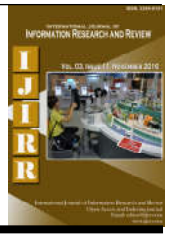
IJIRR

International Journal of Information Research and Review
Vol. 03, Issue, 11, pp. 3077-3080, November, 2016



Research Article

EFFECTS OF LONG-TERM EXPOSURE TO LOW X-RAY ON THE BLOOD CONSISTS OF RADIOLOGY DEPARTMENT STAFF OF HEALTH CENTERS IN LIBYA

Nureddin, A.S. Musa and Nadia.O. Alatta

National Ribat University Department of Radiology and Nuclear Medicine Sudan

ARTICLE INFO

Article History:

Received 28th August, 2016
Received in revised form
22nd September, 2016
Accepted 24th October, 2016
Published online November, 30th 2016

Keywords:

Hematological Parameters,
X-Ray Radiation,
X Ray Technicians

ABSTRACT

This study aimed to determine hematological changes, in particular white blood cell count (WBC), red blood cell count (RBC) and platelets count for X-ray technicians at three centers at Libya. The study aimed to identify the effect of radiation on hematological parameters and their relation to duration of the work in radiation field. Following informed consent, seventy six individuals; and fifty apparently healthy volunteer X-ray technicians worked 8 hours a day for five days per week, and age and sex matched twenty six unexposed healthy controls were enrolled. WBCs, RBCs and platelets cell count were determined for all participants. This study was conducted in Libya (Tripoli Central Hospital TCH, Tripoli Medical Center TMC and Cancer Center Misurata MCC in collaboration with The National Rabat University Faculty of Radiology and Nuclear Medicine Collage., Khartoum., Sudan during the year of 2015/2016. Both groups met with exclusion criteria as per standard. Hematological parameters were observed by using a blood cell auto analyzer. Significant correlation between increased with increased duration of work. Radiation field worker (technicians) showed a statistically significant increased ($p<0.01$ and $p<0.05$) in the mean values of platelets count and white blood cells, respectively when in comparison to controls. However, no significant difference was observed in the rest of hematological parameters between the groups. Its concluded that long-term of work to low X-ray dose may cause a low degree of severity of diseases which is expressed in term of hematological changes.

INTRODUCTION

X-rays are forms of electromagnetic radiation that carry enough energy to ionize atoms and disrupt molecular bonds. This makes it a type of ionizing radiation been capable to penetrate living tissues and generate chemically active free radicals these in turn potentially causes DNA damage (Masumra *et al.,* 2002). X-ray has been used widely in medical practice to create images of human body using different technologies and techniques including computed tomography (CT scan), fluoroscopy. And radiography ("conventional X-ray" including mammography). As in many aspects of medicine, there are risks associated with the use of X-ray imaging. The most common adverse impact is the induction of cancer with a latent period of years of decades after exposure (Hall and Brenner 2008; Brenner 2010; De Santis *et al.,* 2007). World Health organization's International Agency for Research on cancer has classified X-ray as carcinogen (Roobottom*et al.,* 2010). It is estimated that 0.4% of current cancers in the United States are due to CT scan (Brenner and Hall 2007).

****Corresponding author: Nureddin, A.S.,***
National Ribat University Department of Radiology and Nuclear Medicine Sudan.

Experimental and epidemiological data do not support the proposition that there is a threshold dose of radiation below which there is no increased risk of cancer. However, this is under increasing doubt (Calabrese and Baldwin 2003). It is estimated that the additional radiation will increase a person's cumulative risk of getting cancer by age 75 by 0.6 – 1.8 % (Berringtonand Darby 2004). The blood cell count remains fairly constant in healthy persons and is affected by many factors including occupational hazards (Ward*et al.,* 1996) high or low blood cell count even in healthy apparent subjects leads to suspicion of disease since the blood cell forming cells are one of the most sensitive cells to used as an indicator to determine the effect of ionizing radiation and its severity (Theodor*et al.,* 2007). Numerous studies have addressed the effects of partial or total body irradiation on peripheral blood cell count, most of them were focused on high dose radiation received accidentally or therapeutically (Littlefield*et al.,* 1991; Yanget al ., 1995). Worker over exposed to X-ray radiation are prone to develop life-threatening diseases often related with haematopoietic system. While many studies addressing the high dose radiation hazards there is scanty information on the radiation hazards produced in the individuals working in the clinical radiology department specially the probable change in

the basic hematological parameters e.g, RBCs, WBCs and platelets counts that can be used in the evaluation of the harmful effects of X-ray radiations. Thus, this study aimed to determine hematological changes; in particular RBCs, WBCs and platelets count in X-ray technicians in Libya.

