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VOLUMETRIC MODULATED ARC THERAPY TECHNIQUE IN CASES OF TONGUE CANCER IN RADIATION ONCOLOGY INSTLATION MRCCC SILOAM

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ABSTRACT

The development of radiotherapy techniques keeps growing, which one is the technique of irradiation of Volumetric Modulated Arc Therapy. At Radiation Oncology Instalation MRCCC Siloam Semanggi, in the case of tongue cancer irradiation using Volumetric Modulated Arc Therapy technique.

The objective of this research is to describe the procedure of Volumetric Modulated Arc Therapy technique in the cases of tongue cancer at Radiation Oncology Instalation MRCCC Siloam Semanggi. The design of this study is descriptive with one sample primary in the case of tongue cancer with Volumetric Modulated Are Therapy technique. The research methods are conducted by the study literature, observation, interview, and documentation. This research was conducted at Radiation Oncology Instalation MRCCC Siloam Semanggi Hospital April to May 2022.

The results of this research can be concluded that the procedure of Volumetric Modulated Arc Therapy technique in the cases of tongue cancer at Radiation Oncology Instalation MRCCC Siloam Semanggi covers the description of the procedures of patient preparation. Preparation of tools and materials used during the process of irradiation, the iradiation CT simulation process in CT-Simulator, iradiation planning process at the Treatment Planning System (TPS). The verification process of irradiation with On-Board Imager (OBI) and last process ofiradiation of the patient with Linac.

Keyword : Radiation Oncology Instalation ; MRCCC Siloam Semanggi ; Tongue Cancer ; Radiotherapy Procedures ; Volumetric Modulated Are Therapy Technique

Introduction

Tongue cancer is the most common cancer found in the oral cavity. This cancer can affect both men and women.[1] According to statistical data from NCI's SEER (National Cancer Institute Surveillance Epidemiology and End Results) there are 9,800 people diagnosed with tongue cancer.[2] This tongue cancer is the 12th most common in the world and ranks 8th in developing countries.[3] The highest incidence of tongue cancer is in south Asia, namely in India. In India, tongue cancer ranks in the top third and according to research conducted by the International Agency for Research on Cancer (IARC) the incidence of tongue cancer will continue to increase every year.[4] While in Indonesia, cases of tongue cancer are still rare but cases of tongue cancer will become a serious health problem and will continue to grow.[5] According to basic health research (Riskesdas) data in 2007, The incidence of tongue cancer reaches 0.2% of all cancer cases that occur.[6] And according to data from Dharmais National Cancer Center Hospital, a national cancer referral center hospital, there were 163 cases of tongue cancer in Indonesia from 2003 to 2007.5 Some of the factors that cause tongue cancer are smoking and consuming alcohol for a long time.[7] Another factor is the presence of papilloma virus infection.[5] Efforts to treat tongue cancer can be done with several treatment modalities, one of them with radiotherapy.

Radiotherapy is the treatment of cancer using ionizing radiation that provides a measurable and maximum dose to the target organ and gives a minimal dose to the organs around the target so as to reduce normal tissue damage around the target.[8] Treatment with radiotherapy in early stage tongue cancer can provide the same survival rate as other therapies and surgical procedures, however, treatment with radiotherapy can still maintain the maintenance of tongue function.[9] Radiotherapy plays an important role in cancer treatment efforts and radiotherapy techniques continue to evolve as technology evolves to improve the accuracy and precision of radiotherapy irradiation in cancer treatment.[10] One of the latest technologies in the field of radiotherapy is the use of Volumetric Modulated Arc Therapy (VMAT) techniques. At the Radiation Oncology Installation of SILOAM MRCCC Hospital Semanggi the Volumetric Modulated Arc Therapy technique is used in cancer irradiation, including one of which is irradiation in tongue cancer. Volumetric Modulated Arc Therapy technique is the latest radiotherapy technique where Multi Leaf Collimator (MLC) and gantry perform movements during dose distribution when surrounding the patient. The use of volumetric modulated arc therapy radiotherapy techniques refers to the principle of radiotherapy, namely to maximize the distribution of doses to target organs and protect Organs At Risk (OAR).[11] In tongue cancer irradiation, where the tongue organ is an organ that is easily mobile and surrounded by many healthy organs that are at risk of fatality when exposed to radiation, as well as the Volumetric Modulated Arc Therapy radiotherapy technique is a technique with a high level of irradiation accuracy, it is interesting to study further about radiotherapy irradiation in tongue cancer with the Volumetric Modulated Arc Therapy radiotherapy technique.

