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ISOTOPE

225
Ac
Actinium

Actinium-225
“One of the rarest drugs on Earth”

Feature of the Month

Actinium-225

Actinium- 225 (Ac-225) is transforming cancer treatment through Targeted Alpha Therapy (TAT). Its ability to precisely target and destroy cancer cells by emitting high-energy alpha particles offers a beacon of hope for patients with hard-to-treat cancers.

How It Works

In TAT, the isotope is attached to a targeting molecule (e.g., peptide or protein).

The radioactivemolecule locks on a specific target on the cancer cell. When the isotope decays, it emits high-energy alpha particles that kill the cancer cell.

This targeted approach allows for the destruction of cancer cells with minimal impact on surrounding healthy tissue.

Ac-225 is one of the few alpha emitters with an optimal half-life for TAT because it only has a 10-day half-life. An isotope's half-life is the amount of time it takes to decay to half of its original amount.

DID YOU KNOW?

Ac-225 is considered one of the rarest radioisotopes on Earth!

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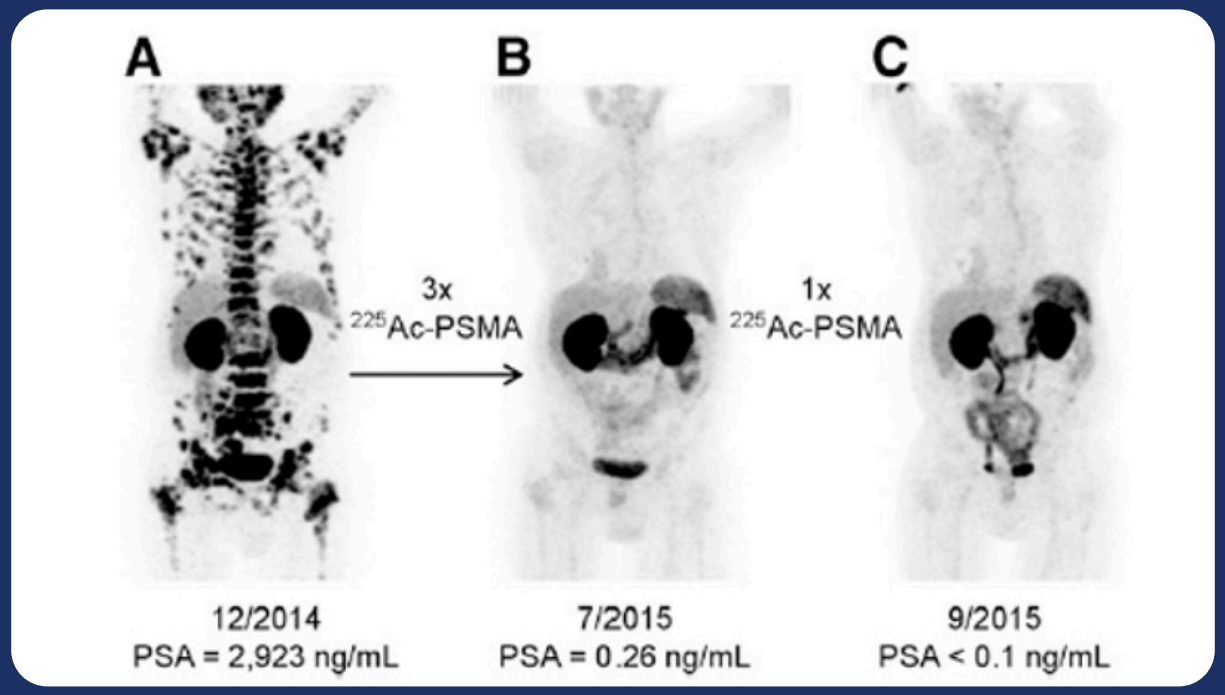
Actinium-225



This image highlights a treatment using Ac-225 at the University of Heidelberg. The first image shows the patient before treatment, the second after three doses and the third following an additional dose.

Challenges and Limitations

- Despite its potential, the widespread use of Ac-225 in medical treatments is limited due to availability and current global production capacity.
- Only a handful of facilities worldwide have the capacity to generate clinical-grade Ac-225 in research- and commercial- scale quantities.

A team at London Health Sciences Centre Research Institute (LHSCRI) was the first in Canada to treat a patient with neuroendocrine tumours (NETs) – a rare form of cancer – using Ac-225 DOTATATE therapy.

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Actinium-225

Case Studies of Canada's Leadership

TRIUMF

Home to the world's largest 520 MeV cyclotron.

TRIUMF is developing a new way to make Ac-225 using leftover particles from the accelerator.

TRIUMF has also developed the Institute for Advanced Medical Isotopes (IAMI) for research into next-generation of life-saving isotopes.

Actineer

Canadian Nuclear Laboratories (CNL) and Isotope Technologies Munich (ITM) launched a new joint venture in 2023 called Actineer™ Inc., aimed at scaling up the production of Ac-225 and expanding its global supply.

Actineer is currently supplying Ac-225 through their partnership with CNL and ITM and is working towards the construction of a new dedicated Actinium Production Facility in Canada.

Isotope Partnership

McMaster University and UK deep tech firm Astral Systems have partnered to produce Actinium-225.

The initial Ac-225 experiments represent the start of a long-term research partnership between Astral Systems and McMaster, which will explore new approaches to yield critical short-life isotopes.

Production Milestones

CNL has been commercially producing generator Ac-225 (using Th-229, a waste byproduct) twice a month for over five years.

In 2024, CNL, the Sylvia Fedoruk Canadian Centre for Nuclear Innovation. and Advanced Cyclotron Systems Inc., enabled the first cyclotron irradiation of Radium for the production Ac-225 in Canada.

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