CHAPTER 2
THEORETICAL BACKGROUND

2.1 The Concept Of Leukemia Diseases

2.1.1 Anatomy Phisiology

2.1.1.1 Anatomy

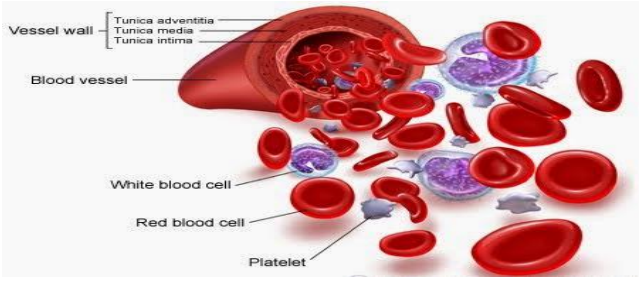
The circulatory system is a means to channel food and oxygen from the digestive tract and from the lungs to the cells of the body. In addition, the circulatory system is a means to remove the remnants of metabolism from cells to the kidneys, lungs and skin which is where the excretion of metabolic remnants.

The organs of the circulatory system include the heart, blood vessels and blood:

a. Heart

Is a hollow organ, located in the mediastinum between the two lungs in the chest cavity above the diaphragm. Its function is to pump oxygen-rich blood into the arterial system (which takes it to the cells) and holds blood from the venous system and passes it on to the lungs for reoxygenation. The function of the arteries, capillaries, veins, and lymph vessels is to bring blood into cells throughout the body.

b. Blood vessel



Ficture 2.1 Blood Anatomy (Eriani, 2014)

1) Arteries

   The arteries leave the heart in the left and right ventricle.

2) Capillaries (hair vessels)

   Capillaries are very small blood vessels that originate from the finest branches of the arteries so that they are invisible, except under a microscope. Capillaries form a webbing throughout the body's tissues, the capillaries subsequently meet one another into larger veins called venous.

3) Veins (back veins)

   Veins carry dirty blood back to the heart.

4) Blood

   Blood is a special connective tissue form, consisting of shaped elements ie blood cells and platelets and a liquid intercellular substance that is blood plasma. There are two main types of blood cells that are depicted according to their appearance in a fresh state without the sigh of red blood (erythrocytes) and white blood cells (leukocytes).

The process of formation of blood cells (hemopoesis) there are three places, namely:

1) Bone marrow that is active in the hemopoesis process is:
   a) Bone vertebrae
   b) Sternum (breastbone)
   c) Costa (ribs)

2) Liver

   Is the largest gland of several glands in the human body.

3) Spleen

   The spleen is located in the upper left part of the abdomen. Reddish half-moon spleen. The spleen is a encapsulated organ with a normal weight of 100-150 gr. The spleen has two functions, namely the lymphoid organ and phagocytes of certain materials in the damaged red blood circulation.

General blood function consists of:

1) As a carrier

   Namely taking O2 or combustion substances from the lungs to circulate throughout the body tissues, transporting CO2 from tissue to be removed through the lungs, taking food substances from the small intestine to be circulated and distributed throughout the body tissues or body tools, lifting or removing substances which is not useful for the body to be removed through the skin and kidneys.

2) As the body's defense against attack of disease seeds and toxins that will destroy the body by leukosit mediation, anti body, or anti-toxic substances

3) Spreading heat throughout the body

2.1.1.2 Physiology

Blood consists of two parts, namely:

a. Erythrocytes

Erythrocytes or red blood cells are cells that have far differentiated and have special functions for oxygen transport. Erythrocytes are shaped like biconcaf discs and when viewed in a flat plane round shape. Red blood cells are elastic and have the ability to change shape. The red blood cells are 7.6 micrometers in diameter and 1.9 microns thick. The amount of erythrocytes in men is 5-5.5 million per millimeter, in women of 4.5-5 million per cubic millimeter. Erythrocytes are reddish yellow because they contain a substance called hemoglobin. This color will increase red if inside contains lots of O2. the function of the erythrocytes is to bind O2 from the lungs to circulate throughout the body and to CO2 thanks to the body's jsringsn to be excreted through the lungs.

b. Platelets (freezing cells)

It is small objects of various shapes and sizes, some are round and some are ovaled with white color with a normal amount of 150,000 - 450,000 / mm3. platelets play an important role in blood clots if they are less than normal. If a wound arises blood does not freeze quickly resulting in continuous bleeding. The process of blood coagulation is assisted by a substance that is Ca2 + and fibrinogen. Fibrinogen begins to work when the body gets injured. If the body is injured the blood will come out, the platelets break and will release a substance called thrombokinase. Thrombokinase will

meet protombin with the help of Ca2 + to become thrombin. The thrombin will meet with fibrin which is fine yarn, an irregular shape of tissue that will hold the blood cells, thereby freezing.

c. Leukocytes (white blood cells)

Blood-shaped blood cells that can move with the artificial toe of the foot (pseudopodia) have a variety of cell nuclei that can be differentiated based on the cell nucleus. Leukocytes are clear (colorless). The amount is approximately 4000-11000 / mm3.

