

## The effect of radiotherapy treatment on some blood elements in patient with some types of cancer

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### Abstract

**Back ground:** Cancer is a term used for diseases in which abnormal cells divide without control and are able to invade other tissues. Cancer cells can spread to other parts of the body through the blood and lymph system. Radiotherapy is one type of treatment used to treating patient with cancer, the most common form of irradiation is the use of external beam photons or electrons. Photons are X-ray or Y-ray and may be considered as bundles of energy that deposit dose as they pass through matter. **Objectives:** 1-The effect of radiotherapy on the blood system and some blood parameters. 2.To record the White blood cells count, red blood cells count and hemoglobin level before and after radiotherapy. **Materials and patients:** The study carried out in Rizgari teaching hospital / Oncology department from Sample size determined by 50 patients distributed as follow: 10 patients for each: skin cancer, breast cancer, lung cancer, brain cancer, colon cancer. Blood obtained from each patients and complete blood picture (CBP) done for them before and after completing the total doses of the radiotherapy **Results:** The mean value of white blood cells decreased significantly (p value=0.000) after radiotherapy treatment in all types of cancer which included in the study. The mean value of red blood cells decreased significantly(p value<0.005) after radiotherapy in all types of cancer which included in the study and also the mean value of hemoglobin level decreased significantly (p value=0.000) after radiotherapy treatment in all types of cancer which included in the study. **Conclusions:** There were a negative effect of RT on the blood count which lead to decrease the mean count of WBCs , RBCs and Hb level which adversely lead to other side effects like infection, anemia, weight loss and bleeding.

**Key words:** cancer, radiotherapy, blood.

### Introduction

Malignant tumor are generally consists of an altered cell population that has become unresponsive to normal controls and to the organize influence of adjacent tissues.<sup>(1)</sup>

The cells in malignant tumors can invade and damage nearby tissues and organs. Cancer cells can also break away from a malignant tumor and travel

through the bloodstream or the lymphatic system to form new tumors in other parts of the body. The spread of cancer is called metastasis.<sup>(2,3)</sup>

Cancer is fundamentally a disease of failure of regulation of tissue growth. In order for a normal cell to transform into a cancer cell, the genes which regulate cell growth and differentiation must be altered.<sup>(4, 5, 6)</sup>

## The effect of radiotherapy treatment on some blood elements in patient with some types of cancer

The affected genes are divided into two broad categories. Oncogenes are genes which promote cell growth and reproduction. Tumor suppressor genes are genes which inhibit cell division and survival. Malignant transformation can occur through the formation of novel oncogenes, the inappropriate over-expression of normal oncogenes, or by the under-expression or disabling of tumor suppressor genes. Typically, changes in many genes are required to transform a normal cell into a cancer cell<sup>(7)</sup>

Many management options for cancer exist with the primary ones including: surgery, chemotherapy, radiation therapy the treatments are used depends upon the type, location and grade of the cancer as well as the person's health and wishes<sup>(8)</sup>

Radiation therapy (radiotherapy) involves treating the cancer with ionizing radiation; for certain localized cancers it may curative. Ionizing radiation can be delivered by radiation emitted from the decay of radioactive isotopes or by high-energy radiation beams, usually X-ray. These methods are usually employed:

- Teletherapy: application from a distance by a linear acceleration<sup>(9)</sup>
- Brachytherapy: direct application of a radioactive source on to or into a tumor<sup>(10)</sup>.
- Intravenous injection of a radioisotope: such as <sup>131</sup>iodine<sup>(11)</sup>.

The biological effect of ionizing radiation is to cause lethal and sublethal damage to DNA. Since normal tissues are also radiosensitive, treatment has been designed to maximise exposure of the tumor tissues

Type of cancer	Total dose/cGy	Daily dose/cGY	Fraction	Dose /week/cGy	Total weeks
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and minimize exposure of the normal tissues<sup>(9)</sup>.

The side effects of radiotherapy depend on the normal tissues treated, their radiosensitivity and the dose delivered<sup>(12)</sup>

There are two types of side effects in radiotherapy treatment: acute side effects and late side effects<sup>(13)</sup>

### **Aim of the study:**

1. The effect of radiotherapy on the blood system and some blood parameters.
2. To record the White blood cells count, red blood cells count and hemoglobin level before and after radiotherapy.

