REVIEW ARTICLE

Nursing Care Plan and Management of Patients With Acute Leukemia

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ABSTRACT

Objective • To provide an overview of the integration of nursing care services for patients with acute leukemia in the past, present and future.

Data sources • Published literature as indexed in Medline, relevant guideline documents, textbooks and clinical experience.

Conclusion • Patients with acute leukemia have significant nursing care demands that are frequently unmet by routine oncology treatment. The initial introduction of expert nursing care into routine oncology treatment boosts patient-centered results in people with advanced solid tumors, according to research. Recent data suggest that patients with hematologic malignancies who have undergone transplantation of stem cells have similarly improved, and further trials are being conducted to assess nursing care treatments in patients with acute leukemia.

Nursing Practice Implications • Nurses are essential in the management of patients with acute leukemia both in and out of the hospital. As a result, having a basic understanding of these illnesses is critical. In the management of oncologic crises, early symptom identification is crucial. (*Altern Ther Health Med.* 2022;28(1):80-85).

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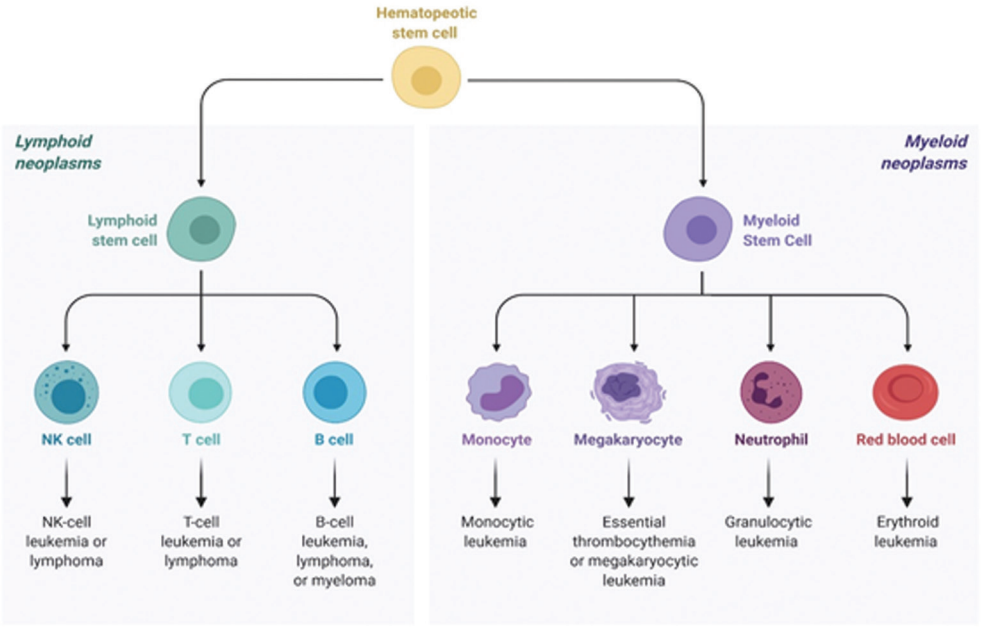
INTRODUCTION

Leukemia is among the most prevalent cancers that affect people all over the world. Leukemia was the 15th most often diagnosed cancer worldwide in 2018, with 437 033 incidences and 309 006 deaths, making it the 11th major cause of mortality related to malignant diseases. Leukemia has a global geographic distribution, with higher frequency and total mortality in more industrialized nations. In underdeveloped nations, however, the death rate is greater.[1] There is a precise pattern of cancer occurrence in general and leukemia in particular. According to the American Cancer Society's Cancer Facts and Figures, 178 520 people in the United States were expected to be diagnosed with lymphoma, myeloma or leukemia by the year 2020.[2] This represents 9.9% of the total 1 806 590 new cases of cancer reported for that year. Although both genders are susceptible; males are more likely to develop leukemia. In the United States in 2018, the age-standardized prevalence rate for leukemia in males and females was 6.1 and 4.3 per 100 000 population, respectively. Males had a death rate of 4.2 per 100 000 population, while females had a rate of 2.8 per 100 000[3] (see Figure 1).

