



UHB RADIOTHERAPY

2018-2020 RESEARCH PRIORITIES

*The Hall-Edwards Radiotherapy Research Group
Research and development to redefine the standard for the best in care*

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A MESSAGE FROM OUR CANCER LEAD

A message from our cancer lead



Mark Cook

There has never been a more exciting time to be involved in the delivery of cancer care to patients. The last 10 years have seen an unprecedented expansion in our abilities to diagnose, prognosticate and treat patients with Cancer. The routine use of high resolution and functional imaging allows us to stage patients more accurately, and assess response dynamically. The advent of affordable genomic testing has opened up the reality of personalized medicine based on the biology of the tumour. The unstoppable progress of therapeutic development has seen a change across all of the modalities of treatment. Robotic surgery now offers the prospect of improved outcomes, shorter stays in hospital and lower complication rates. Technical developments continue apace in radiotherapy, with IMRT and SABR now in routine use, and proton therapy available in the UK from 2018.

Systemic therapies now include targeted therapies, molecules given based on biological or genetic specificities. We are now truly in the era of immunotherapy, with monoclonal antibodies, checkpoint inhibitors and CAR-T cells opening up the prospect of using the patient's immune system to destroy cancer cells. The West Midlands Genomics Medicine Centre, the leading centre in the 100,000 Genomes project is at the heart of an informatics revolution joining all centres together across the Midlands, allowing clinicians to view clinical data and images at the touch of a button.

High quality clinical research underpins all of the progress made to date- it is the key that unlocks the door to new knowledge. All of the developments outlined above are available to Birmingham patients in 2018. Thus it is vital that the discipline of radiotherapy in Birmingham reflects patient need, builds on the best clinical service in the UK and seamlessly integrates high quality research into daily clinical interventions. Birmingham offers a broad repertoire of cancer research, from the fundamental work done in the CRUK Centre in the University of Birmingham to world beating clinical trials delivered at UHB. This strategy document sets out the ambition of the radiotherapy team to tackle the research challenges that are ahead of us in the years to come.

A MESSAGE FROM OUR RADIOTHERAPY LEAD

A message from our radiotherapy lead



Rob Stevenson

Our 2009 strategy set out to modernise the radiotherapy service at University Hospital Birmingham. The aims were simple, to improve access to high quality radiotherapy for all patients and to provide comprehensive access to specialist techniques. The initial focus was to embed intensity modulated radiotherapy with daily image guidance into practice such that it could be delivered efficiently on a large scale. The strategy cut across disciplines and had both Trust Board and QEHB Charity support. The vision included using this high quality clinical platform to facilitate radiotherapy research through clinical trials, and the development or recruitment of staff with a research interest.

The success of achieving clinical goals is reflected in delivery of some of the highest levels of image-guided, intensity modulated radiotherapy in England and the breadth of practice for stereotactic radiotherapy. In fact, University Hospitals Birmingham has nationally led the stereotactic ablative radiotherapy (SABR) practice delivered through the commission through evaluation programme of NHS England. This was also recognised in 2018 with The Chief Executives award for Innovation. The programme could only have been delivered in collaboration with clinical teams across the West Midlands. The drive for improvement also attracted staff from across England committed to improving outcomes.

The radiotherapy team assembled at UHB is experienced in the clinical application of innovative radiotherapy techniques within the NHS pathway. There is also a strong local track record in leadership and delivery on practice-defining clinical trials. This interim strategy will take us forward to 2020 and defines two areas of focus as follows:

- Genomics and Radiomics to predict outcomes
- Developing innovative radiotherapy

Within each area, specific goals have been identified for the next few years. This strategy marks a step on the road to developing a broadly based radiotherapy-research programme in Birmingham.

OUR VISION

Our Vision

Is to deliver world class radiation oncology, built on a platform of high quality research.

