Development of an advanced RTT clinical research role

Background

I am an advanced practitioner therapeutic research radiographer, or radiation therapist (RTT), working at the Leeds Cancer Centre in the UK. Here at Leeds, our intention is to deliver advanced, effective and safe person-centric care. Research is an essential driver in delivering this aim. There is growing evidence to support findings that hospitals with higher rates of participation in clinical research show improved patient outcomes, whilst also utilising evidence-based innovations faster than those not as engaged.1,2,3

Education and initial training

It has taken me quite a while to become more involved in empirical radiotherapy research. When I was 21, I graduated with a degree in neuroscience. I was not really that enthused about working for the rest of my life in a lab, and I'd recently learned more about radiotherapy through people close to me who were receiving it as a treatment. I saw radiotherapy as a fulfilling role in which I would be able to help people, as well as find interest in the science and enjoy a career with great developmental potential. I completed my postgraduate diploma in radiotherapy and oncology in 2007.

Radiotherapy specialisms

Over the last 12 years, I have experienced the massive evolution of technology and radiotherapy techniques. I've specialised in various areas, but always enjoyed service development. My first role as a specialist practitioner was as part of a small team tasked with the establishment of the Gamma Knife service at Leeds. We were led by an inspirational advanced practitioner, who was always keen to discuss new ideas and encouraged us to learn from others; sending us to existing departments to bring back best practice. An example of this was when I was tasked with mitigating risks in use of the Gamma Knife, and I was sent to see what was done in neurosurgical theatres with one of the neurosurgeons we were working with. I ended up translating the World Health Organization's surgical safety checklist, used routinely in theatres, into a 'radiosurgical safety checklist' for use with Gamma Knife radiosurgical procedures.

I applied successfully for a part-time secondment opportunity that arose in 2009 to work with the UK Proton Overseas Programme. This was a relatively new service in which patients, often with rare cancer diagnoses, were referred to a specialised clinical reference panel, which might refer them overseas for high-energy proton-beam therapy. I worked in this role, alongside my more traditional RTT role, for eight years, but the duties varied considerably. My main objective was to reduce referral times by implementing an electronic-referral pathway to handle patient diagnostic images previously couriered around the UK on compact discs. The result helped to reduce the referral-to-decision times by several days. I also spent a short time overseas at two proton-therapy centres to identify what improvements could be made to benefit our patients and streamline our referral processes. I was then given the task of helping to write guidance for patients using the service. I developed my data-handling skills during this time by facilitating data extraction from the databases to highlight areas for further improvement through audit.

Transition into a research role

During this time, I realised I wanted to do more research and set about studying for a masters degree in radiotherapy and oncology, graduating in 2015. By this time I was an advanced practitioner, specialising in workflow and designated with taking the department paperless.

In 2017, an opportunity of a fixed-term RTT research position became available, to which I was appointed. This post was funded by a Cancer Research UK Network Accelerator Award of £4.3 million, which was distributed across the Advanced Radiotherapy Technologies Network (ART-NET). ART-NET is a network of five radiotherapy departments across the UK, dedicated to the development, assessment, and clinical implementation of new techniques and technologies for patients' benefit.4 ART-NET aims to solve problems through use of novel techniques, to identify areas for further research, to devise clinical trials and to establish a framework to aid nationwide improvements in radiotherapy. There are seven workstreams within ART-NET:

1. magnetic resonance-based treatment planning;
2. fast/adaptive re-planning;
3. motion management;
4. functional imaging;
5. proton-image guidance and dose verification;
6. health economics; and
7. trial methodology.

Over the last two years, I have been working within the motion-management workstream on various projects.

The Advanced Radiotherapy Technologies Network (ART-NET) projects

The first major project to which I was assigned was to investigate how we should adapt to intra-thoracic anatomical changes (ITACs) in early stage non-small-cell lung cancer (NSCLC) patients who received stereotactic ablative radiotherapy (SABR). I came up with an idea to survey UK radiotherapy departments to determine what we could learn from existing practice in the UK and highlight areas we could investigate further. I jointly co-led this survey with Dr Sean Brown, a clinical fellow from The Christie, the largest cancer hospital in Europe. We also were lucky enough to work alongside Dr Helen McNair (The Royal Marsden Hospital/The Institute of Cancer Research) at all stages of this survey. We found wide variations in:

- image-guidance workflows used by centres (Figure 1);
- types and content of image-guidance protocols;
- RTT training; and
- lung SABR service provision across the UK.

Respondents also expressed a clear need for more supporting evidence on how to manage anatomical changes to streamline the workflow.5 This has led both Dr Brown and me to lead jointly on another project, an assessment using a traffic-light protocol of ITACs of lung patients treated using SABR. As an RTT, I was able to lead and provide expertise on the technical image-guidance aspects of the project. This work was well complemented by Dr Brown's clinical perspective.

We audited 100 NSCLC patients treated with SABR at two UK institutions, reviewing several hundred cone-beam CT images for the presence, severity, and impact of ITACs during treatment. ITACs included:

- atelectasis;
- infiltrative change;
- pleural effusion;
- tumour baseline shift;
- gross tumour volume (GTV) increase; and
- GTV decrease.

