Radiation Biology

Oral Presentations:

0044

In vitro effect of low level ionizing radiation on endothelial progenitor cells from atherosclerotic patients with lower limb ischemia

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The volume of medical imaging procedures incorporating ionizing radiation (IR) for treatment and evaluation of atherosclerotic conditions has been growing rapidly. Endothelial progenitor cells (EPCs) designed as CD34, CD133 and KDR are thought to play a central role in vascular repair. Little is known about the effects of IR on the levels of circulating EPCs. Accordingly, the aim of the present study is to identify effect of IR on circulating EPCs *in vitro*. Frequency of micronuclei and apoptosis within such cells together with changes in lipid peroxidation and nitric oxide were evaluated. Peripheral blood were collected from atherosclerotic patients with lower limb ischemia and healthy controls. After separation of mononuclear cells, the latter was exposed to 0.25 Gy. Levels of of CD34, CD133, KDR and $CD133^{+}KDR^{+}$, late and early apoptosis were evaluated by flow cytometry. Results showed that *in vitro* irradiation significantly increased the percentages of CD34, CD133 KDR and $CD133^{+}KDR^{+}$ mononuclear cell surface marker 24 hours post irradiation compared to its level before irradiation. The percentage of early apoptotic progenitor cells was significantly higher in atherosclerotic patients than in the controls and was significantly increased post irradiation. In conclusion Low dose ionizing radiation induces *in vitro* endothelial progenitor cell proliferation. The present study suggests that *in vitro* exposure to 0.25 Gŷ induces *in vitro* endothelial progenitor cell proliferation. Further studies should be conducted to whether CD34, CD133 and KDR can offer ideal markers for assessing low dose IR exposure.

0067

The safety of Using Irradiation to Improve Yield and Nutritional Constituents of Sorghum (*Sorghum bicolor*), Using Albino Rats Fed on them as a Biomarkers by: Mutaman Ali A. Kehail[1]; Yagoub A. Ali[2]; Noha A. Mohamed[1]; Yasir M. Abdelrahim[3]

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Sorghum, the world's fourth major cereal in terms of production, is a staple food crop of millions of poor in semi-arid tropics of the world. The objective of this study was to investigate the safety of using X- ray, Gamma ray and UV light to improve yield, nutritional constituents of sorghum (*Sorghum bicolor* (L.) Moench), by testing the renal and liver function parameters of Albino rats fed on these irradiated sorghum seeds. Sample of sorghum seeds was brought from the local market, cleaned manually, divided into six groups and put in clean Petri dishes. Four groups were treated with low and high doses of X-ray and gamma ray, one group was treated with the UV light, while the last was the control. The nutritional contents and the yield component of four successive generations (F1-F4) were carried out, in addition to determination of minerals. Fifteen Wister Albino rats were weighed and distributed randomly in six groups according to their irradiated sorghum feed. After 60 days, blood samples of the Albino rats were collected

from the retrorbital sinus. The blood serum was separated using centrifuge. Renal function and liver function parameters were determined. The results showed that, the productivity of most irradiated samples were far more than the control specially in F3. In all generations, irradiation affected slightly the nutritional contents comparing to control. The mutant sorghum seeds were safer to be used (no significant differences in renal and liver functions on the Rats). Similar studies on other crops should be run.

0082

National Biodosimetry Laboratory for the Assessment of Radiation Overexposure in Saudi Arabia

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Cytogenetic biodosimetry is a proven, ISO and IAEA standardized biotechnology technique for calculating medically relevant radiation doses. We have developed biological dosimeters to help the nation's ability to respond to sporadic and mass radiation casualty incidents. Accurate calculation of radiation doses received result in evidence based treatment decisions and better management of valuable emergency resources. The cytogenetic method is standardized and scalable. In addition to diagnosis of overexposure, it provides triage capability for rapid stratification of patients who need more specialized medical care. It can also detect false positives and false negatives exposure particularly in cases of legal allegations.
The dose-response calibration curve for dicentric chromosomes, pre-required to estimate doses received, was established and a standard calibration curve was determined in Saudi individuals and networked with international BioDoseNet in cooperation with IAEA/WHO. Being the first in the region, the formation of this expert laboratory in biodosimetry may have an impact on the ability of Saudi Arabia to respond to nuclear events. The various activities of this reference biodosimetry laboratory can also provide officials with tools to distinguish affected from the worried individuals, and alleviate public concerns about the health effects of possible radiological exposures. It also adds depth to information for decision-makers and public health officials who assess the magnitude of public, medical, occupational and accidental radiation exposures in addition to providing a platform for advanced education, research and development. Supported by the National Science, Technology & Innovation Plan KACST-NSTIP Project number 9-MED749-20 (RAC# 2110 005) and 15-MED4114-20.

