Scientists discover how salt in tumors could help diagnose and treat breast cancer

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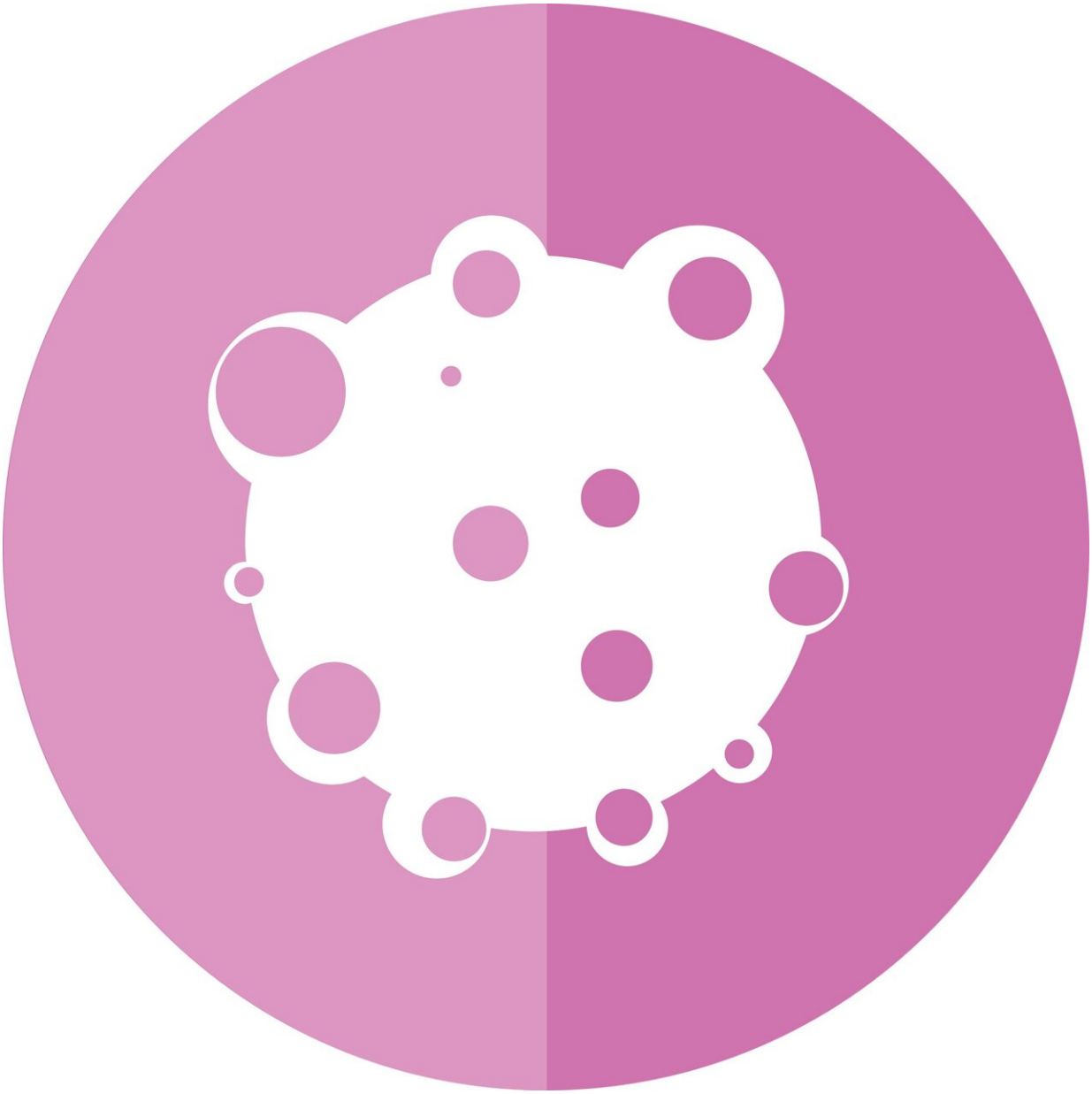

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Analyzing sodium levels in breast cancer tumors can give an accurate indication of how aggressive a cancer is and whether chemotherapy treatments are taking effect, new research has shown.

In a study, by the universities of York and Cambridge and funded by charities Cancer Research UK and Breast Cancer Now, researchers developed a technique using sodium magnetic resonance imaging (MRI) to detect salt levels in breast cancer tumors in mice.

Using this technique, the researchers looked at breast cancer tumors and discovered that salt (sodium) was being accumulated inside cancer cells and that more active tumors accumulate more sodium.

The researchers then took a group of 18 tumors and targeted some of them with chemotherapy treatment. When they scanned the tumors a week later they found that sodium levels had reduced in the tumors treated with chemotherapy.

There are currently around 55,920 new cases of breast cancer diagnosed in the UK each year and it is the leading cause of cancer-related death in women worldwide.

Imaging salt levels could be a vital new tool to help diagnose and monitor breast cancer, the researchers say. The team is now conducting an observational study to see if their results can be replicated in human breast cancer patients.

Senior author of the study, Dr. William Brackenbury from the Department of Biology at the University of York, said: "We have known

for a while that solid tumors are high in salt, but this research brings us a step closer to understanding why. Our findings show that the high levels of sodium in breast cancer tumors is coming from inside the cancer cells rather than the surrounding tissue fluid, meaning that there is something strange about their metabolic activity which leads to them accumulating more salt than healthy cells do.

"There are currently only a handful of sodium MRI scanners across the country, but our study paves the way for them to be used as a new technique for diagnosing breast cancer, monitoring the success of treatments and improving survival rates for patients."

According to the authors of the study, there is also the potential for the development of drugs to block sodium channels in cancer cells, slowing the growth and spread of tumors. Previous research led by Dr. Brackenbury identified a drug currently used to treat epilepsy which showed promise in targeting sodium channels and slowed cancer progression in laboratory models of breast cancer.

The researchers would also like to explore ways to improve the resolution of sodium MRI, which currently produces a relatively pixelated image in comparison to a normal MRI scan. The team wants to develop new technologies—such as the design of new radiofrequency coils and associated cooling systems—to improve the signal quality of sodium imaging. This would enable them to do further research including investigating whether there are sodium hotspots in tumors where growth is most active.

Clinical co-author on the study, Professor Fiona Gilbert from the University of Cambridge said,: "We are excited about using these techniques in the clinic."

Dr. Charles Evans, Research Information Manager at Cancer Research

UK, said: "This interesting study demonstrates that using sodium MRI could be a powerful new way to improve detection of breast cancers. The technique also holds the potential to provide us with deeper insights into how breast cancers respond to treatments. What's more, these techniques could be applied to other cancer types. The study is at an early stage, however, and more research will be needed before sodium MRI can begin to benefit patients."'

Dr. Simon Vincent, Breast Cancer Now's Director of Research, Support and Influencing, said: "It's vital breast cancer is diagnosed quickly and accurately, and its response to treatment closely monitored, to ensure patients receive the best possible care. This innovative early-stage research into sodium MRI has the potential to improve patient care, giving medical teams more in-depth information. We look forward to scientists building on this discovery to understand how it can work in practice to benefit patients in the clinic. The way that breast cancer can accumulate sodium should also be investigated further as it may help discover new ways to treat this devastating disease."

"Sodium accumulation in breast cancer predicts malignancy and treatment response" is published in the the *British Journal of Cancer* insert link once published. The study was also supported by the Engineering and Physical Sciences Research Council (EPSRC) and Biotechnology and Biological Sciences Research Council (BBSRC).

More information: Andrew D. James et al, Sodium accumulation in breast cancer predicts malignancy and treatment response, *British Journal of Cancer* (2022). DOI: 10.1038/s41416-022-01802-w

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