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## Acute Myeloid Leukemia

Also called: Acute myelogenous leukemia, AML, ANLL

### What is leukemia?

Leukemia [<https://medlineplus.gov/leukemia.html>] is a term for cancers of the blood cells. Leukemia starts in blood-forming tissues such as the bone marrow. Your bone marrow makes the cells which will develop into white blood cells, red blood cells, and platelets. Each type of cell has a different job:

- White blood cells help your body fight infection
- Red blood cells deliver oxygen from your lungs to your tissues and organs
- Platelets [<https://medlineplus.gov/plateletdisorders.html>] help form clots to stop bleeding

When you have leukemia, your bone marrow makes large numbers of abnormal cells. This problem most often happens with white blood cells. These abnormal cells build up in your bone marrow and blood. They crowd out the healthy blood cells and make it hard for your cells and blood to do their work.

### What is acute myeloid leukemia (AML)?

Acute myeloid leukemia (AML) is a type of acute leukemia. "Acute" means that the leukemia usually gets worse quickly if it's not treated. In AML, the bone marrow makes abnormal myeloblasts (a type of white blood cell), red blood cells, or platelets. When the abnormal cells crowd out the healthy cells, it can lead to infection, [anemia](https://medlineplus.gov/anemia.html) [<https://medlineplus.gov/anemia.html>] , and easy bleeding. The abnormal cells can also spread outside the blood to other parts of the body.

There are several different subtypes of AML. The subtypes are based on how developed the cancer cells are when you get your diagnosis and how different they are from normal cells.

### What causes acute myeloid leukemia (AML)?

AML happens when there are changes in the genetic material (DNA) in bone marrow cells. The cause of these genetic changes is unknown. However, there are certain factors that raise your risk of AML.

### Who is at risk for acute myeloid leukemia (AML)?

The factors that raise your risk of AML include:

- Being male
- Smoking, especially after age 60
- Having had chemotherapy [<https://medlineplus.gov/cancerchemotherapy.html>] or radiation therapy [<https://medlineplus.gov/radiationtherapy.html>]
- Treatment for acute lymphoblastic leukemia [<https://medlineplus.gov/acutelymphocytic leukemia.html>] (ALL) as a child
- Exposure to the chemical benzene
- A history of another blood disorder such as myelodysplastic syndrome [<https://medlineplus.gov/myelodysplasticsyndromes.html>]

### What are the symptoms of acute myeloid leukemia (AML)?

The signs and symptoms of AML include:

- Fever [<https://medlineplus.gov/fever.html>]
- Shortness of breath [<https://medlineplus.gov/breathingproblems.html>]
- Easy bruising [<https://medlineplus.gov/bruises.html>] or bleeding [<https://medlineplus.gov/bleedingdisorders.html>]
- Petechiae, which are tiny red dots under the skin. They are caused by bleeding.
- Weakness or feeling tired [<https://medlineplus.gov/fatigue.html>]
- Weight loss or loss of appetite
- Bone or joint pain, if the abnormal cells build up near or inside the bones

## How is acute myeloid leukemia (AML) diagnosed?

Your health care provider may use many tools to diagnose AML and figure out which subtype you have:

- A physical exam
- A medical history
- Blood tests, such as a complete blood count (CBC) [<https://medlineplus.gov/lab-tests/complete-blood-count-cbc/>] and blood smear [<https://medlineplus.gov/lab-tests/blood-smear/>]
- Bone marrow tests [<https://medlineplus.gov/lab-tests/bone-marrow-tests/>]. There are two main types - bone marrow aspiration and bone marrow biopsy. Both tests involve removing a sample of bone marrow and bone. The samples are sent to a lab for testing.
- Genetic tests [<https://medlineplus.gov/genetictesting.html>] to look for gene and chromosome changes

If you are diagnosed with AML, you may have additional tests to see whether the cancer has spread. These include imaging tests [<https://medlineplus.gov/diagnosticimaging.html>] and a lumbar puncture [<https://medlineplus.gov/lab-tests/cerebrospinal-fluid-csf-analysis/>], which is a procedure to collect and test cerebrospinal fluid (CSF).

