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Application of Low Doses of Radiation for Curing Cancer

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Abstract

Successful clinical trials of low dose irradiation therapy for curing cancer were carried out in the USA in the 1970s and, more recently, in Japan and France. A cure of colon cancer and a case study of the successful control of a cancer of the blood following this low-dose therapy are reported. The prompt, beneficial response of the patient's blood data to the radiation exposures supports the notion of radiation hormesis in humans. Widespread application of low dose therapy would help many cancer patients and could help to correct misconceptions and resolve the controversy about the biological effects of low doses of ionizing radiation.

Introduction

Beneficial health effects following low doses of ionizing radiation have been observed for more than a century, but such applications fell into disrepute in the early 1930s following incorrect association of such treatments with homeopathy and well publicized cases of large overdoses.[1] Fear of radiation was augmented by the use of A-bombs in World War II and by the subsequent development, testing and stockpiling of very large numbers of nuclear weapons. Fear of low-dose radiation was promoted by well-meaning, ban-the-bomb scientists, and the linear no-threshold model of radiation carcinogenesis - "the LNT model" - which had been formulated in the 1930s, was adopted by regulators to protect people from avoidable exposures to radiation.

The LNT model was challenged by scientists, from the beginning. A comprehensive review of contradictory data was produced by T.D. Luckey in his 1980 and 1991 books on *radiation* hormesis, a particular agent of hormesis – the stimulatory effect of a *subinhibitory dose* of a stressing agent: physical, chemical or biological. His 1982 paper in the Health Physics Journal led Japanese investigators to request an assessment by the US EPRI and to the international symposium in 1985. This event stimulated the start of a large research program in Japan to study this phenomenon.[2] In addition, organizations were formed, such as: Biological Effects of Low Level Exposures (BELLE) to chemicals and radiation, the International Committee on High Natural Background Radiation and Radon Areas (ICHNBRRA), and the International Centre for Low Dose Radiation Research (ICLDRR) at the University of Ottawa. Japanese scientists published many scientific studies, which lent support to radiation hormesis. The controversy among nuclear professionals over the beneficial health effects following low doses, which had been simmering for decades, has become increasingly intense as many of them realized that public fear of radiation is impairing development work and applications in all areas of nuclear technology.[3] Some believe this fear would diminish significantly if the net effect of low doses of radiation could be convincingly shown to be beneficial.

The overall assessment of the origins, history and scientific foundations of radiation hormesis by Calabrese and Baldwin[1] gave additional confidence in the existence of this phenomenon. Pollycove has provided a biological explanation of how low doses stimulate the body's natural defenses to prevent and cure cancers (and other diseases) and how high doses impair these defenses.[4]

The people with the greatest stake in the resolution of the controversy over low-dose radiation are the patients who suffer from cancer and other life-threatening diseases, such as diabetes.[2] Many of them could be treated successfully by low-dose radiation, with negligible side effects, if this therapy was available.

Cancer therapy with low doses of radiation

Administration of low-dose total-body irradiation (TBI) therapy to patients with non-Hodgkins lymphoma, receiving standard chemotherapy and localized high dose radiation of tumors, was reported from Harvard University by Chaffey et al[5] and Choi et al[6], from Tohoku University, Japan by Sakamoto et al[7] and from Institut Bergonie RCC by Richaud et al.[8] The Harvard 1976 and 1979 studies reported that low-dose TBI increased the four-year survival to 70% and 74% of those treated, which is greater than that of the controls, 40% and 52% of those treated, respectively, who received early COP and subsequent CHOP chemotherapy and local high-dose radiation. Similar TBI, or equally effective upper half-body irradiation (HBI), therapy at Tohoku University increased four-year survival to 84% of those treated, which is greater than the survival of the controls, 65% of those treated, who received CHOP and local high-dose radiation therapy. Subsequently, all Japanese patients receiving TBI or HBI survived five additional years, while the survival of the controls at nine years was 50% of those treated. Sakamoto stated that 12-year survival of these 20 patients continues to be 84%.[9] The Bergonie Institut reported that low-dose TBI was very well tolerated, gave a high response rate (83%) and extended recurrence-free survival. Safwat provided a new, positive assessment of this therapy.[10]

Japanese medical scientists have been studying the effects of low doses of radiation on living organisms for more than 20 years.[2] Sakamoto carried out research on mice from the late 1970s.[7] Over the past ten years, he has treated ~150 cancer patients using repeated TBI or HBI treatments of 10 to 15 cGy (rad) – 30 cGy per week for five weeks – a total dose of 150 cGy, and has achieved beneficial results including long-term cures with no symptomatic side effects.

