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Singapore researchers develop novel Nanovaccine to halt tumour growth and reduces cancer recurrence

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Major step forward in post-operative cancer immunotherapy, offering hope for more eventual, durable treatment outcomes and a new frontier in personalised cancer vaccines.

Professor Shawn Chen Xiaoyuan, Nasrat Muzayyin Professor in Medicine and Technology from the Department of Diagnostic Radiology, and Director at the Nanomedicine Translational Research Programme at NUS Medicine, and Dr Qing You, first author of the paper, Department of Diagnostic Radiology, NUS Medicine.

Researchers from the Yong Loo Lin School of Medicine, National University of Singapore (NUS Medicine) and National Center for Nanoscience and Technology, the Chinese Academy of Sciences (CAS), have jointly developed an approach to significantly reduce the risk of cancer recurrence and metastasis after surgery, by targeting both bulk cancer cells and the elusive cancer stem cells (CSCs) responsible for relapse. Next-generation enhancements could further boost efficacy through precision immune cell targeting and improved antigen design. The study marks a major step forward in post-operative cancer immunotherapy, offering hope for more eventual, durable treatment outcomes and a new frontier in personalised cancer vaccines.

One of the biggest challenges in cancer treatment is preventing the disease from returning or spreading to other parts of the body. Cancer recurrence happens when some cancer cells survive treatment (such as surgery, chemotherapy, or radiation) and begin to grow again at the original site or nearby. Cancer recurrence poses significant challenges due to the presence of cancer stem cells (CSCs), a small but potent subset of cells within tumors. These cells are resistant to conventional treatments, can remain dormant, evade immune detection, and later drive tumor regrowth and metastasis, making them a key factor in cancer progression.

“This nanovaccine approach tackles hurdles in cancer therapy – the ability of stem-like tumour cells to cause cancer relapse,” said Professor Shawn Chen Xiaoyuan, Nasrat Muzayyin Professor in Medicine and Technology from the Department of Diagnostic Radiology, and Director of the Nanomedicine Translational Research Programme at NUS Medicine. “Nanovaccine not only activates the immune system to attack these cells, but also creates lasting memory to help prevent the cancer from returning.” Prof Chen is also from the Department of Diagnostic Radiology at NUS Medicine.

The NICER nanovaccine helps the immune system destroy cancers more effectively by eradicating both CSCs and cancer cells. The result is a potentially stronger and longer-lasting immune response that could help stop the cancer from coming back.

“In laboratory models which included breast cancer, melanoma, and highly invasive CSC enriched tumours, NICER not only halted tumour growth but also reduced recurrence and lung metastasis following surgical tumour removal,” said first author Dr Qing You, Department of Diagnostic Radiology, NUS Medicine. “When combined with immune checkpoint inhibitors, the vaccine demonstrated synergistic effects, enhancing tumour control and survival outcomes.”

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