A preliminary study on sonodynamic therapy of human colon cancer cells using sinoporphyrin sodium as the sonosensitizer

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Background, Motivation and Objective

Sonodynamic therapy (SDT) is a promising cancer modality which can locally activate the sonosensitizer preferentially accumulated in the tumor to produce a cytotoxicity effect. Sinoporphyrin sodium (DVDMS) is a novel sonosensitizer depurated from the Photofrin II, possessing high chemical purity, low phototoxicity and high singlet oxygen production. In the present study, the effect of sonodynamic therapy on human colon cancer cells was investigated in vitro using DVDMS as the sonosensitizer.

Statement of Contribution/Methods

HCT116 (5×10^4 cells/mL) were seeded into a cell culture dish and incubated with 5 μg/mL DVDMS for 5h. The intracellular DVDMS was first imaged with a confocal scanning microscope (Zeiss LSM880, German) after washing by PBS. For SDT treatment, cells were randomly divided into four groups: control group (control), DVDMS alone (DVDMS), ultrasound alone (US), SDT mediated by DVDMS (SDT, frequency: 0.970 MHz; acoustic power: 3.45 W; duration: 3 min; duty cycle: 30%). The cone tip of the ultrasound transducer was immersed into the culture dish which was placed above a water tank filled with degassed water and a layer of sound absorbing material at the bottom (Fig. 1a). After the treatments, the cell apoptosis and necrosis were detected by flow cytometry (BD Accuri C6 Plus, USA) and the production of reactive oxygen species (ROS) was detected by DCFH-DA assay.

Results/Discussion

The confocal fluorescence image showed efficient uptake of DVDMS by HCT116 cells (Fig. 1b). The cell apoptosis and necrosis proportion of the SDT group (22.45%) was 5.7 times of that of the control group (3.96%), while that of the other two groups were 4.33% (DVDMS) and 6.32% (US), respectively (Fig. 1c). Figure 1d showed the level of intracellular ROS production in the four groups. Compared with the other three groups, increased green fluorescence intensities could be observed in the cells of the SDT group indicating significant ROS production induced by the SDT. The results suggested that SDT mediated by DVDMS could induce significant cytotoxicity on human colon cancer cells and the therapeutic effect on animal models will be further investigated.

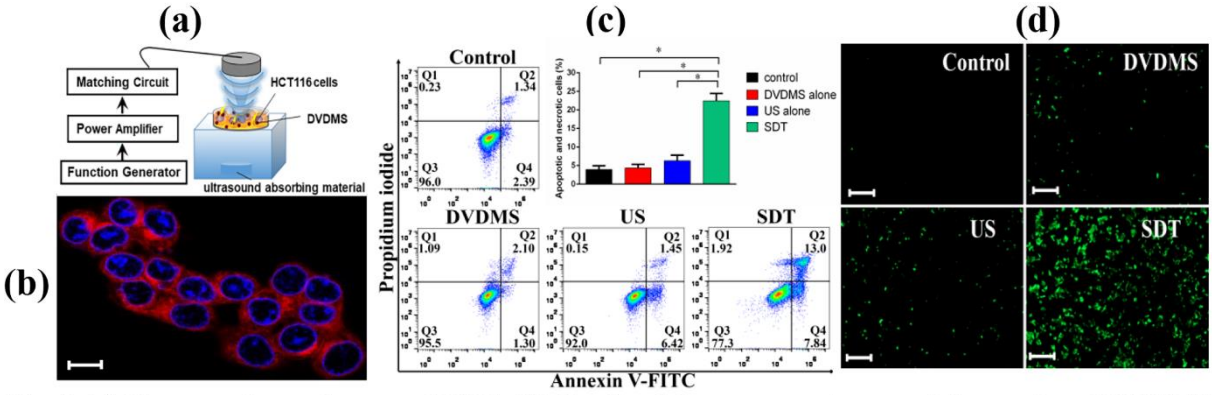

Fig. 1 (a) The experimental setup of SDT. (b) Confocal fluorescence image of the uptake of DVDMS (red) by HCT116 cells. The nuclei were stained with DAPI (blue). Bar: 20 μm. (c) Flow cytometry analysis of cell apoptosis and necrosis in the four groups. *$p < 0.05$. (d) Fluorescence images of the intracellular ROS production (green) in the four groups. Bar: 500 μm.