MATERIALS AND METHODS

Following informed consent, seventy six individuals were enrolled; fifty apparently volunteer X-ray technicians worked 8 hours a day for five day per week were randomly selected from the Radiology Departments in different hospitals in Tripoli and Misurata states; matched twenty six unexposed control group. Subjects with gross anemia, known chronic infection, autoimmune disease and malignancy were excluded from the study.

The results were computed on computer in Excel program .the results are given as the mean ±SEM. The statistical analysis was conducted using a paired t test (two-tailed) and the level of significance was taken as a P-value less than 0.05.

RESULTS

The male: female ratio was 30 Male and 20 Female and the mean age of the X-ray technicians was 38.24 ±1.09 years. The mean work duration was 11.02±1.095. All samples were tested for the blood cell count. The results of the correlation between the duration of the exposure to X-ray (work duration) and the blood cell counts were as following: positive association with WBCs (P value =0.0043); no correlation with RBCs count (P value = 0.0043) and platelets count (P value=0.8454).

Table1. Shows compare between Blood cell count for X-ray technicians and Control group

Parameters	Control group	Case group	Percentage change%	P value
Age	37.46 ±1.60	38.24 ±1.09	-0.69	0.0811
WBC (count $\times 10^3/\mu l$)	6.3423± 0.2048	6.9206±0.2262	-9.1	0.0043
RBC (count $\times 10^6/\mu l$)	4.9454±0.0894	4.7646±0.0796	3.7	0.3241
Plt(count $\times 10^3/\mu l$)	223.423 ±15.120	237.224±7.025	2.3	0.8454

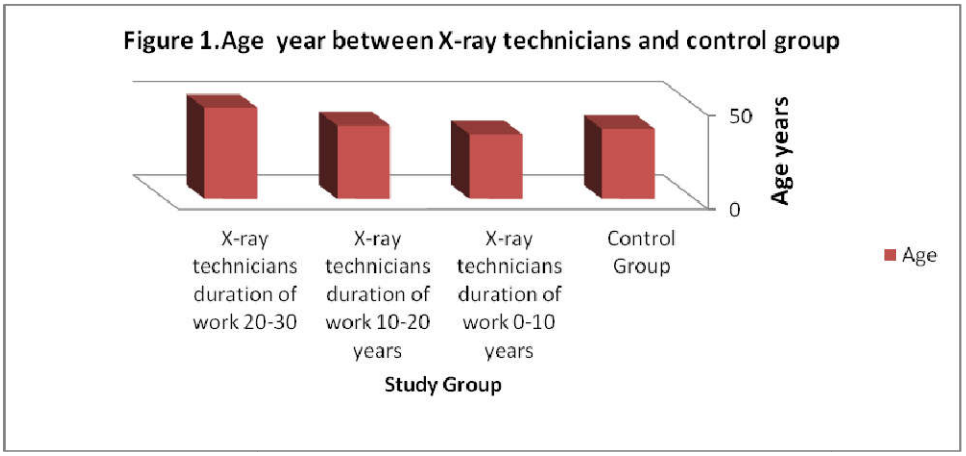


Table 2.Shows Blood cell count data for X-ray technicians on the basis of duration of work (0 - 10 years) compared with their matched control group (n=26)

Parameters	Control Mean ±S.E.M	X-ray Technicians Mean ± S.E.M	Percentage change%	Significance Level <0.05
RBCs µ/lit	4.9454±0.0894	4.7722±0.1011	3.2%	0.2078
WBcs µ/lit	6.3423±0.2048	6.6952±0.3090	- 6.98%	0.3659
Platelts µ/lit	223.423±15.120	233.804±9.275	- 1.9%	0.6394
Age (year)	37.46±1.60	34.56±1.31	8.16%	0.2669

