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Research Study *Medical research*

Radiotherapy of Cervical Cancer at Dr.Kariadi Hospital

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ABSTRACT

This study aims to determine the procedure of cervical cancer radiation at Dr. Kariadi Hospital, because cervical cancer sufferers have increased every year, and attack anyone regardless of age limit. The results showed that there were no special preparations for cervical cancer irradiation. The cervical cancer radiation procedure goes through several stages, namely the stage of diagnosis and consultation, the positioning stage, immobilization and CT simulator, the counturing stage, the treatment planning system, the verification stage and the radiation stage. Radiation is carried out by Linac modality using Intensity Modulated Radiation Therapy (IMRT) so that the maximum dose is obtained for the tumor and the minimum dose for healthy tissue with a total dose of 50Gy.

Keywords: Cervical Cancer, Radiotherapy, IMRT

INTRODUCTION

Cancer is a disease characterized by uncontrolled growth and spread of abnormal cells. During its development, these cancer cells can spread to other parts of the body, causing death. And it is the cause of death for 7.9 million people every year where cervical cancer is one of the diseases that often affects women in developing countries [1]. The number of cancer sufferers has increased each year, and attacks anyone regardless of age limit. The main cause of cervical cancer is the human papilloma virus or HPV which is transmitted through skin-to-skin contact. In Indonesia, cervical cancer ranks second out of the top 10 cancers based on data from Anatomical Pathology in 2010 with an incidence of 12.7%. According to current estimates by the Indonesian Ministry of Health, the number of new women with cervical cancer ranges from 90-100 cases per 100,000 population and every year there are 40 thousand cases of cervical cancer [2] The definitive treatment for early-stage uterine cervical cancer is surgery or radiotherapy with or without chemotherapy. In surgical care, adjuvant treatment for patients who have prognostic risk factors after radical hysterectomy has been recommended [3]. With treatment, 80-90% of stage I disease and 60-75% with stage II tumors can survive 5 years. The survival rate decreased to 30-40% for women with stage III tumors and 15% or less than 5 years after analysis with staged growth [4]. Curative intent radical radiotherapy for cervical cancer consists of external beam radiotherapy, brachytherapy, and concomitant chemotherapy with cisplatin. For each element, new developments aim to increase the level of tumor control or treatment tolerance. Intensity Modulated Radiotion Therapy (IMRT) has been shown to reduce gastrointestinal toxicity and can be used to selectively increase radiotherapy doses. Individual

image-guided brachytherapy allows better adaptation of high-dose volume to tumor expansion [5]. IMRT can reduce the incidence of complications and decrease the cumulative incidence of 3 years compared to the rate when 3D conformal radiotherapy (3DCRT) is used in the patient's postoperative uterus cancer [6]. IMRT has also been reported to be able to contribute more than 3DRT for a better quality of life [7]. The low level of education and knowledge about this cancer coupled with poor hygiene and various other factors resulted in the majority of patients coming to check themselves and undergoing treatment at an advanced stage [8]. Forecast depends on the phase of malignancy. With treatment, the five-year survival rate for the most rapid stage of prominent cervical tumor was 92% [4]. Because the number of cervical cancer patients increases every year, the authors are interested in conducting research on cervical cancer that can be treated using the Linac IMRT technique modality.

METHODS

The type of research in the writing of this paper is qualitative research with a case study approach which aims to examine and analyze information about the Cervical Cancer Radiation Procedure at Dr. Kariadi Hospital. As research subjects in this paper are Radiation Oncologists, Medical Physicists, and Radiographers at Dr Kariadi Hospital. This research was conducted in the Radiotherapy Unit of the Radiology Department at Dr. Kariadi Hospital. 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 cervical cancer radiation procedure can be carried out in stages from the initial planning to the radiation and evaluation. The examination procedures for cervical 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 Perez [9] For invasive carcinoma, patients should have the following laboratory studies: complete peripheral blood evaluation, including hemogram, white blood cell count, differential and platelet count; blood chemistry profile, with particular attention to blood urea nitrogen and creatinine; liver function values; and urinalysis. .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 IMRT 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 requirements. According to Susworo [8], 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. Room CT Simulator for cervical cancer patient planning

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 [8] 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. The results of the Treatment Planning System will be transferred to the Linac data. The patient is given a total dose of 50 Gray irradiation with the IMRT technique.