Methods

This research was conducted by the Radiation Oncology Installation at MRCCC Siloam clover, The research design used in this study is descriptive qualitative, namely to describe the procedure "Volumetric Modulated Arc Therapy Radiotherapy Technique in Cases of Tongue Cancer in siloam Semanggi MRCCC radiation oncology installation. The instruments used in this study Worksheets, namely to record the results of observations made during the study, interview guideline sheets, namely to record verbal data in the form of interviews obtained from radiation oncology doctors, medical physicists and radiotherapists, documentation results in the form of documentation of tools and materials used during the patient undergoing radiotherapy procedures, namely data on the CT Simulation process, print out results of the Treatment Planning System data, and the radiation irradiation process in the linac room. Data processing and analysis in this study used descriptive analysis. Data analysis begins with processing the data obtained through direct observation of the course of the volumetric modulated arc therapy radiotherapy irradiation procedure in cases of tongue cancer at the

Siloam Semanggi MRCCC radiation oncology installation. Then the authors collected various supporting data by conducting interviews with radiotherapists, medical physicists, and radiation oncology doctors related to the process of planning and radiation irradiation. The collected data is presented in narrative form.

Result and Discussion

The patient undergoes a radiotherapy procedure or stage in accordance with the SOP at siloam Semanggi MRCCC radiation oncology installation. The procedure starts from the patient concerned coming to the Siloam Semanggi MRCCC Radiation Oncology Installation to meet the administration by bringing a referral letter for the radiation oncology doctor from a specialist doctor (poly doctor), anatomical pathology results, lab examination results, radiological diagnostic support examination results (MRI, CT-Scan, PET-Scan, USG). Then the patient meets and consults a radiation oncologist at the radiotherapy polyclinic. At the polyclinic, radiation oncologists perform anamnesis on patients including oral cavity examinations for tongue cancer patients, namely the patient's dentition whether there are cavities or dental caries. If there are cavities or caries, the patient first performs a filling or tooth extraction and during irradiation the patient's teeth must be clean. Then an evaluation is carried out from the results of supporting examinations, then the radiation oncology doctor will determine the purpose and explanation of radiotherapy treatment. After that, the patient signs a letter of approval for radiotherapy. Based on the results of observations at siloam Hospital Semanggi's MRCCC radiation oncology installation, the patient data used as a sample has a diagnosis of tongue cancer with T2N0M0 post hemiglossectomy staging. The radiation irradiation scheme from radiation oncology doctors uses the Volumetric Modulated Arc Therapy technique with 6 MV of energy which aims to be curative with a total dose of 6600 cGy and a dose per fraction of 200 cGy given 33 times.

In carrying out and supporting the procedure of volumetric modulated arc therapy radiotherapy techniques for tongue cancer patients, the radiotherapist prepares tools and materials used for the CT Simulation process and radiation irradiation. In the CT Simulation process, a CT Simulator supporting tool with the Philips Brilliance Bigbore 16 CT Simulator brand is used which is equipped with a moving laser located in 2 horizontal sections and 1 vertical section. Then, in immobilizing tongue cancer patients in the CT Simulator room, using an immobilization tool or fixation tool in the form of:Lock-Bar mounted on H4 table index, Head and Neck Base Plate, White Fixation Pillow, Head and Neck Mask, Tongue Spatel, and Traction. In immobilizing, and localizing targets in the Simultor CT room, supporting tools are also used in the form of Water Baths which are used to smelt masks, then there are Permanent Markers, Lead Points, and Micropore which are used to mark reference points. Then, in carrying out the radiation planning process, supporting tools are used, namely the Treatment Planning System (TPS) computer device with the Eclipse 10 Inverse Planning Oncology System operating system which is equipped with software to carry out the contouring process, making radiation planning with volumetric modulated arc therapy techniques and to see patient radiation scheduling. Furthermore, in carrying out the radiation irradiation process, a Linac support tool produced by the Medical System Variant company was used, Clinac IX SN4740 which is equipped with MLC and a tool for verification, namely On Board Imager (OBI).

Based on the theoretical studies discussed by the author, specifically according to the book Technical Manual Radiotherapy Risk Profile by Michael Barton, in the CT Simulator room, immobilization is carried out, and localization of irradiation targets is carried out. The radiotherapist prepares the tools and materials needed during the simulation process, including fixation tools in the form of lock bars, base plate head and neck, white fixation pillows, head and neck masks, tongue spatels, and traction. After the immobilization tool has been prepared, then the patient is positioned head first supine, position the body straight, set the head on a white pillow, chin extension with both hands beside the body holding traction. Then the officers put a tongue spatel made of wooden stick arrangements that are used for fixation of the tongue part so that the tongue does not move and the pallatum part

does not touch the tongue. Furthermore, the patient is put on a mask for fixation and immobilization of the patient during radiation irradiation. The radiotherapist determines the position of the X, Y and Z coordinate reference points (0,0,0), as a guide for the shift in the position of the isocenter at the TPS. Next, scan the operator of the CT Simulator console, for cases of tongue cancer cancer, set the Topogram with the upper limit vertex, the lower limit of Carina and the Slice Thickness of 3 mm. The scanning results are then sent to the TPS via Dicom. Then the patient is allowed to go home and the officer provides information that the patient will be contacted again when the scheduling of radiation irradiation will be carried out.

