey. Lack of support is of course only one of many reasons why a person may decide not to proceed with cancer treatment, and people with good support may not wish to start or continue their treatment for a wide variety of personal reasons, which is entirely their choice. However, what is disturbing is when lack of support, in the absence of other factors, drives the patient's decision making.

Understanding patients' personal support, travel and mobility needs, which are associated with cancer treatment should be a routine and regular part of assessment, especially if the patient

The psychological and social impact of a cancer diagnosis is immediate and significant.



is already socially isolated or lonely at diagnosis. However, more than a third of healthcare professionals (37%) do not always ask if a patient has support from family or friends; this increases to almost half (47%) of GPs[2].

RISK OF LONELINESS AND ISOLATION AFTER TREATMENT HAS ENDED

Once treatment and rehabilitation is over, cancer care teams and primary care professionals may lose sight of the need to actively consider whether a patient is feeling lonely and isolated in the long term. However, cancer patients who felt well supported before and during treatment, may feel more isolated[10,11] due to the ongoing effects of the diagnosis and treatment, or side effects (see figure 1).

A good example is where pelvic radiotherapy has caused late-onset chronic bowel dysfunction and sexual difficulties (such as vaginal stenosis or erectile dysfunction). Someone affected by faecal incontinence, to the extent that they feel completely unable to leave the house, will have their whole life changed. Every day activities such as going to work or college, walking the dog, seeing friends, going shopping or going on holiday, now seem impossible. Even having family or friends to their home can be extremely difficult due to the embarrassment from accidents and odours. They may be unable to control their bowels at night and have to sleep in a separate room to their partner. Use of continence products adds to the sense of being abnormal and undesirable. Not being able to have sex (due to the physical and/or psychological consequences of treatment) adds to this loss of physical intimacy, creating further problems, which can lead to relationship breakdown and depression.

For someone in this situation, the initial isolation caused by the physical symptoms has resulted in a cycle of problems with very serious life-long consequences to their health and well-being. What can heighten this isolation still further is where the person feels that no one else must be going through the same, and that their healthcare team appears unable to help them. Some people in this position consider their life to be not worth living[12].

THE ROLE OF THE HEALTH PROFESSIONAL

The physical and psychosocial consequences of cancer and its treatment are closely intertwined, each impacting on the other, so a holistic approach to needs assessment, support and treatment is vital. It is now recognised that preparation for recovery and for living beyond cancer must start at diagnosis[13]. The National Cancer Survivorship Initiative in England has been working since 2008 to learn more about the needs of people living with and beyond cancer, and to provide realistic solutions to how the NHS, business, the third sector and cancer patients and carers can manage the increasingly complex impact of cancer and its treatment on 21st century lives. A range of interventions is now proposed for wider implementation, key elements of which are the 'Recovery Package'[14], supporting people to return to work, increasing physical activity and making other healthy lifestyle choices.

Health professionals also need to ensure that people are well informed of the impact of cancer and its treatment on their future life, so that quality of life can be optimised. Provision of information about potential consequences of treatment is extremely important, potentially reducing uncertainty and psychological distress[15].

Corner and colleagues[16] analysed the qualitative responses in the Department of Health pilot survivorship patient-reported outcome measures (PROM) survey and found factors mitigating against poor quality of life included

"quality aftercare, provided by named healthcare professionals, especially clinical nurse specialists, with whom survivors and their families could remain in contact and discuss problems as they arose, and who supported the development of self-management strategies".

The authors also found that survivors who coped well after treatment had found self-management strategies for themselves, often with the support of friends or family members, or through talking to others with similar experiences, rather than having had them explained by professionals. Therefore those without family and friends may need more support from professionals to help them develop self-management strategies.

Professionals can help by asking patients if they have support from family or friends, and signposting isolated people to alternative sources of support, which may include financial advice organisations, health websites (including those with personal stories, such as *www.healthtalkonline*.org[17]), high street pharmacies and personal blogs, as well as the many phone support lines, web fora and information centres run by cancer charities. In addition, directing people to local cancer patient support groups offers the opportunity for people to talk to others who understand what they are going through. Activities such as Walking for Health[18] provide social contact as well as the physical health benefits of exercise.

Ongoing monitoring of patients for late-onset consequences of treatments, mental health issues and psychosocial problems, will help to ensure that patients are referred to appropriate services at an early stage, reducing the risk of isolation.