It would appear that many cancer patients† could benefit greatly from this therapy, at little (if any) risk. Unfortunately, low-dose X-ray therapy of metastatic malignancy remains virtually unavailable in the United States, Canada, and Europe due to reluctance of medical practitioners and institutions to employ this form of treatment.

Total body irradiation for Kiyohiko Sakamoto MD

Dr. Sakamoto, at age 66, is himself a survivor of advanced colon cancer. Following surgery to remove tumors in three places, he was in very poor health. After applying his TBI protocol to himself in July 1997 and repeating it in February 1998 as a booster, he recovered to excellent condition.[9]

† In the USA, more than a quarter of human mortality is due to cancers of all types.

Total body irradiation for Edward J. Bauser[11]

US Navy Captain (retired) E.J. Bauser, age 81, has Waldenstrom's Macroglobulinemia – a rare cancer of the blood – another incurable lymphoma. With the present median survival rate of five years, there are between 6000 and 12,000 people with this disease in the United States at any one time; the incidence rate is approximately 1000 per year.

Mr. Bauser explained that the problem is the overproduction of a normal protein, IgM, in his bone marrow where both the lymphoma and new blood cells grow. Not only does this impair (starve) production of new white cells, red cells and platelets; the very high concentration of this protein makes his blood very thick, putting a strain on his heart. It also leads to strokes and other problems. The symptoms normally associated with this disease are weakness, fatigue, drowsiness, fever and other symptoms.

The disease was first diagnosed in 1992, during analysis of a sample of his bone marrow. Regular blood tests followed for several years as plasma viscosity and IgM concentration continued to increase to the point where his marrow was fully packed with lymphoma cells. The IgM concentration in the blood reached ~4000 mg/dL, well above the normal range of 50 to 330.

In January 1998, Bauser was placed on oral chemotherapy (Chlorambucil, which is also a carcinogen, and Prednisone) for six months. During this treatment, he experienced nervousness and extreme sleeplessness, but the IgM and plasma viscosity decreased to about one-half of the highest readings. This treatment had to be stopped because complete loss of the marrow blood cell system can result from over-medication.

The symptoms of the disease began to return after the termination of the chemotherapy. Bauser's colleague from the Rickover nuclear submarine propulsion program, Dr. Ted Rockwell, informed Bauser about a low-dose, total-body irradiation (TBI) therapy which had been developed in Japan. It appeared to have no adverse side effects. Bauser contacted Dr. Myron Pollycove, who was familiar with this medical protocol, and eventually more than a dozen medical and radiation oncologists at various medical institutions in the US. He asked whether they would agree to perform this irradiation procedure on him, but was unable to arrange for the procedure at any of these institutions. He said the responses ranged from outright abhorrence of the concept, to an interest in performing the procedure, but begging off for a variety of reasons. Bauser was also told that his bone marrow blood cell system would be completely destroyed by such a treatment.

Dr. Pollycove referred Capt. Bauser to Dr. James S. Welsh at the Johns Hopkins Medical Center in Baltimore. Being disappointed with the partial effectiveness of chemotherapy and remembering his suffering, Bauser refused additional chemotherapy and requested the TBI therapy instead. Dr. Welsh reviewed all of the Harvard and Japanese data on the procedure and concluded it had sufficient merit and a low enough risk to justify its use.

During a subsequent visit to his earlier oncologist, a new pharmaceutical for another round of chemotherapy was proposed. (There are now half a dozen chemotherapeutic procedures being prescribed for this disease.) However, when Bauser informed this oncologist that he was undertaking TBI, the doctor declined him further patient status.