Leukocytes serve as body soldiers that kill and eat the seeds of disease or bacteria that enter into the body tissue Retikulo Endotel System, another function is as a carrier, where leukocytes carry and carry fatty substances from the intestinal wall through the spleen and blood vessels. There are main groups of leukocytes, agranular and granular:

1) Agranular leukocytes have a cytoplasm that appears homogeneous and essentially spherical. There are two types of agranular leukocytes:
   a) Lymphocytes

      Is another mononuclear leukocyte in the blood that has a round and oval nucleus surrounded by a narrow cytoplasmic rim of blue that contains little granules. The shape of chromatin of the nucleus with associated meshes inside. Lymphocytes vary in size from small (7-10 micrometres) to large-sized granulocytes and appear to originate from

pluripotential stem cells in the bone marrow and migrate to other lymphoid tissues including lymph nodes, lymph, thymus and mucosal surface of the gastrointestinal tract and respiratory tract.

There are 2 types of lymphocytes: T lymphocytes depend on the thymus, long-lived, formed in the thymus, T lymphocytes migrate from the thymus gland to other lymphoid tissues. This cell is typically found in the lymph node paracrine and the periarteriole lymphoid sheet of the white pulp of the lien. T lymphocytes are responsible for the immune response cellular through the formation of reactive antigen cells. Whereas B lymphocytes do not depend on the thymus, B lymphocytes are dispersed with lymph node follicles, livers, and medulla lymph nodes. B lymphocytes if stimulated properly would differentiate into plasma cells that produce immunoglobulins, these cells responsible for humoral immune responses.

b) Monocytes

Monocytes are larger than neutrophils and have relatively simple monomorphic nuclei. The bottom is folded or grooved and appears to be pierced with a fold like a brain. The cytoplasm looks more in comparison with its core and absorbs a less gray-blue color, its granules are evenly distributed. Differentiation

of maturation and monosid release occurs more than 24 days, a longer period of granulocytes. Monocytes leave the circulation and become tissue macrophages and are part of the monocyte-macrophage system. Monocytes have the function of phagocytes, removing injured and dead cells, cell fragments and microorganisms.

2) Granular leukocytes: This leukocyte stores a specific granule (alive in the form of half-liquid droplets) in its cytoplasm and has a nucleus that exhibits many variations in its shape. There are 3 types of granular leukocytes:

   a) Neutrophils

      Neutrophils are the primary body's defense system against bacterial infections, the defense method is the process of phagocytosis.

   b) Eosinophils

      Eosinophils have a weak phagocyte function that is not clearly understood. Eosinophils appear to function in antigen, antibody and increased reactions in asthma attacks, drug reactions, and certain parasitic infestations.

   c) Basophils

      Basophils carry heparin, histamine activation factors and platelets in its granules to cause inflammation of the tissues. The actual function is not known with certainty. Increased basophile level (basophilia) is found in the proliferative disorder of blood-forming cells.

d) Blood plasma

The bloody part of the dilute blood cells without clear yellow color almost 90% of blood plasma consists of:

(1) Fibrinogen is useful in blood clotting process.
(2) Mineral salts (calcium, potassium, sodium and other salts useful in metabolism and also osmotic).
(3) Blood proteins (albumin and globulin) increase blood viscosity and also generate osmotick pressure to maintain fluid balance in the body.
(4) Food substances (amino substances, fat glucose, minerals, and vitamins).
(5) Hormones are a substance that is produced from the body glands.
(6) Antibody or anti toxin (syaifuddin, 2011).

2.1.2 Definition / description of Illness

Leukemia is an abnormal, malignant, leukocyte cell-mediated polypsy, often with other than normal forms of leukocytes, excessive amounts and can cause anemia, thrombocytopenia and end with death (Nurarif, 2013).

