PBCP study takes breast cancer research to the next level in the development of personalised cancer medicine

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Background

Breast cancer is the second most common cancer and the main cause of death from cancer in women worldwide. Even though the number of patients surviving for five or more years after diagnosis is increasing, this devastating disease still kills almost 500,000 women every year worldwide.

At present, patients receive treatment based on the results of the microscopic examination of the tumour tissue collected during a biopsy. Although this traditional grouping of cancer patients based on the specific characteristics of their tumour is a first step towards a personalised cancer treatment, it is still very much a ‘one-size-fits-all approach’, and it is unfortunately very difficult to predict which treatment will be effective. Better ways to target and individualise treatments are urgently needed.

In response to this challenge, this project will use state-of-the-art genome sequencing technology to look at breast cancer tumours in the hope that, ultimately, it will lead to improved diagnosis, and treatments tailored to the individual patient.

The genome

Our genome is all of the genetic information that our body requires to function. Our genome is similar to that of our family members but some features are unique to each of us. Our genome is made up of code called DNA and RNA. This code can be investigated using a technique called “sequencing”. Recent developments in science and technology mean it is now possible to sequence the whole genome. These advances mean that we may soon be able to use knowledge about the genome to improve patient care.

What can sequencing a whole genome tell doctors and researchers?

- Understanding more about the genome can help to identify changes in our DNA (called ‘mutations’) that may mean that we are more likely to develop a disease such as breast cancer.
- Comparing the genome in our healthy cells to the genome of our cancer cells can also give clues about how the cancer grows and spreads, and may help doctors to understand how best to treat it.
- Researchers can use knowledge already available and any new findings to help spot patterns of changes that occur more in one type of breast cancer than another.
- They may also find specific changes that make someone more vulnerable to side-effects from treatments.
- Sometimes these patterns can also reveal information that could be important to other family members.

The PBCP

The pilot was supported by Addenbrooke’s Charitable Trust, who fund-raised the £2 million needed to launch the PBCP, through their ‘Bracode’ campaign. As a result, the PBCP pilot, led by Professor Carlos Caldas and Dr Jean Abraham, officially opened to recruitment on 29th September 2016, and formed the first part of the wider Personalised Breast Cancer Program, which aims to learn how to personalise cancer treatment by looking at the genome of the tumour.

The PBCP pilot aimed to sequence the genome (DNA and RNA) of 250 patients diagnosed with breast cancer, allowing the team to examine whether or not the processing and delivery of genomic “sequencing” results is practically possible within 12 weeks. This involved assessing the logistics and timeframes needed to deliver this service in an NHS oncology unit. However, the pilot was also focussed on assessing patient perspectives, looking at the acceptability of, and attitudes towards, not only the amount of genomic data that patients wish to receive, but also how they would like to receive it.

As part of the program, the researchers collect blood and tissue samples from patients so that they can produce genetic “fingerprints” from the breast cancer, which they can then analyse. The blood and tumour samples (for whole genome sequencing) are sent to Illumina Ltd who sequence each patient’s genome and send back ‘rough’ data on their sequence. The PBCP team then focus on key breast cancer-causing ‘mutations’, and recheck the findings with a Molecular Diagnostics Laboratory in Cambridge. A results report is then sent to an NHS Oncogenetics Review Board. This Review Board is a panel of experts who examine the results and provide a summary to share with each patient. This summary results report has been carefully designed with the help of the Oncogenetic Review Board Committee (including patient representatives, oncologists, geneticists, genetic counsellors, pathologists, nurses, and laboratory staff), in order to provide patients and their families with a clearly worded document detailing any genetic changes that may have been found, and their impact for the patient and their treatment.

With the target of 250 patients for the feasibility study having been met at the end of March 2018, the protocol for the full study—aiming to recruit a further 2,000 patients, is currently being written, with the hope that it will open in Cambridge in the late summer of 2018. Once the project is up and running, it will be rolled out to some key sites across the UK in 2019. An interim amendment means that patients attending the breast unit between now and the summer can still be recruited to the PBCP, so that they still have the opportunity to have their genomes sequenced.

It is hoped that the full PBCP study will take research on breast cancer to the next level in

order to drive forward the development of personalised cancer medicine. The research team aims to facilitate new discoveries that will help them understand why some people are cured of their cancer, and others are not, and why some people experience more side-effects than others. Furthermore, the PBCP will support doctors and researchers to develop new drugs and diagnostic tests, with the goal of developing “genomic medicine” within the NHS, to benefit all cancer patients.