Clinical Research Facility at The Royal Marsden

Supporting medical imaging research at The Royal Marsden and The Institute of Cancer Research
The National Institute for Health Research (NIHR) is funded through the Department of Health to improve patient health through research. One of the ways it does this is through the funding of Clinical Research Facilities (CRFs) for experimental medicine.

Established in 2012, the CRF provides infrastructure support for our experimental medicine research at The Royal Marsden utilising medical imaging. Our CRF works in close partnership with our Experimental Cancer Medicine Centre, Phase I Clinical Trials Unit, as well as our NIHR Biomedical Research Centre to deliver high-quality research that utilises advanced imaging.

Imaging is able to visualise the structure and function of the body’s internal organs; and has become an essential part of cancer care and research. It is used to diagnose cancer, to assess how a patient is responding to treatment, and to plan surgery and other treatment options.

Our facility has five Magnetic Resonance Imaging (MRI) and three Positron Emission Tomography/Computed Tomography (PET/CT) scanners and a multidisciplinary team of specialist clinical research and support staff. This includes professionals (with expertise in medical physics, radiology and nuclear medicine) and patient representatives who ensure our research reflects patient needs. Together they enable a wide range of research studies and the further development of imaging techniques that will guide improved treatments, allowing a better quality of life for patients with and beyond cancer.

What is an MRI scan?

An MRI scanner uses a magnetic field and radio waves to build up detailed pictures of various parts of the body by picking up signals sent out by water molecules. Computer systems help with this but no X-rays are used. MRI scans are investigations that can be used to help make a diagnosis or plan and assess the effects of treatments.
More information is available in The Royal Marsden “MRI Scan” patient information leaflet, which is available in the MRI Unit.

We are supporting research into advanced MRI techniques that provide information on tumour function as well as size and location, enabling enhanced treatment planning.

**What is Positron Emission Tomography (PET)?**

PET is a medical imaging technique in which a radioactive tracer is injected into a vein. The most commonly used tracer in PET is FDG (fluoro-deoxy-glucose), which is a radioactive form of glucose. The scan shows how the body breaks down and uses the glucose. Abnormal cells use glucose differently and this will show up on the scan.
More information is available in The Royal Marsden information leaflet “Having a positron emission tomography (PET/CT) scan (FDG)”, which is available in the Nuclear Medicine Department.

We are supporting research into the development of new tracers and novel radiopharmaceuticals to target cancer cells.

**What is a PET/CT scan?**

A Computerised Tomography (CT) scan uses x-rays to produce images of the body. By combining PET and CT, we are able to provide detailed information about your cancer.
Our research

We provide imaging expertise and resource to support trials that:

- evaluate response to new treatments developed at The Royal Marsden and Institute of Cancer Research
- develop enhanced scanning techniques to improve tumour detection and characterisation and to select the most appropriate treatment option for each patient
- develop new technologies to provide more accurate image-guided surgery and radiotherapy.

On average each year the CRF facilitates approximately 1,000 patient visits for MRI or PET/CT imaging across more than 100 clinical trials covering most cancer types.

Patient and public involvement (PPI) and engagement within the Clinical Research Facility

The NIHR has a clear vision to create a health research system which is “focused on the needs of patients and the public”. This ensures research reflects the needs and views relevant to those affected by the implementation of the research results.
We ensure our research is focused on the needs of the patient by actively engaging with patients and the public and encouraging their involvement in all stages of the research process. Our researchers present proposed research plans to a patient and public advisory group to incorporate patients’ experiential knowledge into the study design.

We have patient representatives who input directly into the management of the CRF and play an active role at all levels of our research studies. This can include: prioritising research; advising on study design and funding applications; preparing patient information sheets; attending research study management and steering group meetings, right through to dissemination and public presentation of research results.

They also work with us to provide PPI training for both researchers and patients who would like to become involved with the work we do.

Our PPI strategy can be viewed on our website:

www.royalmarsden.nhs.uk/our-research/our-research-facilities/nihr-imaging-clinical-research-facility

Our CRF participates in research awareness activities both within The Royal Marsden and in the local community. We maintain information on The Royal Marsden website and produce newsletters and leaflets like this to help the public understand more about the imaging research work we do.
Our expertise

We are exploring the latest advances in technology to help diagnose and assess cancer earlier.

The technology behind big data and artificial intelligence (AI) allows us to assess large amounts of data more efficiently. This in turn allows us to develop tailor-made treatments for cancer patients, thereby eliminating the potential of overtreatment and reducing side effects.

Within the CRF our consultants are working, together with patient representatives, on several machine learning studies that will assist radiologists in reporting whole body MRI (WB-MRI) scans. Generally, about 1,000 images for each scan are generated, which need to be examined individually by a radiologist. Since machine learning is a type of AI in which computers are taught how to do things independently, it will be of great benefit in identifying scans that show evidence of cancer from healthy images.

