RIOT
Research Information Outreach Team

Ten Hallmarks of Cancer Series

How to ensure treatment is starving tumour of oxygen and nutrients - Hallmark #8

One of the hallmarks of cancer growth is the ability for a tumour to encourage blood vessels from neighbouring tissue to grow into it. This process is called angiogenesis and serves to supply sufficient oxygen and nutrients to sustain the metabolically active cancer cells. One effective treatment of cancer is therefore to stop this new growth of blood vessels using angiogenesis inhibitors. However, like other anti-cancer drugs, these inhibitors can have severe side effects, for example, hypertension, bowel perforation and abscess. Furthermore, because angiogenesis inhibitors have to be taken for months to be effective and have a high price tag, the treatment cost relative to traditional chemotherapy can be up to 7 times more expensive. A method to identify patients unlikely to benefit from anti-angiogenesis treatment would avoid harm to these patients as well as save on scarce health care resources. My research is focused on developing such a method using CT scanning, which has the advantage that it is easily accessible in all hospitals and cancer treatment centres across Canada.

The method I developed is called CT Perfusion because it uses a CT scanner to measure perfusion, which refers to blood flow in the capillaries of either normal tissue or tumour. Wherever there is active angiogenesis, as in a tumour, perfusion would be higher than in normal tissue. On the other hand, if angiogenesis is knocked down by inhibitors, tumour perfusion would decrease. If the tumour is investigated by CT Perfusion before and after treatment, a decrease or increase in perfusion would tell us whether a patient's tumour is responding or not responding to the anti-angiogenesis treatment. In other words we could individualize each patient's treatment plan using CT Perfusion.

A CT Perfusion study involves injection of an x-ray contrast (dye) into a vein and then using a CT scanner to scan or take pictures of the tumour at a rapid rate – up to one picture per second – to observe the injected dye as it is carried by blood flow (perfusion) into and out of the tumour. Special software that we have developed is then used to calculate tumour perfusion from the rate of arrival of dye at the tumour relative to that in a supply artery. Advantages of the CT Perfusion method include: first, it does not require use of a specially designed CT scanner; second, the study procedure is simple enough that no special training is required. These advantages mean CT Perfusion can be readily implemented in all hospitals and cancer treatment centres throughout the country.

The CT perfusion method to monitor treatment responses in individual patients was tested in a group of 76 ovarian cancer patients. The project involved 19 cancer treatment centres in the US. All of them used the same scanning protocol we designed, and the CT Perfusion data they gathered was sent to us for analysis. As we had predicted, increased tumor perfusion was associated with faster tumor growth and progression after treatment.

We have shown via the multi-centre trial that CT perfusion can be implemented successfully with sufficient uniformity across multiple sites and scanner platforms to yield positive results in a multi-centre clinical trial. Change in tumour perfusion as measured by CT Perfusion a few weeks after initiating therapy may provide early information on treatment response and time to progression, and it could be used to stop ineffective treatments. Furthermore, since it can be incorporated easily into routine CT imaging for the follow-up of cancer treatment, CT Perfusion not only can be used in clinical trials but can also be considered for routine monitoring of cancer treatment.

Collaborators of the ovarian cancer trial are gratefully acknowledged.

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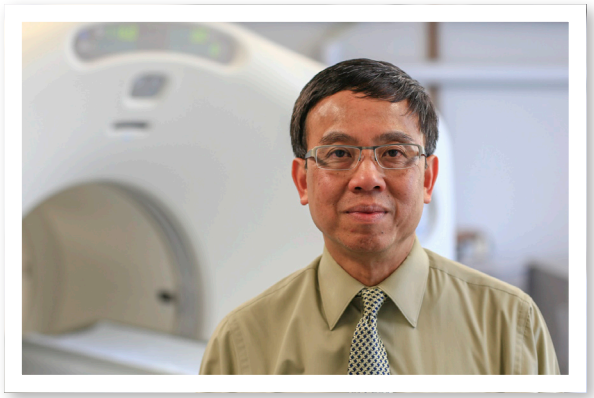

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