## What are the treatments for acute myeloid leukemia (AML)?

Treatments for AML include:

- Chemotherapy
- Radiation therapy
- Chemotherapy with stem cell transplant [<https://medlineplus.gov/stemcells.html>]
- Other anticancer medicines

Which treatment you get often depends on which subtype of AML you have. Treatment is usually done in two phases:

- The goal of the first phase is to kill the leukemia cells in the blood and bone marrow. This puts the leukemia into remission. Remission means that the signs and symptoms of cancer are reduced or have disappeared.
- The second phase is known as post-remission therapy. Its goal is to prevent a relapse (return) of the cancer. It involves killing any remaining leukemia cells that may not be active but could begin to regrow.

*NIH: National Cancer Institute*

## Start Here

- Acute Myelogenous Leukemia (AML) [<https://www.mayoclinic.org/diseases-conditions/acute-myelogenous-leukemia/symptoms-causes/syc-20369109?p=1>] (Mayo Foundation for Medical Education and Research)  
Also in Spanish [<https://www.mayoclinic.org/es/diseases-conditions/acute-myelogenous-leukemia/symptoms-causes/syc-20369109?p=1>]
- AML Guide: Information for Patients and Caregivers [[https://www.lls.org/sites/default/files/file\\_assets/amlguide.pdf](https://www.lls.org/sites/default/files/file_assets/amlguide.pdf)] (Leukemia & Lymphoma Society) - **PDF**  
Also in Spanish [[https://www.lls.org/sites/default/files/2023-11/PS66S\\_AML\\_Guide\\_2023\\_Spanish.pdf](https://www.lls.org/sites/default/files/2023-11/PS66S_AML_Guide_2023_Spanish.pdf)]
- General Information about Adult Acute Myeloid Leukemia [[https://www.cancer.gov/types/leukemia/patient/adult-aml-treatment-pdq#\\_1](https://www.cancer.gov/types/leukemia/patient/adult-aml-treatment-pdq#_1)]  (National Cancer Institute)  
Also in Spanish [<https://www.cancer.gov/espanol/tipos/leucemia/paciente/tratamiento-lma-adultos-pdq>]

- What Is Acute Myeloid Leukemia (AML)? [<https://www.cancer.org/cancer/types/acute-myeloid-leukemia/about/what-is-aml.html>] (American Cancer Society)

Also in Spanish [<https://www.cancer.org/es/cancer/tipos/leucemia-mieloide-aguda/acerca/que-es-leucemia-mieloide-aguda.html>]

## Diagnosis and Tests

- Acute Myeloid Leukemia (AML) Subtypes and Prognostic Factors [<https://www.cancer.org/cancer/types/acute-myeloid-leukemia/detection-diagnosis-staging/how-classified.html>] (American Cancer Society)  
Also in Spanish [<https://www.cancer.org/es/cancer/tipos/leucemia-mieloide-aguda/deteccion-diagnostico-clasificacion-por-etapas/como-se-clasifica.html>]
- Blood Count Tests: MedlinePlus Health Topic [<https://medlineplus.gov/bloodcounttests.html>]  (National Library of Medicine)  
Also in Spanish [<https://medlineplus.gov/spanish/bloodcounttests.html>]
- Blood Tests [<https://www.nhlbi.nih.gov/health/blood-tests>]  (National Heart, Lung, and Blood Institute)  
Also in Spanish [<https://www.nhlbi.nih.gov/es/salud/analisis-de-sangre>]
- Lab and Imaging Tests [<https://www.lls.org/treatment/lab-and-imaging-tests>] (Leukemia & Lymphoma Society)  
Also in Spanish [[https://www.lls.org/sites/default/files/2021-05/PS41S\\_SP\\_Understanding\\_Labs\\_FINAL\\_2020.pdf](https://www.lls.org/sites/default/files/2021-05/PS41S_SP_Understanding_Labs_FINAL_2020.pdf)]
- Stages of Adult Acute Myeloid Leukemia [[https://www.cancer.gov/types/leukemia/patient/adult-aml-treatment-pdq#\\_164](https://www.cancer.gov/types/leukemia/patient/adult-aml-treatment-pdq#_164)]   
(National Cancer Institute)  
Also in Spanish [[https://www.cancer.gov/espanol/tipos/leucemia/paciente/tratamiento-lma-adultos-pdq#\\_151](https://www.cancer.gov/espanol/tipos/leucemia/paciente/tratamiento-lma-adultos-pdq#_151)]
- Tests for Acute Myeloid Leukemia (AML) [<https://www.cancer.org/cancer/types/acute-myeloid-leukemia/detection-diagnosis-staging/how-diagnosed.html>] (American Cancer Society)  
Also in Spanish [<https://www.cancer.org/es/cancer/tipos/leucemia-mieloide-aguda/deteccion-diagnostico-clasificacion-por-etapas/como-se-diagnostica.html>]

