Effect of the Exposure to Radioactive Iodine I-131 on Lymphocyte and Granulocyte Levels in Blood Samples of Hospital Workers

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Abstract

This study was achieved to examine the impact on hematological parameters for medical workers that work on radioactive iodine I-^{131}. Its indicated that's the mean value of radiation exposed (RE) workers were 29.2% of lymphocyte and 64.4% granulocyte% in compared with 30.2% and 60.6% respectively of radiation unexposed persons. Results showed that 17% of granulocyte increased, while 8.5% of the granulocyte level was declined in compared to fluctuated decrease and increase in the lymphocyte level in hospital workers. Results showed that there females are higher influenced than male. Finally, the study indicated that Complete blood count is promising, safe and economical routine test for hospital workers as Examination program.

***Keywords*:** Radioactive iodine, lymphocyte, granulocyte, radiation exposure

تأثير التعرض لليود المشع 131 على اللمفوسايت والكراينولوسايت في دم العاملين في المستشفى

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الخلاصة

انجزت هذه الدراسة لاختبار تأثير المؤشرات الدم للعاملين الذين يعملون على اليود المشع 131 . تبين النتائج ان قيمة المعدل للاشعاع للعاملين المتعرضين للاشعاع كانت 29.2% من اللمفوسايت و**64.4** %من الكراينولوسايت بالمقارنة مع **30.2**% و **60.6%** على التوالي من الاشخاص الغير معرضين للاشعاع. بينت النتائج بان نسبة 17% من الكراينولوسايت قد ازدادت، بينما

8.5% من مستوى الكراينولوسايت قد انخفظت بالمقارنة مع الانخفاض المتذبذب والزيادة في مستوى المفوسايت في العاملين بالمشفى. بينت النتائج بان النساء اكثر تاثرا من الرجال. واخيرا، الدراسة تبين بان فحص حساب صورة الدم الكاملة هو اختبار واعد، وامن وروتين اقتصادي للعاملين بالمستشفى كبرنامج للاختبار.

الكلمات المفتاحية: اليود المشع ، الخلايا اللمفاوية ، الحبيبية ، التعرض للإشعاع.

Introduction

Hematopoiesis is among the most sensitive systems in the body to radiation (1). Ionizing radiation can have profound effects upon bone and marrow and blood forming units. Numerous studies on animals and human beings have demonstrated dramatic decreases in leukocytes, erythrocytes, and platelets following total body irradiation (2, 3, 4, 5). Radioiodine (RAI) has been used for more than 40 years for treatment of well-differentiated thyroid carcinoma. It was soon observed that the large activities of RAI required for efficient treatment of thyroid carcinoma also could depress the blood forming organs and even cause fatal pancytopenia (6). Several authors have since reported pancytopenia and leukemia after treatment of thyroid cancer with RAI (7,12). Human beings are continually exposed to IR in nature as well as from nuclear weapons testing, occupations, consumer products, and medical procedures (13). The effect of exposure to IR is of interest to the space exploration community as well as patients considering radiotherapy (14).

Ionizing radiation (IR) damages biological tissues by exciting or ionizing their atoms and molecules. Depending on the exposure to radiation dose and the biochemical processes, damage may be prompt (expressed minutes to weeks after exposure) or delayed (expressed several months to years later) (13). Ionizing radiation (IR) has a sufficient amount of energy to induce physical symptomatology within minutes of exposure, appearing as the acute radiation syndrome (ARS). The prodromal phase of ARS includes nausea, vomiting, and fatigue. The quality of radiation, dose, and dose-rate are all contributing factors to the differential symptoms of ARS (14).

These prodromal symptoms can be followed by dramatic decrease in Peripheral blood cell counts, as hematopoietic cells represent a renewal system consisting of cells with fast division rates that are known to be sensitive to IR (14). When cells are exposed to IR, they respond in a variety of ways that differ quantitatively and qualitatively according to the absorbed dose and the cell type that generally reflects damage caused to a well-defined cellular components and molecular structures (15).

However, the mechanisms of the considerable tolerance to hemopoietic failure at low dose-rates are largely unknown but likely linked to stem cell responses (16). The aim of present study is to evaluate the effect of low dose radioactive iodine on some blood components in workers of Al-Amal National Hospital.

Methods

Study Design and Data Collection

The current study included 35 workers who exposed to radioactive iodine at Al-Amal national hospital of tumors as part of their routine work.

Measurements and Protocols:

Measurements of hemocytometer parameters were performed with a calibrated automatic hematology analyzer (Samsung LABGEOHC10 hematology analyzer, Korea). All the variables were selected based on the previous literature reports hypothesized to be important as biomarkers. All necessary criteria were followed as required in a clinical measurement setting.

Data were collected from workers according to questionnaire to determine the age, sex, and specialization, Number of years in service, mertual status, family history and others.

Results and Discussion

The present study investigates the effect of radioactive iodine exposure on the hospital workers compared with normal healthy unexposed workers. Results showed that there is no significant difference in lymphocyte and granulocyte levels, as mean level of lymphocyte reached to 30.2% in compared to 29.2% while the granulocytes level reached to 64.4% compared to normal unexposed persons 60.6%. It's indicated that there is a significant increase in levels of granulocytes in radiation exposed workers compared with their levels in control group. It was also found that the most increase was in female rather than males samples Figure (1), table (1).

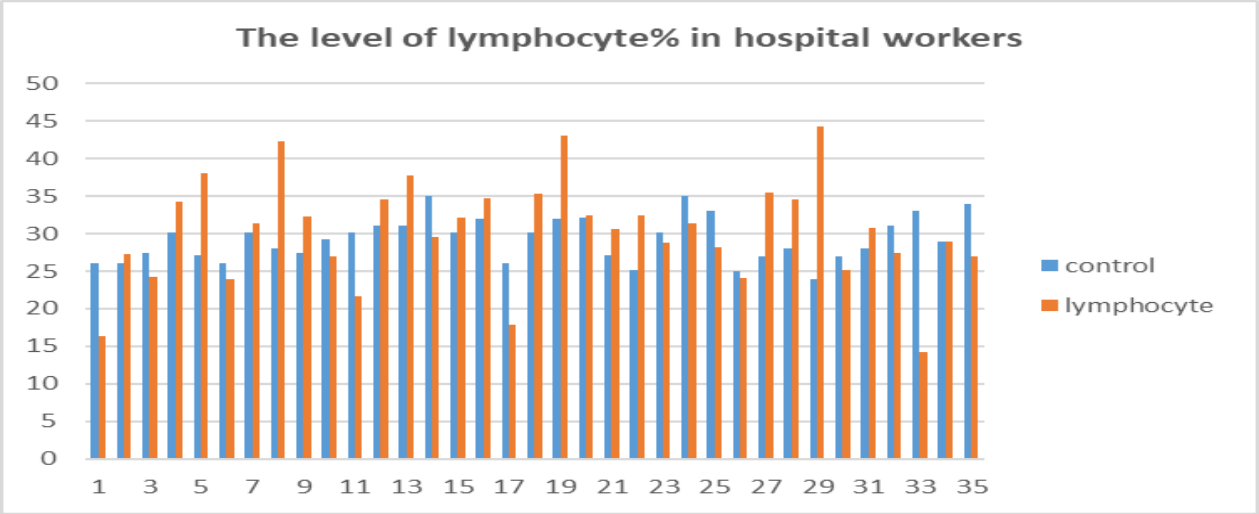

Figure (1): comparison Levels of lymphocytes% in study and control groups.

Table (1): Percentage of lymphocytes in blood samples collected from hospital workers compared with control group

No.	Age	Years in services Category1 (1 ≤) Category 2 (1-5) Category 3 (5≥)	Years in service	Gender	Control group		Exposed workers group	
					Lymphocytes (%)	Level	Lymphocytes (%)	Level
1.	20-30	Category 1	1	M	26.1	Normal	16.4	Low
2.	30-40	Category 1	1	M	26.1	Normal	27.2	Normal
3.	50-60	Category 2	2	M	30.1	Normal	34.2	Normal
4.	20-30	Category 2	2	M	27.1	Normal	38	Normal
5.	20-30	Category 2	2	F	28	Normal	34.5	Normal
6.	20-30	Category 2	3	F	30.1	Normal	28.8	Normal