### **Materials and patients**

The study carried out in Rizgari teaching hospital / Oncology department from May 2011 until December 2011. Sample size determined by 50 patients distributed as follow:

10 patients for each: skin cancer, breast cancer, lung cancer, brain cancer, colon cancer.

For each patient a form prepared and the name, sex, age recorded.

Blood obtained from each patients and complete blood picture (CBP) done for them before and after completing the total doses of the radiotherapy

Each patient received radiotherapy by linear accelerator and as follow:

The effect of radiotherapy treatment on some blood elements in patient with some types of cancer

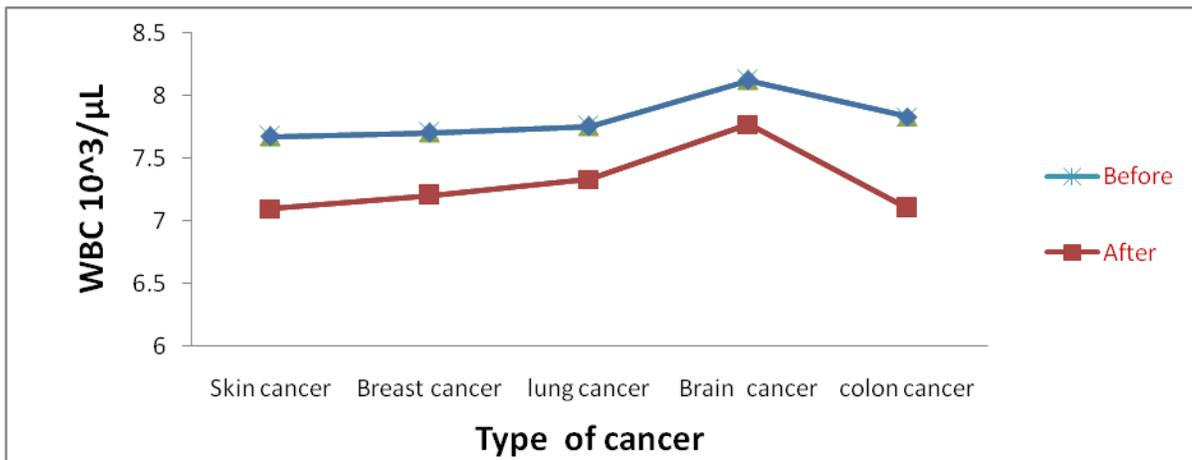
Skin	4000	200	20	1000	4
breast	5000	200	25	1000	5
Lung	5000	200	25	1000	5
Brain	4500	180	25	900	5
Colon	3000	150	20	750	4

**Results**

**Table (1):** The mean value of white blood cells count before and after radiotherapy

Type of cancer	WBC <sup>10<sup>3</sup>/μl</sup> before RT	WBC <sup>10<sup>3</sup>/μl</sup> after RT	P value	
Skin cancer	7.6700	7.0940	0.000	HS
Breast cancer	7.7000	7.2040	0.000	HS
lung cancer	7.7510	7.3310	0.000	HS
Brain cancer	8.1230	7.7700	0.000	HS
colon cancer	7.8300	7.1100	0.000	HS

HS highly significant



**Figure (1):** the mean value of WBC in some types of cancer before and after RT

As shown in table (1) and Fig(1) that the mean value of WBCs decreased after RT with highly significant(HS) statistically.

**Table (2):** the mean value of red blood cells before and after RT

Type of cancer	RBC <sup>10<sup>6</sup>/ μl</sup>	RBC <sup>10<sup>6</sup>/ μl</sup>	P value	
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The effect of radiotherapy treatment on some blood elements in patient with some types of cancer

	before RT	after RT		
Skin cancer	4.9910	4.4220	0.000	HS
Breast cancer	4.8500	4.2640	0.000	HS
lung cancer	4.9790	4.5960	0.000	HS
Brain cancer	4.9440	4.2610	0.04	S
colon cancer	5.2280	4.7750	0.000	HS

