A basic study on the possible application of tetra-glycoconjugated tetraphenylporphyrins and tetraphenylchlorins for photodynamic therapy

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Photodynamic therapy (PDT) is a treatment modality based on the selective accumulation of a photosensitizing compound in malignant tissues following systemic administration to animals bearing tumor. Subsequent irradiation of the tumor with laser-delivered light of an appropriate wavelength activates the photosensitizer and causes a photochemical reaction that leads to tissue necrosis. The major side effect of PDT is prolonged cutaneous photosensitivity. There has been significant interest in new photosensitizers of the following properties : a low level of phototoxicity, selectivity for tumor tissue, and effective outcome.

The purpose of this study was to evaluate the pharmacokinetics of newly established four photosensitizers, which had variations in the glycosyl moiety and the basic structure. The changes of localization patterns of four sugar-linked porphyeins and chlorins in various tissues of female Balb/c mice bearing B16 F1 melanoma were examined after an i. p. injection by measuring their fluorescence intensity.

The changes in their side chain and structure induced different pharmacokinetics in each organ. A higher fluorescence intensity of tissues was observed by tetraglucose-linked porphyrin than tetragalactose-linked one. After the intensity of tetragalactose-linked derivatives formed a peak and decreased within 24 hours, and then increased gradually in 48-96 hours. This might suggest that the galactose chain made the accumulation of photosensitizing agents in organs. The basic structure of photosensitizers changed the peak time of their fluorescence intensities in some organs. In addition, on the basis of the area under the intensity-time curve (AUC) value, the photosensitizers were investigated about their affinities for organs. All agents had a weak affinity for brain and muscle, and had high affinity for liver, spleen, intestine, skin and tumor. The combination of the sugar chain and the basic structure varied the affinity for organs.

We need more studies about the derivatives with more sugar chains, on the basis of our data for characteristics of their chains and structures, we hope that new glycoconjugated photosensitizers for PDT will be designed and developed.