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Effect of Chronic Exposure to X-Ray on the Heart and Aorta in Male Albino Rats: Histopathological Study

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***Abstract*— This study was designed to investigate the effect of the X-ray in the cardiovascular system of adult male albino rats. Ten adult male rats were randomly divided into groups 5/group control group while the treated group was exposed to 300KV/2M daily for 1 month. The histological section of the heart of the treated group showed damage to muscle fiber, mild damage in the intercalated disc & congestion with inflammatory cell infiltration, compared with the control group. In contrast, a histological section of the large artery showed thickening in the endothelium with adhered damaged cells &foamy cells found in the subendothelial layer, in conclusion, exposure to the x-ray caused tissue damage in the heart and large artery.**

***Keywords* — X-ray, heart, Aorta, histopathological studies,rats.**

I. INTRODUCTION

X-RADIATION and gamma radiation are both part of the electromagnetic radiation spectrum. Similar to the assertion that matter comprises atoms, electromagnetic radiation consists of photons. The energy of gamma radiation and X-radiation is sufficiently high to disrupt atomic and molecular bonds, resulting in ionization and alterations in matter, including living cells. This high-energy segment of the spectrum is termed 'ionizing radiation' (1). Exposure to ionizing radiation induces effects that impact all systems of the organism. The nature and frequency of such effects are significantly influenced by the absorbed radiation dose and the exposure conditions (2).

Irradiation is the standard therapeutic approach for cancer patients. In addition to its cytotoxic effects on malignant cells, it may also influence the biology of surviving cells (3). Radiotherapy is an effective treatment for oral cancer when used in conjunction with surgery. Nonetheless, irreparable harm transpires to unblemished bone tissue following therapeutic irradiation, contingent upon the dosage of ionizing radiation administered (4).

Fetuses exhibit varying levels of sensitivity during different stages of gestation. Fetuses exhibit heightened sensitivity to radiation throughout their early developmental phase, specifically between weeks 2 and 18 of gestation. The health repercussions can be grave, even at radiation levels insufficient to induce illness in the mother. Consequences may encompass inhibited growth, abnormalities, aberrant brain function, or cancer that could manifest later in life (5). X-ray inspection is a widely utilized method for assessing the quality of solder joints on surface-mounted BGA packed devices on circuit boards. It is well recognized that semiconductor integrated circuits can incur damage from (dis)charging effects induced by X-ray energy (6).

X-ray apparatus are essential instruments in diverse fields of contemporary research. However, the x-rays generated by such technology can present a risk to human health. Consequently, specific care must be adhered to when use these devices (7).

Irradiation of embryonic cells can result in rapid cell death, nuclear pyknosis within hours, congenital abnormalities, and cancers that may manifest after a variable latency period (8). Epiphyseal cartilage plates. Significant modification of the epiphyseal cartilage was a prevalent characteristic in nearly all of the irradiated subjects (9).

Additionally, observe parturient abnormal fetuses exhibiting microcephaly and cognitive impairment in mothers exposed to radiation during gestation (10). Observe current nodules measuring less than 0.5 mm in diameter and discrete foci of thyroid tissue that have only minor differences from the surrounding parenchyma (11).

Following 20 days of exposure to mobile phones, a substantial

increase in brain tissue was seen (12). Ten days post-irradiation, the quantity of spermatogonia is significantly diminished, particularly in the tubules next to the testicular surface (13).

II. Materials and Methods

This study was conducted on laboratory animals, which ranged ages between 4-5 months, ranged weights between 200-250gm, figure (1).

