Research Article

WBC Changes In Cancer Patients undergoing Radiation Therapy- A Prospective Study

F. Mariyam Niyas*
Saveetha Dental College, Chennai, Tamilnadu, India.
***Corresponding author's E-mail:** marlog7494@gmail.com

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ABSTRACT

Normal WBC counts ranges from 4500-11,000 cells per microliter of blood. Radiation therapy or radiotherapy is a therapy using ionizing radiation, generally as a part of cancer treatment to control or kill malignant cells. However normal cells are affected too including WBC. Radiation therapy may change the count, size and morphology of WBC, but this study is aimed at changes in WBC count only. Effectiveness, adverse effects and progressiveness of therapy can be estimated this way.

Keywords: Radiotherapy, Ionizing radiation, apoptosis.

INTRODUCTION

Treatment of cancer is multimodal. The common treatment modalities in practice now are Surgery, Radiotherapy and Chemotherapy. Radiotherapy uses Ionizing radiation (IR) which causes cell damage and death [1]. Evaluation of cell response to IR is used to determine the clinical efficacy of radiation treatment [2, 3]. The accepted rationale for using radiotherapy in cancer is underpinned by tumor cell death and effects on tumor-associated stroma caused by DNA damage[4]. The conventional view is that rapidly dividing cancer cells are more sensitive to ionizing radiation than normal tissue, and therapeutic radiation is therefore applied to induce apoptosis and other forms of cell death within a defined area while minimizing toxic effects on normal tissue around the treatment field [4, 5].

Inevitably, irradiation of living tissue involves damage to that tissue, whether it is tumor tissue, normal host stroma, normal host parenchyma, or leukocytes [2]. The attenuation of lymphocyte numbers by radiotherapy, in patients undergoing treatment for gynecologic [6] or prostate [7] malignancies, might therefore be viewed as an adverse effect. The ultimate manifestation of this is seen in patients who undergo total body irradiation (as widely used in conditioning regimens for hematologic malignancies), who experience prolonged pancytopenia [8].

Normal WBC counts ranges from 4500-11,000 cells per microliter of blood. Bone marrow suppression can arise after IR treatment[9]. There are many factors that affect the frequency and severity of bone marrow suppression. These include the prescribed and total cumulative IR doses, frequency of treatments and clearance rate of IR therapy, and additively, the patient's bone marrow reserve and degree of bone marrow metastases [10].

White blood cells protect the body by fighting bacteria, viruses and other foreign invaders that cause infections. Leukopenia results from an abnormally low level of WBCs in the blood [11]. When the WBC count is low, the treatment may be delayed or a lower dose is recommended until the WBC counts return to a normal level. Antibiotics also may be prescribed as a preventive measure [12]. There are also certain drugs or other therapies that may be used to treat leukopenia. For example, growth factors such as granulocyte-colony stimulating factors, or G-CSFs and granulocyte-macrophage colony stimulating factors may be used to stimulate the bone marrow to produce WBCs [13].

Different radiation techniques are Fractionation, 3D conformal radiotherapy (3DCRT), Stereotactic body radiation therapy (SBRT), Intensity modulated radiation therapy (IMRT), Image-guided radiotherapy (IGRT) [14].

MATERIALS AND METHODS

The WBC values of patients from the age of 30-75 years of age undergoing palliative radiotherapy with 5 fractions are given below. Complete Blood Count reports were collected from a local cancer clinic with the consent of patients and the WBC counts were collected for 5 fractions. Complete blood picture was taken for each patient after every fraction of radiation therapy. Dosages of colony- stimulating factors were given to the patients after the first fraction of radiation therapy. The technique of radiation used was three dimensional conformal radiation therapy (3DCRT) technique for all the patients.

RESULTS

Throughout the radiotherapy the WBC counts can vary from 8800-8980 cells/microliter of blood. After the first, second, third, fourth and fifth fraction of radiotherapy the average range of WBC is from 7700- 7900 cells/microlitre, 13770-13950 cells/microlitre, 8260-8450 cells/microlitre, 6850- 7000 cells/microliter and 7380-7560 cells/microliter respectively. The increase in WBC count on day 2 is attributed due to the administration of colony stimulating factors such as Granulocyte Colony stimulating factor and Granulocyte Macrophage- Colony Stimulating factor.

Table 1: Results of WBC count changes in patients

Samples	Age	Gender	Fraction 1	Fraction 2	Fraction 3	Fraction 4	Fraction 5
1	49	F	11660	26800	3900	3700	13400
2	62	M	6500	9300	11400	26000	1200
3	60	M	8730	9200	8700	10000	7680
4	40	F	8100	9600	5580	9220	8660
5	34	F	6840	4700	7100	5900	7800
6	63	M	9000	20600	10900	9000	12300
7	62	M	5400	15200	10800	9600	7400
8	30	F	3500	19600	7600	10800	6700
9	50	F	9800	20000	9800	7600	6800
10	60	F	5100	8000	10000	7800	6500
11	45	M	7400	8900	3300	3600	3700
12	53	F	10300	10300	9800	11200	6800
13	37	F	4900	5600	9600	6000	3450
14	75	F	12600	10700	8600	7900	11300
15	60	F	5300	33900	8400	9300	7800
16	45	F	10000	9380	8400	6800	8000

DISCUSSION

It is observed that the effects of radiotherapy do not show drastic decrease in WBC counts as the effect of bone marrow suppression due to radiotherapy is countered with the administration of granulocyte colony stimulating factors [13]. Examples of such drugs are lenograstim (Granocyte), filgrastim (Accofil,Neupogen, Nivestim, Ratiograstim, Zarzio, TevaGrastim) and pegylated filgrastim (Neulasta). It is given after radiotherapy to stimulate the bone marrow to make white blood cells. These blood cells help to fight infection. It is given before a stem cell transplant to encourage more stem cells to be produced and released into the blood. These can then be collected for use in a transplant. Stem cells are blood cells at their earliest stage [15].

CONCLUSION

This is a pilot study conducted with 16 patients. The pathological complete response is yet to be analyzed by obtaining more than 50 patients.

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