We graded each image using a traffic-light protocol, as described by Kwint et al., 2014. In this protocol, a traffic-light colour is assigned to each image depending on how any ITAC has affected planning target volume (PTV) coverage of the GTV.6 We used this system to provide a surrogate for the risk of significant dosimetric changes such as target under-coverage or organ-at-risk overdose that may occur as a result of the ITACs. Some examples are shown in Figure 2. We recorded the frequency of requests for physics or clinician review of the impact of ITACs. We used a linear mixed-effects model to assess the fixed-effect relationship between set-up time and ITAC grade.

We found that ITACs occurred in 21% of patients, but most were minor, requiring no adaptation to treatment. Despite this, as shown in Figure 3, ITACs were significantly correlated with lengthier and potentially more uncomfortable treatment times for patients, and they represented a significant resource burden, requiring additional support from medical physicists and consultant clinical oncologists. We have concluded that with improved guidance, the burden on departmental resources might be reduced, and patient experience can be enhanced.

We're currently writing up the results for publication and planning a quality-improvement project to improve image guidance for RTTs. I presented the abstract at a poster discussion session at the European SocieTy for Radiotherapy and Oncology (ESTRO) 38 and won the best poster award, presented to a radiation therapist, 2019.

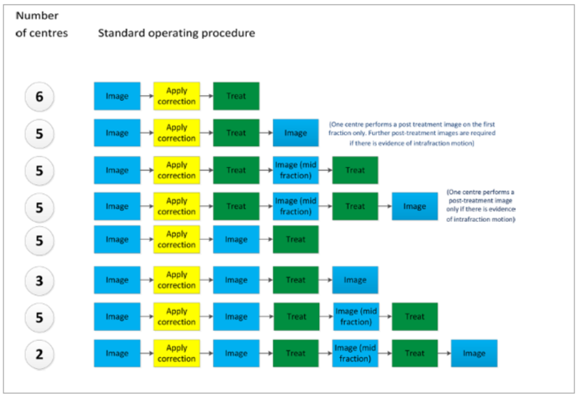

Figure 1. Wide variation in lung SABR IGRT – eight different workflows

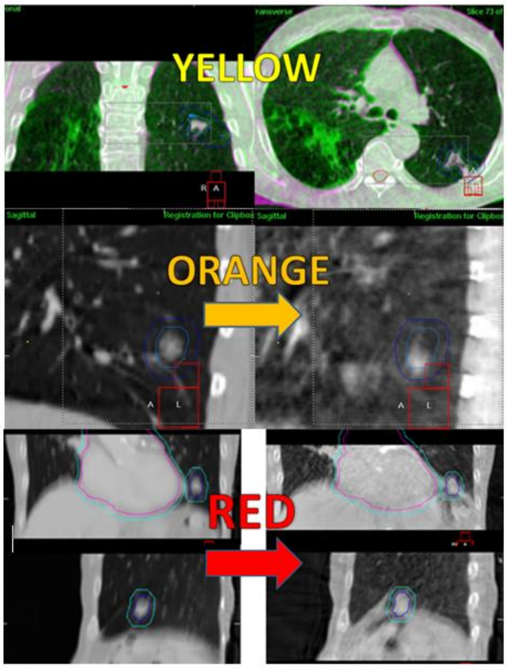

Figure 2. Examples found during the audit. Top image shows an overlay of infiltrative

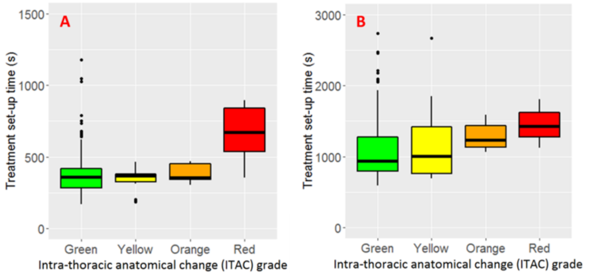

Figure 3. Set-up times according to grade of ITAC in centres A and B

Future directions

I have two years remaining in my current position. Switching to a RTT research post has been one of the best decisions I've ever made. It has been a huge learning curve, but I love my job. Collaborating in a multi-disciplinary team across five different centres, all with complementary strengths, has been extremely rewarding and has led to some exciting future-development work.

In the short-term I'm currently convening a group on introduction of a traffic-light protocol into clinical practice for lung SABR. In addition I am leading on an evaluation of our cone-beam CT image quality system for use in pelvic SABR, which we hope to use to improve image quality for this patient sub-group. I'm also co-supervising two fourth-year medical students, who are just writing up their research project, which has investigated organ-at-risk contouring in pelvic SABR patients. I hope to supervise more students in the future, as this is a great way to accomplish research projects with clear outcomes that we can use to improve patient care.

My long-term ambition is to apply for a doctoral fellowship. I am keen to utilise my clinical and academic skills to ensure the appropriate translation of technical developments from other medical disciplines into routine clinical practice for the benefit of patients.

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