



Investigation of Cobalt radiation on the Heart of Rat

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ABSTRACT

The objective of this experiment was to evaluate the influence of Cobalt radiation on heart of Wistar rats weighing 160 to 180 gr. A total of 60 rats were divided into 4 groups with 15 rats each. T1, First group as control group did not receive any radiation, T2) was irradiated with 5 Gy, T3) was irradiated with 7.5 Gy, T4) was irradiated with 12 Gy. These findings demonstrate dosage dependent changes in different parts of the lung tissue. The muscular strings of heart were narrowed and became atrophic which led to the gap between heart muscular strings (edema) in groups 2 and 3 while, rupture and necrosis can be seen in group 4.

KEY WORDS: Cobalt, Irradiation, rat, necrosis, Lung.

INTRODUCTION

Radiation may be used as adjuvant or primary therapy in a variety of tumors in the chest, abdomen and pelvis. Therapeutic radiation affects not only malignant tumors but also surrounding normal tissues. The risk of injury depends on the size, number and frequency of radiation fractions, volume of irradiated tissue, duration of treatment, and method of radiation delivery. Combination of surgery, chemotherapy and radiation treatment are the mainstay of the modern cancer therapy [1]. Studies from exposed human and animals indicate that radiation from cobalt can affect a wide variety of tissues with greater levels of cellular divisions [2], Necrosis and inflammation were the key features of high dose radiation injury. Exposure to the moderately low doses of cobalt 60 radiation has resulted in decreased body weight [3]. In patients with breast cancer, the combination of lumpectomy and radiation therapy as primary treatment has become more commonplace. Studies from exposed human and animals indicate that radiation from cobalt can affect a wide variety of tissues particularly those with greater levels of cellular turnover and divisions also expose to the Moderately low doses of cobalt-60 radiation has resulted in decreased body weight and organ weight [4-6]. Radiation injury to the heart can manifest in many different ways. Therapeutic radiation can cause damage to the pericardium, myocardium and vasculature of the heart. The incidence of pericardial disease is related to the dose, fraction size, volume irradiated and technique.

At doses below 40 Gy, the incidence is low ranging between 2 and 6% [7-8]. Moderate sized mediastinal fields have a 1% incidence of pericardial disease that rises to 17% when the fields are larger with treatment of extensive disease [8]. The purpose of the present study was to investigate the impact of cobalt irradiation on the heart tissue response to cobalt irradiation.

MATERIALS AND METHODS

Sixty adult male and female Wistar rats were used in this experiment. Animals were housed under standardized conditions for light and temperature. A commercially prepared diet and clean drinking water were provided ad libitum. The rats were anesthetized with an intraperitoneal injection of mixture of ketamin (80mg/kg) and xylazine (8 mg/kg) prior to irradiation. Rats were randomly divided into four groups (n=15/group) and three groups were irradiated with 5 Gy, 7.5 Gy and 12 Gy, on the whole body for 10 to 15 minutes. The first group served as normal control. Irradiation was performed through the use of cobalt 60 rays with the device from a Canadian company Tretron, model Phoenix, belonging to the Cancer treatment center of Omid hospital, in Urmia. The cobalt radiation was administered to the body using a 250 kv orthovoltage system. A custom designed positioning device based on the standard steriomatic frame was used so that 15 animals could be simultaneously irradiated. Dosimetry was performed by implanting lithium fluoride

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thermoluminescent dosimeters into various areas. The corrected dose rate was determined to be 205/69c GY/min and irradiated with a distance of 7.5 cm on the field of 35x35 in the dorsoventral axis.

During 30 days after irradiation behavioral changes and other changes, mainly on the body surface, and lethality were recorded. The surviving rats at the end of experiment were sacrificed with carbon dioxide.

Samples for histological analysis were processed by commonly used methods. Whole lungs were fixed in %10 formaline.

RESULTS AND DISCUSSION

On the first day after the irradiation the animals were very lethargic. However the apparent lack of gross evidence of any severe effect for several days was unusual. About the fifth to sixth day following exposure weight loss and ruffled fur were observed in group one and by eight day some of them died. Daily mortality increased by 10th to 14th day then subsides. When the radiation increased to 7.5 GY somewhat different pattern of illness and death occurred. The animals in this group were severely injured by the day 3rd to 4th. Loss of weight were pronounced and by the fifth day some of them were dead. There was a sharp peak of mortality. None were survived beyond the 2nd week. The animals which received the highest dose of irradiation were severely prostrated, very wet with sweat and by the second day some of them were already dead by the 3rd day. All the rats in this group died in the 1st week period. Result of quantitative analysis of structural disorders in the muscular strings of heart were narrowed and became of atrophic which led to the gap between heart muscular strings (edema) in groups 2 and 3. While, rupture and necrosis can be seen in group 4. Blood is observed in the spaces of heart muscular strings. A vein in the heart is shown in group 3 which is of degeneracy of fibroids. The wall of hyaline vein becomes monotonous and the cells of endothelium are swollen. (Fig1). Radiation pericarditis generally presents 6–9 months after therapy and the majority of cases occur within 12–18 months of therapy [9]. Both pericardial effusions and pericardial fibrosis are known to occur. Pericardial effusions can be small and incidental findings or large enough to require intervention. Eccentric effusions may occur likely due to adhesions of the treated pericardium [10]. Fibrosis of the myocardium can also occur and is aggravated by the use of cardiotoxic chemotherapy with agents such as doxorubicin [11]. The incidence of myocardial infarction is higher in patients treated for left breast carcinoma than in patients treated for right breast carcinoma as would be expected with the portals used [12].

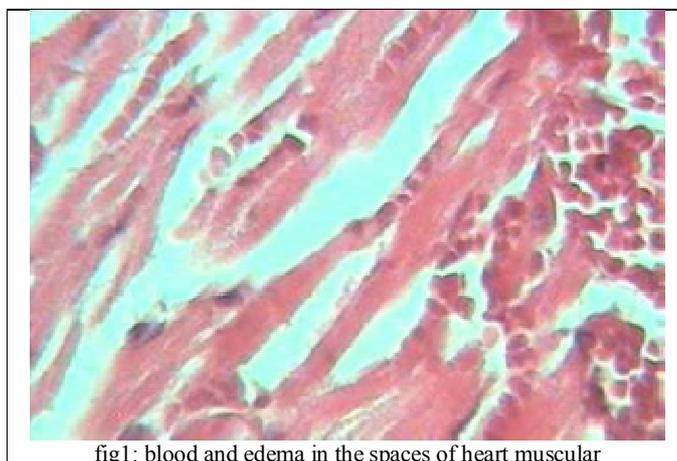


fig1: blood and edema in the spaces of heart muscular

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