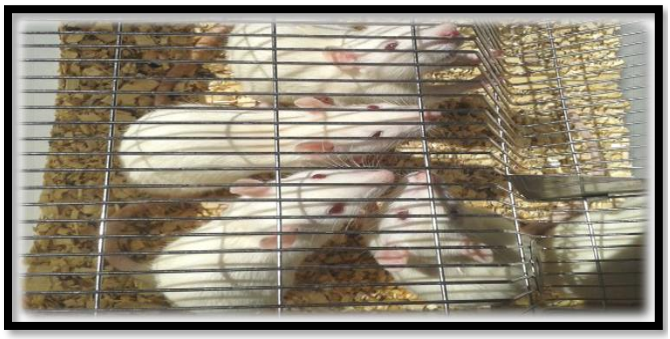

Figure 1: explains adapted rats

Rats exposed to x-rays which were given daily doses worth 300 kV for a period of 30 days where exposed to direct rays were placed near the radiographic device inside the radiographic room in the laboratory, figure (2).

Figure 2: x-ray apparatus used in radiation the animal

Retain the rats in the laboratory until they accumulate the radiation dose emitted by the radiographic device at 300 kV, noting that the dose administered to each patient varies by user or exposure location. Subsequently, the rats are transferred to a remote laboratory, where the cages are cleaned and disinfected with alcohol before being switched out. The band returned the following day and underwent the requisite quantity of radiation, among other procedures.

Following 30 days of irradiation, the rats were euthanized using chloroform, and the samples were preserved in 10% formalin after the animals were eradicated.

To examine the impacted animals, X-ray tissue sections were analyzed in medical Sadr City, utilizing the sophisticated technique delineated by Presell & Schreibman, 1997.

III. Results and Discussion

The treated animal group were exposed to x-ray for 30day showed behavior disorder like anorexia, hair loss with depression & white spots on the tail, figure (3 and 4).

Figure 3: shows swelled the body of animals exposed for X-ray for period one month

Figure 4: shows white spot 0n tail skin of treated groups.

The histological portion of the heart in the treated group exhibited muscle fiber degeneration, loss of intercalated discs, and congestion with infiltrating inflammatory cells, in contrast to the control group. These findings align with those of other investigators. Moreover, certain researchers (17) noted that x-ray exposure resulted in thickening of the endothelium, with adhered injured cells and foamy cells present in the subendothelial layer, in contrast to the control figures (12, 13, and 14).

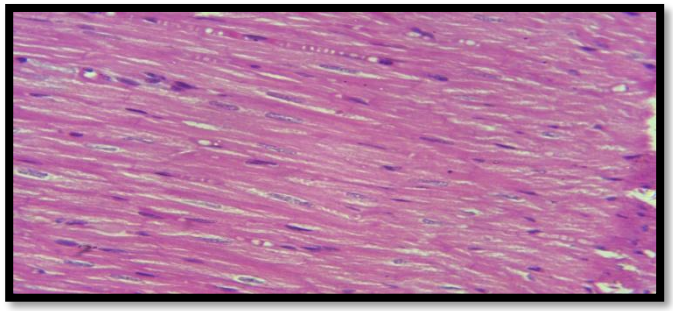

Figure 5: histological section in the heart of control group shows normal structure (E&H 40x).

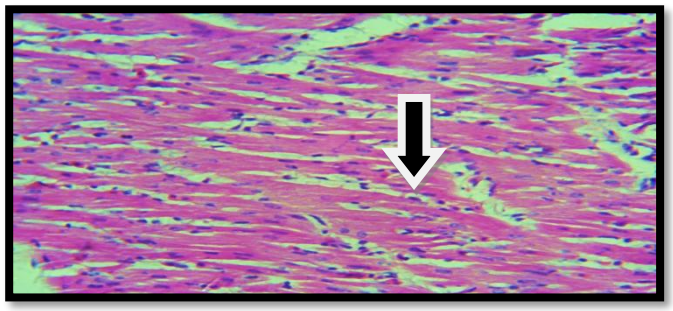

Figure 6: histopathological section in the treated group shows cardiac cells(H&E40x)

