Ultrasound Activation of New Drugs for Killing Cancer Cells

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Abstract: It has been previously reported that such chemicals as hematoporphyrin are activated by ultrasound energy. In the present study, in vitro ultrasound cell killing effect in the presence of the non-toxic red stain, Rose Bengal, was evaluated. Gastric cancer cells were exposed to ultrasound with or without Rose Bengal. Greater ultrasound cell killing effects were obtained in drug included samples. Whereas drug alone had no toxic effects.

INTRODUCTION

The study of the destructive action of ultrasound in conjunction with drugs upon cancer has become an exciting area. New substances that are chemically activated by ultrasound energy have recently been discovered (1-5). In the present report, non-toxic red stains known to be activated by light energy were biologically evaluated for enhanced ultrasound cell killing effects.

METHODS

MKN-45 Human gastric cancer cells were suspended in Pyrex test tubes (5 X 10^6 cells/ml). An ultrasound emitting element (6 X 6 X 0.62 mm) was directly inserted into the suspension. Assessment of cell viability and survival were performed by Trypan blue exclusion method before and immediately after ultrasound treatment. Ultrasound (317kHz, 1.1 W/cm^2) was irradiated to the cells for 30 or 60 seconds (n=3). Rose Bengal drug concentration were 0, 400, 800, 1600 μg/ml. All treatment were carried out in room temperature.

RESULTS

The effects of the survival rate of MKN-45 cells subjected to ultrasound alone or in combination with various Rose Bengal concentrations are shown in Figure 1. Ultrasound irradiation for 60 sec in the presence of Rose Bengal showed significant differences (p<0.05) compared to ultrasound alone. The survival rates of cells exposed to ultrasound alone for 60 sec were 64%, whereas ultrasound in combination with 400, 800, 1600 μg/ml of Rose Bengal resulted in survival rate of 46%, 49%, 20%, respectively. Drug alone at concentrations 400, 800, 1600 μg/ml had no toxic effects (100%, 99%, 99% respectively).

![Figure 1. Cell survival rate after ultrasound irradiation](image-url)
CONCLUSION

Significant differences were obtained in cancer cell killing by ultrasound in the presence of the red stain, Rose Bengal. It is postulated that this substance was either chemically activated by ultrasound to induce cell killing effects or the energy of ultrasound itself was enhanced. Although further evaluation on the mechanism is needed, the present study suggests that Rose Bengal could be applied as a new booster agent for the treatment of cancers by ultrasound.

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REFERENCES