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Possible effect of background radiation on cancer incidence in Chaharmahal and Bakhtiari province

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ABSTRACT

Background: The induction of cancer appears to be the most important effect of low-dose ionizing radiation to occur in an exposed population. In developing countries 94% of human radiation is from natural sources. In Iran some high altitude regions such as, Chaharmahal & Bakhtiari has high levels of the natural background radiation (higher than the worldwide average). Therefore, investigation of the incidence of cancer relevant to the radiation is very important in this province.

Materials and Methods: In this study 751 cases suffering from cancer were investigated according to ICD_{10} named malignant during 5 years (since 1377 till 1381). 362 cases were selected those suffering from skin, breast, lung, thyroid cancers and leukemia. All data was obtained from health centers and pathological sections of relevant hospitals and statistical test, chi-square, was used for to analyse the data.

Results: The result of this study showed that the prevalence of skin, breast, thyroid and lung cancers and leukemia as compared with total recorded cancers was about 20.5%, 7.5%, 2.6%, 1.1% and 16.2%, respectively. From all studied cases 48.3% were male and 51.7% were female. The total radiation induced cancer risk was greater for women than for men.

Conclusions: The possibility of skin and thyroid cancers and leukemia is high due to the high levels of the natural background radiation in this province. *Iran. J. Radiat. Res., 2003; 1(3): 171 - 174*

Key words: *Natural background radiation, cancers, incidence, Chaharmahal and Bakhtiari.*

INTRODUCTION

The presence of natural background radiation is due to the distribution of radionuclides in the earth and causes exposure to all living organisms. The contents of natural radionuclides as well as the thin layer of atmosphere in the higher altitude regions are reasons why they have high levels of human exposure (Cember 1983, Hollins 1990).

The induction of cancer appears to be the most important effect of low-dose ionizing radiation such as, natural background radiation, to occur in an exposed population (Stewart 1992). However, the induction of cancer by radiation is only detectable by statistical means; that is, the cancer of any given person can not be attributed, with certainty to radiation, as opposed to some other cause. The major site of solid cancers induced by whole-body radiation exposure is breast in women, skin, thyroid, lung, leukemia and some digestive organs (Gustafsson 1983, Stewart 1992).

In general, such studies have been attempted by comparing large groups of people living in areas of higher than normal background radiation average, with similar groups living in low background areas (Jagger 1998, Katayama *et al.* 2002). The results have invariably shown that the effects of the higher radiation are masked by the effects due to other differences in the two groups.

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The conclusion then is that low-dose ionizing radiation and its relationship to induction of cancer is questionable.

In the United States, Jagger (1998) showed a clear negative correlation of natural background radiation with overall cancer death. In Nigeria, researchers (Jibiri 2001) reported that about 160 individuals annually are at risk of incurring cancer due to exposure to terrestrial gamma radiation. Epidemiological evidence from exposed workers and the atomic bomb survivors of Hiroshima and Nagasaki (Katayama *et al.* 2002) showed positive correlation between incidence of cancers and radiation. In high background radiation area of Yangjiang in China (Tao *et al.* 1999) results showed that an increased cancer risk associated with the high levels of natural radiation in high background radiation area was not found. Cytogenetic studies in inhabitants of Ramsar (Ghiassi-nejad *et al.* 2002) showed no significant differences between people in the high background compared to people in normal background areas. All these results show that the correlation between cancer incidence and radiation is doubtful.

Investigations of the dose from natural radiation and its effects on health are of great value as a reference when standard and regulatory control actions on radiation protection are to be done. In developing countries, such as Iran, the main source of human exposure is natural radiation (94%). Recently, researchers focused on some program surveys regarding the induction of cancers in different regions of Iran (Mortazavi *et al.* 2002, Ghiassi-nejad *et al*. 2002). For this reason, the Department of Medical Physics, Shahrekord University of Medical Sciences carried out a survey of cancers incidence relevant to the natural background radiation in Chaharmahal and Bakhtiari province during five years (1377-1381).

