



Nursing Challenges in Managing Rare Hematological Conditions: An Evidence Review of Acute Myeloid Condition

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Abstract:

Background: Acute Myeloid Leukemia (AML) is the most common form of leukemia in adults, comprising 80% of leukemia cases. Characterized by the uncontrolled proliferation of immature "blast cells," AML leads to bone marrow failure, anemia, and frequent infections. Despite advances in treatment, the prognosis for elderly patients remains poor, with cure rates of about 15% in those over 60 years. Key nursing challenges involve managing symptoms like fatigue, infections, bleeding, and bone pain, while providing comprehensive care during complex treatments.

Aim: This review aims to evaluate the nursing challenges in managing AML, highlighting the clinical manifestations, risk factors, treatment regimens, and the role of nursing in improving patient outcomes.

Methods: A comprehensive review of literature, clinical guidelines, and evidence-based practices regarding the nursing care of AML patients was conducted. Sources included peer-reviewed journals, case studies, and treatment protocols focused on symptom management, treatment toxicities, and patient education.

Results: Nursing challenges in managing AML include addressing complications from chemotherapy, managing side effects like fatigue and bleeding, and ensuring timely supportive care for infections. The "7+3" induction therapy remains the standard but is highly toxic, requiring intensive monitoring. AML's classification, based on genetic abnormalities, significantly impacts prognosis and treatment. Nursing

interventions focus on symptom control, preventing infections, managing nutritional needs, and providing emotional support.

Conclusion: Effective nursing management of AML requires a thorough understanding of the disease's pathophysiology, treatment side effects, and the complex needs of patients. Nurses must address both the physical and emotional challenges faced by AML patients, promoting quality of life and survival. There is a critical need for continued education and support to manage the evolving treatment landscape and enhance patient outcomes.

Keywords: Acute Myeloid Leukemia, Nursing Management, Induction Therapy, Hematological Malignancies, Symptom Control, Patient Care, Oncology Nursing, Chemotherapy, AML Classification.

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Introduction:

Acute myeloid leukemia (AML) represents the most prevalent form of leukemia in the adult population, constituting approximately 80% of all leukemia cases. This hematological malignancy is characterized by the clonal proliferation of immature "blast cells" within the peripheral blood and bone marrow, leading to impaired erythropoiesis and subsequent bone marrow failure. Recent advancements in therapeutic protocols have resulted in improved survival outcomes, with cure rates reaching approximately 15% for patients aged over 60 years and around 40% for those under 60 years. However, despite these advancements, the prognosis for elderly patients remains notably poor [1][2][3]. Nursing Diagnosis includes a range of clinical manifestations such as anorexia, fatigue, general malaise, weakness, bruising, bone pain, fever, frequent infections, and nosebleeds, which are frequently observed in AML patients.

Classification of AML:

The classification of AML can vary based on factors such as etiology, genetic abnormalities, immune-phenotype, and morphological characteristics [4][5]. Historically, the French-American-British (FAB) system categorized AML into eight distinct subtypes, designated M0 to M7:

- **M0:** Undifferentiated AML
- **M1:** AML with minimal maturation
- **M2:** AML with maturation
- **M3:** Acute promyelocytic leukemia (APL)
- **M4:** Acute myelomonocytic leukemia
- **M5:** Acute monocytic leukemia
- **M6:** Acute erythroid leukemia
- **M7:** Acute megakaryocytic leukemia

In 2016, the World Health Organization (WHO) revised the classification system to include new categories based on recurrent genetic abnormalities, myelodysplasia-related changes, therapy-related myeloid neoplasms, not otherwise specified (NOS), myeloid sarcoma, and myeloid proliferations associated with Down syndrome. AML with recurrent genetic abnormalities includes:

- **AML with t(8;21)(q22;q22.1); RUNX1-RUNX1T1**
- **AML with inv(16)(p13.1q22) or t(16;16)(p13.1;q22); CBFB-MYH11**
- **APL with t(15;17)(q22;q12); PML-RARA**
- **AML with t(9;11)(p21.3;q23.3); MLLT3-KMT2A**
- **AML with t(6;9)(p23;q24); DEK-NUP214**

