MedicalXpress

'Extracellular vesicles' may open new opportunities for brain cancer diagnosis and treatment

April 8 2013

The recent discovery of circulating "nano-sized extracellular vesicles" (EVs) carrying proteins and nucleic acids derived from brain tumors may lead to exciting new avenues for brain cancer diagnosis, monitoring, and treatment, according to a special article in the April issue of *Neurosurgery*, official journal of the Congress of Neurological Surgeons.

The review article by Dr. David Gonda from the laboratory of the corresponding author Dr. Clark C. Chen, with contributions from the senior author, Dr. Bob S. Carter of University of California, San Diego, Dr. Fred Hochberg at Massachusetts General Hospital and Dr. Steve Kalkanis of the Henry Ford Hospital brain tumor programs discusses "the biological processes mediated by these EVs and their applications as biomarkers for brain tumor diagnosis, monitoring, and therapeutic development." The researchers add, "Opportunity exists to use EVs as delivery vehicles or immune modulatory tools" for brain cancer treatment.

Nano-Sized EVs Play Role in Cancer Growth and Survival

The authors use the term EVs to refer to various types of "membrane-encapsulated cellular components" released from cells. Microscopic EVs—tiny even in relation to the cells that produce them—have been isolated from all bodily fluids, including the blood and cerebrospinal

fluid of patients with brain tumors. Extracellular vesicles are like nano-sized "bubbles" of material sent out by cells, containing proteins and other cellular materials—including nucleic acids that carry genetic information.

So far, researchers have identified three general biological functions of EVs: remodeling and removal of cellular components; elimination of "toxic metabolites or unneeded membrane components" from cells; and intercellular communication, providing a means for transferring proteins or genetic information from one cell to another.

In patients with brain cancer, EVs may also provide a way for tumor cells to alter the microenvironment in which they grow. Different types of EVs may perform functions enabling cancers to grow and spread while evading the immune responses that would target tumor cells for destruction.

Could EVs Be Used for Cancer Detection and Treatment?

Scientific efforts to understand EVs and their functions—in normal physiology as well as in cancers and other disease states—are just getting started. But researchers envision new opportunities for the development of biomarkers for diagnosis and monitoring of brain cancers, as well as possible new treatment strategies based on EVs.

Approaches based on identifying specific proteins and genetic material carried by EVs could be useful in identifying brain cancers, and monitoring their status over time. For example, EVs might be used in identifying specific mutations of the IDH1 gene, recently linked to a type of brain cancer called glioblastoma multiforme. Corresponding author Dr. Chen noted in correspondence that "A large consortium effort

among neurosurgeons and neuro-oncologists is emerging to assess the clinical utility of the basic science findings highlighted in our review. We anticipate that the next several years will yield important information as teams of scientists and clinicians work to study these questions."

Further studies of the function of EVs may open at least three directions for brain cancer treatment. Treatments could be devised to inhibit the secretion and uptake of tumor-related EVs, which might interfere with their ability to grow or spread. New approaches to immunotherapy might be developed, using EVs to stimulate immune responses against tumor cells. It might also be possible to engineer EVs to serve as "delivery vehicles" to target drugs directly to cancer cells.

"Enhanced secretion of EVs by tumors offers an opportunity to detect tumor-specific genetic material as biomarkers for diagnostic or therapeutic monitoring," the authors conclude. While extensive research is still needed to understand how EVs work and how they can be exploited for specific uses, they write, "Awareness of these developments should augment the armamentarium available to oncology-dedicated neurosurgeons."

Provided by Wolters Kluwer Health