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Protection Against Radiotherapy-Induced Damage to Bone Tissues by Melatonin

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INTRODUCTION

Nowadays, exposure to ionizing radiation is almost inevitable, with diagnostic imaging and radiotherapy accounting for most radiation doses received by humans. While radiation doses for diagnostic imaging are far less than therapeutic doses, both modalities can give rise to side effects (toxicities) to healthy tissues. The bone is a vital tissue in the body which has shown side effects following exposure to ionizing radiation.

AIM

This study aimed to investigate the protective effect of melatonin (a pineal hormone with potent free radical scavenging effect) against radiotherapy-induced damages to the bone.

METHOD

Twenty male wistar rats were randomly assigned to four groups; C: rats in control group received neither radiation nor melatonin, M: rats received only 100 mg/kg (1) melatonin intraperitoneally, R: rats' right legs were exposed to 30 Gy (2) single dose gamma radiation, and MR: rats received 100 mg/kg melatonin 30 min before irradiating their right legs with 30 Gy single dose gamma radiation. Four weeks after irradiation, all rats were sacrificed. Thereafter, their skin, gastrocnemius and tibial muscles were carefully removed, leaving behind the tibial bones. 5 µm sections of the bone tissues were obtained and stained with hematoxylin and eosin for histological evaluation. The degree of changes was evaluated as follows; grade 0: normal, grade 1: mild, grade 2: moderate, and grade 3: severe.

RESULTS

Four weeks after irradiation, histological evaluations (table 1) showed that irradiation with 30 Gy induced damages to the bone tissues as characterized by reduced vascularization, loss of osteocytes on the cortical bone and osteoblasts from bone margins, separation of the periosteum, loss of hematopoietic cells and fibrosis around the blood vessels supplying the bone marrow. However, treatment with melatonin before irradiation was able to prevent the aforementioned damages to the bone tissue.

Table 1. Histological changes to bone tissues four weeks after irradiation.

Group	Vascularization of bone	Osteocytes on the cortical bone	Osteoblasts of bone margin	Blood vessels of periosteum damage	Hematopoietic cell	Blood vessels of bone marrow damage
C	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
M	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00
R	2.00±0.71	1.40±0.55	2.40±0.55	1.80±0.45	2.00±0.71	2.20±0.45
MR	0.40±0.55	0.40±0.55	1.40±0.55	0.60±0.55	0.80±0.84	1.00±0.71

CONCLUSIONS

Results of our study suggest the potential of melatonin to protect against bone tissue damages after radiotherapy. Further research is necessary in order to evaluate the clinical efficacy of this approach.

REFERENCES

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