- **AML with inv(3)(q21.3q26.2) or t(3;3)(q21.3;q26.2); GATA2, MECOM**
- **AML (megakaryoblastic) with t(1;22)(p13.3;q13.3); RBM15-MKL1**
- **AML with mutated NPM1**
- **AML with biallelic mutations CEBPA**

The NOS category encompasses cases that do not fit into the above classifications, such as AML with minimal differentiation, AML without maturation, and acute monoblastic/monocytic leukemia, among others. Additionally, AML can be classified based on its etiology into de novo AML, secondary AML (s-AML), which arises from pre-existing myeloproliferative disorders (MPD) or myelodysplastic syndromes (MDS), and therapy-related AML (t-AML), which develops after exposure to chemotherapy, radiation therapy, or other toxic agents.

Etiology:

The 2022 consensus recommendations from the European LeukemiaNet (ELN) offer a comprehensive framework for classifying Acute Myeloid Leukemia (AML) based on mutational profiles, which serves as a crucial tool for understanding disease progression and prognosis. However, in order to fully utilize this framework, it is essential to comprehend the origins and pathways that lead to the development of AML. For instance, patients with high and very high-risk myelodysplastic syndrome (MDS), clinically characterized by transfusion-dependent cytopenias and peripheral blasts, are at a heightened risk of progressing to AML and therefore require vigilant and ongoing surveillance. Moreover, individuals with myeloproliferative neoplasms, which include conditions such as myelofibrosis, essential thrombocythemia, polycythemia vera, and chronic myeloid leukemia, may also progress to higher-grade myeloid neoplasms, including AML. The progression indicators in these conditions, such as thrombocytosis in essential thrombocythemia, are often marked by declining blood counts and elevated peripheral blast levels. These diseases, along with MDS and myeloproliferative neoplasms, and other conditions like aplastic anemia, contribute to the development of secondary AML. Another cohort at increased risk for AML consists of patients who have previously undergone chemotherapy for other cancers. Exposure to alkylating agents or radiation, such as the use of cyclophosphamide in breast cancer treatment, has been associated with the development of MDS or AML, frequently with chromosomal abnormalities on chromosomes 5 or 7, occurring typically 5 to 7 years post-treatment. Additionally, chemotherapy agents like topoisomerase inhibitors are linked to AML development, often accompanied by 11q23 rearrangements, marking a subset known as therapy-related MDS/AML. Environmental factors, including radiation exposure, tobacco smoke, and benzene, further contribute to AML risk. Despite these established risk factors, the majority of AML cases arise de novo, without any identifiable underlying cause.

Epidemiology:

In the United States, the annual incidence of AML is approximately 4.3 cases per 100,000 individuals, translating to over 20,000 new cases annually. The disease's onset typically occurs at a median age of 68, with a higher prevalence observed among non-Hispanic White individuals. Additionally, a gender disparity exists, with a higher incidence in males compared to females, presenting a ratio of 5:3.

Pathophysiology:

AML is primarily characterized by the clonal expansion of undifferentiated myeloid precursors, known as blasts, within the bone marrow. This proliferation is largely driven by the accumulation of various genomic and cytogenetic abnormalities. As a result, the bone marrow's ability to effectively produce erythrocytes, megakaryocytes, and other blood cells is compromised, leading to bone marrow failure. AML's heterogeneity necessitates individualized cytogenetic and molecular assessments to guide treatment and prognostication. Broadly, patients can be categorized into favorable, intermediate, or high-risk groups based on the ELN 2022 guidelines. Favorable-risk AML is often associated with chromosomal translocations such as t(8;21)(q22;q22.1) or inv(16)(p13.1q22), as well as the absence of FLT3-ITD mutations, or the presence of CEBPA mutations. It has been reported that up to 35% of AML patients exhibit mutations in