CHALLENGES FOR THE FUTURE

Isolation and loneliness are having a negative impact on many cancer patients' health with some deciding to reject treatment altogether, because of a lack of support. Loneliness can be felt, even where someone is not socially isolated, because of difficulty in talking about cancer with people close to them, or because of physical consequences of treatment, such as disfigurement or incontinence, that causes physical or emotional separation.

With increasing survivorship, coupled with increasing numbers of people living alone, the numbers of people affected will grow. Contact with health professionals at many points along the cancer care pathway provides opportunities to ensure patients and their carers are able to benefit from effective self-management strategies and interventions that reduce isolation and

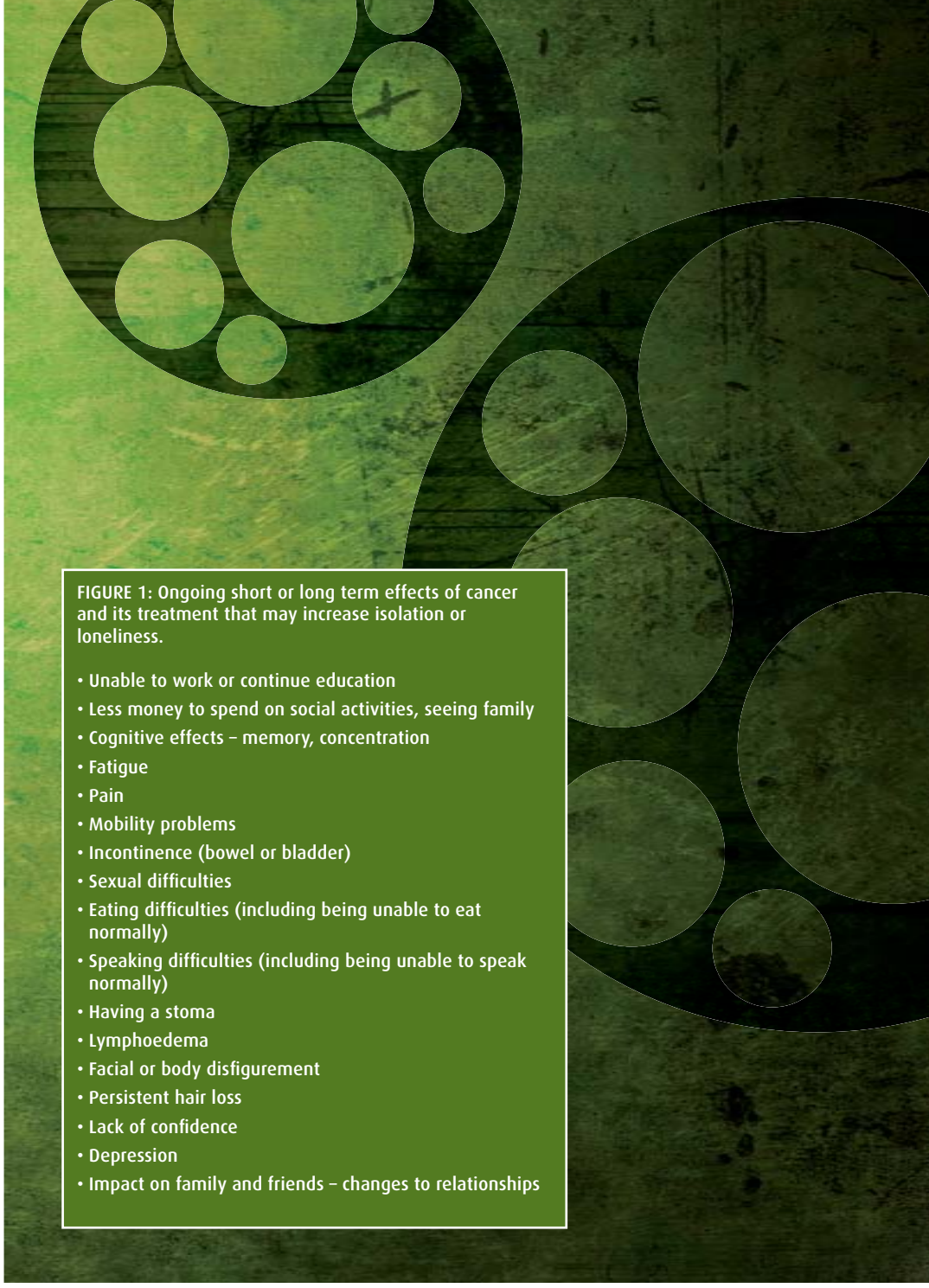


FIGURE 1: Ongoing short or long term effects of cancer and its treatment that may increase isolation or loneliness.

