Proton beam therapy

The current state of research

Proton beam therapy – the current state of research

The introduction of new technology into a healthcare setting is usually based on safety and efficacy. This means that often a new technology is introduced, evidence is collected through trials, and then the evidence is evaluated to see if it is better technology than what we already have. So, for example, robotic surgery was launched with much noise and celebration, but there is now no evidence to show that this technology is any better than laparoscopic surgery. The new, expensive technology does not always lead to better patient outcomes.[1]

Why do we need research?

And so, this is the conundrum with proton beam therapy (PBT). We don't know for which cancers proton beam therapy is more effective than conventional radiotherapy.[2] We need more evidence to be able to answer this. It's very complex due to:

- the large number of reasons for radiotherapy
- the degree of variation in patients and their cancers
- the limited experience of proton beam therapy in more common cancers
- the small number of patients who have had proton beam therapy.

[1] Amos, R. *et al.* (2018).

[2] Mohan, R. (2022).

This makes it extremely difficult to evaluate the clinical effectiveness of proton beam therapy for every potential clinical condition. We also have more advanced types of radiotherapy, which can be just as effective as proton beam therapy, such as intensity-modulated radiotherapy (IMRT).

Some evidence from the US has suggested that while proton beam therapy might be more effective for people diagnosed with prostate cancer, those that did have proton beam therapy had more side effects. For the study, investigators looked at data from nearly 13,000 men treated with radiation for non-metastatic prostate cancer (that is, cancer that had not spread beyond the prostate) between 2000 and 2009. The men had been treated with conventional radiation, IMRT or proton beam therapy.

The investigators found that IMRT was associated with fewer adverse gastrointestinal effects and fewer hip fractures than conventional radiation, but more erectile dysfunction. Overall, there was no significant difference between proton beam therapy and IMRT, with one major exception. Men treated with IMRT were 34% less likely than those who had proton beam therapy to develop gastrointestinal problems after their treatments.[3]

So, we need more research to find out if proton beam therapy is as good as, or better than, the different types of radiotherapy that we have already. It may be that for certain populations (such as children) and for certain types of cancer, it will prove to be, but at the moment, we need the best evidence for the majority of the adult population. This will take time.

[3] Sheets, N.C. *et al.* (2012).

How do we build the evidence?

In different ways. Current methods used to provide evidence on safety and efficacy are outlined here.

Computer planning research

Some researchers use computer modelling (in silico) to develop planning models. These models help select which patient will benefit most from either proton beam therapy or conventional radiotherapy, which provides a large amount of observational data. Where there is no clear evidence for either treatment, patients are entered into a trial so that the two treatments can be compared and we can discover which future patients will benefit from which treatment.

Clinical trials

A clinical trial is a research study that involves people. People test treatments or approaches to prevention or diagnosis of an illness. This tells us whether the new approaches are safe and effective. A typical trial might research:

- whether a new drug is as effective as an existing one
- whether a combination of treatments (e.g. radiotherapy and chemotherapy, or two types of chemotherapy) works better if the treatments are used at the same time
- whether giving a drug in a different way can be more effective
- whether a technology gives better outcomes for patients
- whether an intervention might make quality of life better, such as exercise or counselling.

We need clinical trials so that we can continue to develop better healthcare. They provide evidence so that doctors know which treatments work best. For more information on clinical trials, please refer to our online information **https://brainstrust.org.uk/brain-tumour-support/navigating-your-pathway/clinical-trials**.

How is proton beam therapy research being developed in the UK?

We have an excellent track record of developing clinical trials in the UK across many disease areas. Until 2023, the proton beam therapy research strategy was driven by the PBT Clinical Trial Strategy Group. This group's role was to:

- set the scene
- track all proton beam therapy clinical trial development
- help to develop specific high-priority trials
- liaise with funders
- develop international links
- help with prioritisation – we can't do everything all at once.

This group, which had a broad membership and was made up of clinicians, patients, healthcare professionals and researchers:

- identified and prioritised the scientific and clinical questions
- developed the proton beam therapy clinical trial portfolio
- engaged and formed productive partnerships with consumers, the clinical oncology community, clinical study groups, funders and clinical trial units (CTUs)

- ensured trials were underpinned by multidisciplinary translational and pre-clinical research, including tissue and blood biobanking, imaging and quality-of-life data collection
- developed the infrastructure to ensure delivery of clinical trials
- coordinated the research portfolio and ensured it was effective and patient-centred.

The intention is always that all patients who have proton beam therapy will be on a prospective outcomes study. A prospective study watches for outcomes, such as the development of a disease, during the study period and relates this to other factors, such as suspected risk or protection factors. This means that all the data attached to each patient will be collected along the pathway, from referral to long-term follow-up.

Until we have the evidence to say otherwise, uncertainties will remain. This means that it is important that patients always ask about whether there is a clinical trial appropriate for them. Without patients, we cannot continue to make a major contribution to clinical research. With patients, we can collaborate internationally and develop relevant approaches and relevant trials for current patients, future patients and society as a whole. Future patients will benefit directly from the knowledge gained. This knowledge will enable patients to make more informed treatment decisions. The patient is the only source of data.

References

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