Acute leukemia is a malignant disease that results from malignant transformation and abnormal proliferation of one or more blood forming elements and is accompanied by infiltration into the bone marrow and other organs, resulting in the failure of the normal systematic formation that causes death in the patient.

In non-lymphocytic acute leukemia (LANL) the malignant proliferation of cell stem cells is the origin / stem cell of immature granolocyte cell, whereas in acute lymphocytic leukemia (LAL) the proliferating cell cell is also the parent cell of the lymphocyte which is still immature (Misnadiarly, 2016)

Leukemia is divided into acute leukemia and chronic leukemia. This division does not describe the length of life expectancy but describes the speed of the onset of symptoms and complications. On the outline leukemia division is as follows:

2.1.2.1 Myeloid leukemia

a. Granulositik leukemia / myeloid / myelositik / myelogenous chronicles
b. Myeloblastic / granulocytic leukemia / myeloid / myelocytic acute

2.1.2.2 Lymphoid leukemia

a. Chronic lymphocytic leukemia
b. Acute lymphocytic leukemia

(Ginarsih, A. 2013).

2.1.3 Etiology

The exact cause is not known, but there are predisposing factors that cause leukemia, namely:

2.1.3.1 Genetic factors: Certain viruses cause gene structure changes (Tcell Leukemia-Lymphoma Virus / HLTV)

2.1.3.2 Radiation

2.1.3.3 Immunosuppressive drugs, cardiogenic drugs such as diethylstilbestrol

2.1.3.4 Hereditary factors, eg monozygotic twins

2.1.3.5 Chromosomal abnormalities, such as Down syndrome

Leukemia usually affects white blood cells. The cause of most types of leukemia is unknown. Exposure to radiation (radiation) and certain chemicals (eg benzene) and the use of anti-cancer drugs, increases the risk of leukemia. People who have certain genetic disorders (eg Down syndrome and Fanconi syndrome), are also more sensitive to leukemia (Nurarif, 2013).

Many things that affect the occurrence of leukemia, including:

2.1.3.1 Exogenous Factors

a. Radiation, particularly those involving bone marrow, may increase leukemia in patients treated with radiation or chemotherapy.
b. Chemicals, such as benzene, arsenic, chloramphenicol, phenylbutazone, and anti-neoplastic agents. Exposure to chemicals can lead to spinal dysplasia, aplastic anemia and chromosomal changes that can eventually lead to leukemia.
c. Viral infection, in the early 1980s isolated the HTLV-1 (Human T Leukemia Virus) virus from human T cell leukemia in lymphocytes of a skin lymphoma patient and has since been isolated from serum samples of T cell leukemia patients.

2.1.3.2 Endogenous factors

a. Hereditary, increased incidence in some hereditary diseases such as Down syndrome has a 20x fold incidence of acute leukemia and a family history of leukemia. higher leukemia incidents than siblings of affected children, with incidence rising to 20% in monozygotic twins.

b. Genetic abnormalities, genetic mutations of genes that regulate blood cells that are not inherited (Price, 2014).

2.1.4 Symptom Signs

2.1.4.1 Cold does not heal

2.1.4.2 Pale, lethargic, easily stimulated

2.1.4.3 Fever and anorexia

2.1.4.4 BB down

2.1.4.5 Ptechiae, bruises without cause

2.1.4.6 Bone and joint pain

2.1.4.7 Abdominal pain

2.1.4.8 Limphadenopathy

2.1.4.9 Hepatosplenomegaly

2.1.4.10 Abnormal WBC

(Nurarif, 2013).

2.1.5 According to Ginarsih

A (2013) signs of leukemia symptoms are:

2.1.5.1 Chronic granulocytic leukemia (LGK)

LGK is a myeloproliferative disease characterized by a relatively mature production of granulocyte series. Symptoms of LGK include fatigue, BB reduction, fullness in the stomach and bleed easily. In physical examination almost always found splenomegaly, ie in 90% of cases. Also often found tenderness in the sternum and hepatomegaly. Sometimes there are purpura, retinal hemorrhages, heat, enlarged lymph nodes and sometimes priapismus.

2.1.5.2 Acute myeloblastic leukemia (LMA)

Symptoms of LMA sufferers include fatigue, pallor, loss of appetite, anemia, petechiae, bleeding, bone pain, infection, enlarged lymph nodes, spleen, liver and mediastinal glands. Sometimes also found gum hypertrophy, especially in acute monoblastic and mielomonocytic acute leukemia.