HS Highly significant  
S Significant

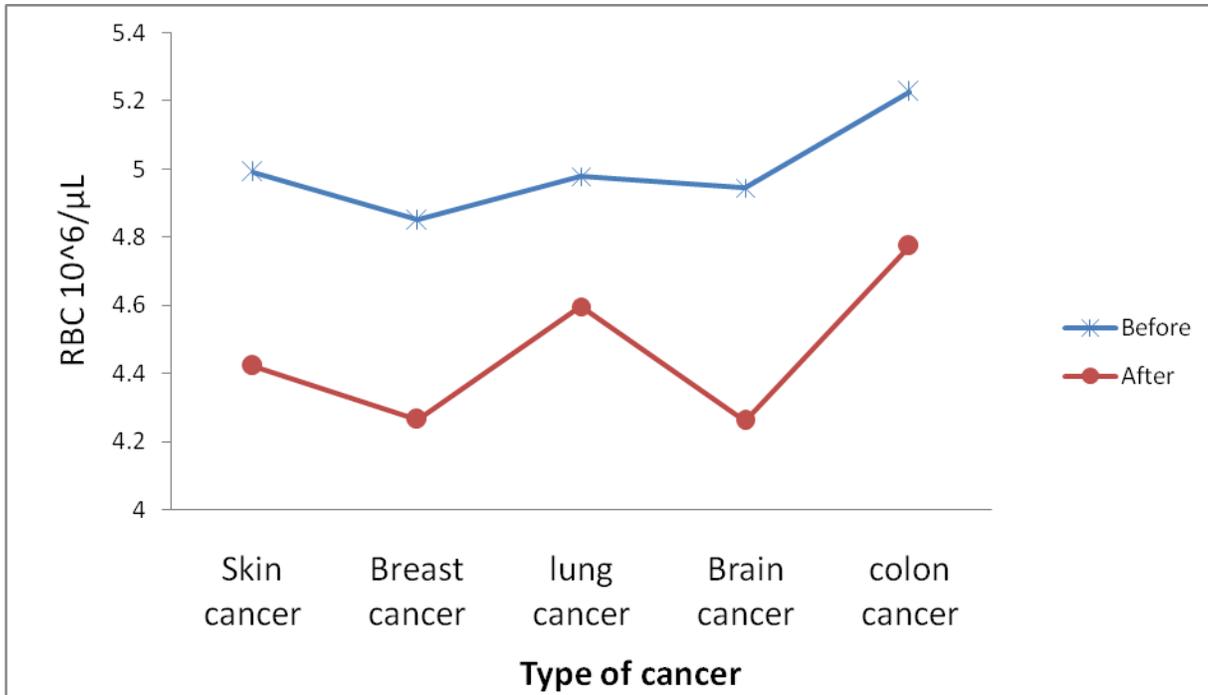
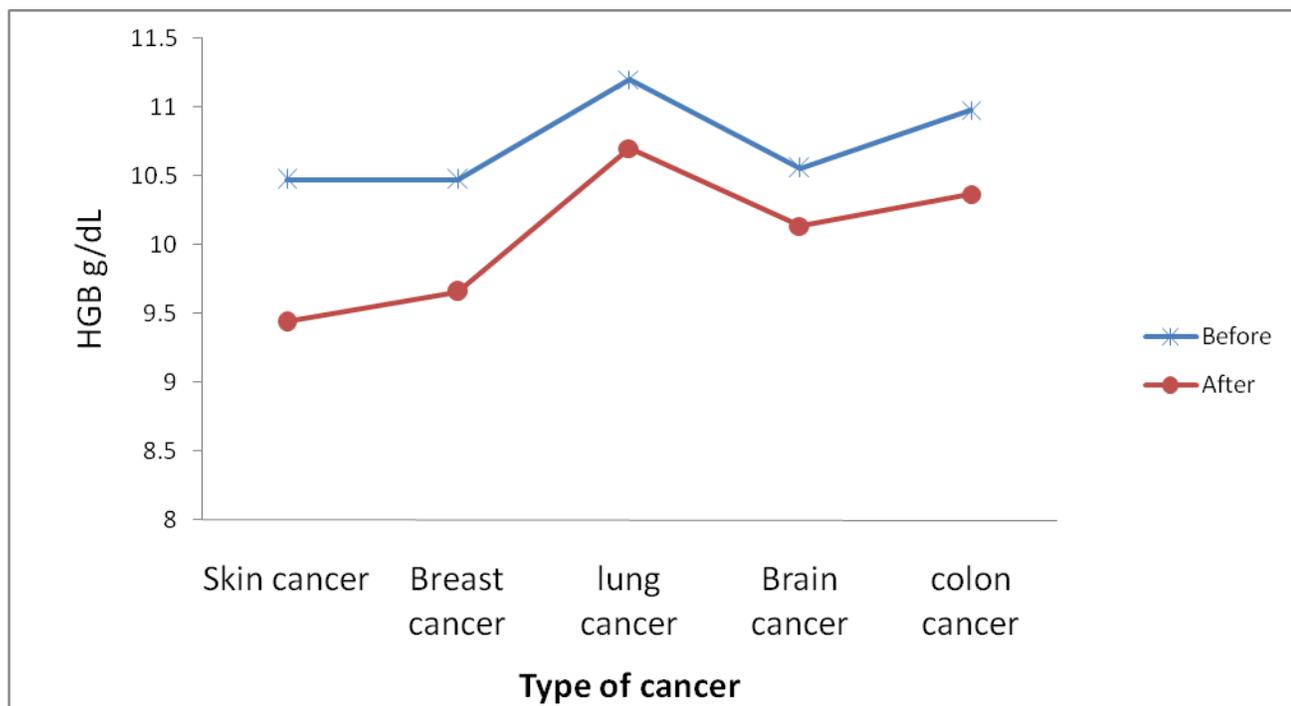


