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Radiotherapy of Prostate Cancer at Dr. Kariadi Hospital

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ABSTRACT
This study aims to determine the technique of prostate cancer radiation therapy at Dr. Kariadi Hospital, because prostate cancer sufferers are the most common cancer suffered by men and the number increases with age. The results showed that there was no specific preparation in prostate cancer irradiation. Prostate cancer radiation techniques at Dr. Hospital Kariadi uses the Linac modality through several stages, namely the diagnosis and consultation stage, the positioning stage, immobilization, CT simulator, the counturing stage, Treatment Planning System (TPS), the verification and radiation stages using the 3DCRT (Three Dimensional Conformal Radiation Therapy) technique and a dose of 46 Gy with fractionation 2Gy/day then followed by 20Gy of a prostate booster.

Keywords: prostate cancer, radiotherapy, 3DCRT.

INTRODUCTION

Prostate cancer occurs when cells in the prostate gland grow uncontrollably, which can spread or cause complications due to abnormally enlarged prostate. This type of cancer is the second most common type of cancer in men globally, according to the World Health Organization (WHO). The prostate gland is a small, walnut-shaped gland that sits under the bladder and surrounds the urethra, the tube that carries urine out of the body. These glands are responsible for producing nutrient-rich seminal fluid that houses and carries sperm. Prostate cancer does not occur in women because women do not have a prostate gland.[1]

Definitive radiation therapy offers curative treatment for local prostate cancer without major surgery and is the treatment of choice for many men.[2] In addition, men with adverse pathological features after prostatectomy benefit from administration of postoperative radiation therapy.[3] In a recently published randomized study, metastasis and overall survival rates have been shown to be comparable.[4] The main categories of radiation therapy for prostate cancer are external beam radiation therapy (EBRT), in which a beam of radiation generated by a machine outside the body is directed at the cancer cells, and brachytherapy, which involves placing radioactive material in the body near the cancer cells. The goal of radiation therapy is to deliver a cancer-sterilizing radiation dose to a treatment target, which may include the prostate, seminal vesicles, prostate resection bed, and / or pelvic lymph nodes, while limiting the dose to surrounding normal tissue, including the bladder, intestines, and intestines. erectile tissue, and the femoral head. Minimizing the dose to the surrounding normal tissue is very important, because the risk of toxicity from radiation therapy is a direct consequence of the number of accidental doses of radiation that are sent to these tissues.[5] 3DCRT (Three-Dimensional Conformal Radiation Therapy) uses CT scans to depict your

anatomy precisely and to produce the optimal radiation dose. 3DCRT can accurately use a patient's unique anatomy to deliver radiation exactly where he needs it, while avoiding the bladder and intestines. This ultra-precision allows doctors to maximize the radiation dose to the tumor.[6] Some prostate cancer patients were exposed to a 3DCRT radiation technique. In the last decade, sophisticated radiation techniques can provide better coverage of tumor volume and provide lower side effects on the healthy tissue around the tumor, both side effects from the intestine, bladder and sexual function.[7]

The main key to successful cancer treatment is the discovery of cancer at an early stage. US data show that more than 90% of prostate cancers are found at an early and regional stage, with the 5-year survival rate approaching 100%. But unfortunately, in Indonesia most patients are already in an advanced stage when they come for treatment.[8] The author is interested in discussing radiotherapy techniques in prostate cancer patients because this cancer is the most common cancer in men and the number increases with age.

METHODS

The type of research in the writing of this paper is qualitative research with a case study approach which aims to study and analyze information about Prostate Cancer Radiation Techniques at Dr. Hospital. Kariadi, as the research subject in this paper is a Specialist Radiation Oncologist, Medical Physicist, and Radiographer at Dr Kariadi Hospital. This research was conducted in the Radiotherapy Unit of the Radiology Department at the Dr. Kariadi Hospital, Semarang. The research method used by the author is the method of observation by observing directly during the examination process, the method of in-depth interviews to obtain oral information from the respondents and the method of documentation study to document relevant data.

RESULTS AND DISCUSSION

After the patient fulfills all the administrative requirements according to the flow of new patient registration in the radiotherapy unit, the prostate cancer radiation procedure can be carried out in stages from the initial planning to the radiation and evaluation. The examination procedures for prostate cancer patients are as follows:

A. Patient Preparation

There are no special preparations for the radiotherapy radiation examination, but there are some general preparations that must be done. General preparations include the patient performing radiological examination protocols such as examinations, ultrasound examinations, blood laboratory CT Scan / MRI, and PA laboratory results. According to Perez[9] The primary role of CT in prostate cancer is for size determination of the prostate gland, radiation therapy treatment planning, and assessment of pelvic nodal metastases. Compared prostate volumes defined by MRI and CT and found a 32% increase in prostate volume when defined by noncontrast CTscan. Using image fusion, they identified four areas, including the posterior aspect, the posteroinferior apical aspect of the gland, the prostatic apex, and the neurovascular bundles, which tended to be areas of discrepancy between the two imaging modalities. Using CT-MRI fusion software for planning three-dimensional conformal radiation therapy (3DCRT), demonstrated that MRI was clearly superior to CT in defining the prostate apex, neurovascular bundles, and anterior rectal wall. The discrepancy in prostate location between the two imaging studies was also greatest at the apex and base of the gland. After the files and administrative requirements are complete, the patient will be irradiated according to the predetermined schedule.