These machine learning studies include:

MALIMAR study (myeloma)

Working in collaboration with Imperial College, London, this study will develop a computer algorithm to recognise the difference between scans of healthy individuals and myeloma patients and to quantify the amount of myeloma disease visible on WB-MRI scans. The time taken for radiologists to evaluate the scans, normally and using machine-learning, will then be compared. It is hoped that AI will not only detect and quantify the disease, but will also reduce the time needed for a radiologist to review the entire scan. This might allow WB-MRI scans to become a test that can be readily offered to myeloma patients throughout the NHS.
WISE Study (prostate)

This involves evaluating the use of WB-MRI for patients with advanced prostate cancer and metastatic bone disease. This multi-centre imaging study will provide the opportunity to evaluate the performance of WB-MRI with novel software diagnostics for evaluating treatment response.

Patients contributed to the successful funding application and continue to have an active role in the project. A patient representative has helped revise the study patient information sheet to reflect a real patient experience of having a WB-MRI scan. They also attended a national conference and presented a poster on their study involvement.

PIRS study (retroperitoneal sarcoma)

We have supported a pre-operative imaging study in retroperitoneal sarcoma (PIRS). Functional MRI was shown to improve tumour assessment and better evaluate response to radiotherapy than CT. Determining treatment response in soft tissue sarcomas can be difficult due to their heterogeneous nature (making biopsies inaccurate) and radiotherapy induced swelling (difficult assessment of tumour shrinkage).
Following this study, we have developed with The Institute of Cancer Research and Cancer Research UK, a new imaging system for the visual, colour-coded assessment of response based on how tumours are functioning. Having the ability to view rotating 3D images, in which the newly developed software can highlight functional differences within tumours, offers a significant benefit to interpretation. This could impact on radiotherapy planning and on the development of personalised and adaptive treatment plans.

**Multiparametric imaging and new technologies (cancer spread to bones)**

We are currently developing research proposals to test how a novel functional MRI scan called Magnetic Resonance Fingerprinting (MRF), on its own and in combination with existing MRI scanning, can tell doctors whether a drug treatment is working for bone disease due to cancer spread. Cancer spread to bones is common, especially in multiple myeloma, prostate and breast cancers; and is a major cause of poor health outcomes.

There are now effective but expensive drugs that can relieve pain, prevent fractures and prolong life, but a quick and reliable way to determine whether a drug is working or not is vital so that patients can be maintained on an existing treatment or switched to a new and more effective therapy and therefore be maintained in their best health for as long as possible. Unfortunately, current standard imaging scans within the NHS (such as CT, radionuclide bone scan (BS) and conventional MRI) are not very sensitive in detecting bone disease or its response to treatment. Through multi-parametric maps acquired simultaneously, MRF is designed to enable tissue characterisation with quantitative parameters to help detect and analyse early tissue changes. MRF may thus provide earlier and more accurate assessment of bone disease response to treatment for patient benefit.
Targeted treatment research studies (prostate cancer)

We are supporting early phase research studies of Targeted Radionuclide Therapy (TRT). In these trials, 68Ga-Labeled radiopharmaceuticals are initially given to patients for PET imaging. Different from FDG, these radioligands target and bind to specific cell receptors on the tumour (like a key to a lock) making it visible. Solid tumours, such as prostate cancer, can therefore be detected at an early stage.

A PET scan can select those patients who have sufficient receptors to benefit from subsequent receptor-targeted treatments. For example, 177Lu-prostate-specific membrane antigen (PSMA) RLT using specific inhibitors of PSMA is a novel therapeutic option in patients with metastatic castration-resistant prostate cancer. Binding to PSMA, the radio-labelled compound delivers the ionising isotope specifically to the tumour cells, destroying them. A reduction or elimination of the tumour is the result.

The SOLLID Dosimetry study

More than 600,000 patients have nuclear medicine scans, such as PET and Single Photon Emission Computed Tomography (SPECT), in the UK each year. Underestimating the radiation risks could cause long term health problems to patients, while overestimating could lead to sub-optimal, ‘under’ treatment risks.

The SOLLID study aims to improve our understanding of the low dose radiation risks associated with these procedures. It will enable development of practical methods to measure accurately the radiation doses delivered to patients referred for nuclear medicine scans. This is the first known study of its type. Patient involvement, through patient representative led discussion groups, has improved the quality, design and user-friendliness of the project. Patients responded well to their lay explanations of research and found it easier to make comments to them than to researchers.
Taking part in research

If you are interested in taking part in a research trial please ask your clinical team about suitable studies. If you are not a Royal Marsden patient, you will need to speak to your GP or oncologist in the first instance and ask about being referred to the hospital.

We maintain a list of active research studies on our website:

www.royalmarsden.nhs.uk/our-research/our-research-facilities/nihr-imaging-clinical-research-facility

You can find out about health and social care research that is taking place across the UK on the UK Clinical Trials Gateway:

www.bepartofresearch.uk
If you would like to become involved with the work of our CRF, make a research suggestion or apply to join the research review panel, please contact us.

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