Effects of Nigella Sative Oil, Thymoquine, Propolis, and Caffeic Acid Phenethyl Ester on Radiation-Induced Cataract

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PURPOSE

The aim of this study was to investigate the antioxidant and radioprotective effects of Propolis and Caffeic acid phenethyl ester (CAPE), Nigella sativa oil (NSO) and Thymoquinone (TQ) against ionizing radiation-induced cataracts in lens after total cranium irradiation of rats with single dose of 5 Gy 60 Cobalt gamma rays.

METHODS

Seventy-four Sprague-Dawley rats were divided into eight groups to test the radioprotective effectiveness of nigella sative oil, thymoquine, propolis or caffeic acid phenethyl ester administered by either orogastric tube or intraperitoneal injection. Appropriate control groups were also studied. Cataract developments in the different treatment groups were compared with Fischer's exact Chi-square test. Statistical and correlation analyses were undertaken using a one-way variance analysis and Spearman's rank correlation test, respectively. Following the analysis of variance, the significance of differences between groups was analyzed using post-hoc LSD test procedure. Acceptable significance was recorded when P values were <0.05. Statistical analysis was performed with Statistical Package for the Social Sciences for Windows (SPSS, version 11.5, Chicago, IL, USA).

RESULTS

Chylack's cataract classification was used in the study. At the end of the 10th day, cataracts developed in 80% of the rats in radiotherapy group. After irradiation, cataract rate drop to 20% in NSO, 30% in Propolis, 40% in CAPE, and 50%in TQ groups which treated with these substances, respectively, and was limited at grade 1 and grade 2. Cataract formation was observed at least in NSO group, and at most in TQ group. Superoxide dismutase activity was lower in IR group while glutathione peroxidase, xanthine oxidase activities and malondialdehyde level in the IR group were higher in this group when compared to the other groups. Total superoxide scavenger activity and nonenzymatic superoxide scavenger activity were not statistically significant in IR group compared with the other groups.

DISCUSSION

Most individuals are exposed to ionizing radiation from radiotherapy or from diagnostic or therapeutic procedures that involve radionuclides in nuclear medicine. It is accepted that ionizing radiation is an important modality for the treatment of human malignancies. However, acute and late toxicity of the radiation on normal tissues limits its role in cancer treatment. The aim of radiotherapy is to kill cancer cells while causing as little damage as possible to normal cells. Ionizing radiation generates free radicals when it passes through living tissues. Interactions of free radicals with DNA can induce genetic damage and cause mutagenesis and carcinogenesis (Hosseinimehr. 2007, Hu et al. 2011). However, while it is important to protect normal tissues, it is not always possible to keep these tissues outside of the treatment field and avoid the side effects and complications of irradiation.

DISCUSSION

The nature and degree of such side effects depends on the dose of radiation and the sensitivity of the organs irradiated. Treatment for a majority of patients with head and neck cancers includes radiation as part of their therapy. The patients treated with radiotherapy suffer severe side effects during and following their treatment (Vitolo et al. 2004). The development of effective radiomodifiers is of great medical importance. Radioprotective agents are synthetic compounds or natural products immediately administrated before irradiation to reduce radiation-induced injuries without compromising tumor treatment. Naturally occurring compounds that function as antioxidants and immunostimulants are important for the development of radioprotective agents. Approved radioprotective agents are expensive and have some severe side effects (Hosseinimehr. 2007, Hu et al. 2011). For this reason, to prevent injury caused by radiation on healthy tissue, many investigations related natural products that have antiviral, anticancer, immunostimulant and antioxidant effects have been constructed. Several studies on radioprotective agent are ongoing. To our knowledge, this is the first report demonstrating lens radioprotection by NSA, TQ, CAPE and Propolis.

CONCLUSIONS

The findings obtained in the study might suggest that Propolis, CAPE, NSO and TQ could prevent cataractogenesis in ionizing radiation-induced cataracts in the lenses of rats, where in Propolis and NSO were found to be more potent.

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