7.	20-30	Category 2	3	F	33	Normal	28.2	Normal
8.	20-30	Category 2	3	F	25	Low	24.1	Normal
9.	20-30	Category 2	1	F	27	Normal	25.1	Normal
10.	20-30	Category 2	4	F	33	Normal	14.2	Low
11.	30-40	Category 3	10	M	27.4	Normal	24.2	Normal
12.	30-40	Category 3	9	F	26.1	Normal	24	Normal
13.	30-40	Category 3	7	F	30.1	Normal	31.3	Normal
14.	30-40	Category 3	7	F	28.1	Normal	42.3	High
15.	20-30	Category 3	7	F	27.5	Normal	32.3	Normal
16.	30-40	Category 3	7	F	29.2	Normal	27	Normal
17.	60-65	Category 3	35	F	30.2	Normal	21.6	Normal
18.	20-30	Category 3	7	F	31.1	Normal	34.5	Normal
19.	20-30	Category 3	7	F	31.1	Normal	37.7	Normal
20.	40-50	Category 3	24	M	30.1	Normal	32.1	Normal
21.	40-50	Category 3	9	F	32	Normal	34.7	Normal

22.	50-60	Category 3	17	F	26.1	Normal	17.8	Low
23.	30-40	Category 3	7	M	30.1	Normal	35.3	Normal
24.	30-40	Category 3	9	F	32	Normal	43	High
25.	40-50	Category 3	30	F	32.1	Normal	32.5	Normal
26.	20-30	Category 3	7	M	27.1	Normal	30.6	Normal
27.	30-35	Category 3	15	M	25.1	Low	32.4	Normal
28.	40-50	Category 3	24	F	35	Normal	31.3	Normal
29.	30-40	Category 3	12	F	27	Normal	35.5	Normal
30.	30-40	Category 3	7	M	24	Normal	44.3	High
31.	30-40	Category 3	19	F	28	Normal	30.7	Normal
32.	50-60	Category 3	9	F	31	Normal	27.4	Normal
33.	50-60	Category 3	10	M	29	Normal	29	Normal
34.	30-40	Category 3	7	M	34	Normal	27	Normal
					Mean= 29.25		Mean= 30.25	

On the other hand, results showed that maximum level of granulocyte has reached to 81.5% while the minimum level reached 49.2%, result showed that category2 less affected by the granulocyte% and lymphocyte% level than the other categories as showed in table (2).

Table (2): Percentage of Granulocyte % in blood samples collected from hospital workers compared with control group

No.	Age	Years in services Category1 (1 ≤) Category 2 (1-5) Category 3 (5≥)	Sex	Years in serves	Granulocyte % level in control	Granulocyte % level in Control level	Granulocyte % level in workers	Granulocyte % level in
1.	20-30	Category 1	M	1	64	Normal	76.7	High
2.	30-40	Category 1	M	1	69	Normal	65.7	Normal
3.	30-40	Category 2	M	4	65	Normal	63.9	Normal
4.	20-30	Category 2	F	3	65	Normal	64.8	Normal
5.	20-30	Category 2	F	3	67	Normal	65.4	Normal
6.	20-30	Category 2	F	2	59	Normal	61.6	Normal
7.	20-30	Category 2	F	1	69	Normal	67.1	Normal
8.	20-30	Category 2	F	4	64	Normal	81.5	Normal
9.	30-40	Category 3	M	10	63.2	Normal	68.9	Normal
10.	30-40	Category 3	F	9	64.3	Normal	70.8	High
11.	30-40	Category 3	F	7	63.5	Normal	61.1	Normal
12.	30-40	Category 3	F	7	67	Normal	48.2	Low
13.	20-30	Category 3	F	7	66	Normal	61.2	Normal
14.	30-40	Category 3	F	7	58	Normal	66.3	Normal
15.	60-65	Category 3	F	35	67	Normal	72.1	High
16.	20-30	Category 3	F	7	65	Normal	58.7	Normal
17.	20-30	Category 3	F	7	66	Normal	55.1	Normal

18.	40-50	Category 3	M	24	63	Normal	58.4	Normal
19.	40-50	Category 3	F	9	58	Normal	57.7	Normal
20.	50-60	Category 3	F	17	63	Normal	73.3	High
21.	30-40	Category 3	M	7	70	Normal	57.2	Normal
22.	30-40	Category 3	F	9	66	Normal	49.2	Low
23.	40-50	Category 3	F	30	64	Normal	60.2	Normal
24.	20-30	Category 3	M	7	55	Normal	61.6	Normal
25.	30-35	Category 3	M	15	58	Normal	61.3	Normal
26.	40-50	Category 3	F	24	66	Normal	61.8	Normal
27.	30-40	Category 3	F	12	67	Normal	58.4	Normal
28.	30-40	Category 3	M	7	70	Normal	48.7	Low
29.	30-40	Category 3	F	19	66	normal	61.00%	Normal
30.	50-60	Category 3	F	9	68	Normal	60.8	Normal
31.	50-60	Category 3	M	10	62	Normal	63.5	Normal
32.	30-40	Category 3	M	7	65	Normal	62.1	Normal
33.	20-30	Category 2	F	3	66	Normal	70.3	High
34.	50-60	Category 2	M	2	58.4	Normal	55.7	Normal
35.	20-30	Category 2	M	2	67.8	Normal	53.4	Normal
					Mean= 64.43429		Mean= 60.666	

