Causes, Risk Factors, and Prevention

Risk Factors

A risk factor is anything that affects your chance of getting a disease such as cancer. Learn more about the risk factors for myelodysplastic syndromes.

- What Are the Risk Factors for Myelodysplastic Syndromes?
- Do We Know What Causes Myelodysplastic Syndromes?

Prevention

There is no way to completely prevent myelodysplastic syndromes. But there are things you can do that might lower your risk. Learn more.

- Can Myelodysplastic Syndromes Be Prevented?

What Are the Risk Factors for Myelodysplastic Syndromes?

A risk factor is anything that changes your chance of getting a disease such as cancer. Different cancers have different risk factors. For example, exposing skin to strong sunlight is a risk factor for skin cancer. Smoking is a risk factor for cancer of the lung and many other cancers. But risk factors don't tell us everything. People without any risk factors can still get the disease. And having a risk factor, or even several, does not mean that you will get the disease.

Cancer treatment

Prior treatment with chemotherapy is the most important risk factor for MDS. Patients
who have been treated with certain chemotherapy drugs for cancer are more likely to develop MDS. When MDS is caused by cancer treatment it is called secondary MDS or treatment-related MDS.

Some of the drugs that can lead to MDS include:

- Mechlorethamine (nitrogen mustard)
- Procarbazine
- Chlorambucil
- Etoposide
- Teniposide
- Cyclophosphamide
- Ifosfamide
- Doxorubicin

Combining these drugs with radiation therapy increases the risk further. Secondary MDS seems to be more common after treatment for Hodgkin disease, non-Hodgkin lymphoma, or childhood acute lymphocytic leukemia. It develops less often after treatment of breast, lung, ovarian, testicular, gastrointestinal system, or other cancers. MDS is also seen in patients who have had stem cell transplants (bone marrow transplants) because these patients receive very high doses of chemotherapy. Still, only a small percentage of people who are treated with these medicines will eventually develop MDS.

More information about cancers caused by chemotherapy and radiation therapy can be found in Second Cancers in Adults.

Genetic syndromes

Some bone marrow problems are caused by abnormal (mutated) genes that have been passed on from one or both parents. People with certain inherited syndromes are more likely to develop MDS. These disorders include Fanconi anemia, Shwachman-Diamond syndrome, Diamond Blackfan anemia, familial platelet disorder, and severe congenital neutropenia.

Familial MDS

In some families, MDS has been found to occur more often than would be expected.
Smoking

**Smoking** increases the risk of MDS. Many people know that smoking can cause cancers of the lungs, mouth, throat, larynx, and other organs, but few realize that it can also affect areas that do not come into direct contact with smoke. **Cancer-causing substances in tobacco smoke** are absorbed into the blood as it passes through the lungs. Once in the bloodstream, these substances spread to many parts of the body.

Environmental exposures

Environmental risk factors, such as radiation and certain chemicals, have been linked to MDS. High-dose radiation exposure (such as surviving an atomic bomb blast or nuclear reactor accident) increases the risk of developing MDS. Long-term workplace exposure to **benzene** and certain chemicals used in the petroleum and rubber industries can also increase the risk of developing MDS.

Age

The risk of MDS increases with age. It is rare in people younger than 40, and most cases are found in those older than 60.

Sex

MDS is more common in men.

- References
  See all references for Myelodysplastic Syndromes

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Do We Know What Causes
Myelodysplastic Syndromes?

Some cases of myelodysplastic syndrome (MDS) are linked to known risk factors, but for most, the cause is unknown.

Over the past few years, scientists have made great progress in understanding how certain changes in DNA of bone marrow cells may cause MDS to develop. DNA is the chemical that carries the instructions for nearly everything our cells do. We usually look like our parents because they are the source of our DNA. But DNA affects more than the way we look.

Some genes (parts of DNA) contain instructions for controlling a cell’s growth and division process. Certain genes that promote cell division are called oncogenes. Other genes called tumor suppressor genes can slow down cell division or even cause cells to die at an appropriate time. Cancers can be caused by DNA mutations (gene defects) that turn on oncogenes or turn off tumor suppressor genes.

Exposure to radiation or certain chemicals can cause mutations that lead to MDS. Sometimes these gene changes occur for no apparent reason. Every time a cell prepares to divide into 2 new cells, it must copy its DNA. This process is not perfect, and copying errors can occur. Fortunately, cells have repair enzymes that read and fix DNA. When a cell can’t fix the DNA error, it is supposed to self-destruct and die. However, some errors may slip past, especially if the cells are growing rapidly.

Human DNA is packaged in 23 pairs of chromosomes. Often, MDS cells contain altered chromosomes. Tests to identify these chromosome problems can help predict the prognosis of patients with MDS. Sometimes part of one chromosome attaches to a different chromosome. This is called a translocation. Like mutations, translocations can turn on oncogenes or turn off tumor suppressor genes. Translocations that develop during life are quite common in some forms of leukemia and MDS. Another chromosome abnormality that can be seen in MDS is called a deletion. This is where part or all of a chromosome is lost, or deleted. Another type of chromosome abnormality is called a duplication. This means there is an extra copy of part or all of a chromosome.
Can Myelodysplastic Syndromes Be Prevented?

Since smoking is linked to the development of leukemia and myelodysplastic syndromes (MDS), not smoking can lower the risk of these diseases. Of course, nonsmokers are also less likely than smokers to develop many other types of cancers, as well as heart disease, stroke, and other diseases.

Treating cancer with chemotherapy and radiation can cause MDS. Doctors are studying ways to minimize the risk of MDS developing in patients who receive these treatments. In some cancers, doctors may try to avoid using the chemotherapy drugs that are more likely to lead to MDS. Some cancers, however, may need these specific drugs. Often, the obvious benefits of treating life-threatening cancers with chemotherapy and radiation therapy must be balanced against the small chance of developing MDS several years later.

Avoiding known cancer-causing industrial chemicals, such as benzene, might lower your risk of developing MDS. However, most people with MDS do not have any known preventable exposure to occupational and environmental radiation and chemicals.

- References
  See all references for Myelodysplastic Syndromes

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