Dr. Welsh began the TBI therapy at Johns Hopkins on September 10, 1999 and completed it on October 11. The doses were 15 cGy, twice a week, for five weeks – ten exposures totaling 150 cGy. Bauser experienced no discomfort whatsoever from this procedure. As shown in Table 1, his IgM readings improved from ~4000 to ~1600 protein mg/dL, which is similar to the improvement achieved with chemotherapy a year before. His spleen, which had enlarged as a symptom of the illness, decreased 30% to normal size following the TBI therapy. The viscosity of his plasma decreased: 3 to 1.7.

Due to marrow sensitivity, the TBI therapy depressed the platelets and white blood cells somewhat, but they returned to normal within 1-2 months. The red blood cell count decreased by only 17% and recovered.

Some months after TBI therapy, the IgM reading began to increase again, reaching 3200 mg/dL in April 2000. Bauser was examined and found to be in healthy shape, "for a person of any age." Dr. Welsh then administered a booster series of the same low-dose irradiations, from April 21 until May 23, but limited them only to the spleen. (Sakamoto's research on mice[7] suggested that low-dose irradiations, localized to the spleen, would produce a beneficial effect like that of TBI, with insignificant marrow suppression.) The IgM concentration stopped increasing, and the June 20 blood sample showed a decrease to 2470 mg/dL, with no decrease of blood platelets or white blood cells.

Bauser praises his association with the Johns Hopkins Medical Centre – "a fine, highly professional organization. I have never been treated with such consideration; they care!" He is quite optimistic about the prospects for success and is keen to cooperate in any reasonable way in the development of knowledge on this radiation procedure. He hopes it will allow him and others to avoid the sickening side effects and complications of chemotherapy.

Conclusions

The prompt, favourable responses of the IgM concentration and plasma viscosity to these applications of low-dose therapy supports the notion of radiation hormesis in humans.

The ease of application, short duration and lack of any significant, adverse side effects suggest this therapy is advantageous for treating cancer, by stimulating the body's natural defenses. Yet many oncologists seem to be very reluctant to employ low-dose irradiation therapy.

Widespread use of this therapy for cancer and study of its applications for treating other diseases would help resolve the controversy over the beneficial effects of low doses of ionizing radiation and lead to greater public acceptance of all nuclear technologies.

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Table 1. Diagnostic data regarding treatment of Edward J. Bauser for Waldenstrom's Macroglobulinemia[11]

Date	IgM mg/dL	PVIS Plasma viscosity	PLTS Platelet count x1000/mL	HgB Hemo-globin g/dL	T Help Cells/mm^3	TH/TS Ratio of helper to suppresser	CD4 cells/mm^3	NK Natural killer cells per mm^3	WBC White blood cells per mm^3	RBC Red blood cells x10^6 per mm^3	PCV packed cell volume	Spleen volume cm^3
Normal	50-330	1.3-1.8	150-400	14-17	variable	changes in life		changes in life	4k to 11k			
Chemo												
1998 Jan	4080	3.3	300	9.9								
1998 Jun	1605	1.8	100	12.4								
TBI												
1999 Aug 31	4170		335	11.1	43.1	1.32	637 43.0		7680	3.75	34.1	
1999 Sep 07	3870	2.9										100.4
1999 Sep 16			301	10.8	48.3	1.43	659 48.3	16	7050	3.63	32.6	
1999 Sep 23	4040	3.1	301	11.2	54.5	1.67	808 54.5	14	5280	3.74	33.7	
1999 Sep 30			199	10.8	52.6	1.62	745 52.6		5450	3.59	32.8	
1999 Oct 07			95	10.8	54.1	1.71	589 ----		3600	3.61		
1999 Oct 11	2530	2.2	74	10.8	55.9	1.65	654 55.9	9	3930	3.53	32.5	72.4
1999 Oct 19	1770	1.9	73	11.1					2200	3.47		
1999 Oct 27			69	10.9					2200	3.41		
1999 Nov 03	1630	1.8	134	11.9					2500	3.57		
1999 Nov 10			174	10.6					2600	3.11		
1999 Nov 17			171	10.9					3600	3.33		
1999 Nov 18			178	11.4					3600	3.38		
1999 Dec 01	1794		266	12.1					5400	3.61		
1999 Dec 31	2420		211	12.9					4800	3.88		
2000 Jan 28	2540	1.7	228	12.4					5400	3.81		
2000 Mar 06	2760	1.9										