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PROPERTIES OF ELECTRON AND NEUTRON THERAPY

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Abstract
The paper examines the properties of electro and neutron therapy. It is shown that after treatment with electrons, there are no visible traces on the skin at the site of previously existing tumor foci, and it is an alternative to surgical treatment methods. Neutron therapy has high biological effectiveness in the treatment of malignant neoplasms.

Keywords: electron therapy, linear accelerator, neutron capture therapy, fast neutrons, boron neutron capture therapy, radiotherapy.

Introduction

In modern radiation therapy, treatment is often carried out using beams of elementary particles such as photons. They are used for tumors that lie at a certain depth in the patient's body. The Elekta Synergy linear accelerator makes it possible to irradiate with other particles - electrons. Because electrons do not penetrate deep into the body, they are very effective in treating skin cancers, such as basalioma, squamous cell skin cancer, etc.

Skin cancer differs from other types of tumors in the ability to see the neoplasm at an early stage with the naked eye. But this gives a very conditional advantage over tumors of other localizations if the patient does not seek qualified help. The high mortality statistics from melanoma confirms this assumption, one of the most deadly oncological diseases, also related to skin cancer. Other types of malignant skin neoplasms are dangerous not so much because of the likelihood of death (although metastases of skin cancer are a common occurrence for some of its forms), but because of serious cosmetic defects and injuries that occur without adequate treatment.

Fig. 1 The main type - squamous cell skin cancer and basalioma

For radiation therapy, there is the possibility of conducting radiation treatment with various types of elementary particles - photons and electrons. In classical radiation therapy, the energy of photons used to treat tumors. However, electrons do not penetrate deep into the body, but have maximum energy in the superficial layers of the skin. After treatment with electrons, there are no visible traces on the skin at the site of previously existing tumor foci. Due to these properties, electron therapy has become an alternative to surgical treatment methods, especially in the treatment of skin tumors located in the facial area - tumors of the eyelid, cheeks, nose, as well as those tumors that localized in visually accessible parts of the body - lip cancer, vulvar cancer, etc. It is known that electron therapy is an effect on the affected superficial area of the body with electrons, the beams of which are generated using linear accelerators. Electrons of different energies (from 1 to 45 MeV) can be used, depending on the depth of invasion. Electrons with energies from 4 to 18 MeV are most widely used in clinical conditions.

Fig. 2. The latest generation linear accelerator Elekta Synergy

Neutron Capture Therapy is a method of radiotherapy. A method of treating cancer-using reactions between radiosensitive drugs and neutrons. In this case, boron and gadolinium (cadmium in the experiment) are pre-accumulated in the tumor, which increases its sensitivity to neutron radiation. Then the tumor is irradiated with a stream of thermal neutrons. Boron-based therapy (Boron Neutron Capture Therapy) is already being used in oncology clinics.

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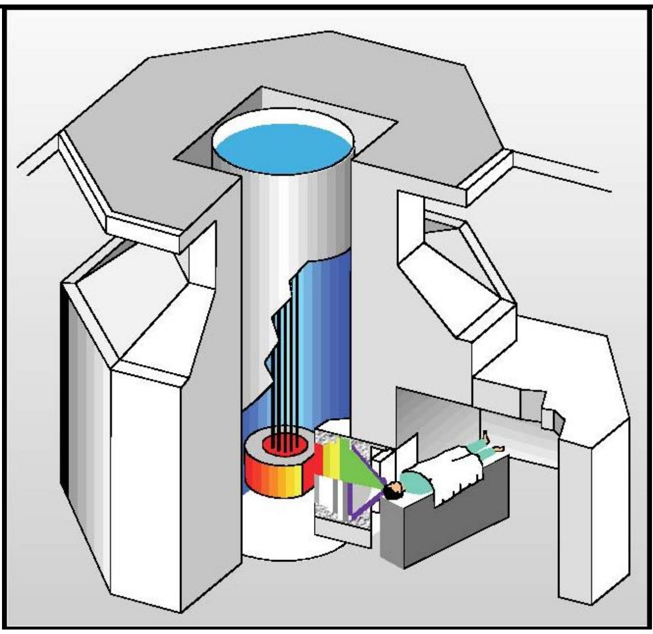

Fig. 3. Scheme of the NCT installation on the experimental Triga reactor.

Neutron therapy is attracting increasing attention due to the high biological effectiveness of neutrons in the treatment of malignant neoplasms. Currently, neutron therapy is implemented in 2 versions: clinical trials of fast neutron therapy are being conducted and neutron capture therapy methods are being developed.

Fast neutron therapy - the main therapeutic effect is achieved due to recoil protons and heavier recoil nuclei. The applicability of neutrons for the treatment of malignant tumors and their advantages were realized immediately after the discovery of the neutron. From 1938 to 1943, neutrons were first used for treatment and brilliant results were obtained ≈ the tumor disappeared in most cases.

