



# Snapshot of International Radiotherapy Center: Single Center Experience



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## Abstract

Cancer can become anywhere in the human body almost including trillions of cells. Cancerous tumors spread or invade into the tissues to form new tumors that named as the process of metastasis. Radiation therapy (RT) was first used to treat cancer over a hundred years ago. The progress has been made to improve the effectiveness of this awesome modality and minimize side effects. RT also has been used with surgery, chemotherapy or immunotherapy in combined modality approaches for numerous malignancies to maximize tumor control while minimizing toxicity and preserving the organs and tissues. We intend to present our patient population whom delivering radiotherapy in our radiotherapy center. The data includes the patients who still delivering radiotherapy, initial or last day of radiotherapy. This article is about a snapshot of a treated patient population in one day at our center. Mean KPS (Karnofsky Performance Score) was 90 (70-100). 2 patients were in stage 1 (2%), 25 (28%) were in stage 2, 35 (39%) were in stage 3 and remaining 23 (26%) were in stage 4. 4 (5%) of all were benign.

**Keywords:** Cancer; Radiotherapy; Experience; Single center

## Introduction

Cancer is a disease that some body's cells grow uncontrollably and spread to other regions of the body. Cancer can become anywhere in the human body almost including trillions of cells. What human cells do is to grow and multiply to form baby cells as the body requires them. If cells grow old or damaged, new cells take their place of died ones. In case this process breaks down, abnormal or damaged cells grow and may form tumors. Tumors can be cancerous or benign. Cancerous tumors spread or invade into the tissues to form new tumors that named as the process of metastasis. Cancerous tumors may also be malignant tumors. Benign tumors do not spread or invade the tissues. If they are removed, benign ones often do not grow back. Benign tumors can rarely be quite large which can cause serious symptoms or life threatening such as in the brain.

Radiation therapy (RT) was first used to treat cancer over a hundred years ago. The progress has been made to improve the effectiveness of this awesome modality and minimize side effects. RT also has been used with surgery, chemotherapy or immunotherapy in combined modality approaches for numerous malignancies to maximize tumor control while minimizing toxicity and preserving the organs and tissues. Multidisciplinary team of clinicians, including surgeons, medical oncologists,

radiation oncologists, and other specialists determine the best approach for the individualized treatment [1,2]. RT may be the sole treatment or be given concurrently with chemotherapy, or may precede or follow surgery to minimize the microscopic disease after treatment. Additionally, RT might be used palliatively for incurable cancers. The duration of RT can vary from a single shot to eight weeks of daily irradiation.

Randomized clinical trials have established similar outcomes between surgery and organ-preservation treatment with an RT for selected patients with prostate cancer, oropharyngeal cancer, breast cancer, laryngeal cancer and sarcoma. Some trials have shown the appropriateness of organ preservation for patients with bladder cancer and early-stage lung cancer. Definitive RT is a very important option for treating selected patients with potentially curable malignancies. In this original article, we intend to share our real data of single radiotherapy center with characteristics, doses, cancer types and treatment approach of all patients.

## Materials and Methods

We intend to present our patient population whom delivering radiotherapy in our radiotherapy center. The data includes the patients who still delivering radiotherapy, initial or last day of

radiotherapy. This article is about a snapshot of a treated patient population in one day at our center. Age, gender, diagnosis, stage, treatment, fraction size, radiotherapy device and Karnofsky Performance Score were collected from files as the patient characteristics. The radiotherapy devices in our center are tomotherapy (HI-ART) and linear accelerator (ELEKTA, UK).

### Statistical Analysis

Statistical Package for the Social Sciences, version 26.0 (IBM Corp. Released 2019. IBM SPSS Statistics for Windows, Version 26.0. Armonk, NY: IBM Corp) software was used for analysis and the level of significance was set at  $P < 0.05$ . Descriptive statistics and survival analysis were applied. Survival analysis and curves were done via the Kaplan–Meier method. Survival curves were analyzed due to the T stage. Logrank test was used for the analysis of T stage survival curves.

