

ASSESSMENT OF ABSORBED DOSE RATE FROM IONIZING RADIATION FOR THE GAMMA-KNIFE STEREOTACTIC GAMMA UNIT

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The Gamma Knife is a radio surgical gamma radiation teletherapy device, designed to treat pathological formations (benign and malignant tumors and vascular malformations) in the cranial cavity with high-absorbed dose values delivered during one procedure. To ensure the radiation safety of cancer patients, it is critically important to strictly follow the quality control procedures for the stereotaxic gamma device, the most important of which is undoubtedly measuring the absorbed dose rate, since it directly affects the amount of the dose delivered to the patient. The development of a new quality control program that included the procedure for the assessment of absorbed dose rate from ionizing radiation for the Gamma-knife will allow more accurately calculate of the planned dose to the patient and thus increase the level of its radiation safety.

Keywords: Radiation therapy, gamma-knife, medical physics, dose measurements, quality control.

The Gamma Knife is a radio surgical device manufactured by the Swedish company Elekta, designed to treat pathological formations (benign and malignant tumors and vascular malformations) in the cranial cavity with high-absorbed dose values delivered during one procedure [1]. On the gamma knife "PERFEXION", installed in the N. N. Alexandrov National Cancer Centre of Belarus in 2017 uses radiation sources with radionuclide Co-60 (cobalt-60) in the amount of 192 pieces. Each of the 192 radiation sources located in the radiation device consists of cobalt-60 beads sealed in a double shell of stainless steel. The maximum radioactivity of cobalt-60 at a loading of 6600 Ci (approximately 244 TBq) for the treatment of patients with tumors of various locations.

Since high-absorbed dose values are delivered in one fraction, to ensure the radiation safety of cancer patients, it is critically important to strictly follow the quality control procedures for the stereotaxic gamma device, the most important of which is undoubtedly measuring the absorbed dose rate, since it directly affects the amount of the dose delivered to the patient [2]. The medical physicists and engineers of the N. N. Alexandrov National Cancer Centre of Belarus developed this procedure.

Measurement of the absorbed dose rate according to the international recommendations is carried out at least once in three months, as well as after preventive works or elimination of the accident, which can affect the formation of radiation beams and the dose rate of gamma radiation. The equipment necessary for the measurement is a clinical dosimeter (such as UNIDOS); ionization chamber (type PTW 31010 with a volume of 0,125 cm³ or similar); specialized water phantom ABS, thermometer, barometer. Clinical dosimeter, thermometer, barometer should be calibrated in the national laboratory of secondary standard. The ionization chamber, the ABS phantom and the thermometer must be in the treatment room for at least 2 hours before starting the measurement [3].

Measurement of the absorbed dose rate is made as follows: the ABS phantom is installed and centered in the isocenter of the device's irradiation using a special adapter; an ionization chamber is located in the phantom, so that the center of its sensitive volume is located directly in the radiation isocenter; the clinical dosimeter is warmed up in the time set in the operating instructions; measurements of in the air temperature and the atmospheric pressure in the treatment room are performed; the value of the correction factor from the verification certificate is entered in the clinical dosimeter and the absorbed dose measurement mode in water is selected; in the "Gamma Knife" all the collimators are installed with a diameter of 16 mm; At least 3 times the amount of absorbed dose is measured for an interval of 2 minutes. The average value of the absorbed dose rate and measurement uncertainty is calculated.

The obtained dose rate value is compared with the value established in the computer planning system used to calculate the dose distributions for irradiation of cancer patients. The deviation of the measured value from the reference value should not exceed $\pm 3\%$.

The development of a new quality control program for the stereotactic gamma apparatus "Gamma-knife" will allow more accurately assessment of the planned dose to the patient and thus increase the level of its radiation safety. Regular quality control of radiotherapy equipment is a prerequisite for the provision of quality medical care to oncological patients in the Republic of Belarus.

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PARASITIC SITUATION ON HORSE HELMINTHOSES ON THE TERRITORY OF THE POLESSKY RADIATION AND ECOLOGICAL RESERVE

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The conducted researches have allowed to reveal high intensity of intestinal strongylatosis, parascaridosis and oxyuris invasions at different species of horse in the reserve. Among helminthoses of horses the most occurred one is intestinal strongylatosis. The eggs of strongylata are found in 95,2 % of fecal specimen of domestic horses and in 84,1 % of fecal specimen of wild horses. Parasitizing of *Anoplocephala perfoliata* is revealed at 9,5 % of the studied fecal specimen of Przewalski's horses.

Keywords: domestic horses, Przewalski's horses, helminthoscopic researches.

There are two types of ecospecies in the Polessky state radiation and ecological reserve (Gomel region, Belarus): domestic horses and wild Przewalski's horses (*Equus ferus przewalskii* Poljakov, 1881):

Comparative study of a species diversity of helminths communities at different types of horse ecospecies, contained together on one territory was carried out by a number of authors [1–3]. For the territory of the Polessky radiation and ecological reserve such researches are performed for the first time.

Helminthoscopic researches by the Fyulleborna flotation method for detection of parasites eggs have allowed to reveal only a nematodosis invasion at the horses who are contained on the horse-breeding farm. Parasites eggs of the families are found: Strongylidae, Trichonematidae, Ascaridae, Oxyuridae, Rhabdiasidae. During the study of 84 fecal specimen of the horses selected before carrying out a worming, all the specimen were infected (% EI-100). At 95,2 % of the studied specimen trichostrongylidae eggs were revealed. At 70,2 % of cases of the studied tests the combination of helminths was revealed – helminthoses (from 2 to 3 species for an animal). Parasitizing only of one species is registered at 32,1 % of horses. At the same time at the majority of animals there were two (63,2 %), more rare three (36,8 %) types of helminths.

From 63 of fecal specimen tests collected from the unrestricted living Przewalski's horses on the territory of the reserve there were 55 specimen of helminths infected by eggs (% EI-87,3). Except of a nematodosis invasion tapeworms are found in wild horses. As well as at domestic horses, at wild horses there were found helminths of Strongylidae/Trichonematidae, Ascaridae, Oxyuridae and Rhabdiasidae. Eggs of tape parasites (*Anoplocephalidae*) are revealed at 6 of 63 surveyed tests (9,5 %). In 74,6 % of cases the combination of helminths – helminthoses is revealed (from 2 to 3 species for an animal). Parasitizing only of one species is registered at 12,7 % of horses. At the majority of animals there a simultaneously found two (57,4 %), more rare – three (40,4 %) species of helminths. Four parasites (2,1 %) are found in one horse.

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