Perspectives for real-time applications of extracellular vesicles (EVs) in surgical oncology

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Abstract

In the vast majority of cancer patient surgery is pivotal to local tumor control and survival.

The aim of "curative" surgical oncology is to remove the targeted tumor, namely, to perform the resection of all visible cancer deposits together with sufficient tumor-free margins, providing whenever possible organ and function preservation according to the interested anatomic/functional district. Techniques able to combine general attention to individual patients components with technology-assisted tools, generating objective information on the status of the presenting clinical pictures, are an unmet need which could impact significantly on the fate of each patient undergoing cancer surgery. Near-infrared fluorescence imaging is a technique which relies on fluorophores, such as the FDA approved indocyanine green (ICG), for generating deep-tissue images.

The ICG-loaded EVs (ICG-EVs) could trace the tumoral mass with enhanced details thus changing the current paradigm of cancer surgery, still bound to the current limitation of a directed view of the tumor location during surgery. The fluorescent signal from ICG-EVs, not perceptible to the human eye, could be detected through special camera systems, currently being used in clinical practice, and superimposed to conventional imaging of the surgical field. This way it would be possible to visualize the tumoral lesions and evaluate their resection margins in real time, thus allowing for a guided and highly precise surgery, guaranteeing a radical intervention with minimal involvement of healthy tissues. ICG-EVs in surgical oncology will potentially increase the individualization of surgery while improving local tumor control, survival and quality of life of cancer patients.