However, this method soon had to be abandoned, since the result was sad ≈ most irradiated patients died from various ulcers and general radiation complications. Therefore, interest in neutron therapy was lost for a long time.

And only after good results were obtained using neutron therapy not as an independent means, but in combination with -therapy, interest in neutron therapy increased again. Since 1985, more than twenty centers in different countries have been conducting research on neutron therapy and about 20 thousand patients in the world have already undergone such treatment.

Boron Neutron Capture Therapy - The concept of neutron capture therapy for cancer was proposed in 1936, 4 years after the discovery of the neutron. In 1951, it was demonstrated for the first time that certain boron compounds allow a higher concentration of boron in cancer cells compared to a healthy cell. A new stage in the development of the neutron capture therapy concept began with the synthesis of pharmaceuticals containing the isotope 10B, which, after being introduced into the patient's blood, create a concentration of the isotope 10B in tumor tissue of up to 40 μg / g, which is 3.5 times more than in healthy tissue. This provides the ability to selectively destroy a cancer tumor. Since the most powerful source of neutrons on Earth is a nuclear reactor, reactor neutron beams are widely used in cancer therapy. The required neutron spectrum is formed by special filters. However, environmental problems associated with the operation of reactors, as well as the inevitable proximity of oncology centers to nuclear reactors, lead to intensive discussions on the development and creation of a neutron source based on a compact and inexpensive accelerator, which could be equipped with almost every oncology clinic.

Fig. 4. The process of neutron therapy

Some healthy cells that fall into the irradiation zone also damaged, but most of them are able to recover. Tumor cells divide faster than the healthy cells surrounding them.
Therefore, irradiation has a more destructive effect on them. These differences determine the effectiveness of radiation therapy for cancer.

References

1. Elmurotova D.B., Ismatova L.N, Xaitov F.N., Odilova N.J. Tubes for x-ray structure analysis // Eurasian Research Bulletin V.7, ISSN: 2795-7365 April, 2022 P. 69-72.
2. Elmurotova D.B., Yusupova N.S., Jo'raqulov Sh.R., Ixrorova S.I. Complex of High Quality Portable X-Ray Systems // Modern Journal of Social Sciences and Humanities ISSN: 2795-4846 V.7 (July-2022). P.1-4, Portugal.
3. Salomov U.A., Elmurotova D.B., Meyliyev L.O. Technological process medicine // World Bulletin of Public Health. ISSN (E): 2749-3644, Impact Factor: 7.635, India.
4. Elmurotova D.B., Tashev B.J., Rakhimov I.T., Bozorov E.X., Mussayeva M.A. Gamma Therapeutic Devices // International journal of health systems and medical sciences, 2022-11-24, 1(5), P. 267-269.
5. Elmurotova D.B., Mamashova N.T., Bozorov E.H., X-ray therapy and its applications // Journal of Academic Research and Trends in Educational Sciences (JARTES) V 1, ISSUE 10 / ISSN 2181-2675. 2022, P 358-363. DOI: 10.5281/zenodo.7241942
6. Elmurotova D.B., Bozorov E.X., Isroilova Sh.A., Uzoqova G.S. “Qaytar aloqa” usulidan foydalanib “skanerlovchi roentgen apparatlari nosozliklari” mavzusida dars-ma'ruza o'tkazish // International Journal of Education, Social Science & Humanities. FARS

Publishers, SJIF-6.786, Finland, V.11, Issue-1, 2023, P.571-576 https://doi.org/10.5281/zenodo.7542747

7. Elmurotova D.B., Meyliyev L.O., Abdullayeva N.U., Bozorov E.X. Maintenance and use of medical devices // Galaxy international interdisciplinary research journal (GIIRJ) ISSN (E): 2347-6915, V.11, Issue 1, Jan. 2023, P.192-195.
8. Elmurotova D.B., Ixrorova S.I., Ergashev A.A. Technical parameters of x-ray equipment // European international journal of multidisciplinary research and management studies ISSN: 2750-8587, V.03, Issue 01, Jan. 2023, P.78-83.
9. Elmurotova D.B., Tursunboyev Q.N., Yusupova N.S., Odilova N.J., Jumanov Sh.E. Main technical characteristics of radiation kilovoltmeter // International Journal of Studies in Natural and Medical Sciences, Amstradam, Niderlandiya, V02 Issue 06, June, 2023 ISSN (E): 2949-8848 Scholarsdigest.org, P.1-5.
10. Elmurotova D.B., Ibragimova M.N., Tashev B.J. Historical X-Ray Tubes // Scholastic: Journal of Natural and Medical Education. 2023, V.1, P.209-213.