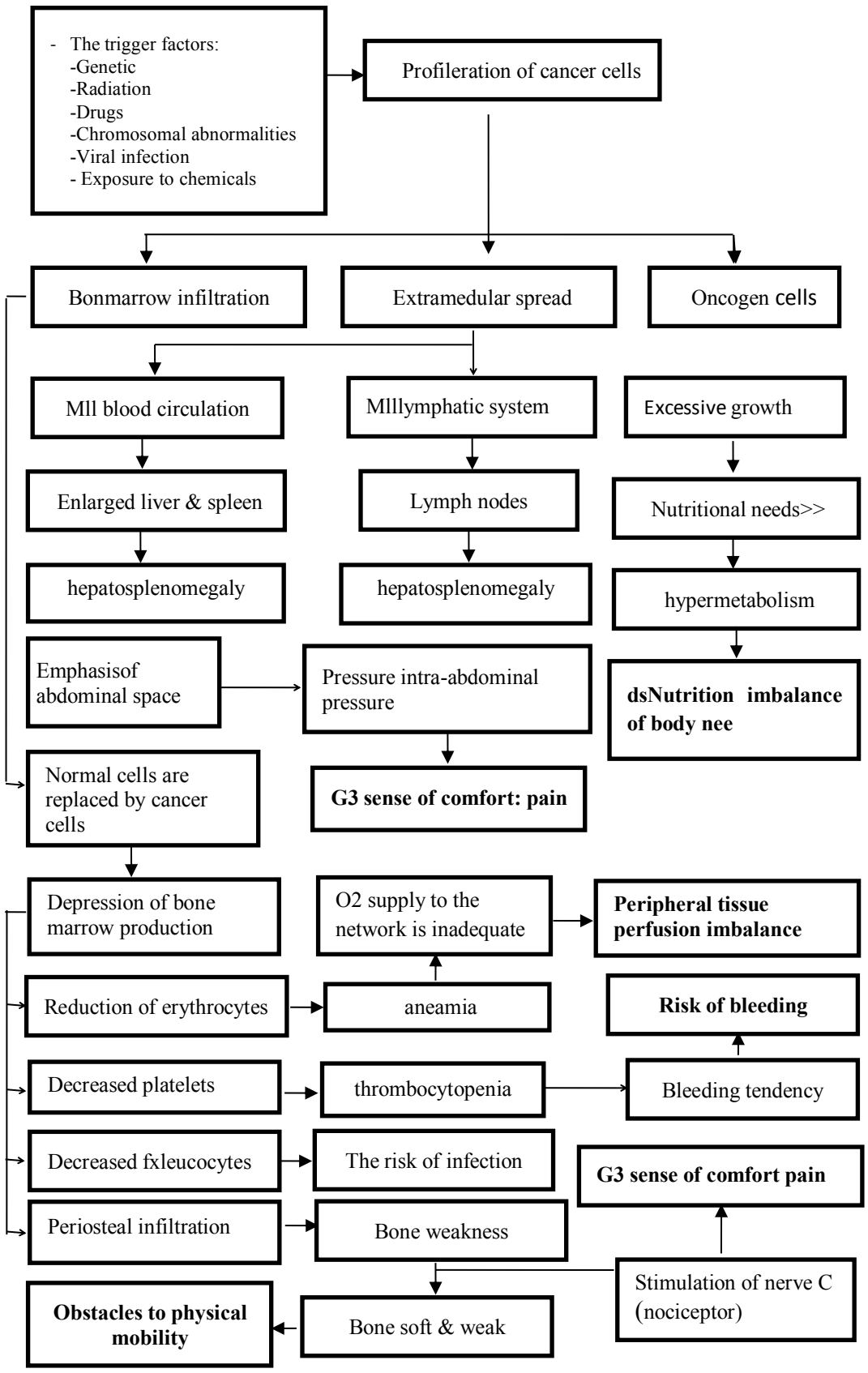
2.1.5.3 Chronic lymphocytic leukemia

Symptoms of LLK include lymphadenopathy, splenomegaly, hepatomegaly, infiltration of other body apparatus (lung, pleura, bone, skin), hemolytic anemia, thrombocytopenia, hypogamaglobulinemia and monoclonal gamopathy so that the patient is susceptible to infection.