Table 3. Shows Blood cell count data for X-ray technicians on the basis of duration of work (10-20) years compared with their matched control group (n=26)

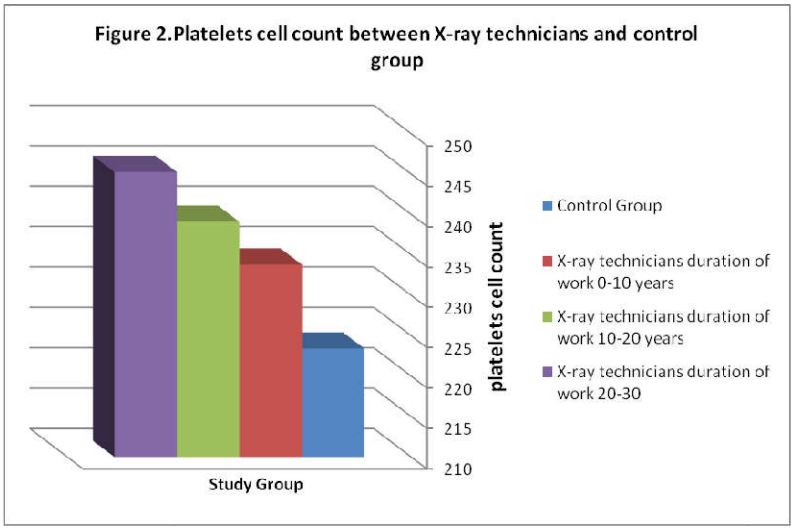
Parameters	Control group Mean S.E.M	X-ray Technicians Mean ± S.E.M	Percentage change%	Significance Level <0.05
RBCs µ/lit	4.9454±0.0894	4.7367±0.1210	3.5%	0.0671
WBcs µ/lit	6.3423±0.205	7.227±0.414	- 16.7%	0.0389
Platelts µ/lit	223.423±15.120	239.100±14.805	- 6.44%	0.0360
Age (year)	37.46±1.60	39.33±0.84	- 2.84%	0.2035

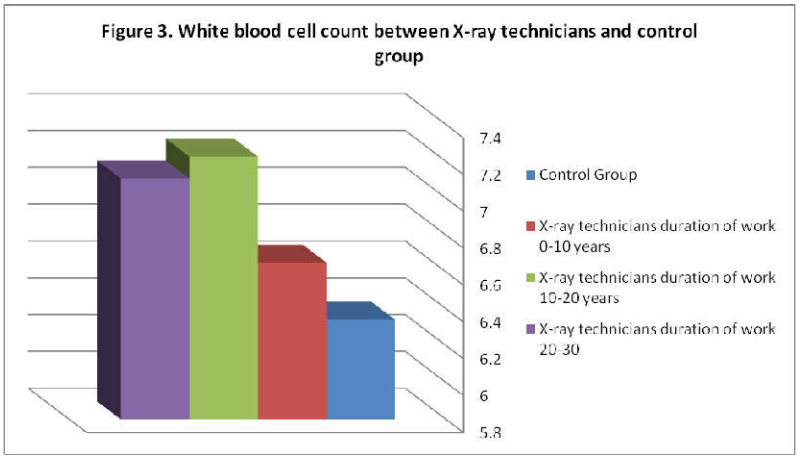
Two ml of EDTA anticoagulated blood was collected from each subject. Blood cell count was performed by automated cell counter (Sysmex KX-21N) at the Department of hematology, faculty of medical laboratory sciences. Tripoli central hospital in Libya.

The results of the blood cells count were as follows: RBC count mean 4.7646±0.0796 x $10^6/\mu$ L; WBC count mean 6.9206±0.2262 $\times 10^3/\mu$L; platelets count mean 237.224±7.025 $\times 10^3/\mu$L.

