Searching for breast cancer gene in younger women

Health[1]
Health[1]Biotechnology [2]Cancer research [3]Diseases [4]Genetics [5]Health [6]The Body [7]Denmark [8]
Videnskab.dk [9]

A very aggressive form of breast cancer, which appears to be caused by genetic mutations, is affecting women under the age of 40. Researchers will now try to find the genes responsible for the disease.

As a rule, breast cancer affects mature women long after they pass the menopause. But younger women are also affected, and when this happens the disease is usually very aggressive.

This aggressive form of breast cancer develops so quickly that it is typically discovered quite late, which has the unfortunate consequence that a considerable number of women die from it.

Researchers at the Centre for Genomic Medicine of the Department of Clinical Biochemistry at Copenhagen University Hospital (Rigshospitalet) are convinced that the cause of this form of breast cancer is genetic. They have started a research project to find the genetic mutations that cause the disease.

The study uses new technology that spots disease-inducing mutations on the basis of blood samples. (See the box below the story.)

Hunt for unknown genetic mutations

“We believe that the majority of young women with breast cancer have the disease because they carry some special genetic variants that have not previously been associated with the disease,” says Thomas van Overeem Hansen, a biochemist at the centre.

“All these genetic variants will form characteristic patterns in the patients’ DNA, and we hope that the new technology will find them.”

By ‘fishing’ in the young women’s genes, the researchers expect to trace the genetic variants in the DNA and determine their composition.

It has long been known that variants of two genes, BRCA1 and BRCA2, can cause breast cancer. The young women with breast cancer in the new research project do not have mutations of BRCA1 and BRCA2, so their breast cancer must be caused by other genetic variants that are not yet identified. But the researchers hope to find them using new technology.

“The challenge is finding genetic variants that can explain why these young women have the disease,” adds Hansen.

Recognising patterns in DNA

The new technology has been given the name ‘Next Generation Sequencing’. The idea is to recognise patterns in the women’s genes: if the same genetic variants are found in the various patients’ DNA, this can indicate that these genetic variants are the cause of the disease.

The researchers need DNA from many women with breast cancer in order to find suspicious patterns in the genes; so far they have recruited 100 women to the project.

All these women are young and suffer from aggressive breast cancer – and they are all in families with other women who have or have had breast cancer. This means there is a great probability that the disease has genetic causes.

The study is still in the start-up phase, but the researchers are expecting much from it. If they are successful in mapping the genetic variants causing the disease, then medical personnel can help the affected women and presumably save many lives.

“As soon as we identify the genetic variants we can examine the families of these women and find other women with these variants in their DNA and who are therefore in danger of developing the disease,” says Hansen.

Preventive measures for women at risk

The plan is to enrol all of these women who are at risk of developing aggressive breast cancer in a programme where they go to regular control and examination of their breasts as part of preventive measures.

A woman who starts to develop breast cancer can undergo chemotherapy treatment or an operation immediately.

“No matter what the affected women choose to do, the new technology will make it possible for them to protect themselves in the best possible way,” says the researcher. “In addition, it is good for the families to know why so many women in their family are hit by the disease.”

Another researcher taking part in the study is Bent Ejlertsen PhD, a consultant at the hospital’s Department of Oncology; he is responsible for the medical treatment of patients. He discusses fertility and pregnancy with the young women – areas that can be both important and problematic.

“Carriers of mutations that can cause breast cancer have a high risk of developing ovarian cancer later,” says Ejlertsen. “We can prevent this to a large extent through information, control checks and preventive treatment, which can help both the individual patient and the family as a whole.”

Read this article in Danish at videnskab.dk [10]

The earlier in life a patient develops cancer, the greater is the risk that the cause is genetic. Cancer can also be caused by environmental factors or lifestyle, but researchers believe this is not the case with the young women with aggressive breast cancer. (Photo: Colourbox) [11]
breast cancer.jpg [12]

Fact box

The project is planned to run over the coming three years, but the researchers expect that the first results will be available during 2012.

Fact box
Seven percent of all European women who develop breast cancer are under 40 years of age. Breast cancer is the most common cause of death among women in the 15-34 age range.

Foetal cells reduce risk of breast cancer [13] Pizza boxes and chip bags may cause breast cancer [14] Screening for breast cancer to what effect? [15] Too much openness about breast cancer can be a burden [16]
Contact details for Thomas van Overeem Hansen [17] Contact details for Bent Ejlertsen [18] About DNA sequencing (Wikipedia) [19]

Side story
Side story

Computer scours women's DNA

The new technology can find genetic variants in very large amounts of data, and this is a necessity when our genes are being examined – humans have about 25,000 genes in their DNA.

To date, researchers have faced limitations in their studies of whether a woman carries a specific genetic mutation that is already known as capable of triggering breast cancer.

The new technology can scour the whole DNA and find new, hitherto unknown genetic mutations that are found in other women with breast cancer – and which therefore are believed with great probability to cause breast cancer.

Analysing the data requires quite powerful computers, as removing the genetic mutations that do not trigger diseases from the DNA data mass is a large task.

Finding these genetic mutations means giving the computer data from a control database built up on blood samples from healthy people.

Comparing genetic variants

Once the harmless genetic mutations have been weeded out, the computer software starts its proper task of comparing the DNA of the women suffering from breast cancer. Comparing the women's genetic variants one by one can be done in a couple of days.

"When the analyses are finished, we will have a list of all the genetic variants that can be relevant," says Hansen. "These genetic variants now become the starting point of further analysis and an examination of the genes' function in order to document any coupling between the genetic variants and breast cancer."

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[3] http://sciencenordic.com/cancer-research
[4] http://sciencenordic.com/category/keywords/diseases
[5] http://sciencenordic.com/category/keywords/genetics
[6] http://sciencenordic.com/health
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