Acute Myelogenous Leukemia (AML)

Leukemia is a malignant disease of the bone marrow and blood characterized by the uncontrolled accumulation of blood cells. Acute Myelogenous Leukemia (AML) results from acquired mutations in the DNA of a developing cell in the marrow. With AML, the leukemic cells are referred to as blast cells, which 1) fail to function as normal blood cells, and 2) block production of normal marrow cells, leading to anemia, thrombocytopenia and neutropenia.

**Incidence, Causes and Risk Factors**

About 12,330 Americans are expected to be diagnosed with AML this year. The incidence of AML increases with age, however almost 15 percent of acute childhood leukemias are cases of AML. The risk for developing AML increases about 10-fold from age 30 to 34 years (about 1 case per 100,000 people) to age 65 to 69 years (about 11 cases per 100,000 people).

Though difficult to cure, the number of patients with AML who enter remission, stay in remission for years or are cured has increased significantly over the past 30 years. A few decades ago almost no adults with AML were cured.

In most cases the cause of AML is not known. Factors associated with increased risk of the disease include exposure to:

- Therapeutic radiation
- Repeated exposure to Benzene which damages the DNA of normal cells.
- Some types of chemotherapy, particularly alkylating agents and topoisomerase II inhibitors.
- Tobacco smoke, now the leading known source of benzene exposure.
- Down syndrome

**Signs and Symptoms**

Some of the signs and symptoms for AML are common to many illnesses. Some changes that a person with AML may have are:

- Fatigue
- Shortness of breath with exertion
- Pale Skin
- Swollen gums / bleeding gums
- Prolonged healing and/or bleeding from minor cuts
- Petechiae / Echymoses
- Low-grade fever
- Arthralgic pain
- Frequent minor infections i.e. pustules or perianal sores
Diagnosis

In addition to findings such as lower-than-expected red cell and platelet counts, a peripheral blood smear usually shows the presence of blast cells. The diagnosis is confirmed by bone marrow aspiration and biopsy. Blood and/or marrow cells are also used for

- Cytogenetic analysis (studies of the number and size of chromosomes).
- Genetic testing which may include polymerase chain reaction (PCR).
- Immunophenotyping, a process for identifying cells based on the types of markers (antigens) on the cell surface.

Types of AML

Historically, most patients diagnosed with AML are placed in one of eight different patterns or subtypes---M0 to M7.

- M0, M1 and M2 are all myeloblastic leukemia. Most people with AML have one of these types.
- M3 is acute promyelocytic leukemia (APL). About 1 in 10 adult AML patients has the APL type.
- M4 is acute myelomonocytic leukemia. About 1 in 5 AML patients has this type.
- M5 is acute monocytic leukemia. About 1 in 15 out of 100 AML patients has this type.
- M6 is acute erythroleukemia and M7 is acute megakaryocytic leukemia. These types are rare.

More recently, WHO has divided AML into two broad categories: Those with cytogenetic abnormalities and those without.

Treatment for AML

Nearly all patients with AML require treatment as soon after diagnosis as possible. Though the principle goal of treatment for AML is to cure the disease, the majority of adults with AML are not cured. Almost half of children with AML are cured. Patients with acute promyelocytic leukemia (APL) have higher cure rates overall compared to adults with other types of AML types.

In most patients, intensive chemotherapy is required to achieve a complete remission, in which

- There is no evidence of leukemic blast cells in the blood or marrow, and
- Normal blood cell production is restored and blood cell counts return to normal levels.

Certain factors may determine the patient’s treatment options and chances for remission/cure:

- Age and general health
- The subtype of AML / cytogenetic abnormalities
- Central nervous system involvement
- Systemic infection at diagnosis
- History of myelodysplastic syndrome or other malignancy
- Relapsed AML
From 2005-2009, 32 local patients, ages 32-86, were diagnosed with AML. Of the 20 patients opting for treatment at the DCH Cancer Center, all received treatment based on NCCN guidelines. The choice of drugs used to treat a patient’s disease depends on the patient’s disease type, age, stage of disease, response to previous treatment and other factors. Elderly patients were more likely to refuse treatment.

**Treatment of AML**

The initial phase of chemotherapy treatment, “induction therapy”, requires an extended hospitalization lasting often for four to six weeks or sometimes longer. In most cases, an anthracycline drug, such as daunorubicin, doxorubicin, or idarubicin, is combined with cytarabine. As the result of severe bone marrow suppression, the patient requires extensive supportive care until a remission is achieved.

Consolidative or “post remission therapy” needed to prevent relapse consists of additional intensive chemotherapy after remission has been achieved, with or without autologous stem cell infusion or allogeneic stem cell transplantation.

Occasionally, radiation therapy may be used to treat a large localized accumulation of leukemia cells.

Bone marrow transplant is considered for patients at high risk of relapse.

**Outcomes**

The relative survival rates for AML differ by age of the patient at the time of diagnosis, gender, race, cytogenetics and subtype of AML. Patients diagnosed before age 65 have an overall five-year survival rate of 34.9 percent. Children under 15 years of age have an overall five-year survival rate of 54.1 percent. Patients diagnosed at age 65 and older have an overall five-year survival rate of 4.1 percent.

**References**

Alabama Cancer Facts and Figures 2009

The Leukemia & Lymphoma Society

MD Anderson Cancer Center