

(1) Applications of a novel microfluidic rare cell isolation platform before the start of all cell therapies

Cell therapies have gradually gained acceptance in recent years as more patients seek to stop aging progression, or treat age-related chronic diseases through stem cell or stem cell exosome therapies, or treat tumors with immunotherapies. However, it is unclear whether these patients are suitable for certain cell therapies before receiving them. For example, stem cell therapies are not beneficial if patients already have cancer for they might increase the risk of tumor progression. Besides, after receiving stem cell therapies or immunotherapies, for physicians and patients there is no good method to evaluate their efficacy. In today's talk, we introduce an FDA listing microfluidic rare cell detection device. It is highly specific, precise, reliable, fast, and nearly noninvasive. It accurately measures the number of circulating cancer cells (CTCs) as well as endothelial progenitor cells (EPCs) in the blood stream and can be used for (1) early cancer detection, determining the ideal combinational cancer treatments, recurrence monitoring and remission evaluation, and (2) the evaluation of stem cell therapy for chronic disease improvement. By applying this device before the start of all cell therapies, we propose an ideal combinational sequence to treat cancer patients and reposition immunotherapies to a more active role in cancer treatment rather than a last hope for late-stage patients. The availability of this microfluidic rare cell analysis platform on the market will greatly improve the reliability and clinical validation of cell therapies.

- (2) Good things come in small packages: Basic science, manufacturing technologies, emerging clinical applications, and therapeutic case reports of MSC derived exosomes.

MSC therapies, also called cell-based therapies, are well known for their therapeutic effects on regeneration. Increasing data have shown that MSCs' therapeutic effects are mainly through cell-cell communication mediated by exosomes, nanosized lipid bilayer vesicles secreted by MSCs. Research have demonstrated that MSC derived exosomes exhibit a similar or even superior therapeutic capacity to their parental cells, MSCs. As a safer alternative, exosome therapies, also called cell free therapies, are less immunogenic, and less tumorigenic. Exosome therapies avoid the risk of unexpected differentiation into other cell types and decrease injury from transplantation surgery. Also, exosomes are easier to store, preserve, administrate and exhibit effects as they require less stringent storage condition, and have multiple administration routes, higher surface/volume ratio, and the ability to cross the blood-brain barrier.

Due to the advantages over MSC therapies, exosomes therapies have gained significant attention by the world. However, it is difficult for physicians to select reliable and effective exosome products. In today's talk, we introduce basic exosome manufacturing specifications, several exosome *in vitro* potency assays, and how to evaluate its *in vivo* efficacy by a novel microfluidic rare cell analysis platform. In the end, we summarize the progress of ongoing clinical trials on exosome therapies worldwide, and share case reports of exosome application in Japan on age-related chronic diseases, inflammatory and autoimmune diseases, stroke, neural injury, neurodegeneration, cardiovascular diseases, diabetes, and reproductive system.