Table 4.Shows Blood cell count data for X-ray technicians on the basis of duration of work (20-30) years compared with their matched control group (n=26)

Parameters	Control group Mean ±S.E.M	X-ray Technicians Mean ± S.E.M	Percentage change%	Significance Level <0.05
RBCs µ/lit	4.9454±0.0894	4.7913±0.3061	- 1.24%	0.6260
WBcs µ/lit	6.3423±0.2048	7.1075±0.5869	- 17.52%	0.3640
Platelts µ/lit	223.42±15.12	245.25±15.58	- 9.34%	0.0709
Age (year)	37.46±1.60	48.63±2.34	- 30%	0.0311





The mean of the blood cells counts showed a significant difference between the X-ray technicians and control group (Table 1).

DISCUSSION

Long-term exposure to low doses of ionizing radiation may affect cells and tissues and result in various adverse health effects. The present study incorporated basic hematological parameters RBCs, WBCs and platelets count. The aim was to determine the effect of low X-ray radiation on blood cell counts in X-ray technicians. The hematological parameters in radiation field worker (X-ray technicians) assuming duration of work in years compared with their match control group. There was no significant difference between the mean values of the age and hematological parameters between control group and group 1. The mean ±SEM. Of duration of work in radiation field worker (X-ray technicians) of group 1 was 5.367±0.501 years (rang 1.6 to 10 years). There was significant difference was observed in the mean values of the age and hematological parameters between the control group and group 2.

The mean ±SEM of duration of work in radiation field worker (X-ray technicians) of group 2 was 14.547±0.746 years (rang 11 to 20 years). There were significant differences between the mean values of age and hematological parameters between control group and group 3. The mean ±SEM. Duration of work in the radiation field worker (X-ray technicians) group 3 was 24.63±1.44 years (rang 20-30 years). Though, the platelets and white blood cell count were increased in radiation field worker (X-ray technicians) with increased duration of work. The comparisons based on the work duration in three initialized groups have been in comparison to control group. Only platelet and white blood cell showed a significant difference and positive correlation relative to duration of work between radiation groups and control group. The rest hematological variables and age showed no significant changes. The platelets blood cell count show a significant (P>0.05) (0.6394) difference between group 1 and Control (The mean ±SEM in radiation field worker (X-ray technicians) of group 1 was 233.804±9.275µ / lit compared to 223.423±15.120 µ / lit), significant (P<0.05) (0.0360).

Difference between group 2 and Control (The mean ±SEM in radiation field worker (X-ray technicians) of group 2 was 239.100±14.805 µ / lit compared to 6.3423±0.205), and a significant (P<0.05) (0.0709) difference between group 3 and Control (The mean ±SEM in radiation worker (X-ray technicians) of group 3 was 245.25±15.58 µ / lit compared 223.42±15.12µ / lit). The white blood cell count did not show a significant (P>0.05) (0.3659) difference between group 1 and Control (The mean ±SEM in radiation field worker (X-ray technicians) of group 1 was 6.6952±0.3090 µ / lit compared to 6.3423±0.2048), significant (P<0.05) (0.0389) Difference between group 2 and Control (The mean ±SEM in radiation field worker (X-ray technicians) of group 2 was 7.227±0.414 µ / lit compared to 6.3423±0.205), and significant (P<0.05) (0.3640) difference between group 3 and Control (The mean ±SEM in radiation worker (X-ray technicians) of group 3 was 7.1075±0.5869 µ / lit compared to 6.3423±0.2048). Many studies (Zachariah *et al.,*2001; Nothdurft *et al.,*1995) reported that exposure to low doses of ionizing radiation may affect the cells and tissues and result in various adverse health effects. They reported that the blood count droop soon after irradiation, however, their observations concerned patients exposed to radiotherapy but not X-ray worker. Zachariah *et al.,*Rozaj et al. (2001) showed a statistically significant decrease in the mean values of RBCs, WBCs and platelet counts in X-ray worker (X-ray technicians) as compared with Control groups. Hrycek *et al*. (1995) reported that workers handling X-ray equipment have disturbances of peripheral blood neutrophil metabolism. In addition, they also observed that neutrophil phagocytic activity was weakened in persons working over five years with X-ray equipment. Our finding probably reflects a low degree of severity of disease with long-term exposure to X-ray which is expressed in terms of hematological changes.