We anticipate that radiotherapy will be:

- based on the best available evidence, with research integrated to address the evidence gaps
- based on the best available diagnostics, including genomics
- integrated with agents to improve outcomes locally and systemically

Bringing this vision into reality involves research teams that span the globe. This interim research strategy identifies the contributions to this world-wide effort that will be made in Birmingham in the years 2018-2020.

WHAT HAVE WE DONE AND WHAT WILL WE DO?

What have we done and what will we do?

BUILDING ON RECENT SUCCESS

Over recent years our team have

- Developed a comprehensive image-guided intensity modulated radiotherapy service
- Begun a routine adaptive radiotherapy service based on daily CT images
- Delivered the highest levels of stereotactic ablative radiotherapy in England
- Developed the physics of flattening-filter-free radiotherapy which is now implemented by Elekta
- Developed and tested new methods for managing respiratory motion in radiotherapy
- Been a leading partner in a UK consortium developing new forms of imaging with proton beams for application in proton radiotherapy
- Led practice-changing trials for patients with cancers of the bladder, prostate and of the head and neck

CENTRAL AIMS FOR THE NEXT FEW YEARS

We will work to develop the following

- An excellent radiotherapy clinical service, with research at its heart
- A programme to develop and clinically evaluate novel techniques and technologies
- UHB/UoB at the heart of a network of active radiotherapy researchers
- A programme to develop leaders of the future
- A local patient / public community that engages with the radiotherapy team

PARTNERSHIPS AND COLLABORATION

We will work with partners and collaborate widely to achieve the most for our patients.

This document represents an interim Research Strategy for the Radiotherapy Research teams in Birmingham to be delivered over the years from 2018 to 2020.

THEME 1: GENOMICS AND RADIOMICS TO PREDICT OUTCOMES

Theme 1: Genomics and radiomics to predict outcomes

UHB is a global exemplar in the use of digital technologies and methodologies in healthcare. Close collaboration with the West Midlands genomic medicine unit opens enormous potential for research, harnessing ongoing developments to make genomic, imaging and pathology data available on a regional footprint. Our long-term aim is to make radiotherapy plan data and clinical outcome data also available across this same footprint and to use this as a basis for research and improvement in clinical pathways and treatment.

In this area we will focus on specific projects as follows

- In the next 3 years we will initiate a project to develop an intelligent imaging centre that will harness the power of imaging (cross-sectional and microscopy), genomics and artificial intelligence.
- We will develop our *Platform for Radiotherapy Plan Evaluation and Learning* (Propel™) for wider use to give us high quality data for clinical care and research. The system is currently supporting the national SABR commissioning through evaluation (CtE) project for 17 sites across England. By 2020 we will be evaluating statistical process control techniques for one clinical cohort across the West Midlands.
- The local capability for radio-genomic research will be utilised to explore treatment response assessment and correlation with clinically recorded and patient reported outcomes, especially evaluating treatment related toxicity and its dependency on dose / volume and genomic data.
- We are carrying out a comprehensive programme of basic & translational science relating to radiosensitivity and biomarker development. This has been facilitated by a CRUK Advanced Clinician Scientist award (Andrew Beggs) that is funding a programme of organoid derivation from rectal cancer to make clinically relevant pre-clinical models of radiosensitivity. We will also use techniques such as next generation sequencing, genome-wide CRISPR/Cas9 screens and high throughput drug screening to examine the molecular determinants of radiosensitivity.

In addition to these specific projects, we will promote an awareness of the importance of well curated data recording, handling and processing in all aspects of our clinical service.

THEME 2: DEVELOPING INNOVATIVE RADIOTHERAPY

Theme 2: Developing innovative radiotherapy

The Birmingham team were key to developing the case for proton therapy in the NHS which ultimately lead to the investments in the two NHS treatment facilities, and are the UK leaders in research into neutron capture therapy. Over the next few years our main aims are as follows.