NPM1. Intermediate-risk AML includes cases with FLT3-ITD mutations or t(9;11)(p21.3;q23.3) involving MLL/KMT2A rearrangements. High-risk AML is defined by more severe cytogenetic or molecular abnormalities, such as monosomy 5, del 5q, monosomy 7, del 7q, or complex karyotypes with at least three unrelated abnormalities, as well as mutations in genes like ASXL1, EZH2, SRSF2, or TP53. The RUNX1 gene, located on chromosome 21, is pivotal in hematopoiesis and is frequently translocated with the ETO gene on chromosome 8q22, leading to the AML-ETO translocation (t(8;21)(q22;q22)), present in approximately 12% of AML cases. These mutations, commonly associated with trisomies 13 and 21, have been linked to resistance to standard induction therapies. Mutations in isocitrate dehydrogenase (IDH) are oncogenic, found in 15% to 20% of all AML cases, and 25% to 30% of cases with cytogenetically normal AML. These mutations are more common in older populations. Additionally, mutations in TP53 are associated with poor prognosis and chemotherapy resistance.

History and Physical:

Patients with AML may present with a range of symptoms due to ineffective hematopoiesis and bone marrow failure, including recurrent infections, anemia, easy bruising, excessive bleeding, headaches, and bone pain. Generalized fatigue, shortness of breath, and chest tightness are also common, particularly depending on the severity of anemia. These symptoms generally develop rapidly, often over the course of days to weeks. Physical examination findings typically include pallor, bruising, and hepatosplenomegaly. Lymphadenopathy is rare in AML. Myeloid sarcoma, a form of extramedullary myeloid proliferation, may present as thickened, hyperpigmented, and coarse skin lesions. Disseminated intravascular coagulation (DIC) is frequently observed in AML patients and is characterized by clinical signs such as oral mucosal hemorrhages, purpura, petechiae on the extremities, and bleeding from intravenous sites.

Risk Factors:

The incidence of AML in the general population is approximately 4.2 new cases per 100,000 individuals annually, with over 20,000 cases diagnosed each year in the United States alone. The average age at diagnosis is approximately 65 years, and the disease is most commonly observed in non-Hispanic white populations. The male-to-female ratio is approximately 5:3, indicating a higher prevalence in males compared to females.

Assessment:

Due to impaired erythropoiesis and bone marrow failure, patients with acute myeloid leukemia (AML) often present with a wide range of symptoms, including recurrent infections, anemia, easy bruising, excessive bleeding, headaches, and bone pain. The severity of anemia can lead to generalized weakness, fatigue, shortness of breath, and chest tightness. On physical examination, signs such as bruising, pallor, hepatomegaly, and splenomegaly may be evident, although lymphadenopathy is uncommon. Disseminated intravascular coagulation (DIC) is frequently observed in patients with acute promyelocytic leukemia (APL).

Evaluation:

AML should be strongly suspected in individuals with unexplained cytopenias, which involve a reduction in white blood cell count, hemoglobin, or platelets, the presence of circulating blast cells in peripheral blood, or symptoms such as easy bruising, bleeding, or recurrent infections. In certain cases, patients may present renal failure due to tumor lysis syndrome, an oncologic emergency [6][7][8][9]. The diagnosis of AML is confirmed by the presence of at least 20% blasts in the bone marrow or peripheral blood. Bone marrow aspiration and biopsy are standard diagnostic tools. Additional diagnostic procedures include flow cytometry, cytogenetics, and fluorescence in situ hybridization (FISH). The detection of Auer rods, clumps of azurophilic granules resembling elongated needles, is a hallmark of AML. While Auer rods can be found across various AML subtypes, they are most commonly observed in APL. AML is also associated with several oncologic emergencies, including neurologic or respiratory distress resulting from leukostasis, APL-induced DIC, tumor lysis syndrome, and central nervous system (CNS) involvement [10].