Conclusion

Long-term exposure to X-ray may cause a low degree of severity of disease which is expressed in terms of hematological changes.

Recommendation

We recommended that, in addition to the safety and protective measures that have adopted in the different radiology departments, X-ray technicians must undergo periodic medical surveillance check including blood cells count that can helps detecting the low degree of severity of disease with long-term exposure to X-ray.

Acknowledgement

Firstly thank Allah Almighty and I would like to express my thanks and gratitude to my supervisor Dr. Nadia Omer Attia For all their information that they give me. Last , but not least I wish to extend my thanks to National Ribat University-College of Radiological and Nuclear Medicine Science Khartoum–Sudan and My team in Tripoli Central Hospital , Medical Physics Department.

REFERENCES

Berrington, G.A. and Darby, S. 2004. Risk of cancer from diagnostic X-rays: estimates for the UK and 14 other countries.Lancet .363:345-351

Brenner, D.J. 2010. Should we be concerned about the rapid increase in CT usage? Rev Environ Health.25:63-8., De Santis N, Ceari E, Nobili E, Straface G, Cavaliere AF and Caruso A.2007. Radiation effects on development. Birth Defects Res. C Embryo Today .81:177-82. , Hall EJ and Crenner DJ.2008. Cancer risks from diaqnostic radiology. *Br J. Radiol*.81:362-78.

Brenner, D.J. and Hall, E.J. 2007. Computed tomography- an increasing source of radiation exposure. N.*Engl.J.Med*., 357:2277-84.

Calabrese, E.J. and Baldwin, L.A. 2003. Toxicology rethinks its central Belif.Nature.421:691-2

Hrycek, A., Stieber, M., Zielinsks, H.,Flakus, L.1995. Study of nitroblueterazolium reducation by granulocytes in workers handling X-ray equipment .Wiadlek48:15-9.

Littlefield, L.G., Joiner, E.E., Colyer, S.P., Ricks, R.C., Lushbaugh, C.C. and Hurtado, M.R. 1991. The 1989 Scan Salvador co radiation accident: Cytogenicdosimetry and follow up evaluation in three accident victoms. RadiatProtDosim, 35:115-123. ,Yang FE, Vaida F, Ignacio L, Houghton A, Nauityal J , Halpern H,et al ., 1995. Analysis of weekly complete blood counts in patients receiving standard fractionated partial body radiation therapy. Int J RadiatOncolBiol Phys.33:607-17.

Masumura, K., Kuniya, K., Kurobe, T., Fukuoka, M., Yatagai, F., Nohmi, T. *et al.,*2002. Ion-induced mutations in the gpt delta transgenic mouse: comparison of mutation spectra induced by heavy-ion, X-ray, and gamma-ray radiation. Environ Mol Mutagen.40:207-15.

Nothdurft, W., Fliedner, T.M., Fritz, T.E. Seed, T.M. 1995. Response of hemopoiesis in dogs to continuous low dose rate total body irradiation . Stem Cells 13 Suppl 1:261-7.

Roobottom, C.A., Mitchell, G., Morgan-Hughes, G. 2010. Radiation-reduction strategies in cadiac computed tomographic angiography. ClinRadiol.65:859-67.

Therodor, M. Fliedner, Dieter Graessle, Viktor Meineke, and HaraldDorr.2007.Pathophysiological principles underlying the blood cell concentration response used to assess the severity of effect after accidental whole-body radiation exposure: An essential basis for an evidence-based clinical triage. Expermental Hematology.35:8-16.

Ward, E., Hornung, R., Morris, J., Rinsky, R., Wild, D., Halperin, W. et al. 1996. Risk of low red or white blood cell count related to estimated benzene exposure in a rubber worker cohort (1940 – 1975). *Am J Ind Med.,* 29:247-57.

Zachariah, B., Jacob, S.S., Gwede, C., Cantor, A., Patil, J., Casey, L., Zachariah, A.B. 2001. Effect of fractionated regional external beam radiotherapy on peripheral blood cell count. In J RadiatOncolBiol Phys.50:465-72.

****