Proceedings International
Platinum Open Access Journal (ISSN 2668-6384)

Proceedings, Abstract
Volume 4, Issue 1, 2022, 50
https://doi.org/10.33263/Proceedings41.050

New Porphyrin-loaded Magnetic Drug Delivery Nanosystem for Enhancement of Photodynamic Therapy Efficacy on Human Melanoma †

Mihaela Balaș [1,*], Mădălina Andreea Badea [1], Alina Mădălina Popa [1], Nistorescu Simona [2], Boni Mihai [2], Lungu Iulia [2], Staicu Angela [2], Florian Dumitrache [2], Anca Dinischiotu [1]

[1] Department of Biochemistry and Molecular Biology, Faculty of Biology, University of Bucharest, Bucharest, Romania;
[2] National Institute of Laser, Plasma and Radiation Physics, Magurele, Ilfov, Romania;
* Correspondence: mihaela.balas@bio.unibuc.ro (M.B.);
† Presented at 1st OncoHub Conference – Connecting Scientists for Next Generation Cancer Management (13-15 October 2021, virtual)

Received: 25.10.2021; Accepted: 5.02.2022; Published: 14.02.2022

Abstract: The conventional photosensitizers used in photodynamic therapy (PDT) present low efficacy against melanoma due to the dark toxicity, low solubility, and lack of selectivity. Here, we propose to investigate the therapeutic efficacy of a new drug delivery nanosystem (PDDN) composed of ɣ-Fe_2O_3 magnetic iron oxide nanoparticles (NPs) and porphyrin for use in PDT. Thus, Mel-Juso cells were exposed for 24 h to PDDN at different concentrations of porphyrin (0.01 - 2 µg/mL) and NPs (0.05 - 11 µg/mL) and then irradiated with a LED (ʎ = 405 nm) at 1 and 2 mW/cm^2 power densities for 0.5 to 5 min. Upon 24 h from irradiation, cell viability, morphology, proliferation, cell adhesion, and some oxidative stress and apoptosis markers were analyzed. Untreated cells, porphyrin, and NPs alone were used as controls. Phototoxicity of PDDN on melanoma cells depended on led power density, time of irradiation, and porphyrin concentration. A decrease of cell viability with approx. 50% was obtained for cells incubated with PDDN at a dose of 0.75 µg/mL porphyrin and irradiated at 1 mW/cm^2 power density for 1 min. In the same conditions, a visible alteration of cellular aspect and pronounced inhibition of MCM-2 and β-catenin protein expression was obtained. The generation of reactive oxygen species upon irradiation triggered a weak response of the cell antioxidant defense system. Finally, induction of apoptosis in Mel-Juso cells was demonstrated by activation of caspase-3, the elevation of Bax, and inhibition of NF-kB protein expression. PDDN showed high anti-tumoral efficacy and great potential for use in PDT of melanoma.

Keywords: photodynamic therapy; iron oxide nanoparticles; melanoma; porphyrin; apoptosis.

Funding

This work was supported by contract no. 63PCCDI/2018 (PN-III-P1-1.2-PCCDI-2017-072).

Acknowledgments

This research has no acknowledgment.

Conflicts of Interest

The authors declare no conflict of interest.