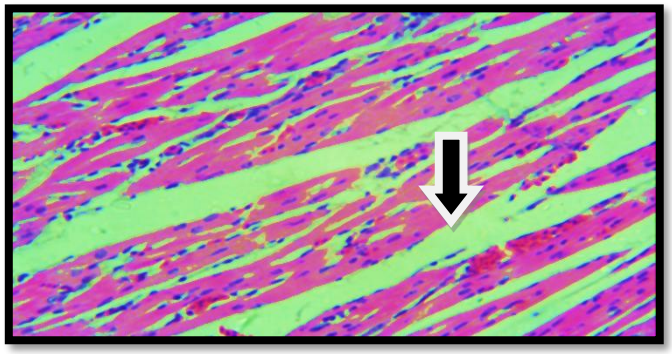

Figure 7: histopathological section in treated group shows cardiac cell necrosis with hemorrhage(H&E40x).

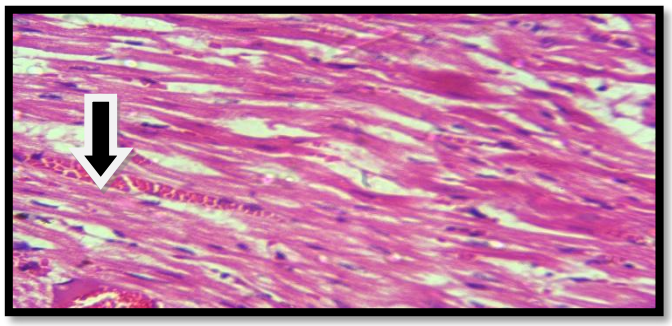

Figure 8: histopathological section in treated group shows damage in cardiac cell with hemorrhage (H&E40x).

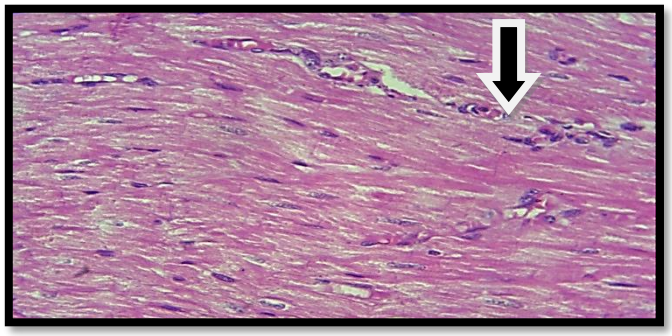

Figure 9: histopathological section in treated group shows inflammation in muscle-fiber of heart represent in present inflammatory cells (H&E40x).

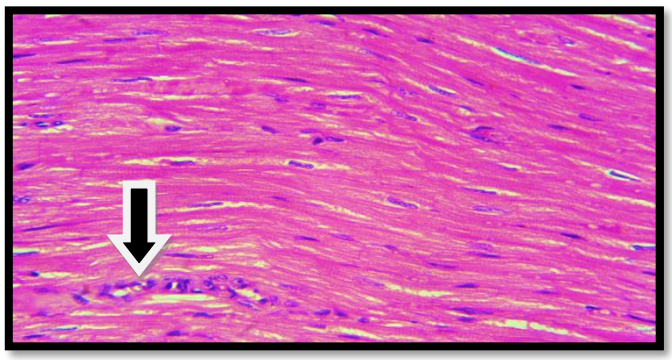

Figure 10: histopathological section in treated group shows inflammation in muscle fiber of heart represent in present inflammatory cells (H&E40x).

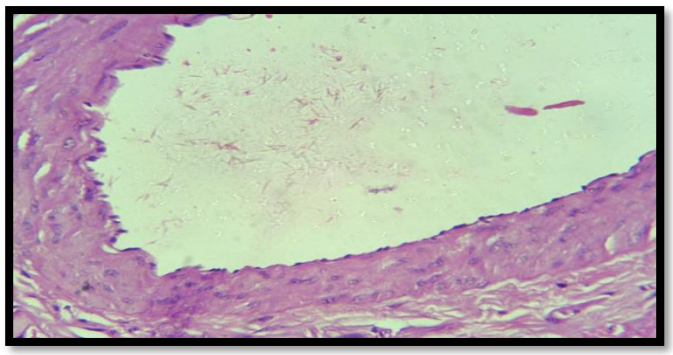

Figure 11: histological section in control group shows normal structure of large artery (H&E40x).