0084

Role of HPV Infection and Integration in Cervical, Colorectal, Breast and Head & Neck Cancers in Saudi Arabia

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The involvement of HPV infection in uterine cervix, head & neck (H&N), colorectal and breast cancers in Saudi patients is not fully defined. The aim of this study is to determine the distribution of HPVs infections and genotypes in these cancers, pathological association with p16 protein expression and potential HPV integration based on the assumption that in invasive tumors, the viral DNA is integrated into the host genome while in benign tumors the integration is rare. Since integration often disrupts the E2 gene, the

assay is based on the quantification of E6 relative to E2 DNA. Paraffin-embedded tumor samples from more than 600 patients treated for cervical (n=200), H&N (particularly oro-pharynx; n=200), colorectal (n=100) and breast (n=100) cancers are being examined. Response to cancer treatment is examined for possible association with HPV status, p16 protein positivity and HPV integration. So far we have processed more than 300 samples for HPV detection and genotyping. Detection of HPV-16 physical status (integration) using qRT-PCR technique. HPV was detected in 160 cervix and 4 oropharyngeal cancer patients (75% and 2%; respectively). Seven different single HPV genotypes (16, 18, 31, 45, 56, 59, 73) and 5 double infections (16/18, 16/39, 16/70, 35/52, 45/59) were detected. The most common genotype was HPV-16 (71%), followed by 31 (7%), and 18, 45, 73 (4% each). Testing HPV integration in 81 cervical cancers indicated that about one-third of samples have highly integrated HPV-16 in the host genome. Supported by NSTIP-KACST 12-MED2945-20 (RAC#2130 025).

0147

Biological and Health Effects of RF/MW Radiation on the Liver of Albino Rats

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This research was an attempt to determine the effects of radio frequency (RF) and microwaves (MW) radiation emitted from a mobile phone base stations on the liver of Wister albino rats(Rattus norvegicus Album). A number of ninety six male rats were exposed to three radiation levels (10.5 µW/cm^2, 0.6 µW/cm^2 and zero level). The experimental animals were divided into three groups, 32 each. Group A, serves as the control, was not radiated. Group B, was exposed to radiation of power density 10.5 µW/cm^2 and at a distance of 10 meter from the base of transmitter. Group C received radiation with power density 0.6 µW/cm^2 at a distance of 50 meter from the base of tower. Eight rats of each group were examined after six weeks and were then removed from the experiment. After 12 weeks, another eight rats of each group were tested to investigate the effects of base-stations radiation.The radiated rats were exposed for 12 hours/day; throughout the exposure periods. Histopathological studies were conducted to investigate the structural changes in the liver tissue after exposure to the tested radiation. The results showed clear alterations in all the investigated parameters: growth, behavior and anatomy. The microscopic investigation indicated that the irradiated rats showed many changes in their livers structure e.g. cell necrosis, disappearance of nucleoli, congestion, hemorrhage and inflammatory hepatic cells. The present findings suggest that exposure to mobile tower radiation can cause real damage to the rats livers and modify the rat's liver structure at tissue level.

Posters

0020

The bilogical effect of Microwave Radiation MWR emitted from Wireless device on Rats blood

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In this research the effects of radiofrequency radiation emitted from wireless internet device on rats blood were studied .the experimental animals was divided into two groups. Group one located near the radiation device serve as exposed group, while the other group set free from radiation and represent control group.

The exposed group was radiated continuously to radiation emitted from wireless device for 21 days, by the end of exposure period the rats were scarified , blood samples were collected in specific containers. Some physical, chemical and biological parameters were tested. The results shown that there is a clear decreasing in blood conductivity for exposed, also the absorption spectra for this group was increased comparing to the control one. The blood film for exposed group was showed break in the RBCs. Some behavioral changes was observed in the exposed group.