## Prevention and Risk Factors

- Can Acute Myeloid Leukemia (AML) Be Prevented? [<https://www.cancer.org/cancer/types/acute-myeloid-leukemia/causes-risks-prevention/prevention.html>] (American Cancer Society)  
Also in Spanish [<https://www.cancer.org/es/cancer/tipos/leucemia-mieloide-aguda/causas-riesgos-prevencion/prevencion.html>]
- Risk Factors for Acute Myeloid Leukemia (AML) [<https://www.cancer.org/cancer/types/acute-myeloid-leukemia/causes-risks-prevention/risk-factors.html>] (American Cancer Society)  
Also in Spanish [<https://www.cancer.org/es/cancer/tipos/leucemia-mieloide-aguda/causas-riesgos-prevencion/factores-de-riesgo.html>]

## Treatments and Therapies

- Blood Transfusion [<https://www.lls.org/treatment/types-treatment/blood-transfusion>] (Leukemia & Lymphoma Society)
- Bone Marrow Transplantation: MedlinePlus Health Topic [<https://medlineplus.gov/bonemarrowtransplantation.html>]   
(National Library of Medicine)  
Also in Spanish [<https://medlineplus.gov/spanish/bonemarrowtransplantation.html>]
- If Acute Myeloid Leukemia (AML) Doesn't Respond or Comes Back after Treatment [<https://www.cancer.org/cancer/types/acute-myeloid-leukemia/treating/recurrence.html>] (American Cancer Society)  
Also in Spanish [<https://www.cancer.org/es/cancer/tipos/leucemia-mieloide-aguda/tratamiento/recurrencia.html>]
- Immunotherapy [<https://www.lls.org/treatment/types-treatment/immunotherapy>] (Leukemia & Lymphoma Society)  
Also in Spanish [[https://www.lls.org/sites/default/files/file\\_assets/FS9S\\_SP\\_Immunotherapy2020.pdf](https://www.lls.org/sites/default/files/file_assets/FS9S_SP_Immunotherapy2020.pdf)]
- Integrative Medicine and Complementary and Alternative Therapies [<https://www.lls.org/treatment/integrative-medicine-and-complementary-therapies>] (Leukemia & Lymphoma Society)  
Also in Spanish [[https://www.lls.org/sites/default/files/2022-05/FS8S\\_Integrative\\_Medicine\\_Complementary\\_Therapies\\_04.22\\_Spanish.pdf](https://www.lls.org/sites/default/files/2022-05/FS8S_Integrative_Medicine_Complementary_Therapies_04.22_Spanish.pdf)]
- Treatment Option Overview (Adult Acute Myeloid Leukemia) [[https://www.cancer.gov/types/leukemia/patient/adult-aml-treatment-pdq#\\_36](https://www.cancer.gov/types/leukemia/patient/adult-aml-treatment-pdq#_36)]   
(National Cancer Institute)  
Also in Spanish [[https://www.cancer.gov/espanol/tipos/leucemia/paciente/tratamiento-lma-adultos-pdq#\\_18](https://www.cancer.gov/espanol/tipos/leucemia/paciente/tratamiento-lma-adultos-pdq#_18)]

