Injectable lab finds your best cancer drug by trying many at once

- 19:00 22 April 2015 by **Michael Slezak**
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Injecting a mini diagnostic lab into your body may make the time-consuming trial-and-error approach used to find the right cancer drug a thing of the past. Two devices – one already tested in a handful of people – promise to let doctors investigate a swathe of potential drugs at once, right inside the patient's tumour. By seeing how the drugs affect different parts of the tumour, doctors can see which is likely to work best.

Unlike bacteria and viruses, tumours don't grow easily in a dish. This makes tailoring cancer treatment to the individual hard. The type of treatment a person has is likely to depend on how aggressive their cancer is, its location and whatever information can be gleaned from the cancer cells extracted during a biopsy.

As a result, it's not uncommon for people to be treated with several standard cancer drugs one after the other as their doctors search for one that will work on their particular cancer – a stressful and demoralising experience that is also expensive for the healthcare system. Growing personalised tumours on the backs of mice – essentially creating your own mouse avatars – is another option, but it is similarly expensive and takes at least a month of a patient's precious time.

Two groups in the US may have hit on a way to speed things up. They have developed devices that test multiple drugs in an individual and return the results within 24 hours. We're essentially putting the lab into the patient, said Oliver Jonas of the Koch Institute for Integrative Cancer Research at the Massachusetts Institute of Technology.

Dyeing tumours

The device developed by Jonas and his colleagues is about the size of a grain of rice. Once the implant has been injected into a tumour, tiny amounts of different drugs are released from micro-wells in its walls. After 24 hours, the implant and the tissue around it are removed, and the tissue is analysed to see which drug worked best.

The team tested it in mice that had melanoma, breast and prostate cancer. As hoped, the drugs that appeared to kill the most cancer cells in the tissue were the drugs known to work best for those diseases.

A different device developed by Richard Klinghoffer at Presage Biosciences in Seattle and colleagues uses six long needles to inject different drugs into the tumour, along with different coloured dyes. After 24 hours, part of the tumour is removed, then the various regions marked by the dyes are inspected to see which drug worked best.

The device was tested on human lymphomas grown on mice, as well as in four people with lymphoma. In the mouse studies, the device correctly predicted which drugs would kill the most cancer cells. The researchers also found that a form of lymphoma they thought was drug-

resistant actually responded well to a particular drug.

The tests on people were limited, but showed that using the device caused only mild discomfort and minor side effects, such as swelling, that went away without treatment.

Elegant engineering

"These techniques offer a possible alternative to the 'hit-and-miss' way of using anti-cancer drugs in patients that has unfortunately become accepted practice," wrote R. Charles Coombes from Imperial College London in a comment article published alongside the studies.

Neil Watkins of the Garvan Institute in Sydney, Australia thinks that the devices are surprisingly simple. "It's an example of an elegant engineering solution to an obvious problem that is difficult to deal with," he says.

Watkins's own research looks at ways of better matching existing chemotherapy drugs to patients and he believes these devices could help. "This can fast-track our ability to rethink standard chemotherapy and deliver it in a more effective and safer way," he says. "Even if all this did was help you identify patients that you don't want to treat with toxic therapy, that would be a major advance." He says the devices should also accelerate drug development by allowing safer human trials and producing faster results.

Assuming the devices show good results in larger human trials, the limitation will be what kinds of cancers they can reach. "You have to have a way of accessing the tumour," says Watkins. "In a brain tumour it's probably not going to work."

Journal references: *Science Translational Medicine*, DOI: 10.1126/scitranslmed.3010564 (Jonas et al.), 10.1126/scitranslmed.aaa7489 (Klinghoffer et al.)