B. CT Simulation

According to Oncolink[10] at this stage the radiation oncologist will determine the location of the body that will receive the radiation, then the best positioning and immobilization aid will be selected to reduce patient movement based on radiation techniques and objectives that can be applied always the same or reproducible in every radiation fraction. In addition to the location and position of the oncologist, the oncologist also determines the radiation dose that will be given to the patient. The main objective of radiotherapy is to provide the optimal dose to the target tumor volume but with the smallest dose to the surrounding organs at risk. To achieve this goal, the 3DCRT technique can be used. Accuracy and accuracy in providing radiation are the most basic things in radiation techniques. In order to achieve maximum accuracy and precision, precise positioning and immobilization is one of the main

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requirements. According to Susworo[11], the patient's comfortable position must be considered, this greatly determines the accuracy and accuracy of the radiation. Patients who are not in a comfortable position will result in a poor reproducible set up. Positioning the patient and using immobilization devices is one of the important processes in the simulation in the CT Simulator room. Positioning and immobilization between the CT Simulator room and the radiation room must be the same. In addition to positioning and immobilization, markers need to be installed that aim to determine the reference point to help set up radiation. The complete CT Simulator data is then sent to the TPS for radiation planning.

Figure 1: CT Simulator room for prostate cancer patient planning

Figure 2: Positioning and Immobilization in the CT Simulator Room

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C. Treatment Planning System (TPS)

The data entered from the CT Simulator will be analyzed and processed by doctors and medical physicists. According to Susworo[11], to obtain a homogeneous radiation dose on the tumor mass or to avoid critical organs, radiation planning is required based on the curve of each energy in a certain field area. The doctor delineates the target volume or counting, while the medical physicist will determine the direction of irradiation and the shift in the point of irradiation. According Perez[9] The International Commission on Radiation Units and Measurements (ICRU) has recommended definitions of terms and concepts for radiation therapy treatment volumes and margins : The gross tumor volume (GTV) denotes demonstrable tumor. It includes all known gross disease including abnormally enlarged regional lymph nodes. In the determination of GTV, it is important to use the appropriate CT and/or magnetic resonance imaging (MRI) settings and, if appropriate, PET scan to give the maximum dimension of what is considered potential gross disease. The clinical target volume (CTV) denotes the GTV and subclinical disease (i.e., volumes of tissue with suspected tumor). The planning target volume (PTV) denotes the CTV and includes margins for geometric uncertainties. One also should account for variation in treatment setup and other anatomic motion during treatment such as respiration. Because the PTV does not account for treatment machine characteristics, the actual treated volume is that volume enclosed by an isodose surface that is selected and specified by the radiation oncologist as being appropriate to achieve the goal of treatment. It is impossible to design a radiation therapy treatment plan that limits the prescribed dose to the PTV only. Some tissues en route to the target or near the target also will be irradiated to the same dose as the target. The treated volume is, therefore, almost always larger than the PTV and usually has a somewhat simpler shape. Treatment 3DCRTtechniques became increasingly available. Although these techniques vary in some aspects, they share certain common principles that offer significant advantages over conventional treatment techniques. CT-based images referenced to a reproducible patient position are used to localize the prostate and normal organs and to generate high-resolution 3D reconstructions of the patient. Treatment field directions are selected using beam's-eye-view techniques and the fields are shaped to conform to the patient's CT-defined target volume, thereby minimizing the volume of normal tissue irradiated. The results of the Treatment Planning System will be transferred to the Linac data. Radiation stages using the 3DCRT Technique (Three Dimensional Conformal Radiation Therapy) and a dose of 46 Gy with fractionation 2 Gy/day then followed by a Prostate Booster at a dose of 20 Gy.

