PRECISION NANOMEDICINE: NOVEL BIOMIMETIC NANOSYSTEMS FOR CANCER THERAPY

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Advances in nanobioengineering have allowed the manipulation of cell membranes (CM) to be used as efficient biomimetic nanosystems to deliver organic and inorganic molecules for cancer therapy. In this study we report the development of EVs and cell membrane-based nanocarriers encapsulating nanoparticles and anticancer drugs for both cancer photothermal and chemotherapies, respectively. Our results reveal a higher tendency of the EV-coated nanorods to interact with macrophages yet both EV- and cell membrane-coated nanorods were internalized in the metastatic breast cancer cells. Additionally, highly stable nanoparticles containing Gemcitabine (GEM), Paclitaxel (PTX), and Temozolomide (TMZ) were obtained using the major components isolated from tumor cell membranes. The nanoparticles containing GEM or PTX (NP-GEM-PTX) induced higher cytotoxic effects on pancreatic PANC-1 cells, in comparison to the use of pure GEM+PTX, indicating that membrane-covered nanoparticle favors the targeting and interaction with tumor cells. The biomimetic NP-TMZ system was built with isolated cell membrane from a U251 glioblastoma cell line and showed a greater affinity to U251 cells compared to other glioblastoma cell lines. The internalization of MNPs-TMZ in U251 cells was almost 2 times greater compared to U87 cells, and nearly 4 times greater compared to HCB151 cells. The use of EV- and cell membrane-coated nanoparticles opens up new possibilities regarding the development of efficient biomimetic nanosystems for cancer therapy and brings benefits to the field of personalized medicines.