Medical Management:

Patients who achieve complete remission (CR), defined as a blast count of less than 5% in the bone marrow following induction therapy, typically have improved survival outcomes. Despite this, minimal residual disease often persists, necessitating consolidation therapy to reduce the risk of relapse by eliminating these residual malignant cells. Although therapeutic advancements have been made, the core treatment regimen remains a combination of cytarabine-based and anthracycline-based therapies. For eligible individuals, allogeneic stem cell transplantation should be considered as part of the treatment strategy [11][12][13][14].

Induction Therapy:

Induction therapy is the standard treatment for younger patients, elderly individuals with a low risk of treatment-related mortality (TRM), and those with favorable or intermediate-risk factors. This therapy is highly toxic to the bone marrow, leading to pancytopenia and complications such as bleeding, gastrointestinal distress, kidney failure due to tumor lysis syndrome, and electrolyte imbalances. It may take up to one month for blood cell counts to recover, requiring intensive monitoring to manage potential complications. Prior to initiation, baseline cardiac function should be assessed, and ejection fraction (EF) should be carefully monitored due to the cardiotoxic effects of anthracyclines. While studies suggest that higher doses may yield greater therapeutic benefit, toxicity limits their application. The "7+3" regimen, which consists of a continuous infusion of cytarabine for seven days in combination with anthracycline administration on days 1 to 3, is the cornerstone of induction therapy. For patients with refractory disease, the use of higher doses of cytarabine or a combination of fludarabine, cytarabine, and idarubicin has been shown to improve CR rates and overall survival (OS). Although TRM remains a concern for the elderly (over 65 years), chemotherapy has been shown to improve survival in this age group. Additionally, decitabine, a methylating agent used for myelodysplastic syndromes (MDS), has demonstrated an improvement in OS in elderly AML patients. Following the initiation of induction therapy, response should be evaluated by performing a bone marrow aspirate and biopsy after two weeks. Reinduction therapy with high-dose cytarabine or a combination of etoposide may be considered in cases where disease persists. Approximately 60% to 80% of patients with de novo AML achieve CR with induction therapy. In cases where APL is suspected, treatment should commence immediately with all-trans retinoic acid (ATRA). Early administration of ATRA has been shown to reduce the risk of DIC and associated mortality.

Consolidation Therapy:

Once CR is achieved with induction therapy, consolidation therapy is initiated, typically involving high-dose cytarabine (HiDAC) and hematopoietic cell transplantation (HCT). HCT is recommended for patients under 60 years of age with intermediate or poor prognosis. If a suitable donor is available, allogeneic HCT is preferred over autologous HCT. Post-transplantation, patients must be closely monitored for signs of acute or chronic graft-versus-host disease (GVHD).

Novel Targets:

Ongoing research is focused on exploring novel treatment options, including Fms-like tyrosine kinase 3 (FLT3) inhibitors, IDH inhibitors, and immune therapies, as potential targeted therapies for AML.

Nursing Management:

It is essential to regularly assess laboratory results, particularly those related to coagulation parameters, to monitor for any abnormalities. Vital signs should be continuously monitored to detect any changes in the patient's condition. Skin protection is crucial to prevent injury and maintain integrity, while vigilant monitoring for signs of infection and sepsis is necessary to address potential complications promptly. Efforts should be made to maintain normothermia, ensuring that the patient's body temperature remains within normal limits. Patient and family education plays a key role in improving outcomes, ensuring that they understand the condition and its management. Monitoring fluid intake and output (I&Os) is critical for maintaining hydration and electrolyte balance, alongside assessing whether nutritional

needs are being met. Emphasis on hand hygiene should be promoted to prevent infections, and patients should be encouraged to actively participate in their own care to foster independence and well-being.

When To Seek Help

Clinical indicators necessitating urgent intervention include fever, hypotension, bleeding, loss of consciousness (LOC), altered mental status, severe bruising, and unmanageable pain. These signs warrant immediate medical attention and may indicate severe complications such as infection, shock, or hemorrhagic events.