- We will continue our leadership in stereotactic ablative radiotherapy and intend to be leading partners in UK trials of this technology. Two likely trials in development in Birmingham are for treatments for hepatocellular carcinoma and renal carcinoma.
- We will continue to develop imaging with high energy proton beams to ensure that clinical proton therapy can deliver on its potential. By 2020 we aim to have performed demonstrations of computed tomography with scanned proton beams and provided clear plans for improved technology.
- In our research team we are developing nanoparticle agents for dose enhancement and inhibition of repair of radiation damage. It is intended to begin experimental testing of one such agent by 2020.
- Our programme of research in accelerator systems for Boron Neutron Capture Therapy has paused in recent years but we continue to work on improved compounds utilizing both boron and gadolinium. By 2020 we will
 - have modernised or replaced our high power accelerator and obtained the investment to develop a facility for clinical trials of this promising modality
 - tested at least one new compound in cell cultures under neutron irradiation
- Microbeam and flash radiotherapy are new and promising approaches. We intend to establish research activities in these areas and will work to make links with the International community developing these promising modalities. The University of Birmingham Cyclotron will be a focus for these efforts.

Through these research activities we seek to keep UK radiotherapy at the International forefront.

UNDERPINNING ACTIVITIES: CLINICAL AND EDUCATION

Underpinning activities: clinical and education

CLINICAL EXCELLENCE FOR HIGH PRECISION RADIOTHERAPY

Our clinical radiotherapy practice has developed to be one of the most technically capable in the UK, with very high levels of intensity modulated radiotherapy, stereotactic ablative radiotherapy and high levels of trial recruitment. These will continue to be major themes for the next few years, but as specific areas of focus we will

- expand our programme of research in the area of control and mitigation of respiratory motion. We are currently evaluating a portable ventilator at UHB for selected patients and by 2020 we intend to have a proven capability for patients with lung cancer.
- continue to lead in stereotactic ablative radiotherapy (SABR), pursuing trials as well as routine clinical delivery. By 2020 we aim to
 - increase current SABR delivery from the current approximately 14% to in excess of 20% of radical treatment courses
 - Open at least 1 trial of SABR lead from Birmingham
- build-on our practice for surface-guided radiotherapy, currently in use to facilitate breath-hold treatments for patients with breast-cancer, with the aim of delivering tattoo-less radiotherapy for these patients
- transform our HDR brachytherapy capability by:
 - Developing boost treatments for patients with high grade prostate cancers
 - Applying this as a mono-therapy for patients with low grade prostate cancer
 - Adding MRI-based dosimetry for patients undergoing gynecological treatments
- develop sophisticated approaches to adaptive radiotherapy, which is already routine for many of our patients based on cone-beam or megavoltage CT. In particular we aspire to use MRI-based assessments of target volume and tumour response and by 2020 we aim to have 1 trial ongoing which incorporates on-treatment MRI response assessments for selected patients.

These clinical developments will enhance the leading position of the UHB radiotherapy service, and underpin our research efforts.

UNDERPINNING ACTIVITIES: CLINICAL AND EDUCATION

DEVELOPING THE LEADERS OF THE FUTURE

As we pursue our research and clinical activities we will create an environment that is supportive to trainees, young researchers and NHS staff with an interest in research. Specifically we will

- Recruit clinical staff with the desire / capability to develop laboratory-based research programmes and support them to do this
- Find mechanisms to give research active clinicians the scope to develop and deliver. By 2020 we aim to have 2 NHS clinicians with explicit academic sessions in their job plan
- Designate or otherwise create scientist and radiographer posts that have research as a key part of their role description
- Support the UoB Clinical Oncology MSc and focus efforts on providing high quality projects for students
- Hold monthly departmental meetings where research topics, including available grant funding are discussed
- By 2020 we aim to add 2 students (clinical or AHP) per year studying for MD or PhD degrees

Through these foundations, we will build a department and a clinical service where research is embedded in all aspects.

CONTACT INFORMATION

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