2.1.5.4 Acute lymphoblastic leukemia

Symptoms of LLA sufferers are as follows: fatigue, heat without infection, purpura, bone and joint pain, various infections, weight loss and often found an abnormal period. Physical examination found splenomegaly (86%), hepatomegaly, lymphadenopathy, chest bone pain, ekimoses and retinal hemorrhage.

2.1.6 Pathway



Picture 2.2 Pathway

2.1.7 Pathophysiology

Leukemia has the characteristic of irregular proliferation or accumulation of white blood cells in the bone marrow, replacing normal bone marrow elements. There are two problems associated with leukemia cells that is the overproduction of white blood cells, both the abnormal or immature cells of white blood cells, so the function and structure is not normal. Increased production of white blood cells suppresses other blood cell elements such as decreased erythrocyte produc- tion resulting in anemia, platelets become decreased by thrombocytopenia and leukopenia in which normal white blood cells become less. The presence of thrombocytopenia results in the easy occurrence of bleeding and the state of leukopenia causes easy infection occurs. White blood cancer cells can also invade bone marrow and periosteum which causes the bones to become brittle and bone pain. Besides the infiltration of various organs such as brain, kidney, liver, spleen, lymph glands cause the enlargement and disturbance in related organs (Ginarsih, A. 2013).

Leukemia is a type of disorder in a fatal hemapoetic system associated with bone marrow and lymph vessels characterized by uncontrolled proliferation of leukocytes. Large numbers of cells first clot in their original site (granulocytes in bone marrow, lymphocytes in lymph nodes) and spread to hematopoietic organs and progress to larger organs resulting in hematomegaly and splenomegaly.

Immature lymphocytes proliferate in bone marrow and peripheral tissue and disrupt normal cell development. As a result, normal hematopoesis is inhibited, resulting in a decrease in the number of leukocytes, erythrocytes, and platelets. Erythrocytes and platelets may be low or high but there are always immature cells.

Proliferation of one cell type often disrupts the normal production of other hematopoietic cells and leads to rapid cell division and cytopenia or decrease in the number. Cleavage of white blood cells increases the likelihood of infection due to immune deficiency.

Thrombocytopenia results in bleeding expressed by ptechiae and ecchymosis or bleeding in the skin, epistaxis or nasal bleeding, hematoma in the mucous membrane, as well as gastrointestinal and urinary tract bleeding. Painful and tender bones caused by bone infarction (Robbina & contran, 2010).

2.1.8 Investigations

2.1.8.1 Chronic granulocytic leukemia (LGK)

In laboratory tests leukocytosis was found to be greater than 50,000 / mm3, left shift to type count, thrombocythaemia, Philadelphia chromosome, low or no alkaline leukocyte phosphatase levels, increased levels of vitamin B12 in the blood. In bone marrow examination, hyperselular condition was found with increasing number of megakaryocytes and granulopoesis activity.

2.1.8.2 Acute myeloblastic leukemia (LMA)

Examination of immunologic markers using monoclonal antibodies supports the diagnosis of LMA.

2.1.8.3 Chronic lymphocytic leukemia

Examination of peripheral blood showed lymphocytosis more than 50,000 / mm3, in the bone marrow obtained infiltration evenly by small lymphocytes, ie more than 40% of the total cells that berinti.

2.1.8.4 Acute lymphoblastic leukemia

On the examination of peripheral blood found young cells lymphoblasts and there is usually leukocytosis (60%), sometimes leukopenia (25%). The number of leukocytes is usually directly proportional to the number of blasts. The number of neutrophil leukocytes is often low, as are the levels of Hb and platelets. The results of bone marrow examination usually show the dominant blast cells.

2.1.9 Complications

Leukemia can cause various complications, including:

2.1.9.1 Bone marrow failure (Bone marrow failure)

Bone marrow fails to produce red blood cells in sufficient quantities, which are:

a. Weak and shortness of breath, due to anemia (too little red blood cells)
b. Infection and fever, due to reduced number of white blood cells
c. Bleeding, due to too few platelet counts.

2.1.9.2 Infection

Leukocytes produced when LGK is abnormal, do not perform the proper immune function. This causes the patient to become more susceptible to infection. In addition LGK treatment can also lower levels of leukocytes until too low, so the immune system is not effective.

2.1.9.3 Hepatomegaly (Enlarged Liver)

The enlargement of the heart exceeds its normal size.

2.1.9.4 Splenomegaly (Enlarged Spleen)

The excess of blood cells produced when LGK states partially accumulates in the spleen. This causes the spleen to grow larger, even at risk for rupture.

