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How CyberKnife is revolutionising radiation oncology

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A robotic radiation system uses advanced imaging and real-time tracking



Radiation therapy has long been an effective and valuable modality for fighting cancer, but recent advances have taken its benefits to a whole new level. What we are talking about here is CyberKnife - a highly precise and non-invasive robotic radiosurgery system used to treat cancerous and non-cancerous tumours.

Unlike in conventional radiation therapy, where radiation is typically delivered over several weeks and may require larger treatment margins to account for patient movement, robotic stereotactic radiation systems are designed to deliver highly precise radiation doses directly to the target area while minimising exposure to surrounding healthy tissues, which can significantly change the treatment journey for many patients.

Precision Like Never Before

One of the biggest challenges in radiation therapy has always been ensuring that the radiation reaches the tumour accurately, while sparing nearby organs and critical structures. This becomes especially important when treating tumours located close to sensitive areas such as the brain, spine, lungs, liver, pancreas, or prostate.

A robotic radiation system uses advanced imaging and real-time tracking to continuously monitor the tumour's position during treatment, and adjusts the radiation beams automatically when the target moves due to breathing or other natural body movements. As a result, treatment can be delivered with exceptional precision, reducing the risk of treatment-related complications.

A Non-Invasive Alternative

Many cancerous tumours required surgery as the primary treatment approach. However, not every patient is a suitable surgical candidate due to factors such as old age, underlying health conditions, tumour location, or personal preferences. A highly focused stereotactic radiation therapy offers a non-invasive treatment option for selected patients. In most cases, the procedure does not require incisions, anaesthesia, or hospitalisation, and patients can return to their normal activities shortly after treatment.

Fewer Treatment Sessions

Conventional radiation therapy often involves multiple sessions scheduled over several weeks. While effective, this schedule can be physically and emotionally tiring for patients and caregivers. A robotic stereotactic radiation system, on the other hand, allows oncologists to deliver very high doses of radiation with remarkable accuracy, which means fewer sessions (1 to 5), depending on the type, size, and location of the tumour.

Expanding Applications

While the robotic radiosurgery system was initially developed for treating certain brain lesions, it is now being used for a wide range of cancers and non-cancerous conditions, including tumours of the lung, liver, pancreas, prostate, spine, and other challenging locations.

The technology has also expanded treatment possibilities for patients with recurrent tumours or limited metastatic disease, where precise targeting is essential. In many cases, it can be used in conjunction with surgery, chemotherapy, immunotherapy, and other cancer treatments as part of a multidisciplinary treatment plan.

Improving Quality of Life

Beyond tumour control, modern cancer care increasingly focuses on preserving quality of life. By reducing radiation exposure to healthy tissues, advanced stereotactic radiation from a robotic radiosurgery system may help minimise side-effects and support faster recovery compared to traditional approaches. Patients often experience fewer interruptions to their daily routines, and the non-invasive nature of treatment can reduce help anxiety. While outcomes vary depending on the individual diagnosis and treatment plan, the ability to deliver highly targeted therapy is indeed an important step toward more personalised cancer care.

The Future of Radiation Oncology

As cancer treatment continues to evolve, precision medicine is becoming central to improving outcomes and patient experiences. Robotic stereotactic radiation systems exemplify this shift by combining advanced imaging, artificial intelligence-driven tracking, and highly accurate radiation delivery into a single treatment approach. While not suitable for every patient or every cancer type, their ability to provide precise, non-invasive, and efficient treatment make them one of the most significant recent innovations in radiation oncology.

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