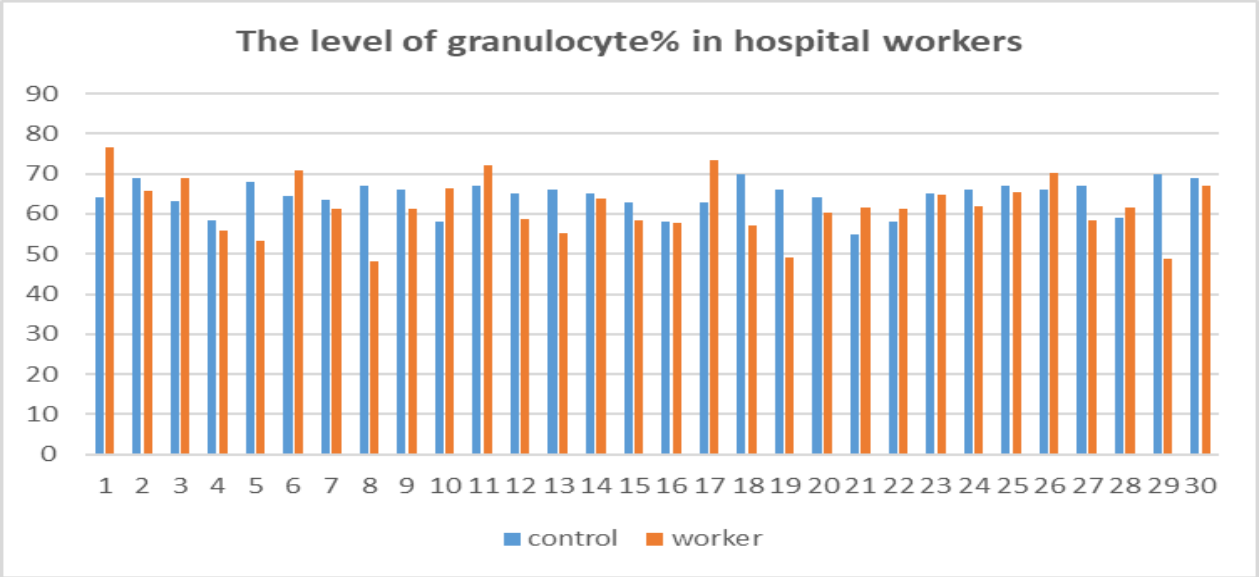

Figure (2): comparison Levels of granulocyte % in study and control groups.

Figure (2), indicated a fluctuation in lymphocyte and granulocyte levels in comparison with control samples. Shahid *et. al.*, (2014), was discovered that odds of developing low MCHC were 6.84 times higher and the odds of developing low Neutrophil were 9.69 times higher for those who were radiation exposed compared to those who were not exposed to occupational radiations (17).

The decreased number of circulating lymphocytes and granulocytes by radiations can lead to infections and long term work on radiations can induce anemia. Therefore, long-term damage caused by IR can induce various hematological diseases etc. (18, 19, 20).

The relationship between the inflammatory and noninflammatory diseases such as acute appendicitis, varicocele, cancers, coronary artery diseases, idiopathic pulmonary arterial hypertension, and tinnitus and some of the hemocytometer parameters are investigated in recent years (20, 21, 22).

Among these hemocytometer parameters, it's indicated that granulocyte are the most effective ones.

Conclusion

Hematopoietic system is found to be sensitive for radiation workers because mostly CBC parameters were observed suppressed, however a weak (though significant) association has been linked with the low doses of radiation exposure.

The long-term impacts of low ionizing radiation doses on the immune functions in relation to human health should be evaluated. The decreased number of circulating lymphocytes and granulocytes by radiations can lead to infections and can induce anemia.

In conclusion, close monitoring of complete blood counts (CBCs) should become routine test for most hospital workers in clinical radiation departments.

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