Cooperative tumour cell membrane targeted phototherapy

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Targeted cancer therapy generally refers to therapy that targets specific molecules involved in the growth and generation of tumor for inhibition of cancer proliferation. However, targeted therapy is effective in patients who have valid targets and the effect is compromised in patients with few or heterogenous targets. In this study, a technology that can deliver synthetic receptors throughout entire tumor via combination of liposomes and extracellular vesicles. This technology can be applied to treat various cancers that are hard to target.

1. Background

The targeted delivery of therapeutics using antibodies or nanomaterials has improved the precision and safety of cancer therapy. However, these targeted therapies have often failed because the paucity and heterogeneity of identified molecular targets within tumors have resulted in poor and uneven distribution of targeted agents. A fundamental limitation of current approaches to targeted therapy is that, in most cases, they depend on the existing molecular targets within tumors for treatment outcome.

2. Contents

In this study, we report, for the first time, the development of a cooperative membrane-targeting nanosystem in which synthetic and biological nanocomponents participate together in the tumor cell membrane-selective localization of synthetic receptor-lipid conjugates(SR-lipids) to amplify the subsequent targeting of therapeutics (see Figure). Synthetic nanocomponents(fusogenic liposomes) first deliver the SR-lipids specifically to tumor cell membranes in the perivascular regions of solid tumors. By hitchhiking with biological nanocomponents (extracellular vesicles, EVs) secreted from the cells, the SR-lipids are transferred to neighboring cells and further spread throughout the tumor tissues where the molecular targets were limited. We show that this EV-mediated membrane localization of SR-lipids throughout the tumor can lead to uniform distribution and enhanced phototherapeutic efficacy of the targeted photosensitizers. Furthermore, we show that this cooperative membrane-targeted phototherapy can result in complete tumor regression following a single treatment.

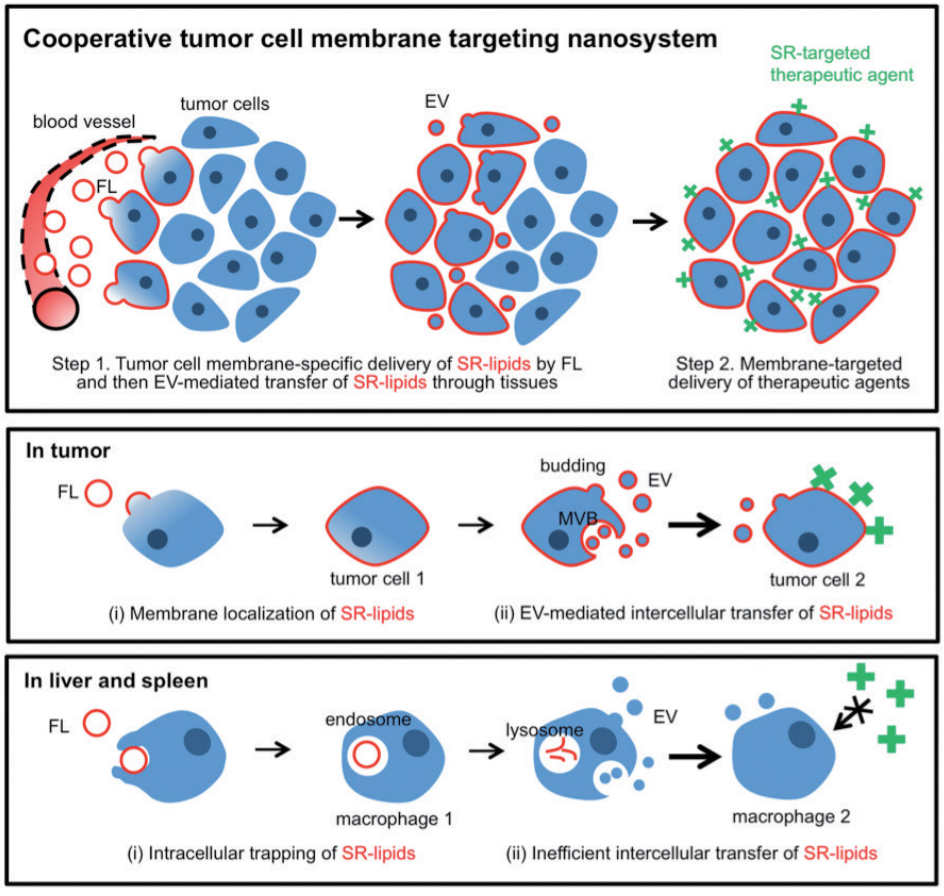

Fig. 1. Schematic representation of cooperative tumor cell membrane–selective targeting nanosystem

3. Expected effect

We believe that this cooperative membrane-targeting approach has the potential to improve therapeutic efficacy in tumors that possessed a limited quantity of specific membrane receptors for targeted therapy.

Research Funding

• This work was supported by the Basic Science Research Program (Grant No. NRF–2015R1A1A1A05001420) through the National Research Foundation funded by the Ministry of Science, ICT & Future Planning, and the National R&D Program for Cancer Control (Grant No. 1220070) funded by the Ministry for Health and Welfare, Republic of Korea

Research Outcomes

• "Cooperative Tumor Cell Membrane Targeted Phototherapy" Heegon Kim, Junsung Lee, Chanhee Oh, and Ji–Ho Park, Nature Communications (2017) 15880