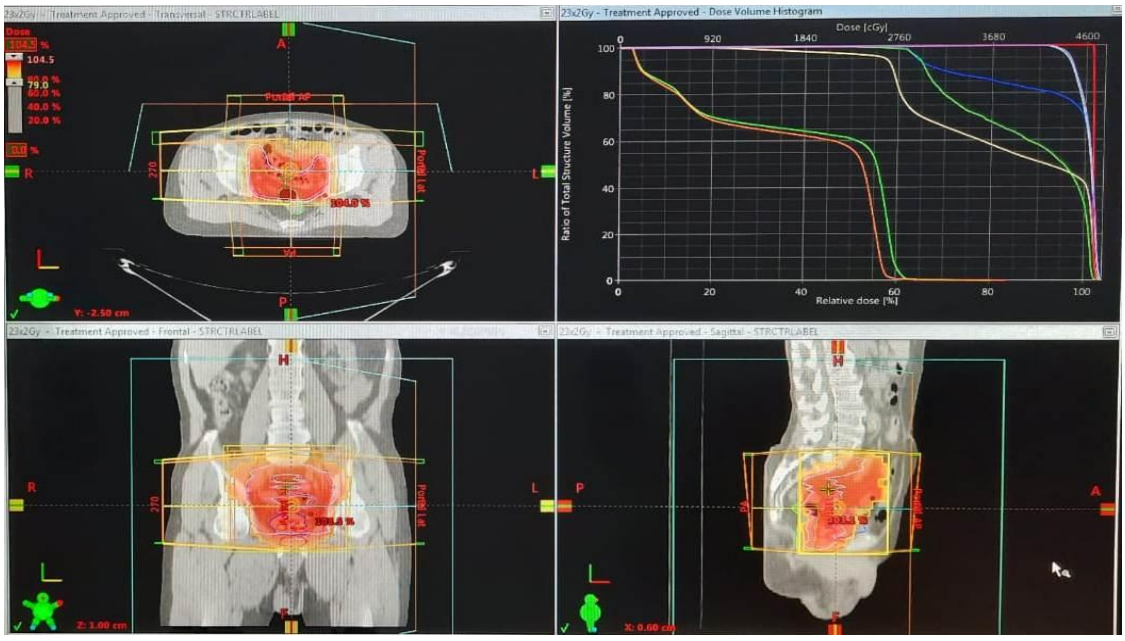

Figure 3: Results of the Treatment Planning System with 3DCRT Technique

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D. Treatment using Linac

External irradiation was carried out on the Linac modality. According to Khan's[12], Linear Accelerator or Linac, it is a device that uses high-frequency electromagnetic waves to accelerate charged particles such as electrons to high energy through a linear tube. The high-energy electron beam can be used to treat superficial tumors or it can be made to hit targets to produce X-rays to treat tumors that are located deeper. External radiation or teletherapy is a way of delivering radiation where there is a distance between the radiation source and the radiation target. With this technique a modality is placed that emits radiation on the target organ. Patient data from TPS are programmed in the Treatment Calendar. Before the irradiation is carried out, it will be verified first. Verification is a process to ensure that the tumor volume radiation is the same as the radiation performed in the radiation modality. Verification is done by comparing pictures or data from the therapy plan or treatment plan with the radiation that is done. Verification can use image information or data from both 2D and 3D systems which will be corrected in translation (x, y and z) or rotation (degrees). There are two steps of verification in radiotherapy, namely geometric verification to ensure radiation is in the right location and dosimetric verification to ensure that the correct radiation dose is given. After verification, obtaining approval from a radiation oncologist, then the radiation oncology is performed using the 3DCRT technique. Radiation must be carried out routinely as planned, there should be no delay because it will result in decreased control of cancer and affect the survival of prostate cancer.

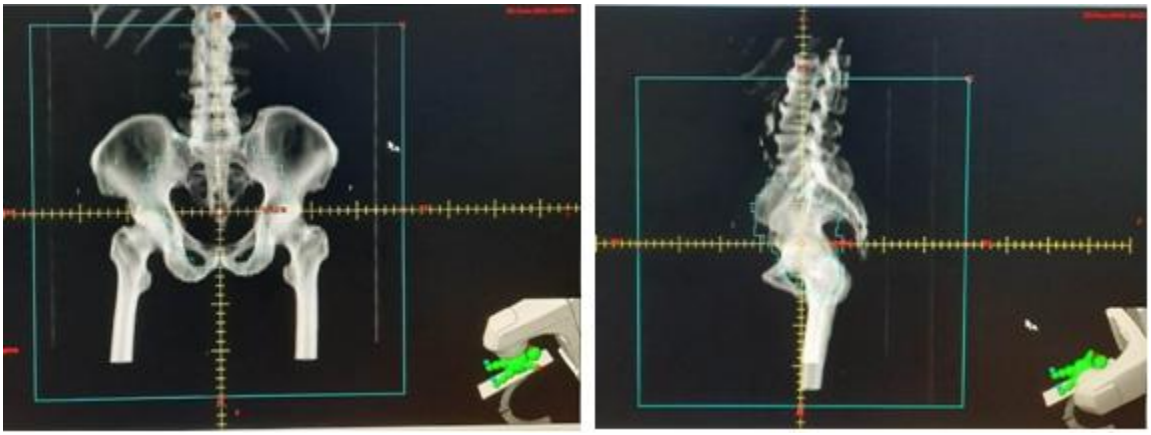

Figure 4: Anteroposterior and Lateral Portal Images for Verification

Figure 5: Prostate Cancer Radiotherapy with 3DCRT Technique using Linac

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