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Enhanced therapeutic effect of Adriamycin on multidrug resistant breast cancer by the ABCG2-siRNA loaded polymeric nanoparticles assisted with ultrasound

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The overexpression of the breast cancer resistance protein (ABCG2) confers resistance to Adriamycin (ADR) in breast cancer. The silencing of ABCG2 using small interfering RNA (siRNA) could be a promising approach to overcome multidrug resistance (MDR) in cancer cells. To deliver ABCG2-siRNA effectively into breast cancer cells, we used mPEG-PLGA-PLL (PEAL) nanoparticles (NPs) with ultrasound-targeted micro-bubble destruction (UTMD). PEAL NPs were prepared with an emulsion-solvent evaporation method. The NPs size was about 131.5±6.5 nm. The siRNA stability in serum was enhanced. The intracellular ADR concentration increased after the introduction of siRNA-loaded NPs. After intravenous injection of PEAL NPs in tumor-bearing mice, the ABCG2-siRNA-loaded NPs with UTMD efficiently silenced the ABCG2 gene and enhanced the ADR susceptibility of MCF-7/ADR (ADR resistant human breast cancer cells). The siRNA-loaded NPs with UTMD+ADR showed better tumor inhibition effect and good safety in vivo. These results indicate that ADR-chemotherapy in combination with ABCG2-siRNA is an attractive strategy to treat breast cancer.

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Molecular breast imaging

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Molecular breast imaging (MBI) is an emerging technique that utilizes small semiconductor-based γ-cameras in a mammographic configuration to provide high-resolution functional images of the breast and requires injection of radioactive tracer of Tc99m sestamibi. Unlike mammography that generates radiographic images based on breast anatomy and morphology, MBI generates functional images based on the physiological processes within the breast tissue. Therefore, in contrast to mammography, the sensitivity of MBI is not influenced by the density of the breast tissue, implants, architectural distortion or scars from prior surgery or radiation. In patients with suspected breast cancer, MBI has an overall sensitivity of 90%, with a sensitivity of 82% for lesions less than 10 mm in size. Studies have shown that MBI has comparable sensitivity to breast MRI and higher specificity. MBI has been proven to be able to detect additional ipsilateral and contralateral malignant foci in patients with newly diagnosed breast cancer with a sensitivity (88-95% vs. 89-98%) equivalent to MRI but with higher specificity (74-90% vs. 40-65%). Another promising MBI application is monitoring of neoadjuvant chemotherapy and assessment of residual disease, which may influence and alter surgical planning. MBI has been shown to be a useful supplemental screening modality to mammography, showing a sensitivity of 91% for detection of breast cancer in women with dense breasts. It was shown that addition of MBI to screening mammography provides lower cost per cancer detected than with screening mammography alone. MBI is a highly complementary functional breast imaging modality to existing anatomical techniques.

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