About Myelodysplastic Syndromes

Get an overview of myelodysplastic syndromes and the latest key statistics in the US.

Overview and Types

If you have been diagnosed with a myelodysplastic syndrome or are worried about it, you likely have a lot of questions. Learning some basics is a good place to start.

- What Are Myelodysplastic Syndromes?
- Types of Myelodysplastic Syndromes

Research and Statistics

See the latest estimates for new cases of myelodysplastic syndromes in the US and what research is currently being done.

- Key Statistics for Myelodysplastic Syndromes
- What's New in Myelodysplastic Syndrome Research?

What Are Myelodysplastic Syndromes?

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Myelodysplastic syndromes (MDS) are conditions that can occur when the blood-forming cells in the bone marrow become abnormal. This leads to low numbers of one or more types of blood cells. MDS is considered a type of cancer[1].

Normal bone marrow

Bone marrow is found in the middle of certain bones. It is made up of blood-forming cells, fat cells, and supporting tissues. A small fraction of the blood-forming cells are blood *stem cells.* Stem cells are needed to make new blood cells.

There are 3 main types of blood cells: red blood cells, white blood cells, and platelets.

Red blood cells pick up oxygen in the lungs and carry it to the rest of the body. These cells also bring carbon dioxide back to the lungs. Having too few red blood cells is called *anemia*. It can make a person feel tired and weak and look pale. Severe anemia can cause shortness of breath.

White blood cells (also known as leukocytes) are important in defending the body against infection. There are different types of white blood cells:

- **Granulocytes** are white blood cells that have granules that can be seen under the microscope. In the bone marrow, granulocytes develop from young cells called *myeloblasts*. The most common type of granulocyte is the **neutrophil**. When the number of neutrophils in the blood is low, the condition is called *neutropenia*. This can lead to severe infections.
- **Monocytes** are also important in protecting the body against germs. The cells in the bone marrow that turn into monocytes are called *monoblasts.*
- **Lymphocytes** make proteins called *antibodies* that help the body fight germs. They can also directly kill invading germs. Lymphocytes are not usually abnormal in MDS.

Platelets are thought of as a type of blood cell, but they are actually small pieces of a cell. They start as a large cell in the bone marrow called the *megakaryocyte*. Pieces of this cell break off and enter the bloodstream as platelets. You need platelets for your blood to clot. They plug up damaged areas of blood vessels caused by cuts or bruises. A shortage of platelets, called *thrombocytopenia*, can result in abnormal bleeding or bruising.

Myelodysplastic syndromes

In MDS, some of the cells in the bone marrow are abnormal (dysplastic) and have problems making new blood cells. Many of the blood cells formed by these bone marrow cells are defective. Defective cells often die earlier than normal cells, and the body also destroys some abnormal blood cells, leaving the person without enough normal blood cells. Different cell types can be affected, although the most common finding in MDS is a shortage of red blood cells (anemia).

There are several different types of MDS, based on how many types of blood cells are affected and other factors.

In about 1 in 3 patients, MDS can progress to a rapidly growing cancer of bone marrow cells called _____

Types of Myelodysplastic Syndromes

- Clinical classification of MDS

Myelodysplastic syndromes (MDS) are classified using the World Health Organization (WHO) classification system, which was most recently updated in 2016. It divides MDS into types based mainly on how the cells in the bone marrow look under the microscope, as well as some other factors:

- How many early forms of cell types in the bone marrow (red blood cells, white blood cells, or platelets) show **dysplasia** (look abnormal under the microscope).
- How many types of **low blood cell counts** (cytopenias) a person has.
- What portion of early red blood cells are **ring sideroblasts** (cells that contain rings of iron deposits around the nucleus).
- The portion of **blasts** (very early forms of blood cells) in the bone marrow or blood.
- Certain **chromosome changes** in the bone marrow cells.

Based on these factors, the WHO system recognizes 6 main types of MDS:

- **MDS with multilineage dysplasia (MDS-MLD)**
- **MDS with single lineage dysplasia (MDS-SLD)**
- **MDS with ring sideroblasts (MDS-RS)**
- **MDS with excess blasts (MDS-EB)**
- **MDS with isolated del(5q)**
- **MDS, unclassifiable (MDS-U)**

Because small differences in the way the cells look can change the diagnosis, doctors may sometimes disagree on a patient's exact type of MDS.

MDS with multilineage dysplasia (MDS-MLD)

In MDS-MLD:

- Dysplasia is seen in at least 10% of the early cells of **2 or 3 cell types** (red blood cells, white blood cells, and/or megakaryocytes [the cells that make platelets]) in the bone marrow.
- The person has low numbers of at least 1 type of blood cell.
- There is a normal number (less than 5%) of very early cells called blasts in the

bone marrow, and blasts are rare (or absent) in the blood.

This is the most common type of MDS. In the past, it was referred to as *refractory cytopenia with multilineage dysplasia* (RCMD).

MDS with single lineage dysplasia (MDS-SLD)

In MDS-SLD:

- Dysplasia is seen in at least 10% of the early cells of **1 cell type** (either red blood cells, white blood cells, or megakaryocytes [the cells that make platelets]) in the bone marrow.
- The person has low numbers of 1 or 2 types of blood cells, but normal numbers of the other type(s).
- There is a normal number (less than 5%) of very early cells called blasts in the bone marrow, and blasts are rare (or absent) in the blood.

This type of MDS is not common. It seldom, if ever, progresses to acute myeloid leukemia (AML)[1]. Patients with this type of MDS can often live a long time, even without treatment.

This was referred to as *refractory cytopenia with unilineage dysplasia* (RCUD) in the previous classification system. It includes **refractory anemia** (RA), **refractory neutropenia** (RN), and **refractory thrombocytopenia** (RT), depending on which cell type is affected.

MDS with ring sideroblasts (MDS-RS)

In this type of MDS, many of the early red blood cells are ring sideroblasts. For this diagnosis, at least 15% of the early red blood cells must be ring sideroblasts (or at least 5% if the cells also have a mutation in the *SF3B1* gene).

This condition is further divided into 2 types, based on how many of the cell types in the bone marrow are affected by dysplasia:

- **MDS-RS with single lineage dysplasia (MDS-RS-SLD):** dysplasia in only one cell type
- **MDS-RS with multilineage dysplasia (MDS-RS-MLD):** dysplasia in more than one cell type

This type of MDS is not common. It rarely turns into AML[2]

bone marrow. Or the cells in the bone marrow have at least one certain chromosome abnormality that is only seen in MDS or leukemia.

This type is rare, so it has not been studied well enough to predict prognosis (outlook).

Clinical classification of MDS

Along with the WHO classification, MDS can also be classified based on the underlying cause. This is known as a *clinical classification*.

- If no cause can be identified, it's called **primary MDS**. (This type is more common.)
- When the cause of the disease is known, it's called **secondary MDS**.

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What's New in Myelodysplastic Syndrome Research?

Genetics and biology of MDS

not helpful for everyone, and they eventually stop working for most people. **Guadecitabine** is a newer drug that is related to decitabine, but it stays inside cells longer, so in theory it might work better. It has helped some people in early studies, and is now being tested in a larger study.

Researchers are also testing oral (by mouth) forms of azacitidine and decitabine, which might be easier for patients to take.

Research is also under way to see if there are some patients who might benefit from

Platzbecker U, Germing U, Götze KS, et al. Luspatercept for the treatment of anaemia in patients with lower-risk myelodysplastic syndromes (PACE-MDS): A multicentre, open-label phase 2 dose-finding study with long-term extension study. *Lancet Oncol*. 2017;18(10):1338-1347.

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