Acute leukemias are cancerous clonal diseases of the hematopoietic organs that affect one or more hematopoietic cell lines. The replacement of bone marrow with aberrant immature and undeveloped hematopoietic cells results in a decrease in the number of red blood cells (RBCs) and platelets in the peripheral circulation in these diseases. They are categorized based on the origin of the aberrant hematopoietic cells involved, such as myeloid, lymphoid, mixed or immature.[4] Chronic leukemias, on the other hand, cover a wide range of illnesses marked by unregulated growth and proliferation of mature, differentiating hematopoietic cells. Chronic leukemias are therefore categorized according to the kind of hemopoietic cells involved.[5]

Patients with acute leukemia frequently encounter both symptoms of the illness and adverse events from the therapy. Nurses are an important part of the interdisciplinary team

Figure 1. Types of leukemia



Abbreviation: NK, natural killer.

that treats these patients. The bedside nurse is frequently the first to notice minor changes that might lead to significant problems.[6] Temperature increase, hemorrhage, vomiting, infection, change in mental state, uneasiness, bleeding and diarrhea are just a few of the issues that patients with acute leukemia may face. Distinguishing between disease- and treatment-induced symptoms can be difficult, and necessitates a thorough grasp of the illness process, symptom control and pharmacotherapy.[7] This population's complicated nursing care comprises not only physical but also behavioral disturbances, in the the patient as well as their defined support network. This article discusses the detection, chemotherapy and nursing care of patients with acute leukemia.

SELECTION FOR LITERATURE REVIEW

The findings came from Mendeley/Medline/Google Scholar/Science Direct/Springer/PubMed. Several keywords were utilized in the literature review, both individually and collectively, including "acute myeloid leukemia," "acute leukemia," "acute lymphocytic leukemia," "clinical presentation," "oncology nursing care," "diagnosis," "acute promyelocytic leukemia" and "treatment." All retrospective, prospective, cross-sectional, exploratory, observational, qualitative, longitudinal and randomized controlled trial (RCT) studies using self-reported quality of life (QoL) or symptom instruments were eligible for inclusion. The search was limited to studies reported in English and with adults age 18 years or older. The resulting group of studies looked at survivors undergoing treatment, survivors after induction treatment and long-term survivors. Studies on survivors after hematopoietic stem cell transplantation were not included because of the complexity and toxicity of this treatment modality. Exclusions included case reviews, summary reports, clinical reviews and literature and systematic reviews

ACUTE MYELOID LEUKEMIA

Acute myeloid leukemia (AML) is a hematopoietic progenitor cell disease that causes a surge in immature myeloid cells in the bone marrow. AML is the more prevalent acute leukemia in adults, with a 2.7 per 100 000 population prevalence rate or approximately 21 000 cases in the United States annually. Every year, 14 new instances of leukemia are identified per 100 individuals, as well as approximately 1.6% of both genders who will be diagnosed with leukemia at some point in their lives.[8] The etiology of AML is still a mystery. Benzene, ionizing radiation, chemotherapeutic medicines and cigarettes are among the environmental variables linked to the illness.[9]

Clinical Aspects

Patients with non-specific main concerns may report to healthcare practitioners, local intensive care, or emergency room with various leukemias and may be managed with symptomatic therapy. The intensely proliferative cancerous "blasts" entering the bone marrow, where normal cells are routinely generated, cause symptoms. Because there isn't enough room for cells to proliferate and evolve into healthy erythrocytes, platelets and white blood cells (WBCs), anemia, thrombocytopenia and leukopenia develop.[10] Tiredness, breathlessness during routine activities, chest discomfort, vertigo and paleness are all symptoms of anemia. WBC malfunction and leukopenia cause fever, recurrent infections and poor wound repair. Leukocytosis can sometimes develop

into leukostasis (a medical emergency characterized by reduced tissue perfusion). If not handled correctly, leukostasis is induced by leukemic cells aggregating in capillaries and is linked to early death.[11]

Diagnosis

The patient's blood sample is generally tested for anemia, leukopenia and thrombocytopenia as the initial stage in the assessment of AML. Leukopenia, as well as leukocytosis, is a possibility. Aspiration and bone marrow biopsy is used to diagnose leukemia, as well as blood samples for immunophenotype, flow-cytometry, morphologic characteristics and genetic testing. A hypercellular marrow with a modest quantity of healthy hematopoietic cells and a dispersed group of blasts is frequently seen in bone marrow aspirates and biopsy findings.[12] Flow cytometry is a technique that classifies leukemia cells using a range of colors and chemical compounds. The arrangement of surface proteins on leukemic cells determines immunophenotyping, which distinguishes healthy cells from leukemia cells. Categorization and identification are linked to the configurations of cell surface proteins and the degree of differentiation.[13]

