ENGINEERED EXTRACELLULAR VESICLES AND NANO PARTICLES: PROMISING TOOLS FOR DISEASE TREATMENT

Living forever is a beautiful vision that human being has been pursuing. With the development of science and technology, an increasing number of approaches have been emerging for repairing and regenerating the damaged organs, such as cell therapy, gene therapy and transplant etc. However, the side effects of these methods limit their clinical use. For example, myoblast transplantation leads to an increase in number of early postoperative arrhythmic events\(^1\). Therefore, it has a long way to use these approaches for clinical therapy in a short-term and it is urgent to look for secure effective strategies. Recently, extracellular vesicles (EVs) have attracted extensive interests as a potential therapeutic strategy of diseases such as cancer, cardiovascular diseases etc. A growing number of investigations demonstrate that various engineered EVs can repair the damaged tissue in \textit{vivo}\(^2\).

This editorial highlights 6 selected papers dedicated to the engineered extracellular vesicles as well as nanoparticles, including: 1) classical strategies for modifying EVs; 2) the roles of engineered EVs in...
treatment. Besides, the outlook for engineered EVs has been briefly discussed.

To improve the efficiency of EVs as well as targeted tissue retention, several investigations were performed. Kyle et al firstly used a cardiomyocytes specific peptide (CMP) to make the cardiac-targeted EVs. It was then verified that the modified EVs (CMP-EVs) can be specifically taken up by cardiomyocytes both in vitro and in vivo. This approach laid the foundation for cell and cardiac-specific EVs delivery, which gives a reference for studying targeted-EV. Interestingly, Tang et al came up with a novel idea based on the recruitment of platelets by injured endothelial cells. These authors decorated platelet-microvesicles (inside of platelet, similar with EVs) on the surface of cardiosphere-derived cardiac stem cells (CSCs), which significantly increased the retention in the heart. This manipulation approach is safe and straightforward, which opens novel insights into targeted-EVs for therapy. Recently, Liming et al used an adhesive hydrogel to enhance the retention of EVs. The EVs were immobilized in an adhesive hydrogel (Exo-pGel) and the encapsulated-EVs can stay at the injured area. The Exo-pGel presents a promising strategy for preclinical treatment.

It has been well established that the engineered EVs have great potential for disease treatment in animal models. Vandergriff et al systematically investigated the role of CMP-EVs in cardiac dysfunction treatment. The authors found that EVs conjugated with cardiac homing peptide (CHP, similar with CMP) can protect heart from ischemia/reperfusion injury owing to their increased retention. This work demonstrates a novel approach for increasing delivery of myocardial infarction treatment. Liu et al reported that EVs loading with novel complex hydrogels can promote wounds healing, which provides another effective hydrogel strategy for engineering EVs. Li et al investigated the roles of Exo-pGel in treatment of spinal cord injury. The Exo-pGel significantly promoted nerve recovery via inhibiting oxidative stress and inflammation. Besides, Chuanjiang He et al give an insight into how EVs engineered as powerful tools in translational medicine.

In conclusion, there are strategies for engineering EVs/nanoparticles, with potential roles in disease treatment. Notably, more preclinical investigations and clinical trials are still needed to elucidate the possibility of engineered EVs and nanoparticles in human diseases treatment.
la façon dont les VE sont conçus comme des outils puissants en médecine translationnelle.

En conclusion, il existe des stratégies pour concevoir des VE/ nanoparticules, avec des rôles potentiels dans le traitement des maladies. Notamment, davantage d’investigations précliniques et d’essais cliniques sont encore nécessaires pour élucider le potentiel des véhicules électriques et des nanoparticules dans le traitement des maladies humaines.

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Conflicts of Interest

The authors declare that they have no conflict of interest.

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