MATERIALS AND METHODS

This study was performed in the prospective method, using previously results of the average exposure rate of 49 nGy/h and the annual average effective dose equal to 0.49 mSv in Chaharmahal and Bakhtiari province (Shahbazi-Gahrouei, 2003). This value is higher than the world-wide mean value of 44 nGy/h and is comparable to the annual effective dose equivalent of 0.38 mSv.

This study was performed on 751 cases suffering from cancer, which had been recorded by health centers and pathological sections of relevant hospitals from 1377 to 1381. 362 cases were selected those suffering from skin, breast, lung, thyroid cancers and leukemia. All information such as sex and age of patient was collected. The statistical analysis was performed using SPSS and Excel software. The statistical tests, chi-square and Anova were used for data analysis.

RESULTS

The result of this study showed that the prevalence of skin, breast, thyroid and lung cancers and leukemia as compared with total recorded cancers was about 20.5%, 7.5%, 2.6%, 1.1% and 16.2%, respectively (table 1). From all studied cases 48.3% were male and 51.7% were female.

Table 1. The frequency of studied cancer relevant to the natural background radiation in studied years (1377-1381).

Type of cancer	Recorded cases	Recorded cases compared with cancer relevant to radiation	Recorded cases compared with total recorded cancer
Skin	154	%42.5	%20.5
Leukemia	122	%33.7	%16.2
Breast	57	%15.7	%7.5
Thyroid	20	%5.5	%2.6
Lung	9	%2.5	%1.1

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The possibility of skin and lung cancer and leukemia in men was higher than that of women. In contrast, the possibility of breast and thyroid cancer was higher in women. The total radiation induced cancer risk was greater for women than that for men. Table 2 shows the incidence of studied cancers during different studied years. As can be seen from this table, there is no significance meaningful relationship ($p<0.05$) between the type of cancers and years of study. As table 2 shows, the recorded cancer in year 1381 is much higher than that for previous studied years.

Table 2. The prevalence of lung, thyroid, skin and breast cancers and leukemia relevant to the radiation in studied years (1377-1381).

Type of cancer Years	Total (Percentage)	Lung	Thyroid	Breast	Leukemia	Skin
1377	50 (%13.8)	1	1	8	16	24
1378	59 (%16.8)	2	3	13	15	26
1379	76 (%21.0)	1	4	11	23	37
1380	79 (%21.8)	2	3	11	32	31
1381	98 (%27.1)	3	9	14	36	36

DISCUSSION

Radiation can cause the cell has lost the ability to control the rate at which it reproduces and at low doses it is the only known deleterious health effect. This type of event is very unlikely to occur, and an estimate of its frequency can only be obtained by measuring the effect at higher doses and calculating the probability at low doses.

The carcinogenic effects of ionizing radiation at high doses are unquestionable. On the other hand, the deleterious exposure effects to low doses have not been totally proven, mainly due to methodological problems and difficulty in measuring reliable dose exposure.

The results of this work show that total radiation induced cancer risk is greater for women than that for men. This is because breast cancer occurs almost exclusively in women and thyroid cancer induction by radiation is higher for women than for men (as is the natural incidence). With respect to other cancers, the radiation risks for the two sexes are approximately the same.

As table 2, shows total number of recorded cancer increases with the year of study (in year 1381 the number of recorded cancer was higher than the other years) and this may be due to increases in diagnostic instruments and improvement in recording systems. Although relationship between cancers incidence and radiation is doubtful, but the results of this study shows that the possibility of skin and thyroid cancers and leukemia is high due to the high levels of the natural background radiation in this province.

The findings of this work are in good agreement with some literatures such as Nigeria (Jibiri 2001) and Hiroshima and Nagasaki ((Katayama *et al.* 2002) findings, those showed the positive correlation between incidence of cancers and radiation.

The results from this exploratory study support the need for further studies to document the pattern of relationship among different cancers incidence and radiation. For future experiences, prospective, longitudinal studies with occupational cohorts, measuring radiation exposure with adequate registry and follow-up, are suggested.

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