Treatment

All individuals diagnosed with AML should participate in clinical studies if they are accessible, according to the National Comprehensive Cancer Network. The amount of AML therapy is determined by the age of the patient, risk category and fundamental health status. In patients younger than age 60 years with favorable or treatment-related AML or intermediate-risk AML, introduction chemotherapy with anthracycline and cytarabine is often utilized (idarubicin or daunorubicin).[14] The most common name for this regimen is 7+3. Liposomal encapsulation of cytarabine and daunorubicin can be given to treatment-related patients with AML or a background of myelodysplastic syndrome. Combining ozogamicin gemtuzumab in patients with favorable-risk AML may also be beneficial, according to more recent research.[15] Patients with FMS-like tyrosine kinase 3 (FLT3) mutations may be administered midostaurin as part of their 7+3 initiation. On day 14, a second bone marrow examination is generally conducted to determine the existence of hypoplastic marrow, and again around the time of count restoration to assess the therapy response.[16]

ACUTE PROMYELOCYTIC LEUKEMIA

A less common subclass of AML, acute promyelocytic leukemia (APL), was previously thought to be the most deadly form of AML due to its higher tendency toward bleeding and the high death rate linked to earlier hemorrhagic mortality. However, during the last 40 years, breakthroughs in our knowledge of the illness mechanism and advances in accessible treatments have made it the most treatable.[17] APL accounts for 5% to 10% of all cases of AML and has been found to be common among individuals of Latin American origin, accounting for up to 20% to 25% of patients with AML in Latin countries. The annual incidence of APL diagnosis in the United States is believed to be between 600 and 800 cases. APL is rarely diagnosed in youngsters, and is most often found in adults between the ages of 20 and 50 years.[18]

Clinical Aspects

The clinical presentation of APL, like that of AML, can be rather nondescript, with many patients experiencing days to weeks of nonspecific symptoms followed by the occurrence of bleeding and thrombosis. Increased temperature, excessive perspiration, bleeding, tiredness, bruising, infections and tachycardia are just a few of the signs and symptoms. Patients frequently seek emergency room treatment. The possibility of infection or bleeding can lead to misdiagnosis; because therapy must be started as soon as possible, this may result in poor clinical results.[19]

Diagnosis

Aspiration and bone marrow biopsy, lactate dehydrogenase uric acid, metabolic panel and complete blood count tests are all recommended for APL. Diagnosis of APL should include disseminated intravascular coagulation (DIC) testing. A complete blood count will indicate a rise in WBCs but a reduction in platelets and RBCs in preliminary tests. A higher percentage of promyelocytes may be found in the WBCs. Reverse-transcription-polymerase-chain-reaction (RT-PCR) will be utilized to test the bone marrow for the presence of the PML-RARa gene, although complete results may take up to a week. Fluorescence in situ hybridization (FISH) detects PML-RARa translocation, whereas genetic abnormalities are detected by using cytogenetic testing.[20]

Treatment

APL has a recognized clinical urgency due to the bleeding problems it causes, and treatment immediately starts as soon as it is detected. Therapy with all-trans retinoic acid (ATRA) is started right away if APL is diagnosed based on research of the peripheral blood smear and the patient's associated clinical symptoms. Therapy should begin before cytogenetic and bone marrow biopsy findings are available, which is different from other kinds of acute leukemia. ATRA has a low toxicity profile and can be stopped if the APL diagnosis is subsequently ruled out.[21] Postponing the administration of ATRA, on the other hand, might result in significant consequences, such as deadly bleeding. Induction therapy for both intermediate- and low-risk APL includes both arsenic trioxide and ATRA. Uniquely, ATRA aids in the treatment of coagulopathy. Rather than killing the aberrant promyelocytes, it aids in the differentiation of cancerous promyelocytic blasts into granulocytes, allowing initiation treatment to begin.[22]