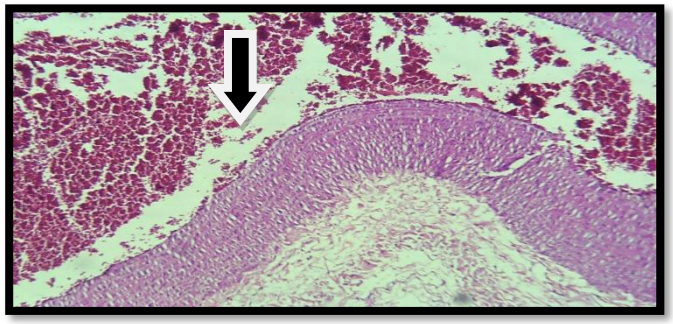

Figure 12: histopathological section in treated group shows thickening in the endothelium with adhere damaged cells (H&E40x)

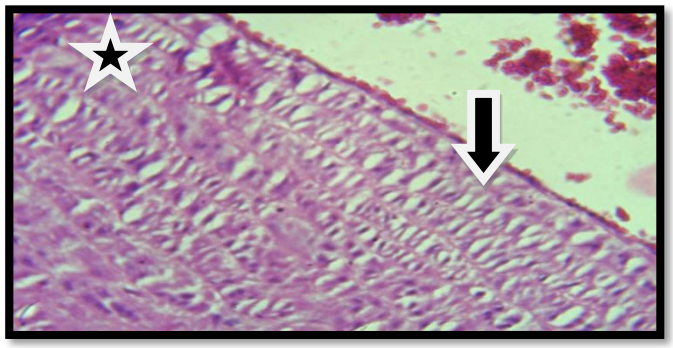

Figure 13: histopathological section in treated group shows thickening in the endothelium with adhere damaged cells& foamy cells found in the sub-endothelial layer (H&E40x).

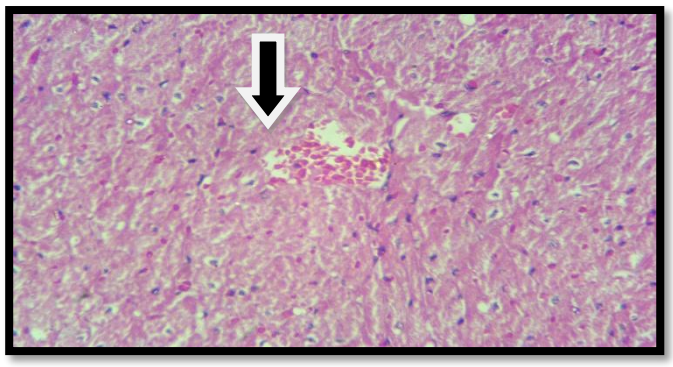

Figure 14: histopathological section in treated group shows damaged with hemorrhage in sub-endothelial layer (H&E40x).

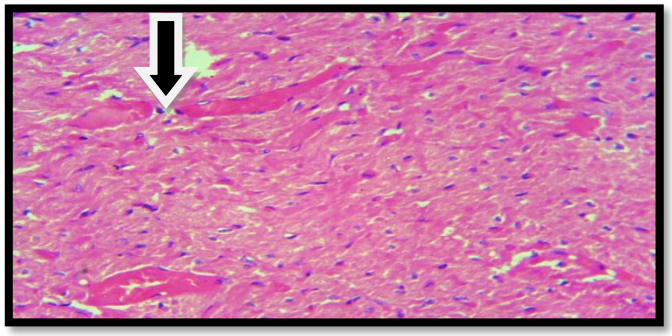

Figure 15: histopathological section in treated group shows damaged cells with hemorrhage in sub-endothelial layer (H&E40x).

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