2.1.9.5 Limpadenopathy

Lymphadenopathy refers to abnormalities of lymph nodes in size, consistency, or amount.

2.1.9.6 Death

2.1.10 Management

Leukemia management is determined by the classification of prognosis and comorbidities.

2.1.10.1 Blood transfusion.

If Hb levels of less than 6.9% in severe thrombocytopenia and massive bleeding may be given platelets.

2.1.10.2 Implementation of chemotherapy

There are 3 phases of chemotherapy :

a. Induction phase: commenced 4-6 weeks after diagnosis in standing in this phase is given corticosteroid (prednisone) vinaistim, and L-asparagigination. The induction phase is declared successful if the signs of the disease are reduced or absent and in the bone marrow found youth cell count is reduced from 5%.

b. Central Nervous System Prophylaxis: in this phase, methotrexate, cytarabine, and hydrocortisone therapy are given intra thecal to prevent invasion of leukemia cells into the brain. Cranial irradiation therapy is only performed on leukemia patients with central nervous system disorders.

c. Consolidation: in this phase a combination of treatment is done to maintain remission and reduce the number of leukemia cells circulating in the body, periodically, weekly or monthly complete blood tests are performed. To begin the bone marrow response to

treatment. If bone marrow suppression occurs then treatment is stopped. Temporary or reduced drug doses.

2.1.10.3 Bone marrow transplantation

Bone marrow transplantation is the best alternative to leukemia treatment. This therapy is also common in patients with lymphoma, aplastic anemia.

2.1.10.4 Nursing Management:

Psychosocial approaches should take precedence, aseptic rooms and aseptic work

2.2 Planning Clients Of Clients With Leukemia

2.2.1 Assessment

2.2.1.1 Nursing History

a. Disease history : previous cancer treatment
b. Family history : the presence of haematological disorders, the presence of hereditary factors eg monozygotic twins

2.2.1.2 Physical examination : data focus

Assess for signs of anemia: weakness, fatigue, pallor, headache, anorexia, vomiting, spasms, rapid breathing

Assess for signs of leukopenia: fever, stomatitis, symptoms of upper respiratory infections, urinary infections; skin infections can appear redness or hiotam without pus

Assess for signs of thrombocytopenia: ptechiae, purpura, mucous membrane hemorrhage, hematoma formation, purpura; examine signs of extra-medullary invasion: lymphadenopathy, hepatomegaly, splenomegaly.

Assess for enlargement of the testes, hemalaxia, hypertension, renal failure, inflammation in the rectal and pain droplets.

2.2.1.3 Investigations (sda)

2.2.2 Possible Nursing Diagnoses

Diagnosis I: risk of infection r.t decreased body defense system (NANDA, 2013:411).

2.2.2.1 Definitions

Vulnerable to the invasion and multiplication of pathogenic organisms that can interfere with health

2.2.2.2 Risk Factors

Lack of knowledge to avoid exposure to pathogens

a. Malnutrition
b. Chronic illness
c. Secondary body defenses are inadequate:
d. Immunosuppression
e. Leukopenia
f. Decrease in HB

(NANDA: 2015-2017: 405).

2.2.3 Planning

2.2.3.1 Diagnosis I: risk of infection r.t decreased body defense system

a. Objectives and Results Criteria

NOC:

1) Immune status
2) Knowledge: infection control
3) Risk control

KH:

1) Clients are free from signs and symptoms of infection
2) Describe the process of disease transmission, factors that influence transmission and management
3) Demonstrate ability to prevent infection
4) The number of leukocytes within normal limits
5) Demonstrate a healthy life behavior (NANDA, 2013: 674).

b. Nursing and rational intervention

1) Infection control:

   R: minimize the spread and transmission of infectious agents
2) Infection protection:

   R: prevent and detect early infections in patients at risk

(NIC NOC, 2012: 425).

2.2.3.2 Diagnosis II: risk of bleeding r.t decrease in platelet count

a. Objectives and Results Criteria

NOC:

1) patients are free from symptoms of bleeding

KH :

1) The loss of visible blood
2) TD within normal limits
3) HB and HCT within normal limits (Hct 41-53% (L), 36-46% (P), Hb 13.5-17.5 gr% (L), 12-16 (P))

(NANDA, 2013: 701).

b. Nursing and rational intervention

1) Bleeding precautions

R: So that bleeding does not happen

2) Control of bleeding

R: minimize bleeding to avoid occurring until abnormal bleeding

(NANDA, 2013: 701).