ACUTE LYMPHOCYTIC LEUKEMIA

Acute lymphocytic leukemia (ALL) affects young lymphocytes, a kind of fully developed WBCs that play an important function in the defense mechanism. Lymphoblasts, a type of abnormally developed WBCs, develop into

lymphocytes, which are present in both the lymphatic system and the blood. Leukemic cells are lymphoblasts that are aberrant or cancerous. In the bone marrow, these leukemic cells proliferate and multiply, pushing out normal cells.[23] After pouring out from bone marrow, lymphoblasts collect in different organs, including the spinal cord, brain, testicles, lymph nodes, spleen, liver and thymus. As the disease develops, cancerous lymphoblasts may not mature into lymphocytes and do not function properly, putting the body's infection-fighting skills at risk. These cancerous cells stop healthy cells from growing and developing, and they proliferate and survive longer than normal cells.[24]

Clinical Aspects

Patients generally report the same presenting indications as for AML to their healthcare practitioner, local urgent care facility or emergency room. Anemia, thrombocytopenia and persistent infections are common reasons for people to seek medical help. The subtype is responsible for some of the distinctive presenting indications of ALL. Patients with B-cell ALL may have central nervous system (CNS) illness, whereas patients with T-cell ALL may have elevated calcium levels, mediastinal mass, extramedullary disease and lytic bone lesions.[25]

Diagnosis

Aspiration and bone marrow biopsy is used to diagnose ALL, as well as blood samples for immunophenotype, flow-cytometry, morphologic characteristics and genetic testing. A hypercellular marrow with a modest quantity of healthy hematopoietic cells and a dispersed group of lymphoblasts is frequently seen in bone marrow aspirates and biopsy findings. Immunophenotyping and flow cytometry can help determine whether the ALL originates from a T cell or B cell lymphocyte. Categorization and identification are linked to the arrangement of cell surface and differentiation level proteins. B cell ALL can be further subdivided into progenitor B cell ALL, middle or "common B ALL," and pre-B cell, which is the most mature, depending on the B cell differentiation. The precursors of B cell CD34, CD10, and CD19 proteins, as well as nuclear terminal deoxynucleotide transferase, are commonly found on the cell surface of ALL cells. Males are more likely to develop mature B cell ALL, which has a large extramedullary disease presentation. CD34, CD7, CD2, CD3 and deoxynucleotide transferase are commonly seen on T cell ALL cells. For morphologic assessment clot sections, eosin and hematoxylin-stained core biopsies, and Wright-Giemsa stained bone marrow aspirate smears are employed.[26]

Treatment

Induction therapy's therapeutic objective is CR, and risk assessment determines treatment alternatives. Many additional criteria, such as the subclass and category of ALL, present health status of patients, therapy adverse reactions and the patient's goals, should all be taken into account. Standard therapies for ALL include chemotherapy using medicines that penetrate the blood-brain barrier, such as higher-dose methotrexate and cytarabine, as well as intrathecal chemotherapy for CNS prophylaxis. Cyclophosphamide, steroids, vincristine and anthracyclines are also used in systemic therapy regimens.[27]

THE ONCOLOGY NURSE'S ROLE

Avoidance and prompt detection of oncologic crises are one of the defining tasks of an experienced, informed oncology nurse. Oncologic crises are described as situations that are extremely life-threatening and are connected to cancer therapy or the disease itself. Many have earlier mild signs that can be readily confused with typical carcinoma signs or related therapy, but if ignored, could swiftly develop into diseases that substantially raise the patient mortality and morbidity of patients with cancer.[28]

Tumor Lysis Syndrome

Tumor lysis syndrome (TLS) is an oncologic crisis characterized by the rapid death of tumor cells. Patients with rapidly proliferative malignant tumors, such as acute leukemias, commonly develop TLS. When tumor cells leak their contents into the circulation either suddenly or in response to therapy leads to TLs, this results in hypocalcemia, hyperphosphatemia, hyperkalemia and hyperuricemia, among other disorders.[29-31] Neurologic and neuromuscular anomalies, gastrointestinal disturbances, cardiac arrhythmias and acute kidney insufficiency can all be caused by electrolyte imbalances. TLS can be detected early enough to avert life-threatening multi-organ collapse.[32]

The best way to deal with TLS is to keep your kidneys healthy. To produce a high urine output, vigorous hydration with intravenous (IV) fluids is used (2 mL per kg per hour). Loop diuretics may be used if IV fluids alone are not enough to achieve this. Allopurinol and, in rare cases, rasburicase is used to treat hyperuricemia. Allopurinol inhibits the production of new uric acid, whereas rasburicase reduces the level of uric acid quickly. Patients with hypocalcemia or hyperkalemia should be monitored closely and have regular blood tests.[33-35]