Genetics

- 8p11 myeloproliferative syndrome: MedlinePlus Genetics [<https://medlineplus.gov/genetics/condition/8p11-myeloproliferative-syndrome>]  (National Library of Medicine)
  - Acute promyelocytic leukemia: MedlinePlus Genetics [<https://medlineplus.gov/genetics/condition/acute-promyelocytic-leukemia>]  (National Library of Medicine)
  - Core binding factor acute myeloid leukemia: MedlinePlus Genetics [<https://medlineplus.gov/genetics/condition/core-binding-factor-acute-myeloid-leukemia>]  (National Library of Medicine)
  - Cytogenetically normal acute myeloid leukemia: MedlinePlus Genetics [<https://medlineplus.gov/genetics/condition/cytogenetically-normal-acute-myeloid-leukemia>]  (National Library of Medicine)
  - Familial acute myeloid leukemia with mutated CEBPA: MedlinePlus Genetics [<https://medlineplus.gov/genetics/condition/familial-acute-myeloid-leukemia-with-mutated-cebpa>]  (National Library of Medicine)
  - What Causes Acute Myeloid Leukemia (AML)? [<https://www.cancer.org/cancer/types/acute-myeloid-leukemia/causes-risks-prevention/what-causes.html>] (American Cancer Society)  
Also in Spanish [<https://www.cancer.org/es/cancer/tipos/leucemia-mieloide-aguda/causas-riesgos-prevencion/que-lo-causa.html>]

## Statistics and Research

- Advances in Leukemia Research [<https://www.cancer.gov/types/leukemia/research>]  (National Cancer Institute)
  - Cancer Statistics: Acute Myeloid Leukemia (AML) [<https://seer.cancer.gov/statfacts/html/amyl.html>]  (National Cancer Institute)
  - Key Statistics for Acute Myeloid Leukemia (AML) [<https://www.cancer.org/cancer/types/acute-myeloid-leukemia/about/key-statistics.html>] (American Cancer Society)  
Also in Spanish [<https://www.cancer.org/es/cancer/tipos/leucemia-mieloide-aguda/acerca/estadisticas-clave.html>]
  - What's New in Acute Myeloid Leukemia (AML) Research? [<https://www.cancer.org/cancer/types/acute-myeloid-leukemia/about/new-research.html>] (American Cancer Society)  
Also in Spanish [<https://www.cancer.org/es/cancer/tipos/leucemia-mieloide-aguda/acerca/nuevas-investigaciones.html>]

## Clinical Trials

- ClinicalTrials.gov: Leukemia, Myeloid, Acute [<https://clinicaltrials.gov/search?cond=%22Leukemia,+Myeloid,+Acute%22&aggFilters=status:not%20rec>]  (National Institutes of Health)
  - Types of Treatment: Clinical Trials [<https://www.lls.org/treatment/types-treatment/clinical-trials>] (Leukemia & Lymphoma Society)

## Journal Articles

References and abstracts from MEDLINE/PubMed (National Library of Medicine)

- Article: Effect of vitamin D status on a disintegrin-like and metalloprotease with...  
[<https://www.ncbi.nlm.nih.gov/pubmed/40671161>]
  - Article: Phase I first-in-human dose escalation study of the oral casein kinase...  
[<https://www.ncbi.nlm.nih.gov/pubmed/40665325>]
  - Article: A Phase 1b/2 Study of TP-0903 and Decitabine Targeting Mutant TP53...  
[<https://www.ncbi.nlm.nih.gov/pubmed/40557912>]
  - Acute Myeloid Leukemia -- see more articles [<https://pubmed.ncbi.nlm.nih.gov/?term=%22Leukemia%2C+Myeloid%2C+Acute%22%5Bmajr%3Anoexp%5D+AND+humans%5Bmh%5D+AND+english%5Bla%5D+AND+%22last+1+Year%22+%5Bdat%5D+AND+%28patient+education+handout%5Bpt%5D+OR+guideline%5Bpt%5D+OR+clinical+trial%5Bpt%5D%29++NOT+%28letter%5Bpt%5D+OR+case+reports%5Bpt%5D+OR+editorial%5Bpt%5D+OR+comment%5Bpt%5D%29+AND+free+full+text%5Bsb%5D+>]