- Unable to work or continue education
- Less money to spend on social activities, seeing family
- Cognitive effects – memory, concentration
- Fatigue
- Pain
- Mobility problems
- Incontinence (bowel or bladder)
- Sexual difficulties
- Eating difficulties (including being unable to eat normally)
- Speaking difficulties (including being unable to speak normally)
- Having a stoma
- Lymphoedema
- Facial or body disfigurement
- Persistent hair loss
- Lack of confidence
- Depression
- Impact on family and friends – changes to relationships

loneliness[19], thus reducing the associated increased risk of mortality.

To improve survival and quality of life after cancer and its treatment, relevant health professionals need to be fully equipped to identify all of a patient's physical, social and emotional concerns throughout diagnosis, treatment and beyond. Using holistic needs assessment[14,20] enables personalised, integrated care planning and the provision of patient information in a timely way that prepares people for issues that they may unexpectedly face after treatment, such as social isolation and breakdown of relationships. It is vital that patients and their family and friends know who they can turn to.

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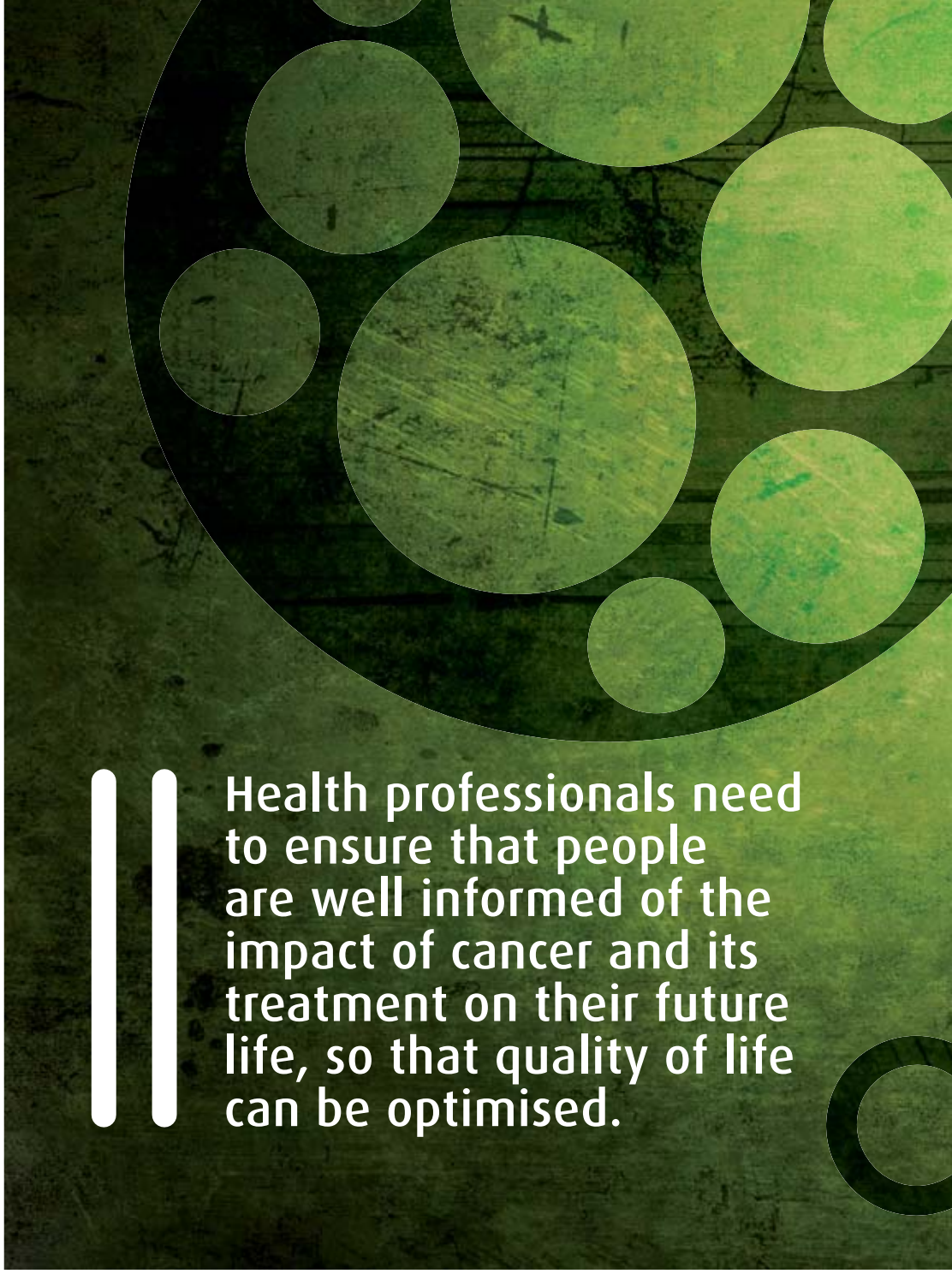

