PATIENT PAGE

Biomarkers and Stroke

Can We Determine Who Is at Risk?

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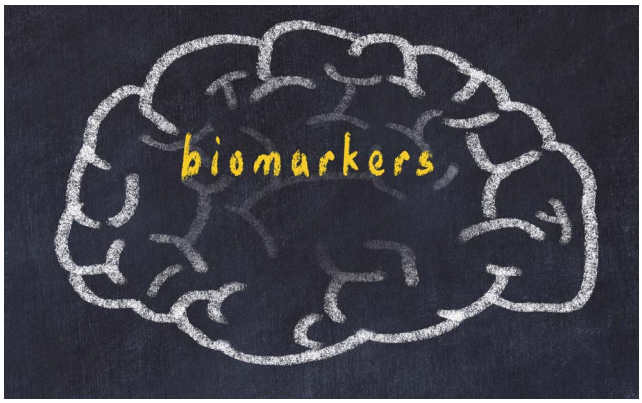

Related Article

Plasma β-Amyloid, Total-Tau, and Neurofilament Light Chain Levels and the Risk of Stroke: A Prospective Population-Based Study

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Medical studies have shown a connection between dementia (the most common cause of which is Alzheimer disease) and stroke. Recurrent stroke is the cause of one type of dementia called multi-infarct dementia. Recognizing this connection, the authors of this study posed a simple question: Is the presence of biomarkers (see below) for dementia helpful in predicting stroke? In their article "Plasma β-Amyloid, Total-Tau, and Neurofilament Light Chain Levels and the Risk of Stroke: A Prospective Population-Based Study," Dr. Heshmatollah and colleagues[1] looked at several dementia biomarkers in a group of people from Rotterdam, the Netherlands. They followed these people for many years to see if the members of the group who were found to have dementia biomarkers were more likely to experience a stroke later on.

How Was the Study Done?

This study was prospective. This means that the doctors took blood samples from a group of people and ran specific tests, and then followed the group for an extended period of time to see what happened. More specifically, they drew blood from 4,661 people who lived in and around Rotterdam. They measured levels of β-amyloid (Aβ), tau, and neurofilament light chain (all of which are proteins that, when present in a person's brain, have been shown to indicate that the person is more likely to develop dementia). The doctors then stored the blood samples for later testing. They performed physical examinations and interviewed the participants every 4 years. They recorded important risk factors such as education (that is, whether each participant had completed primary, intermediate, or higher education), calculated body mass index, measured blood pressure, and documented other possible influencing factors such as age and sex.

What Did They Find?

Dr. Heshmatollah and colleagues followed the 4,661 people in the study for an average of 10.8 years. During this time, 379 of the people in the group experienced a stroke. The researchers thawed the frozen blood samples in 2018–2019 and measured the amount of dementia biomarkers (Aβ, tau, neurofilament light) in these samples. They found that the people who had had a stroke had higher amounts of either tau or neurofilament light in their blood. What was important to note was that the higher amounts of these substances

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were present years before the strokes ever occurred. The researchers found no association between Aβ and stroke.

What Does This Mean?

Dr. Heshmatollah's results confirm the results of other studies that have linked dementia biomarkers to stroke. However, this study does not explain how these proteins are related to stroke. These proteins are responsible, in part, for how nerve cells transport substances from one part of the brain to another. But what is happening in the brain to cause the levels of these proteins to be higher in people who are at risk for stroke? How do these cell transport proteins affect or contribute to stroke risk? We do not yet have the answer to these questions. Further scientific study is needed.

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About Biomarkers and Stroke

Biomarkers (a shortened term for biological markers) are proteins or other substances that can be measured, often in a routine doctor's visit. They could be assessed by blood testing, urine testing, or imaging (like an MRI or CT scan).[2] Biomarkers indicate what is going on in our cells and internal organs. Often, the amount of these markers shows the severity of the disease that may be present. Biomarkers can therefore be very helpful as a screening tool. If measured in very low amounts, their presence could mean that a person is in the very early stages of a disease. They can also be used to find out who might be at risk for developing certain illnesses. In short, detection of biomarkers can be an early warning system: when they are found to be present in a person, the person's doctor may start treatment or begin an aggressive preventative therapy.

In addition to the dementia biomarkers that were discussed in this study, another example of a biomarker is the prostate-specific antigen (PSA). PSA is a protein that can be measured in a simple blood test. It is produced by the prostate gland. It is present normally in people who have a prostate, though in very low levels. When it is produced at higher levels, it points to an injury or illness in the prostate gland. Although abnormally high PSA can also indicate the presence of prostate cancer, it is not specific to cancer. It can also occur, for instance, if there is an infection of the prostate. In other words, an abnormally high PSA does not equal prostate cancer. However, when this test is combined with other measures such as a physical examination, it can be very helpful in identifying this form of cancer.