## Find an Expert

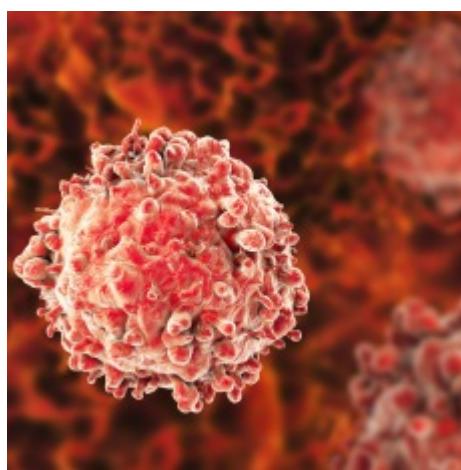
- American Cancer Society [<https://www.cancer.org/>]
- Choosing a Cancer Doctor [<https://www.cancer.org/cancer/managing-cancer/finding-care/where-to-find-cancer-care/choosing-a-cancer-doctor.html>] (American Cancer Society)  
Also in Spanish [<https://www.cancer.org/es/cancer/como-sobrellevar-el-cancer/encontrar-tratamiento/como-elegir-un-medico-y-un-hospital/como-seleccionar-a-un-medico.html>]
- Leukemia & Lymphoma Society [<https://www.lls.org/>]  
Also in Spanish [<https://www.lls.org/node/1690491>]
- National Cancer Institute [<https://www.cancer.gov/>]   
Also in Spanish [<https://www.cancer.gov/espanol>]
- NCI - Designated Cancer Centers [<https://www.cancer.gov/research/infrastructure/cancer-centers>]  
 (National Cancer Institute)  
Also in Spanish [<https://www.cancer.gov/espanol/investigacion/infraestructura/centros-oncologicos>]

## Children

- Childhood Leukemia: MedlinePlus Health Topic [<https://medlineplus.gov/childhoodleukemia.html>]  
 (National Library of Medicine)  
Also in Spanish [<https://medlineplus.gov/spanish/childhoodleukemia.html>]

## Patient Handouts

- Acute myelogenous leukemia (AML) -- children [<https://medlineplus.gov/ency/article/007656.htm>] (Medical Encyclopedia)  
Also in Spanish [<https://medlineplus.gov/spanish/ency/article/007656.htm>]
- Acute myeloid leukemia -- adult [<https://medlineplus.gov/ency/article/000542.htm>] (Medical Encyclopedia)  
Also in Spanish [<https://medlineplus.gov/spanish/ency/article/000542.htm>]
- After chemotherapy - discharge [<https://medlineplus.gov/ency/patientinstructions/000012.htm>] (Medical Encyclopedia)  
Also in Spanish [<https://medlineplus.gov/spanish/ency/patientinstructions/000012.htm>]
- Bone marrow transplant [<https://medlineplus.gov/ency/article/003009.htm>] (Medical Encyclopedia)  
Also in Spanish [<https://medlineplus.gov/spanish/ency/article/003009.htm>]
- Bone marrow transplant - discharge [<https://medlineplus.gov/ency/patientinstructions/000010.htm>] (Medical Encyclopedia)  
Also in Spanish [<https://medlineplus.gov/spanish/ency/patientinstructions/000010.htm>]



## MEDICAL ENCYCLOPEDIA

Acute myelogenous leukemia (AML) -- children [<https://medlineplus.gov/ency/article/007656.htm>]

Acute myeloid leukemia -- adult [<https://medlineplus.gov/ency/article/000542.htm>]

After chemotherapy - discharge [<https://medlineplus.gov/ency/patientinstructions/000012.htm>]

Bone marrow biopsy [<https://medlineplus.gov/ency/article/003934.htm>]

Bone marrow transplant [<https://medlineplus.gov/ency/article/003009.htm>]

Bone marrow transplant - discharge [<https://medlineplus.gov/ency/patientinstructions/000010.htm>]

Bone-marrow transplant - series [[https://medlineplus.gov/ency/presentations/100112\\_1.htm](https://medlineplus.gov/ency/presentations/100112_1.htm)]

Cryoglobulins [<https://medlineplus.gov/ency/article/003555.htm>]

Fibrinopeptide A blood test [<https://medlineplus.gov/ency/article/003373.htm>]

## Related Health Topics

Acute Lymphocytic Leukemia [<https://medlineplus.gov/acutelymphocyticleukemia.html>]

Childhood Leukemia [<https://medlineplus.gov/childhoodleukemia.html>]

Chronic Lymphocytic Leukemia [<https://medlineplus.gov/chroniclymphocyticleukemia.html>]

Chronic Myeloid Leukemia [<https://medlineplus.gov/chronicmyeloidleukemia.html>]

Leukemia [<https://medlineplus.gov/leukemia.html>]

## National Institutes of Health

The primary NIH organization for research on *Acute Myeloid Leukemia* is the National Cancer Institute [<http://www.cancer.gov/>]

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