Adapting cancer treatment in real time

18 November 2013

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Cancer treatments could change radically over the next decade, thanks to technology that can monitor cancer cell mutations in real time.

Nearly 1.3 million people living in the EU will die from cancer and 14 million will live with cancer in 2013. Due to improved early detection, more efficacious treatments and the ageing of the population, those numbers are expected to rise significantly over the coming years. Cancer often starts with a tumour, as mutated cells accumulate, and then spreads throughout the body, a process known as metastasis.

At the moment, doctors typically fight the spread of cancer with a combination of surgery, radiation, and chemotherapy. They’re also starting to use drugs that target a specific protein or gene present in the tumour cells as part of an emerging field of cancer treatment known as targeted therapy.

However, the problem is that tumour cells often mutate to become resistant to these therapies, and that means many cancer patients undergo difficult treatments that either are ineffective or sooner or later stop being effective due to resistance mechanisms.

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To stay one step ahead of the mutations in cancer cells, doctors may soon be able to analyse the tumour cells in real time, checking which drugs work and constantly changing treatments as mutations occur, thanks to technology being developed by EU-funded projects such as CTCtrap and MIRACLE.

‘In real time you are going to make a decision on what treatment the patient should get,’ said CTCtrap’s coordinator Professor Leon Terstappen, from the University of Twente in the Netherlands.

The project is currently developing the technology that will allow doctors to isolate tumour cells in the blood, known as circulating tumour cells (CTCs), so they can be tested. ‘It tells you hopefully exactly what treatments are currently on the market which can help the patient,’ Prof. Terstappen said. ‘And you adapt it all the time because you know that people will get resistance.’

That’s no mean feat, as there are billions of blood cells and very few CTCs. In the technology being developed by CTCtrap, the patient’s blood is passed through a device similar to a dialysis machine that uses antibodies to filter out the CTCs for analysis.

CTCs could become central to treating cancer because testing them means researchers would be able to develop treatments to kill the cells that matter – the ones that are spreading the cancer around the body.

**Holy Grail**

‘Trying to capture those cells and analyse them is actually a Holy Grail for cancer diagnostics since most of the cancer patients die from metastasis and the CTCs are probably responsible for that,’ said Professor Liesbet Lagae, who coordinates the EU-funded project MIRACLE.

MIRACLE is working on a similar area but is more focussed on testing the cells. It is developing a so-called lab-on-a-chip system which picks the CTCs out of the blood, then identifies them and analyses up to 20 markers on a molecular level to give doctors vital information on which drugs will work.

‘The biology of these CTCs is much more relevant than currently used imaging technologies to predict the evolution of the cancer or the individual response of patients to therapy,’ Prof. Lagae said.

However, it is likely to be another decade before the combination of real-time tumour cell testing and administration of targeted therapy is commonly used to treat cancer, according to Prof. Terstappen, as the technology is still being developed and then companies must get approval to start commercialising the technology.

When real-time testing is used as a matter of course, though, it will mean that patients are only given treatments that doctors know will work on them, and that will mean fewer cancer deaths, and less unnecessary suffering.

**More info**

MIRACLE
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