Level of glucose and insulin, calcium gluconate, loop diuretics, and polystyrene sulfate are all common treatments for symptomatic hyperkalemia. Calcium should not be used in the treatment of asymptomatic calcium deficiency, due to the increased possibility of calcium deposition in renal tubules, but in low doses, calcium is used for the treatment of symptomatic calcium deficiency. Hemodialysis may be needed if serious kidney damage develops.[36]

Sepsis with Febrile Neutropenia

Neutrophils, a kind of WBC, are among the most important cells in the body's defense against bacterial infections. Neutropenia can occur in patients with acute leukemia as an outcome of the illness or as an adverse effect of therapy. Because of the infection-fighting function of neutrophils, when an individual develops neutropenia there is

an elevated chance of disease and death. Febrile neutropenia is a medical emergency that can quickly develop into sepsis, as well as frequent adverse events.[37-39] A fever, according to the National Comprehensive Cancer Network (NCCN), is defined as a 38.3°C-temperature for 1 hour. The reference values for neutropenia are neutrophils of 500/mL or 1000/mL with a projected decline to 500 neutrophils/mL during the following 48 hours, according to the NCCN guideline. Prophylactic antimicrobials are given when episodes of neutropenia are predicted, depending on the illness, course, estimated length of neutropenia, risk factors and legislative requirements.[40] Nurses who care for hematology patients must be aware that the occurrence of fever at least once seems to be the primary sign of infection during phases of neutropenia. So, the body's capacity to produce a normal inflammatory response is impaired in neutropenic individuals, although additional symptoms of infection are typically absent.

Nurses are asked to order blood samples, cultures or radiographic images matching the possible sites of infection at the start of a febrile neutropenic episode, and they are effectively distributed if the organism has not yet been detected. Antibiotics will almost certainly be ordered. Antibiotics should be begun within 60 minutes of the onset of the rise in body temperature and after blood samples have been taken, according to assessment guidelines, and antibiotic treatment should not be postponed while waiting for the results.[41] When the immune system is compromised, a febrile neutropenic episode can quickly escalate into a life-threatening sepsis situation. To treat tissue hypoperfusion, early management with fluid replenishment is critical. Reduced tissue perfusion, which happens throughout the sepsis phase, causes acute organ failure, low blood pressure and elevated serum lactate.[42-46] When caring for febrile neutropenic patients with leukemia, nurses must be mindful of the enhanced danger of infection, as well as the need for recognizing even slight changes in these patients' vital signs.

Disseminated Intravascular Coagulation

All leukemia subtypes can have disseminated intravascular coagulation (DIC), although this may be more prominent in patients with APL. In individuals with AML, DIC is frequently seen alongside hyperleukocytosis. DIC is a chronic condition in which the clotting pathway is activated, resulting in the possibility of concurrent thrombosis and bleeding. Thrombi are formed by fibrin and platelets and can occur in the microvasculature, as well as in larger arteries.[47] The utilization of intrinsic clotting factors, platelets, and anticoagulant factors results from the extensive development of thrombi. Fibrinolysis is then triggered at thrombus locations, resulting in the production of fibrin breakdown products that impede both platelet aggregation and fibrin clot formation when present in sufficient levels. Impaired circulation, thrombosis and/or bleeding can cause tissue or organ injury.[43,45]

DIC and the disease that caused it are frequently linked. Organ failure can cause a lot of pain and lead to death. Ecchymoses, petechiae and blood leaking from the wound edge, IV lines, catheters and mucous membranes are all common symptoms. If the gastrointestinal tract, lungs or CNS are affected, the bleeding can be fatal. Arterial thrombosis and venous thromboembolism with organ or tissue ischemia are common thromboembolic symptoms of DIC.[48] Early diagnosis of modest symptoms of bleeding and coagulation in at-risk individuals with leukemia could lead to an earlier assessment of DIC and hence lower mortality and morbidity. If DIC is suspected, clotting characteristics, such as fibrin and fibrinogen break down product values, should be obtained at the point of leukemia detection and regular periods.[49]

CONCLUSION

The diagnosis and treatment of leukemia is complex and the unique subtypes of the disease add to that complexity. Presenting symptoms, treatment and prognosis vary by subtype. Because oncology nurses are at the forefront of the care provided to these patients, an understanding of the differences between subtypes is essential. Nurses can better provide treatment, support patients in crisis and identify early warning signs of complications of acute leukemias when they are well-versed in this complicated disease.

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