APPLICATION PROSPECTS OF ELECTRONIC PORTAL IMAGING DEVICE FOR THE PRE-TREATMENT VERIFICATION IN N.N. ALEXANDROV NATIONAL CANCER CENTRE OF BELARUS

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This article describes prospects of using Electronic Portal Imager Devices (EPIDs) in the radiotherapy department of N.N. Alexandrov National Cancer Centre of Belarus for routine QA procedures. The types of pretreatment verification included in the list of QA procedures are considered. The main methods of these procedures are described. The advantages of EPID are considered. Conclusions about the applicability of these devices in the conditions of our department are given.

Keywords: Electronic Portal Imaging Device, EPID, pre-treatment verification, quality assurance.

Quality Assurance (QA) in radiotherapy treatment planning process is essential to ensure that the dose calculation is performed correctly and to minimize the likelihood of accidental patient exposure [1, 2]. Treatment verification is an important component of radiotherapy QA program.

Radiotherapy treatment verification is the process that enables us to be certain that we are treating the tumor volume the way it is planned. To be certain that correct absorbed dose value has been given to the right place, two procedures are needed – geometric and dosimetric verification [3].

The aim of geometric verification is to ensure that the geometric accuracy of the radiotherapy delivered is within the limits set by the uncertainty margin allowed for the treatment plan [3].

During the treatment planning process, deviations from the planned dose can be present if characteristics of the linear accelerator are not modelled accurately at the treatment planning system (TPS), e.g. parameters such as the tongue-and-groove effect or multileaf collimator (MLC) transmission [4]. These problems could be determined using dosimetric verification.

Usually, all this aims achieved with different systems and devices. The goals of geometric verification are usually achieved using various visualization systems, such as computed tomography (CT) (kV and MV), Electronic Portal Imager Devices (EPID) (MV), kV planar radiographs, ultrasound or other methods [3]. Dosimetric verification as a rule is carried out using special dosimetric films, ionization chambers, thermoluminescent detectors or diodes [5].

The object of this article is EPID, because after configuration and calibration, this device can be equally used for both verification purposes. Also the reason for authors’ interest is that every linear accelerator in our clinic is equipped with this device. Due to these two factors, EPIDs can become a powerful tool for routine QA/QC procedures in our radiotherapy department. In our clinic, EPID is already routinely used for imaging purposes, but its use for dosimetric purposes needs additional research.

Typically, EPID consists of an x-ray converter, an active light-sensitive matrix and an electronic measurement system that processes the received signals and generates digital images based on those. An x-ray transducer is a metal plate, generally made of copper, and a scintillation phosphor screen located directly above the active matrix. The light generated by the scintillator is registered by the pixels of the active matrix (photodiode and TFT transistor). The result of the active matrix signal processing is a "snapshot" representing the spatial distribution of the radiation absorption intensity by the portal detector [6, 7].
According to the literature sources, EPID has the following dosimetric advantages [4, 8]:

- fast imaging acquisition (comparable with patient irradiation time);
- good spatial resolution;
- digital format of output information;
- its potential for in vivo measurements and 3D dose verification.

Thus, based on the above capabilities, as well as due to the wide availability of EPIDs in our clinic, the authors consider the use of these devices will reduce the time spent by medical physicists for routine QA, without losing the quality of the procedures.

**BIBLIOGRAPHY**


**TOTAL BODY IRRADIATION WITH VOLUMETRIC MODULATED ARC THERAPY: DOSIMETRIC DATA AND FIRST PRE-TREATMENT EXPERIENCE**

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This article describes the end-to-end preparation for a total body irradiation (TBI) that has been performed in the N.N. Alexandrov National Cancer Centre of Belarus. The world experience of providing similar procedures was analyzed. Various methods of TBI were considered. According to the literature, therapeutic doses and constraints for organs at risk irradiation were chosen. Dosimetric planning and evaluation of the obtained plans were carried out.

**Keywords:** total body irradiation, TBI, volumetric modulated arc therapy, dosimetric treatment planning.

Total body irradiation (TBI) is used in the management process of hematologic malignancies prior to the transplantation of hematopoietic or bone marrow stem cells. The combination of irradiation and chemotherapy kills the malignant cells, increasing the likelihood of a successful transplant and suppresses the recipient's immune system to prevent immunologic rejection [1].

TBI provides a uniform dose of radiation to the entire body, penetrating areas such as the central nervous system (CNS) and testes, where traditional chemotherapy is ineffective. Additionally, it allows tailoring of therapy with the ability to shield or boost the dose to certain volumes if necessary. The purpose of TBI is threefold: to eliminate residual cancer cells, to provide space for stem cell engraftment through bone marrow depletion, and to prevent rejection of donor stem cells through immunosuppression [2].

The TBI objectives can be achieved using a variety of dosimetric irradiation methods: as a single large open radiation field from the large distance using blocks that shield organs at risk (OARs), or with the help of modern technologies with intensity modulation and rotational irradiation [3]. The latter method is most often