0038

Levels of Some Trace Elements in Serum of Esophageal Cancer Patients

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The association of serum trace elements like selenium, zinc, iron, cobalt and rubidium has been found in different types of cancer. This study was conducted to see the serum level of these five trace elements in cancer esophagus patients for the purpose of medical research. Biopsy confirmed cancer esophagus, 40 patients with 36 healthy subjects were included in this study. Both control and study group patients were of same socio-economic status and dietary habits. Instrumental neutron activation analysis was used to estimate contents. Wilcoxon signed ranks test was used to examine if there was any difference in the concentrations of elements from normal and malignant tissues. It was found that Se, Zn, Fe, Co, Rb elements from the malignant serum are significantly elevated ($P < 0.05$) compared to the normal serum. We observed significant low serum levels of selenium and zinc while high level of serum iron, cobalt and rubidium in carcinoma esophagus patients as compared with normal healthy controls. This shows an association of serum of these trace elements with cancer esophagus. The results obtained have shown consistency with results obtained by some previous studies.

0089

Biomarkers of Radiation Sensitivity and the Association with Genetic SNPs and Cytogenetic CNVs

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The potential stochastic and deterministic consequences of radiation exposure depend on dose and the individual's susceptibility to radiation injuries. Radiogenomic hypothesizes that single nucleotide polymorphisms (SNPs) and cytogenetic copy number variations (CNVs) may associate with individuals' radiosensitivity and be markers of predisposition to radiotoxicities.
To identify SNPs linked to radiation risk we followed two approaches, candidate genes involved in radiation response (TP53 codon 72, HDM2 promoter 309, CDKN1A C31A, ATM G1853A, XRCC1 G399A, XRCC3 C241T, XRCC5 A2790G, Ligase-IV C9T, DNA-PKcs A3434G, and TGF-B T10C) and genome-wide association study (GWAS) with CNVs using the "Whole-Genome 2.6M CytoScan cytogenetics arrays". The study included 124 fibroblast strains.
Results showed that the surviving fraction at 2Gy (SF2) ranged between 0.12 and 0.49 (mean = 0.33, SD = 0.087) indicating wide range of radiosensitivity between individuals. The mean SF2 divided the cell strains into radiosensitive (cases=61) and normal (controls=63). Genotyping of SNPs showed significant association between SF2 and allelic frequencies of ATM codon 1853 G/A, XRCC1 399 G/A ($P \leq 0.05$). GWAS results showed significantly higher CNVs post-radiation in radiosensitive strains ($P=0.0002$).

We conclude that certain genetic variations (SNPs haplotypes and CNVs) are associated with decrease in radiosensitivity. These may underlie chromosomal fragility to clastogenic agents remnant of syndromes such as ATM, ATLD, Ligase-IV deficiency, NBS and Fanconi Anemia. The identification of the genetic loci (risk alleles and CNVs) could be used as predictive markers to personalized medicine to individualize radiation treatment of cancer patients and stratify risk of radiation exposure. Supported by NSTIP-KACST (11-BIO1429-20; RAC#2120 003).

0092

Measurements of Frequent Induction of Giant-nucleated Cells In The Progeny of Normal Human Fibroblasts After Exposure To Low-energy Proton Beam Irradiations In Vitro

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Radiation-induced giant-nucleated cells (GCs) is occurs in the progeny of irradiated populations during or after cell division. Although the potential fate of most of the GCs is death, however, some of them may escape instead divide to asymmetrical semi-normal daughter cells. In this study, normal human foreskin fibroblasts (AG1522) were exposed to a single equivalent clinical dose of 0.2, 1 or 2 Gy of low-energy proton beam irradiation. After irradiation, the AG1522 cells were incubated and maintained active for up to 24 population doublings (PDs). At different intervals, a fraction of cells from each dose point including control (non-irradiated cells) were fixed and labeled with a DNA fluorochrome reagent and imaged microscopically then analysed using a cell-recognition MATLAB code. The yield of the GCs formed in the progeny of either irradiated or control populations was measured at 8, 16 and 24 PDs after irradiation. Our results demonstrate that the induction of GCs in the proton survivors was increased in a dose-dependent manner at 8 PDs. However, the frequency of GCs formed in the 0.2 Gy populations was significantly higher than those formed in the control populations at the statistical significance level of 5% ($p < 0.05$). These results are expected to have implications for studies aimed at evaluating the effectiveness of proton therapy treatment and determining the risk estimates for the low-doses of radiation received by normal cells adjacent to a targeted tumour volume during treatment.