With regard to stroke, there are already several known biomarkers. One of them is elevated blood pressure: having high blood pressure over time increases the risk of developing stroke. The problem is that this biomarker is not very specific. If a person has high blood pressure, he or she also has a higher risk of heart attack, kidney disease, and circulatory problems. Although this biomarker is not very specific when it comes to predicting stroke risk, can we find others that are? With scientific studies like this one, we can begin to understand which proteins, substances, or conditions should be warning signs for a higher risk of stroke. When combined with other tests, like a physical examination or imaging of the brain, these biomarkers may be very helpful in identifying people who have the highest risk for stroke. That way, doctors can develop individualized treatment plans that include strong preventative measures to help people who are at high risk of stroke to avoid experiencing one. In the future, we may use biomarkers as part of the strategy for reducing the occurrence of one of the most serious neurologic illnesses: stroke.

How Does the Brain Work?

It can be difficult to find a simple way to think about how the brain works. One possible way, however, is thinking about the brain as though it were an orchestra. There are many parts to an orchestra: percussion, wind instruments, string instruments, and so on. Each instrument has a part to play in the overall musical story. When playing together, which requires that the musicians listen to one another, the orchestra can perform complex, beautiful music. The brain is just like this. It is divided into sections like language, movement, and sensation. The difference is that the brain is much more complex than an orchestra. A philharmonic may have 150 members. The brain contains tens of billions of neurons.

Suppose that while the orchestra members are playing together, someone suddenly turns out the lights on the strings section. These players would not be able to see the music they were playing. The rest of the orchestra would continue to play without them, but the music would be missing an important part. Likewise, if the section of the brain that was no longer "playing" after a stroke "turned off" access to the portion of the brain that controls language, the person might suddenly be unable to speak, or to understand spoken and written words. However, in a stroke, the lights cannot be simply turned back on, so to speak, as the affected brain cells die and are never replaced. Because we do not yet have a way to rejuvenate or regrow brain cells after a stroke, treatments have been aimed at stroke prevention, using therapies that restore blood flow to the area of the brain affected by a stroke, or finding ways to recover function after a group of brain cells has died. This last focus is similar to what might happen if some of the remaining musicians in our orchestra example were retrained to take over the parts of the missing musicians. They would likely never be as proficient as the original musicians, but they would be able to cover their parts well enough to keep the music going.

What Is Stroke?

A stroke is a sudden neurologic event. There are several symptoms common to most strokes. The American Stroke Association suggests a very simple strategy to identify stroke. It is called FAST (F = face drooping, A = arm weakness, S = speech difficulty, and T = time to call 911). There are other signs of stroke as well, such as sudden numbness, sudden confusion, difficulty seeing, or trouble walking. Any of these symptoms could be a sign of stroke, but regardless of the symptoms present, a stroke is always sudden.

There are 2 main types of stroke: ischemic and hemorrhagic. Ischemic strokes account for about 87% of strokes. They are usually caused by blood clots that block an artery in the brain. Because blood cannot get past the blockage, neither can oxygen. The brain cells that rely on this oxygen then begin to die. Because of this, time is critical: the longer the cells lack oxygen, the greater the number of brain cells that die. There are many treatments that are designed to break up this type of blockage. One of them is called tissue plasminogen activator (tPA). When given intravenously within a short time after the ischemic stroke occurs, tPA can reopen the affected blood vessel and restore blood flow and oxygen. Another treatment, called mechanical

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thrombectomy, involves surgery. A medical device is inserted into the affected artery and is sent to the clot. It removes the clot, restoring blood flow to the brain. The effects of both treatments are rapid and can result in a reversal of brain damage.

In hemorrhagic stroke, bleeding occurs in the brain. This could be due to a weak blood vessel in the brain or an aneurysm that has ruptured. One of the most common causes of hemorrhagic stroke is poorly managed high blood pressure. Constant high blood pressure puts strain on the blood vessels, which can cause them to burst.

Most treatments of stroke are designed to prevent the problem from occurring in the first place. Common causes of stroke include high blood pressure, cigarette smoking, diabetes, obesity, and eating a high-fat diet. For some people, preventing stroke may be a matter of improving their diet: eating healthier foods overall and avoiding foods that contain high fat or high cholesterol. For others, preventing stroke may include good, consistent control of blood pressure or diabetes. Cigarette smoking should be stopped or avoided. Physical inactivity is also a risk factor. Studies have consistently shown the long-term benefits of exercise. The more we move and exercise, the healthier we are.

Portions of this section were adapted from "Treating Stroke From Inside the Blood Vessel: Time Matters."[3]

For more information:

Brain & Life
brainandlife.org

American Stroke Association
stroke.org

Alzheimer's Association
alz.org

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