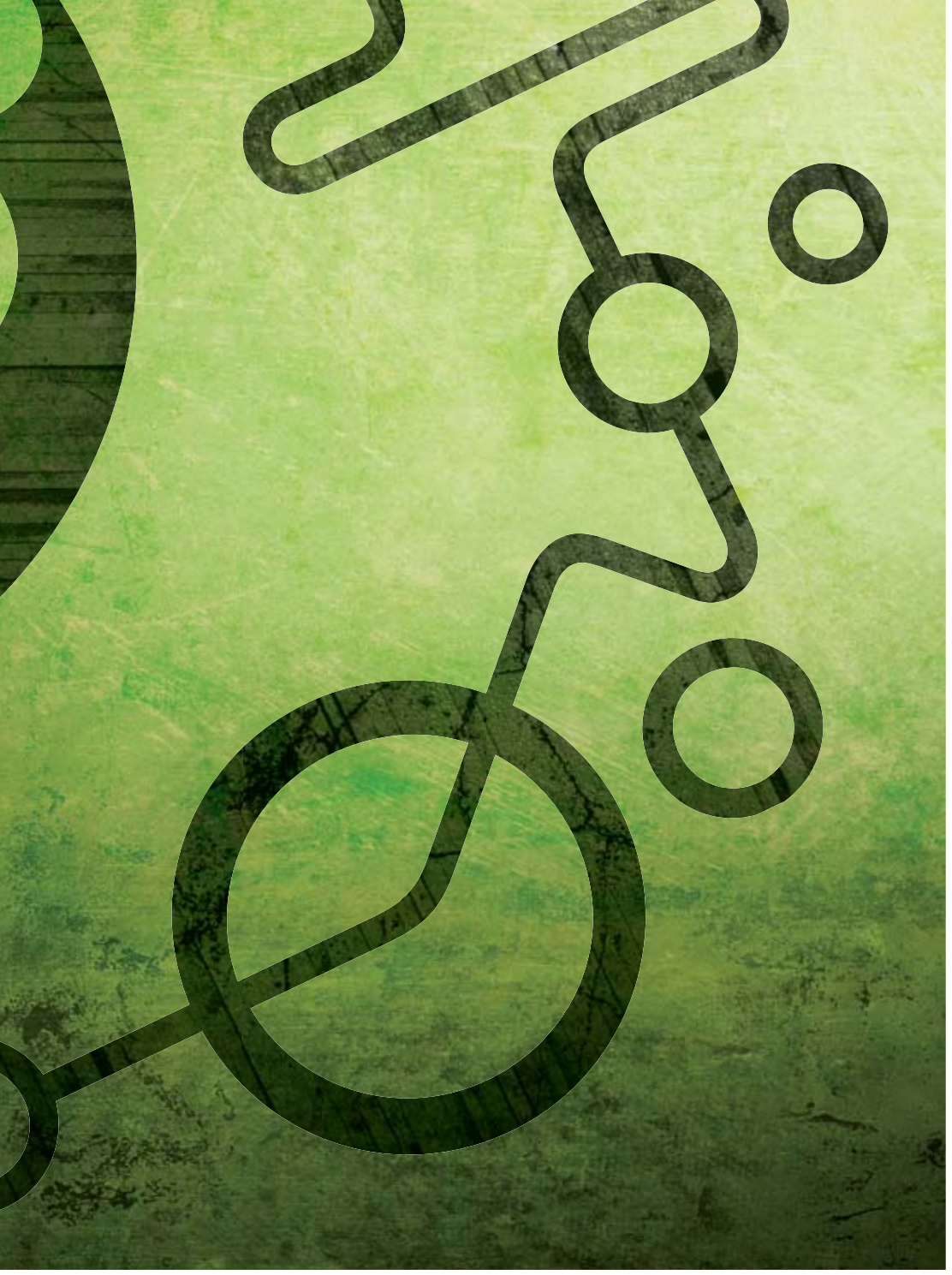

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