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Measurement of absorbed dose in radiotherapy of cancers using thermo luminescence dosimeter

Mohammad Zarei	MSc, Faculty member of "Research Center of Natural Products and Medicinal Plants" & "Nursing Department, Shirvan Nursing Faculty", North Khorasan University of Medical Sciences, Bojnurd, Iran
Hoda Nedaee Oskoee*	MSc, Department of Education Quchan, Iran Corresponding Author
Mahdi Keyvan	MSc, Imam Khomeini Hospital of Shirvan, North Khorasan University of Medical Sciences, Bojnurd, Iran
Majid Dastras	MSc, Faculty member of Zahedan University of Medical Sciences, Zahedan, Iran

ABSTRACT

Cancer is a disease of abnormal cells begins to multiply. Radiotherapy uses ionizing radiation to destroy or shrink cancerous tissues. On the other hand, the radiation sometimes it is necessary in addition to having received treatment planning and dose calculation points of interest in the field, to empirically measure the absorbed dose to the desired point and on the subsequent decisions adopted. Due to the secondary abnormalities observed in prostate cancer radiotherapy, due to the critical organs such as the rectum and bladder tolerated dose which is essential which requires a precise definition of target volume and the volume of the radiation treatment planning is critical.

KEYWORDS : Cancer, Radiotherapy, Dosimeter

Introduction

Cancer is a disease of abnormal cells begins to multiply. Four ways to treat cancer, surgery, radiotherapy, chemotherapy and hormone therapy, depending on the doctor, or a combination of these methods is used. Half of the patients by surgery, radiotherapy, and 10% to 40% and the others are treated with chemotherapy.[1] Conformal radiation therapy progresses, the number of patients increased gradually along with surgery, radiation therapy for cancer treatment matters. Radiation therapy uses ionizing radiation to destroy or shrink cancerous tissues. In this way the damaged DNA, cells treated area (target tissue) destruction will be impossible to continue to grow and divide. The goal of radiation therapy to destroy cancer cells with minimal damage to healthy tissues is maximized.[2] Crucial role in the destruction of the amount of energy transferred to the cells and the cells of the structure are not identical, the sensitivity to ionizing radiation are different. The main goal is to deliver the highest dose of radiation to the tumor cells and the lowest dose to normal tissue. Because of the close relationship between the probability of local tumor control (Local Tumor Control) and damage to normal tissue dose is absorbed, so the control accuracy of the absorbed dose to the target volume is an essential part of the quality control of a radiotherapy department.[3]

Methods

Several methods exist for exposure and transmission of the radiation; in addition, some methods of irradiation can be accurately controlled and used to treat small areas of tissue, without damage nearby tissues and organs, while other types of radiation used to treat larger areas. For example, in the case of large systems, x-rays and gamma rays or electrons produced are sometimes used, then the Patient carefully onto the bed just above the area of cancer treatment, they will be regulated.

On the other hand, the radiation may be in addition to the treatment plan and calculate the absorbed dose to the target in the treatment to experimentally measure the absorbed dose to the desired point it was on the basis of subsequent decisions. These points may be out of treatment, such as critical organs such as the eyes or rectum to check the accuracy of the measurement may be performed. It can also be used to determine the relationship between the doses of a particular point is to get the dose.

In 1990 the technique to implement quality control procedures used in head and neck region. Also in 1991, Leunens and colleagues with the help of this technique error associated with a linear accelerator and a cobalt compared the old system. In 1992 the method to verify the dose calculation algorithms were applied in the pelvic area. Also in 2000, Fiorino et al.'s Method for quality control in order to enhance quality of care and reduce errors was proposed.

For the purposes of dosimeter, film has some advantages. Visual appearance of the radiation field in a plane or curved surface that can easily be adapted to it, to create. Therefore, to determine the location, size and shape of the radiation field is invaluable, the film has a spatial resolution of better than dosimeter systems and therefore to measure the radiation field in space where the speed varies, For example, near the source of radiation, the radiation beam near the border edges, holes or other in homogeneities worthwhile.

The film and gelatin emulsion or the water equivalent of the radiation field rarely changes. Although crystals of silver halogen problems in the measurement of low energy photons, but caused a serious disturbance in the high-energy radiation cannot be measured unless the beam is parallel to the film.