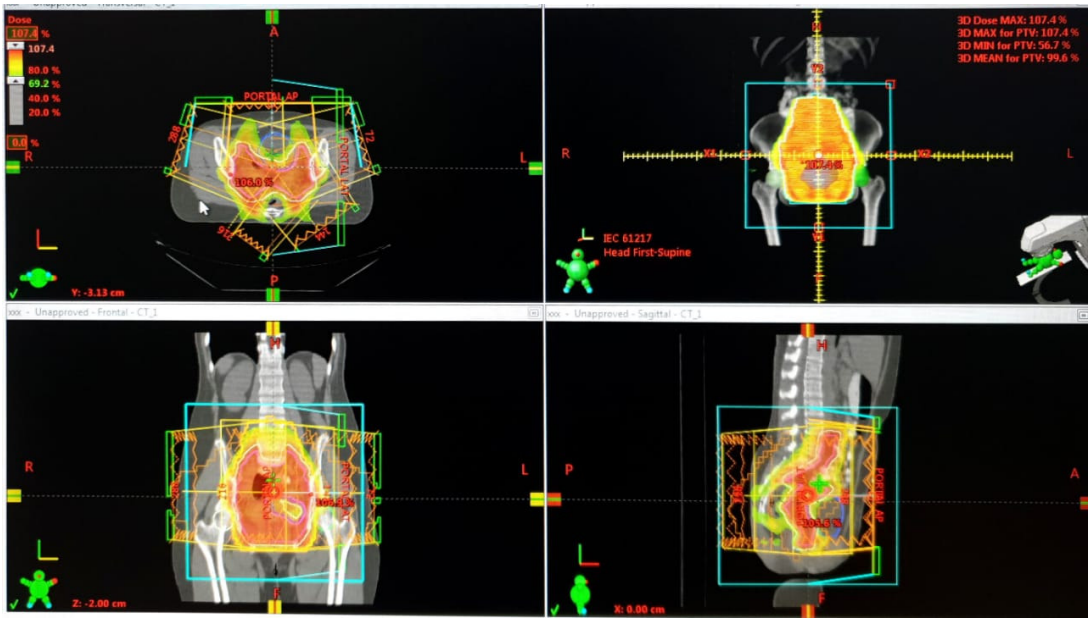

Figure 2. Results of the Treatment Planning System using the IMRT technique

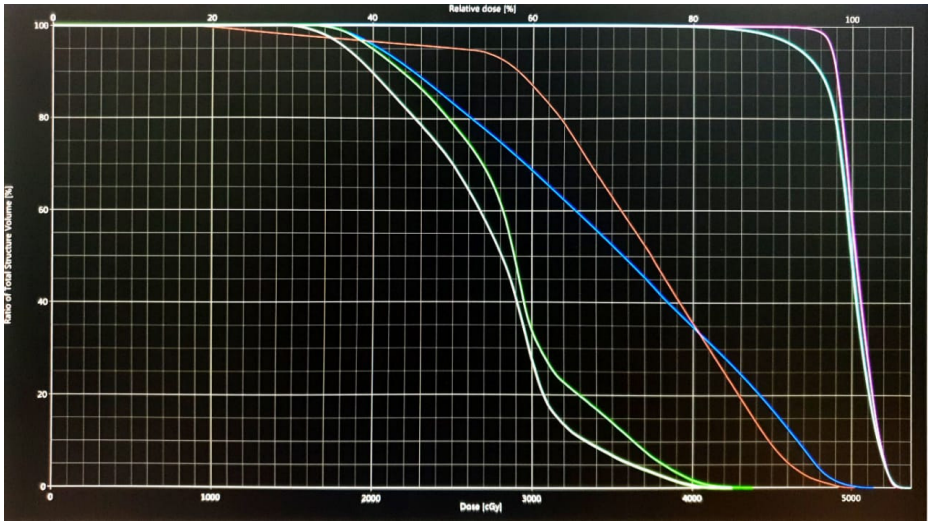

Figure 3. Dose Volume Histogram cervival cancer planning

d. Linac

External irradiation was carried out on the Linac modality. According to Khan's [11] 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. According to Perez [9] External-beam treatments may be routinely administered to cervical cancer patients with stages IB2 to IVA in a curative fashion. Patients with stages IA to IB1 may be considered for external-beam treatment if they are deemed inoperable or prefer to avoid surgery. Patients with stage IVB disease may receive palliative radiation to the pelvis for selected indications such as to stop vaginal bleeding, relieve pain, or alleviate urethral obstruction from extrinsic compression. External-beam radiation covers the primary cervical tumor, treats any adjacent parametrial or uterosacral, uterine, or vaginal extension, and, most important, addresses microscopic disease present in pelvic lymph nodes. In treatment of invasive carcinoma of the uterine cervix, it is important to deliver adequate doses of irradiation not only to the

primary tumor, but also to the pelvic lymph nodes to maximize tumor control. The data that has been processed at the TPS will be transferred to the Linac modality, then a calendar treatment program will be created. 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 IMRT technique. IMRT was developed using the techniques required for inverse planning. That is, one starts with the necessary dose around the target then works backward to develop the requisite beam intensities. IMRT