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The controversy: Which is the better cancer treatment, traditional chemotherapy or nanopharmaceuticals

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Cancer, also known as malignant tumor. When the body is stimulated by various carcinogenic factors, cells of local tissue may lose normal gene regulation and was lead to heterogeneous proliferation and metastasis. Cancer has become the leading cause of global morbidity and mortality according to a report(Torre, Bray, Siegel, Ferlay, Lortet-Tieulent & Jemal 2015) by International Agency for Research on Cancer which belongs to World Health Organization. Lacking of effective diagnosis and treatment of cancer has become one of the major problems in contemporary medicine.

Conventional cancer treatment methods mainly include surgery, radiation therapy and chemotherapy(Peer, Karp, Hong, Farokhzad, Margalit & Langer 2007). Among them, chemotherapeutic drugs are mainly introduced into cancer patients by injection or oral administration to kill cells or inhibit the metastasis and spread of cancer cells. One of the great advantages of chemotherapy is that it is easy to operate and has effective results. However, the clinical anti-tumor drugs have poor targeting, and their concentration in tumor sites is very low, which limits the therapeutic effect of cancer.(Parhi, Mohanty & Sahoo 2012, Wicki, Witzigmann, Balasubramanian & Huwyler 2015). Due to the poor selectivity of anti-tumor drugs, in addition to the distribution of tumor sites in normal tissues, anti-tumor drugs kill cancer cells and kill normal cells, thus producing strong side effects on cancer patients, Such as hair loss, myelosuppression, cardiotoxicity, nerve and liver toxicity, etc.(Priestman 2008) In addition, many anti-tumor drugs are poorly water-soluble. For example, paclitaxel is hardly soluble in water. Therefore, paclitaxel injections used clinically often use polyoxyethylene castor oil and ethanol for solubilization, but the use of co-solvents during intravenous administration will Cancer patients develop severe allergic reactions(Micha, Goldstein, Birk, Rettenmaier & Brown III

2006), such as difficulty breathing, blood pressure drop, angioedema, urticaria, etc. Another major challenge of traditional chemotherapy is the development of drug tolerance during the process, often leading to the ultimate failure of chemotherapy.

In recent years, the rapid development of nanotechnology has brought hope and possibility to open up new ways of cancer treatment. (Cho, Wang, Nie, Shin et al. 2008, Hubbell & Chilkoti 2012). Nanomaterials can be used as drug carriers to load drugs by chemical bond coupling, physical solubilization, surface adsorption, etc., thereby significantly increasing the solubility of hydrophobic drugs in water and effectively improving the mode of administration. (Guo & Huang 2014). Nanocarriers can bind to tumor cell surface specific antigens or overexpressed receptors by modifying specific tumor targeting ligands on the surface to achieve drug accumulation and accumulation in tumor sites. (Bae & Park 2011). Nanocarriers may enable drugs to controllably release appropriate doses at specific times and locations (Ganta, Devalapally, Shahiwala & Amiji 2008). However, the efficacy of nanomedicine has not been as expected. Although many nanomedicines have entered the clinical stage or have been approved for marketing, such as Doxil/Caelyx, DaunoXome and Abraxane, these drugs can only improve or improve patients to some extent. The overall survival rate is still unable to achieve the goal of significantly improving patient survival or even completely curing and eliminating tumors. (Chauhan & Jain 2013). Another reason for limiting the development of nanomedicine is that it is difficult to synthesize and has a low success rate, resulting in high costs. Moreover, at such a small scale, nanomaterials have unique physicochemical properties different from macroscopic materials, and it is difficult to predict what side effects it will produce.

This controversy is important because of the need of effective treatment of cancer, it is significant to decide whether we should continue to develop traditional chemotherapy or spend money and energy on nanopharmaceuticals.

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