The efficiency of photodynamic therapy mediated by curcumin against human amelanotic melanoma in vitro

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Purpose:
Cancer affects millions of people worldwide and is now one of the most common causes of death. Nowadays new medicines are being sought to effectively fight against cancer. Metabolites of natural compounds have been used for anti-cancer therapy for a long time. But in recent years, new active substances of natural origin have been discovered with proven effects that interfere and affect with the metabolism of tumor cells. Of particular interest are compounds exhibiting the low toxicity against normal cells. One of these compounds is curcumin - a component of turmeric. Curcumin has immunomodulatory, anti-inflammatory, anti-cancer effects, influences phase II enzymes and is a potent photosensitizer, thus showing strong potential for use in oncotherapy.

Experimental Design:
Curcumin has been investigated as a potential photosensitizer (PS) in anti-cancer photodynamic therapy (PDT). The phototoxic effect of curcumin is dependent on proper formulations of the compound because of the lipophilic nature of the molecule and the extremely low water solubility at physiological conditions. In the present study, the combination of curcumin was investigated in PDT using human melanoma amelanotic cell line (C32) and normal human fibroblasts from primary culture as a control cells. The cells were maintained in culture and then treated with curcumin at concentrations of 5, 10, 15, 25, 50 and 200 µM for 2, 24, 48, and 72 hours. After that the cells were irradiated with blue light (20 J/cm²) for 5 minutes and incubated for 24 hours. The efficacy of photodynamic effect was evaluated by viability assay (MTT). Additionally, cell death assay and cellular reactive oxygen species assay were assessed. Curcumin intracellular distribution after various time of incubation was visualized by CLSM method.

Results:
The results suggest that curcumin may be and potent alternative to commonly used cytostatics. Depending on the curcumin concentration, the cell survival ranged from 18.95% of control cells after incubation with 50 µM curcumin to 0.91% after PDT. It has been shown that PDT with curcumin can increase oxidative stress and number of apoptotic and necrotic cells in comparison to incubation with curcumin without irradiation. The reduced cytotoxicity compared to other drugs and the potential inhibition of P-glycoprotein (ABCB1 protein) is the basis for the use of curcumin also in complementary treatment of amelanotic melanoma.

Conclusion:
This study has shown for the first time that PDT with curcumin appears to represent an efficient alternative for the treatment of amelanotic melanoma through the in situ application of the photosensitizer followed by irradiation of the photosensitizer-loaded area. Thus, the proposed protocol seems to be promising in the amelanotic melanoma which is extremely resistant to standard chemo- and radiotherapy.
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References: