

Neurotransmitter might improve cancer treatment: study

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Doses of a neurotransmitter might offer a way to boost the effectiveness of anticancer drugs and radiation therapy, according to a new study led by researchers at the Ohio State University Comprehensive Cancer Center – Arthur G. James Cancer Hospital and Richard J. Solove Research Institute.

Using animal models of human breast and prostate cancers, the researchers found that injections of the [neurotransmitter dopamine](#) can improve blood flow to tumors and improve delivery of an anticancer drug, doubling the drug's concentration in tumors and increasing its effectiveness. The increased blood flow also raised tumor oxygen levels, a condition that typically improves the effectiveness of both chemotherapy and [radiation therapy](#).

The study also found that dopamine plays an important role in maintaining the structure of normal blood vessels, and that it does this by working through the D2 dopamine receptor, which is present in normal blood-vessel cells called endothelial cells and pericytes. Dopamine was absent in tumor blood-vessel cells.

The findings are published online in the *Proceedings of the National Academy of Sciences*.

"Our study indicates a use for dopamine in the treatment of cancer and perhaps other disorders in which normalizing abnormal and dysfunctional blood vessels might improve therapeutic responses," says

Dr. Sujit Basu, associate professor of pathology and a researcher in the OSUCCC – James Experimental Therapeutics Program.

"Since dopamine and related agents are already used in the clinic for other disorders, these comparatively inexpensive drugs might be applied to the treatment of cancer to increase the therapeutic responses of chemotherapy and radiotherapy," he says.

The blood vessels that develop inside tumors are structurally abnormal, chaotic and leaky and do a poor job of supplying blood to the tumor, Basu notes. This hinders the delivery of chemotherapeutic agents, and it leaves tumors oxygen deprived. This oxygen deprivation makes tumor cells resistant to chemotherapy and radiation.

Basu and his colleagues found that the dopamine treatment normalizes the structure of abnormal tumor blood vessels, indicating an important role for a neurotransmitter in the remodeling of blood vessels. Other key findings include the following:

- The tumor tissue used in the study showed the absence of dopamine.
- After dopamine treatment, tumor blood vessels in both cases resembled normal vessels in regard to leakiness and architecture. Pretreatment with a dopamine receptor antagonist negated this effect.
- Subcutaneous human colon tumors in mice treated with dopamine and the chemotherapeutic drug 5-fluorouracil (5-FU) accumulated twice the amount of 5-FU as tumors in mice treated with the drug only.
- Subcutaneous human colon tumors in mice treated with both dopamine and 5-FU were less than one-third the size of tumors in mice treated with 5-FU only.

"Overall, our findings suggest that the normalization of [tumor blood vessels](#) using the neurotransmitter dopamine might be an important approach for improving therapeutic efficacy in the treatment of cancer patients," Basu says.

Provided by Ohio State University Medical Center

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