By Sharafi and colleagues in a study in 2007 entitled "The measurement of absorbed dose in radiotherapy for prostate cancer, bladder and rectal dosimeter methods Thermo luminescence" done. In this study, the absorbed dose to the rectum and bladder using thermo luminescence dosimeter TLD-100 chips in conventional two-dimensional treatment planning for prostate cancer on anthropomorphic phantom was measured. The results of the dose absorbed by TLD chips after five times and averaged at different points in Figure 1.

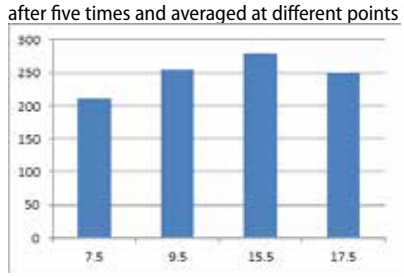

Figure 1: Mean values for the absorbed dose at different distances from the surface of the skin

The results of the mean values calculated by the treatment planning software in different places and at different distances from the skin surface is as follows (Figure 2).

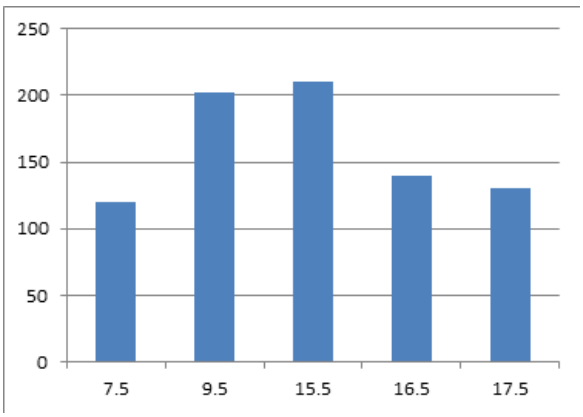

Figure 2: Mean values were calculated dose at different distances from the surface of the skin

Discussion

Because of the secondary abnormalities observed in prostate cancer radiotherapy according to the members, such as the rectum and bladder and tolerable dose is very important which requires a precise definition of target volume and the volume of the radiation treatment planning is critical; of course, this will also be using two-dimensional treatment planning, attained and thus the importance of using newer methods of treatment planning in radiotherapy centers reveals.

Another study by Sharafi and colleagues in 2008 in the "measured dose kidneys, liver, bladder, ovary and kidney test Scintigraphy with 99mTc-DTPA and 99mTc-EC Radio drugs using phantom dosimeter method thermo luminescence" done. The purpose of this study was to measure the absorbed dose to the kidneys and nearby organs, respectively.

The method applied in this study. This is a water phantom made of a humanoid torso and abdomen regions have been formed. The phantom walls, 6 mm thick Perspex sheet of effective atomic number (67/6 = Zeff) and electron density (Electrons / cm3 1023 × 36/3) is used. Phantom geometry similar to the body, forming part of the abdomen and trunk, regular octagon, which is considered to be almost elliptical. For dosimeter of lithium fluoride impurities Mg and Ti is used to guide the 100-TLD. The chips cube with dimensions 9/0 × 1/3 × 1/3 cubic centimeter of effective atomic number and density 2.8 gr / cm3 64/2 respectively.

Absorbed doses to the radiopharmaceutical 99mTc-DTPA in µGy / MBq for people of all ages in ICRP-80 report was published in 1999. In this report, the absorbed dose to the bladder µGy / MBq 4-10 × 3, kidneys µGy / MBq 3-10 × 3, liver µGy / MBq 4-10 × 3 and ovaries are not µGy / MBq 3-10 × 5 is. These values are in agreement with the values obtained in the present study. These differences may be due to a different method of calculating the dose. These differences need further study is necessary.

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The purpose of this study was to measure the absorbed dose to the kidneys and nearby organs. In this study, in addition to kidney absorbed dose, dose liver, bladder and ovarian tissue equivalent phantom using the TLD trashes is measured by the amount of absorbed dose to the kidneys, liver, bladder and ovaries in both groups of patients entering the study, respectively.

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According to the results obtained in this study and other studies it can be concluded carry the medicine renal scan with 99mTc-EC Radio and 99mTc-DTPA injection is for this reason that more patients will be retained in the bladder, therefore, as a major source of organs and other tissues are surrounding the target organ. Frequent emptying of the bladder and advised to discharge patients for renal scan can reduce the amount of absorbed dose to adjacent organs, especially the gonads due to its high sensitivity, effective.

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