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EDITORIAL

Targeting Cancer Stem Cells by Oncolytic Viruses and Nano-Mediated Delivery

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Cancer stem cells (CSCs) as targets for oncolytic virotherapy is a novel concept which involves direct infection of cancer stem cells resulting to their destruction and eventual destruction of the tumor.[1,9] Oncolytic viruses include herpes simplex virus-1 (HSV-1), reovirus, adenovirus, vaccinia virus, myxoma virus, etc. replicate selectively in the cancer cells resulting their destruction without damaging normal cells.[1]

CSCs are considered to be relatively resistant to the most of the anticancer therapies and have been correlated to the progression of tumor, initiating invasion, metastasis and rise of second-line tumors.[2] The presence of cancer stem cells has been shown in different tumors, including breast, lung, pancreas, brain, colon, prostate, ovarian, melanoma and gastric cancers.[3,4]

The recent studies show that engineered oncolytic viruses are capable of targeting not only specific cell-surface biomarkers on CSCs, but also surrounding tumor microenvironment and anti-cancer genes.[5] Surface biomarkers such as CD molecules which differentiate the CSCs from normal stem cells, proposed to be an alternative to increase CSCs specificity of oncolytic viruses infection. CD-133, a membrane protein is one of the first identified and more interesting target due to its high expression in multiple CSCs. Targeting CD-133 positive cells is one of the alternative approaches.[6]

Despite the antitumor activity of oncolytic viruses in preclinical and clinical trials, the success of such treatment modalities has been inhibited by its inability to immunogenicity such as surviving in the patient's circulation, in order to target tumors at distant sites.[7] To enhance the bio-activity, efficiency and specificity of oncolytic viruses, researchers have proposed nanomedicine technologies, such as encapsulating viruses in nanoliposomes.[8]

While current preliminary data support the rationale that encapsulating virus in liposomes strongly preserve its antitumor efficacy by liberating the virus from liposome before or after uptake by cancer cells, more advanced research are needed to investigate the efficiency of this strategy. A recent study reveals the outcome of liposomal system on reducing immunogenicity and immune clearance of oncolytic M1 virus.[10]

Our team and others[11] have successfully encapsulated oncolytic HSV-1 proving preservation of its infectious characteristics during such procedure. By using homing devices on the external surface of the liposomal coat, targeted delivery of these viruses to tumor microvasculature and cancer stem cells seems achievable. Such

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strategy can significantly enhance the bioavailability and specificity of oncolytic viruses.

Disclosure

The authors report no conflicts of interest for this work.

References

1. Yang Y, Xu H, Huang W, et al. Targeting lung cancer stem-like cells with TRAIL gene armed oncolytic adenovirus. *J Cell Mol Med*. 2015;19:915–923. doi:10.1111/jcmm.12397
2. Moltzahn FR, Volkmer JP, Rottke D, Ackermann R. "Cancer stem cells"-lessons from Hercules to fight the Hydra. *Urol Oncol*. 2008;26:581–589. doi:10.1016/j.urolonc.2008.07.009
3. O'Brien CA, Pollett A, Gallinger S, Dick JE. A human colon cancer cell capable of initiating tumour growth in immunodeficient mice. *Nature*. 2007;445:106–110. doi:10.1038/nature05372
4. Hermann PC, Huber SL, Herrler T, et al. Distinct populations of cancer stem cells determine tumor growth and metastatic activity in human pancreatic cancer. *Cell Stem Cell*. 2007;1:313–323. doi:10.1016/j.stem.2007.06.002
5. Sze DY, Reid TR, Rose SC. Oncolytic virotherapy. *J Vasc Interv Ra*. 2013;24(8):1115–1122. doi:10.1016/j.jvir.2013.05.040
6. Bach P, Abel T, Hoffmann C, et al. Specific elimination of CD133+ tumor cells with targeted oncolytic measles virus. *Cancer Res*. 2013;73(2):865–874. doi:10.1158/0008-5472.CAN-12-2221
7. Kim J, Hall RR, Lesniak MS, Ahmed AU. Stem cell-based cell carrier for targeted oncolytic virotherapy: translational opportunity and open questions. *Viruses*. 2015;7:6200–6217. doi:10.3390/v7122921
8. Wang Y, Huang H, Zou H, et al. Liposome encapsulation of oncolytic virus M1 to reduce immunogenicity and immune clearance in vivo. *Mol Pharm*. 2019;16(2):779–785. doi:10.1021/acs.molpharmaceut.8b01046
9. Terai K, Bi D, Liu Z, et al. A novel oncolytic herpes capable of cell-specific transcriptional targeting of CD133± cancer cells induces significant tumor regression. *Stem Cells*. 2018;36(8):1154–1169. doi:10.1002/stem.2835
10. Wang Y, Huang H, Zou H. Liposome encapsulation of oncolytic virus m1 to reduce immunogenicity and immune clearance in vivo. *Mol Pharm*. 2019;16(2):779–785. doi:10.1021/acs.molpharmaceut.8b01046
11. Burnham LA, Jaishankar D, Thompson JM, Jones KS, Shukla D, Tiwari V. Liposome-mediated herpes simplex virus uptake is glycoprotein-D receptor-independent but requires heparan sulfate. *Front Microbiol*. 2016;7:973.doi:10.3389/fmicb.2016.00973.