### Results

Total treated patients number is 89. 15 patients (17%) were treated with tomotherapy and 74 (83%) were delivered radiotherapy with linac. Mean age of population was 57 (12-83) years. 48 (54%) of all were females whereas males were 41 (46%). Mean KPS (Karnofsky Performance Score) was 90 (70-100). 2 patients were in stage 1 (2%), 25 (28%) were in stage 2, 35 (39%) were in stage 3 and remaining 23 (26%) were in stage 4. 4 (5%) of all were benign. 83 (93%) of patient population were treated with conventional fractionation and 6 (7%) of all were treated with SBRT (Stereotactic Body Radiotherapy). 16 (18%) patients were delivered palliative doses and 73 (82%) of all were given curative doses. The diagnosis of patients was seem to be a wide range of different type of cancers. 24 patients (27%) were breast cancer, 5 (6%) of all were prostate cancer, 15 (17%) patients were lung cancer.

Head and neck cancer patients were 6 (7%) of all. 4 (4%) of all group were lymphoma whereas 2 (2%) patients were gynecological cancer. Gastrointestinal cancer patients were 12 (13%) of all. 3 (3%) of all population were skin cancer. Central nervous system cancer were in 3 (3%) patients whereas 2 (2%) of all were pediatric tumors. Benign patients were 4 (4%) and CUP (carcinoma of unknown primary) patient was just 1 (1%). 8 remaining (11%) of all were diagnosed with other type of cancers.

### Discussion

According to the data of International Atomic Energy Association, there are 8403 centers delivering radiotherapy. 15276 mv therapy and only 107 light ion therapy are used in these centers. The number of kv therapy devices are 740. 3380 brachytherapy devices are used for treatment. In Turkey, there are 137 centers for radiotherapy. 281 mv therapy devices are used here and no light ion devices are there in our country. The number of brachytherapy devices are 31.

RT is a treatment approach that delivers energy to kill malignant tumor cells in the targeted area. What RT do is to damage the DNA of cancer cell by ionizing the atoms making the DNA chain. An optimal balance must be achieved between probability of a radiation-induced complication in a normal tissue and the probability of tumor control. The therapeutic ratio is achieved by minimizing the dose to normal tissues or organs while maximizing the dose to the target. At the same time, the total dose of radiation is often divided (fractionated) into smaller daily doses to allow normal tissues to repair the radiation damage between treatments.

External beam radiation therapy (EBRT) is the most common RT approach which delivers the radiation from a source outside the patient [3]. Electrons are accelerated to high energy and are allowed to either exit the machine as an electron beam or to strike a target that produces X-rays (also known as photons), which are directed at the tumor in linear accelerators. Photons are the most widely used radiation mode due to their ability to penetrate deeply and reach internal organs whereas electrons are specifically used for superficial targets such as the skin and breast to minimize radiation to deeper tissues and organs. Treatment planning include definition of tumor target, patient immobilization, imaging, delineation of the target volumes and critical organs, consideration of dose and schedule, set-up and finally treatment.

Intensity-modulated radiation therapy (IMRT) is an ultimate form of 3- dimensional conformal radiotherapy (3D-CRT) that shapes the intensity of radiation in different parts of a single radiation beam while the treatment is delivered [4]. Image Guided Radiotherapy (IGRT) is real-time imaging of the treatment target and normal tissues during each treatment allows for minimization of additional margins and the reduction of irradiated volumes which decreasing missing a target. Particle therapy is a special form of EBRT, with protons being often used [5]. Proton radiation reduces the dose to normal tissues by allowing for more precise dose delivery because of the unique physical specialities of heavy particles [6]. Neutron RT is believed to have an advantage in the treatment of certain tumors such as recurrent or inoperable salivary gland malignancies or incompletely resected sarcomas of soft tissue, cartilage and bone [7,8].

Stereotactic radiation therapy techniques administer the calculated dose of radiation in one or a very limited number of treatment fractions. Stereotactic techniques often utilize photons that are delivered by a linear accelerator or by a cobalt-60 source. Stereotactic radiosurgery (SRS) refers to a single-fraction treatment of intracranial or spinal targets whereas stereotactic body radiation therapy (SBRT) meaning multifractional (typically two to five fractions) treatment of intracranial, spinal, or extracranial sites such as prostate, liver, pancreas, head and neck and lung [9,10].

Total body irradiation (TBI) is widely used as a component of preparative cytoreductive regimens for hematopoietic cell transplantation. Brachytherapy is a form of RT in which a radiation source is located inside or close to the area requiring treatment. The radiation emitted is usually active over only a relatively short distance. Brachytherapy can be delivered with either high dose rate (HDR) or a low dose rate (LDR) system [11,12]. Intraoperative radiation therapy (IORT) that single-fraction treatment used is the delivery method of radiation at the time of surgery and dose is limited by critical structures [13].

## Conflict of Interest

No.

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