In the Treatment Planning System (TPS) room, radiation oncology doctors contour (depiction) of target tumors, namely Gross Tumor Volume (GTV), Clinical Target Volume (CTV), Planning Target Volume (PTV) and Organ At Risk (OAR) which are at risk around the target area according to the guidelines of the International Commission on Radiation Units and Measurements (ICRU) 50. The OAR in tongue cancer includes, parotid, eye, cochlea, mandible, brainsterm, eye lens, spinal cord, mucosa of the oral cavity, laryngeal and pharyngeal muscles. After completion of the contour, then the medical physicist will make a radiation planning or planning. Medical physicists enter beam planning data in the form of determining beam direction, energy, Monitor Unit (MU), gantry angle and collimator angle. Because it uses the Volumetric Modulated Arc Therapy technique, data planning is carried out automatically optimizing doses by computer programs, selecting and adjusting the doses you want to give in each Organ At Risk (OAR) and Planning Target Volume (PTV). Next, proceed with the process of calculating the dose distribution, and calculating the DVH. Based on ICRU 50, it recommends that the coverage of the dose distribution planning target volume (PTV) should be between 95% to 107% of the total prescribed dose. Then the data is checked again and approved by other medical physicists and radiation oncology doctors. Next the patient's radiation planning data set up from the TPS is sent to the Linac computer.

Before radiation irradiation is carried out in the Linac room, the radiotherapist prepares the patient's set-up data according to the patient's identity. Then the patient enters the Linac room and is positioned the same as the position when simulating in the CT Simulator room. The radiotherapist arranges the examination table according to the reference point present in the patient's mask based on the laser present in the Linac room which is the starting point of the field shift benchmark or isocenter beam point by medical physics. If the reference point is right then medical physics performs a calculation of the shifting of the examination table in the Isocenter Verification On Treatment Machine Sheet. The radiotherapist performs the shifting of the table according to the calculations of medical physics, namely lateral, longitudinal and vertical shifts. Then the SSD check is carried out. The officer exited the room and instructed the patient not to move during the irradiation. Then the radiotherapist performs the verification of irradiation. Verification is carried out using the On Board Imager (OBI) to detect treatment delivery errors and to confirm the patient's position according to radiation planning in two-dimensional image imaging, AP and Lateral. For tongue cancer irradiation with the Volumetric Modulated Arc Therapy technique, a verification process is carried out every day. Based on the book Ensuring Geometric Accuracy In Radiotherapy by Jane Barrett, it recommends that the shift tolerance limit in verifying irradiation is 5 mm from the reference point. If the shift is more than the tolerance limit, then the radiotherapist needs to communicate with medical physicists and radiation oncologists before radiation irradiation is carried out.

After the verification process is complete, radiation irradiation is then carried out by sending a dose of radiation given to the patient with a Linac plane. The radiation dose given is in accordance with the planning data sent from the TPS. In the sample studied by the author, the treatment delivery process with the Volumetric Modulated Arc Therapy technique in cases of tongue cancer takes 4 minutes and has a gantry turnover amount of 2 rounds. At one turn, the gantry and MLC rotate around the patient from an angle of 179.0 – 320.0 and at the second turn, the gantry rotates from an angle of 320.0 – 179.0. Gantry and MLC

rotations are adjusted to the location of the tumor. When distributing doses to patients, the gantry rotates and mlc moves dynamically following the shape of the tumor.

Conclusion

Radiotherapy irradiation in cases of tongue cancer at siloam Semanggi MRCCC radiation oncology installation using Volumetric Modulated Arc Therapy technique. The procedures carried out include, Patient preparation procedures, patients bring a referral letter for radiation oncology doctors from specialists (poly doctors), anatomical pathology results, lab examination results, diagnostic support examination results. Then the patient meets and consults with the radiation oncology doctor at the radiotherapy polyclinic to perform anamnesis on the patient, then an evaluation of the results of the supporting examination is carried out, then the radiation oncology doctor will determine the purpose and explanation of radiotherapy treatment. The patient signs a letter of approval for radiotherapy. Preparation of tools and materials used, Linac aircraft, CT Simulator aircraft, lock-bar, head and neck base plate, fixation pillow, head and neck mask, tongue spatel, waterbath, traction, permanent marker, lead point and micropore to support the simulation process and radiation irradiation to the patient. Simulation CT process in the CT Simulator room, the process of determining target localization, and patient immobilization. The patient is positioned as comfortable as possible complete with his or her aids in the CT Simulator room to be used as a reference for the irradiation position in the Linac room, followed by setting the position of the reference point, and scanning the target organ to be radiation.

The radiation planning process in the Treatment Planning System (TPS) room, the contouring process or depiction of the volume of the tumor target organ and the Organ At Risk (OAR) by the radiation oncology doctor as well as the entry of beam data and planning optimization by medical physicists at the TPS. Next, the data is transferred to the linac computer program.

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