spatially modulates the intensity of the beam using the motion of multileaf collimators. Because of the increasing use of intensity-modulated or image-guided radiation therapy (IMRT/IGRT) in the treatment of patients with gynecologic malignancy, there is growing emphasis on imaging the pelvic anatomic structures, including lymph nodes, for treatment planning. According to Perez [9] In patients treated with radiation therapy, overall treatment time should be as short as possible, and any planned or unplanned interruptions or delays should be avoided. Timely integration of external-beam and intracavitary irradiation in patients with carcinoma of the uterine cervix is an important factor in improving pelvic tumor control.

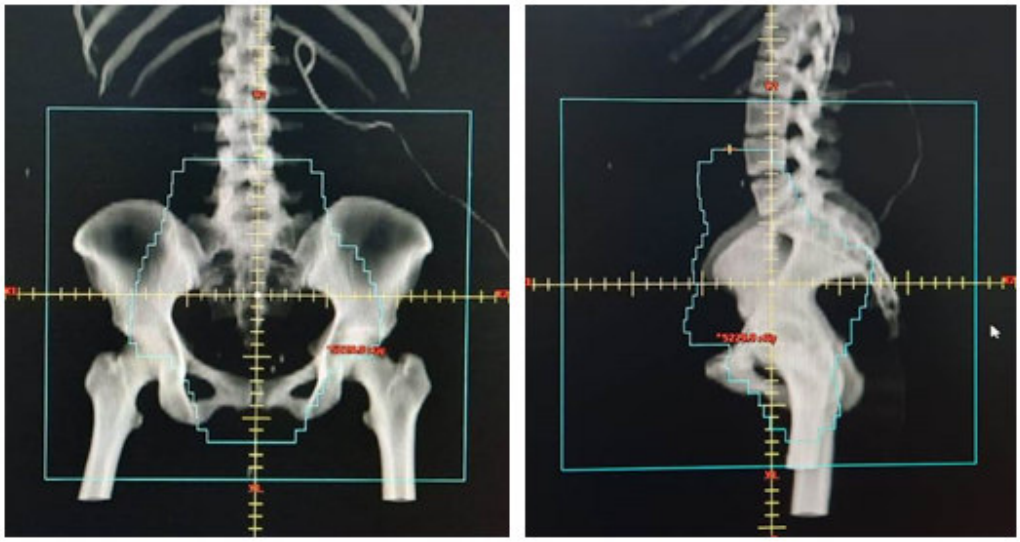

Figure 4. Anteroposterior and Lateral Portal Images for Verification

CONCLUSION

There is no special preparation for cervical cancer radiation examinations with the Linac modality using the Intensity Modulated Radiotion Therapy (IMRT) Technique at Dr. Kariadi Hospital, but there are general preparations for cervical cancer radiation examinations, namely attaching supporting examination files such as USG, CT Scan / MRI, blood laboratories and PA laboratories. Radiation of cervical cancer with the Linac modality using the Intensity Modulated Radiotion Therapy (IMRT) Technique at Dr. Kariadi Hospital goes through several stages, namely the stage of diagnosis and consultation, the positioning stage, immobilization and CT simulator, the counturing stage, the treatment planning system (TPS), the verification and radiation stages with a total dose of 50 Gy fractionation of 2 Gy/day.

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