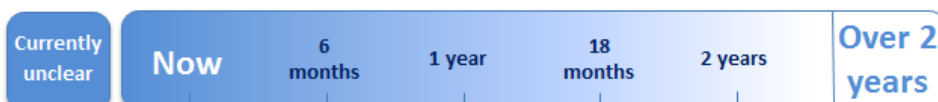


MR-LINAC image guided radiotherapy for cancer treatment

TIMEFRAME: Estimated earliest commercial availability in the UK

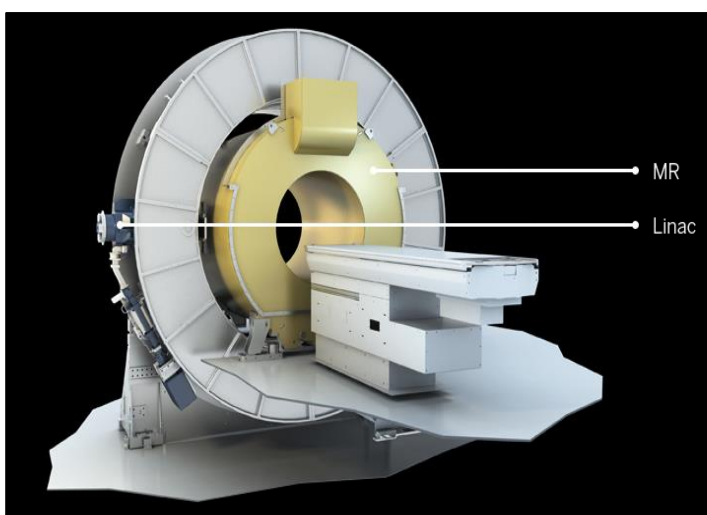


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Summary](#)

TECHNOLOGY

The MR-LINAC is a high-field Magnetic Resonance (MR) image guided radiation therapy system for the treatment of cancer. It is part of an [Elekta](#) led research project.

The MR-LINAC system comprises a digital linear accelerator (LINAC), a high field 1.5 Tesla MR imaging system from Philips and its operating software. The MR imaging system has the capability to image continuously in any plane, to locate tumours. Once located, tumours are irradiated with high energy radiation delivered by the LINAC positioned on a gantry. The gantry can rotate around the MR imaging scanner with the treatment beam passing through the inner MR imaging scanner ring. The Elekta operating software features motion management and online adaptive planning capabilities. Visibility of internal anatomy at the time of irradiation enables the clinician to adapt the radiation treatment plan. This is to accommodate anatomical changes of both the tumour target and the surrounding structures or organs at risk of damage from radiation during radiation treatment.



The first MR-LINAC installation sites in the UK include The Institute of Cancer Research and Royal Marsden Hospital NHS Trust, and the Christie NHS Foundation Trust. The Elekta MR-LINAC Research Consortium includes the University Medical Centre Utrecht, The University of Texas MD Anderson Cancer Centre, The Netherlands Cancer Institute-Antoni van Leeuwenhoek Hospital, Toronto Sunnybrook Health Sciences Centre, The Froedtert and Medical College of Wisconsin Cancer Centre and The Institute of Cancer Research.

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NIHR Horizon Scanning Research & Intelligence Centre,
University of Birmingham. Email: nihrsric@contacts.bham.ac.uk
Web: www.hsric.nihr.ac.uk

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POTENTIAL FOR IMPACT

MR-guided radiotherapy is a new treatment paradigm involving the use of MR imaging during radiation therapy to improve the precision and accuracy of radiation treatment for cancer.

Radiotherapy planning is usually undertaken using X-ray computed tomography (X-ray CT) scans and consideration of the tumour type, position and size, and its nearness to radiation sensitive structures and organs. Prior MR, Positron Emission Tomography (PET) and X-ray images may also be used in planning. Planning enables the dose and shape of the radiotherapy beam to be decided, skin markers positioned and masks produced. However image quality may not be sufficient to reliably distinguish tumour from surrounding healthy tissues. The location of tumours and organs at risk, also changes from day to day and as a consequence of treatment. There is therefore a risk that the planned radiation may not be delivered optimally.

The company state that the ability of the MR-LINAC system to provide real-time MR images during treatment, allows clinicians to visualise the patient's internal anatomy, including soft tissue, and to respond to any changes by adjusting the treatment plan and delivery. The company add that this will enable more precise targeting of the tumour, improving the efficiency of delivery and helping avoid unnecessary radiation exposure and toxicity to healthy tissue. The company also highlight potential benefits arising from reduced radiation exposure from regular X-ray and other imaging procedures. It is anticipated there might be a reduction in treatment visits for some patients, which may provide capacity for the treatment of additional patients. The company and consortium are currently conducting studies to quantify these health service benefits.

If clinical and cost effectiveness can be demonstrated, the MR-LINAC system may provide an additional treatment option for patients with cancer. This technology is predicted to have an impact on the following domain of the NHS Outcomes Framework (www.england.nhs.uk/resources/resources-for-ccgs/out-frwrk):

Domain 5 Treating and caring for people in a safe environment; and protecting them from avoidable harm.

EVIDENCE

PUBLISHED PAPERS

Lagendijk JJ, Raaymakers BW and van Vulpen M. The magnetic resonance imaging-linac system. *Seminars in Radiation Oncology*. 2014; 24(3):207-209.

Kerkhof EM, Raaymakers BW, van der Heide UA *et al*. Online MRI guidance for healthy tissue sparing in patients with cervical cancer: an IMRT planning study. *Radiotherapy and Oncology: Journal of the European Society for Therapeutic Radiology and Oncology*. 2008; 88(2): 241-249.

INFORMATION FROM

This Alert is based on information from the company and a time-limited internet search.

Lay summary

The MR-LINAC system is a new planning and radiotherapy treatment system for patients with cancer. Nowadays, a separate imaging technology such as X-rays is used to find the cancer before it can be treated with radiotherapy. But during treatment, the cancer and body organs can move, which make the exact delivery of radiation treatment difficult. This new system is the first system that can find the cancer and treat it at the same time. The developer says that, by using this system, the doctor can find the exact location of the tumour and treat it, whilst avoiding damage to areas of healthy tissue around the cancer, as much as possible.