Figure (2): the mean value of RBCs in some types of cancer before and after RT

As shown in table (2) and Fig(2) that the mean value of RBCs decreased after RT with significant statistically.

Table (3): the mean value of hemoglobin level before and after RT

Type of cancer	Hbs/dl before RT	Hbs/dl after RT	P value	
Skin cancer	10.4750	9.4400	0.000	HS
Breast cancer	10.4750	9.6590	0.000	HS
lung cancer	11.2010	10.7020	0.000	HS
Brain cancer	10.5550	10.1370	0.000	HS
colon cancer	10.9800	10.3690	0.000	HS



**Figure (3):** the mean value of hemoglobin level before and after RT.

As shown in table (3) and figure (3) that the mean value of hemoglobin (Hb) decreased significantly after RT.

## Discussion

Radiation is a physical form of treatment that damages any tissue in its path, its selectivity for cancer cells may be due to defects in a cancer cells ability to repair sub lethal DNA and other damage<sup>(12)</sup>

When the cancer cells are subjected to radiation it may result in the damage to DNA, which is the critical target in the cell. Any form of radiation, either x or gamma rays, charged or uncharged particles, is absorbed in biological material and will directly interact with DNA and ends up with biological change which may reflect in the biological medium like blood<sup>(14)</sup>

Classically radiation affects three main sites: hematopoietic, gastrointestinal ,neurological and vascular<sup>(15)</sup>

In this study the result shown that the blood element parameters which include white blood cells, red blood cells and hemoglobin level , are decreased after complete dose of radiotherapy this reflect the effect of radiotherapy on rapidly proliferating cells like blood elements.

the mean count of white blood cells decreased after completion of radiotherapy in all types of cancer included in this study as shown in table( 1) and this agree with a result done by Goff et al<sup>(16)</sup>.

In other study done by Pape et al<sup>(17)</sup> they found that the count of lymphocytes and neutrophil decline after radiotherapy.

Bone marrow is a major site of radiation injury. The extreme sensitivity of bone marrow cells to

genotoxic stress largely determines the adverse side effects of radiation<sup>(18)</sup>.

In this study the count of RBC count decreased after exposure to RT and this is because RT can affect the blood-forming cells in the bone marrow. This can lead to low blood counts. The red blood cells and white blood cells are most often affected by radiation, but sometime the platelets are affected, too. This can lead to: Increased chance of infections (from low white blood cell counts), Easy bruising or bleeding (from low blood platelet counts) and Fatigue (from low red blood cell counts)<sup>(19)</sup>.

In this study the hemoglobin level decreased after RT in all types of cancer and this mostly due to the decrease the RBC and also to the other side effects of RT like vomiting, nausea and diarrhoea with loss of appetite<sup>(14)</sup>

The onset and type of symptoms depends on the radiation exposure. Relatively smaller doses result in gastrointestinal effects such as nausea and vomiting and symptoms related to falling blood counts such as infection and bleeding<sup>(20)</sup>.

### **Conclusions:**

There were a negative effect of RT on the blood count which lead to decrease the mean count of WBCs , RBCs and Hb level which adversely lead to other side effects like infection, anemia, weight loss and bleeding.

### **Recommendation**

1. Every patient with any type of cancer should be evaluated before receiving the radiation therapy.
2. Every patient with cancer with anemia or leukopaenia should be treated before the RT to prevent further development of side effects.

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