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Extraordinary anticancer activity of graphene oxide-associated therapeutic antibodies

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Prognosis for advanced cancers remains poor because of lack of effective therapies. The US FDA has approved a number of therapeutic antitumor antibodies (Abs), but the Ab therapies often only slightly prolong patient survival and is by no means curative. We have recently discovered that the Abs, such as rituximab (specific for CD20) or trastuzumab (specific for HER2) can noncovalently associate with nanomaterial graphene oxide (GO) in low salt solution to form stable, multivalent Ab/GO complex that no longer dissociates afterwards under biological conditions such as in buffered saline or human serum. The Ab/GO complex demonstrate much enhanced avidity for binding to the specific antigens. Treating CD20+ lymphoma or HER2+ cancer cells in culture with corresponding Ab/GO complex induces rapid cell death in an antigen-specific manner, and intravenous administration of the Ab/GO into tumor bearing animal eliminates established xenograft human cancers while the free Ab or GO fail to do so. The cancer cells killed by the Ab/GO die by necroptosis, an attractive form of cell death in cancer therapy as opposed to apoptosis. The cytotoxicity of the Ab/GO is derived from the activity of the complex to simultaneously cause oxidative stress and as well as intense intracellular signaling in the cancer cells through the specific receptors recognized by the Abs. The Ab/GO does not affect viability of human lymphocytes and shows no noticeable side-effect in animal models, and thus constitutes a novel, effective but nontoxic cancer therapy, contrasting to conventional chemotherapy or radiation therapy that often compromise the immune function and is associated serious toxic side-effect 1,2. Given that a majority of lymphomas are positive for CD20 and increasing cancer types (in addition to carcinoma of the breast and gastroesophageal junction) are recently found to overexpress HER2, our findings have important clinical implications.

Biography

Chen is an assistant professor of pathology at the University of Utah School of Medicine. He received his MD from Hunan Medical College in Changsha, China and completed residency training in pathology at Emory University School of Medicine. Chen also completed a fellowship in dermatology at Stanford University Medical Center as well as a fellowship in pathology at Emory University School of Medicine.

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