Minimal Residual Disease Testing 101: Definitions to Know

Minimal Residual Disease (MRD)

The very small amount of cancer cells that remain in a patient's body after treatment that cannot be found by routine blood and bone marrow tests. These cancer cells can start to grow and multiply, causing a relapse of the disease. MRD (minimal or sometimes called measurable residual disease) is found using highly sensitive laboratory tests that can detect one cancer cell among one million normal cells.[1] MRD testing is mostly used for blood cancers including leukemia, lymphoma and myeloma.[2] MRD tests are used to determine how well a cancer treatment is working and to help choose future treatment plans by distinguishing which patients need more intensive therapy from those who do not. MRD testing can also potentially detect early signs of returning disease. In addition, it is being used in clinical trials to measure how patients respond to potential new therapies. MRD status is usually the most sensitive way to measure the depth of response to therapy.

MRD Detectable (or Positive)

A test result that indicates that there are still residual cancer cells in the body after treatment.

U-MRD – Undetectable (or Negative)

A test result that indicates that no residual cancer cells were detected in the body after treatment, that the cancer was undetectable.

Methods for Measuring MRD

1. Polymerase Chain Reaction (PCR)

A laboratory test that can be used to detect and measure MRD. PCR can identify cancer cells based on their characteristic genetic abnormalities, such as mutations or chromosomal changes. PCR essentially increases or "amplifies" small amounts of specific pieces of genetic material, either DNA or RNA to make them easier to detect and count. As a result, genetic abnormalities can be detected by PCR even when a very small number of cancer cells remain. With PCR, it is possible to identify one cancer cell within 100,000 to one million normal cells.[3]

2. Flow Cytometry

A laboratory test that evaluates individual cells by checking for the presence or the absence of certain protein markers on the cell surface. The sample is treated with special antibodies created in the laboratory that stick only to the cells that have a specific protein on them. The cells are then

passed through a laser beam. The cells with antibodies attached to them give off light. Based on how the flow cytometry is set up, this approach can find one cancer cell among 100,000 normal cells, but at this time is usually considered reliable to one in 10,000.

3. Next Generation Sequencing (NGS)

This technique refers to a number of different sequencing technologies that can rapidly examine stretches of DNA or RNA. Cancer cells in the body have a unique DNA sequence that differs from the DNA in healthy cells. Next-generation sequencing can detect mutations and other genetic abnormalities in DNA of cancer cells. Based on the DNA of cells in a sample, the test can identify one cancer cell among one million normal cells.

Traditional Terms Used for Measuring Response to Therapy

1. Progression-free Survival (PFS)

The length of time during and after treatment that the patient lives without the disease growing or spreading.[4]

2. Complete Response

The disappearance of all signs of cancer based on the results of standard tests. This does not always indicate that the cancer has been cured. Also called a "complete remission."[5]

3. Partial Response

A decrease of cancer in the body after treatment. The disease has improved, but it is still present. Also called a "partial remission." It is possible to be U-MRD while in a partial remission if for example lymph nodes remain enlarged.

4. Stable Disease

Cancer that is neither getting worse nor getting better.

5. Progressive Disease

Cancer that is getting worse.

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References

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