Outcome Identification

Desired outcomes for patients with acute myeloid leukemia (AML) management include maintaining a normal appetite, achieving stable vital signs, remaining free of infection, staying afebrile, and experiencing no pain. These indicators reflect the success of nursing and medical interventions in stabilizing the patient's condition.

Monitoring

Close monitoring of vital signs is required to ensure that the patient's physiological parameters remain stable. Fluid balance, including ins and outs, must be carefully tracked to prevent dehydration or fluid overload. Regular assessment of body weight is also important to monitor nutritional status. Additionally, neurovital signs should be checked to assess the patient's neurological function. Signs of dehydration, as well as indicators of infection, should be observed promptly to facilitate early intervention and prevent complications.

Coordination of Care

AML, a prevalent hematological malignancy in adults, continues to have a generally poor prognosis despite advances in treatment. Therefore, a multidisciplinary approach is essential for effective management. The healthcare team should include specialists such as a hematologist, oncologist, internist, pathologist, and intensivist, all contributing to comprehensive care. The oncology nurse plays an integral role in the administration of treatments and in the monitoring of potential complications arising from therapy. Pharmacists are responsible for educating patients about the potential side effects of the potent drugs used in AML treatment. Primary care physicians should provide guidance on personal hygiene practices, proper hand washing, and immunization to reduce the risk of infections. Despite slight improvements in life expectancy, most AML patients experience significantly shortened lifespans [15][16].

Health Teaching and Health Promotion

Promoting effective health practices involves educating patients on the importance of hand hygiene to reduce the risk of infections. Patients should be instructed to thoroughly rinse all fruits and vegetables before consumption to minimize exposure to potential contaminants. Avoiding crowded environments is crucial to reduce the risk of contracting infectious agents, particularly in immunocompromised individuals. Emphasis on maintaining optimal personal hygiene is essential in preventing cross-contamination and promoting overall health. Patients should also be encouraged to adhere to follow-up appointments with their healthcare provider to ensure ongoing monitoring and management. Additionally, it is critical that patients take their prescribed medications consistently and as directed to ensure effective treatment outcomes [17].

Discharge Planning

Upon discharge, patients should continue to practice rigorous hand hygiene and properly rinse all fruits and vegetables to minimize the risk of foodborne illness. Avoidance of crowded areas remains important to prevent exposure to infectious agents, particularly for those with weakened immune systems. Patients should maintain high standards of personal hygiene to promote recovery and prevent complications. Regular follow-up with a clinician is vital to monitor progress and adjust treatment plans as

needed. Adherence to the prescribed medication regimen is imperative to ensure the effectiveness of the treatment and to reduce the likelihood of relapse or complications [17].

Conclusion:

Acute Myeloid Leukemia (AML) presents a significant challenge in nursing care, particularly due to its complexity and the toxicity of treatment regimens. Nurses are integral in managing the multifaceted needs of AML patients, which include addressing the clinical manifestations of the disease, such as fatigue, bleeding, and infections, while also providing supportive care to mitigate treatment-related toxicities. The "7+3" induction regimen, a cornerstone of AML treatment, requires careful monitoring due to its potential to cause severe bone marrow suppression and other life-threatening side effects, such as tumor lysis syndrome and gastrointestinal distress. Effective nursing interventions encompass a range of actions, from providing symptom relief to managing the side effects of chemotherapy, including frequent blood transfusions, pain management, and infection control. Nurses play a vital role in educating patients and families about the nature of the disease and the treatment process, ensuring that the patients' emotional and psychological needs are met. Emotional support is particularly critical, as the diagnosis of AML often brings significant distress due to its serious prognosis. One of the most significant nursing challenges is addressing the side effects of the intensive treatment protocols. The adverse effects of chemotherapy, such as nausea, fatigue, and risk of infection, require constant monitoring and adjustment of care plans to ensure that patients maintain their strength and quality of life throughout the treatment course. Moreover, complications like disseminated intravascular coagulation (DIC), which is common in AML patients, require swift nursing interventions to manage bleeding and clotting issues. Finally, ongoing advancements in the understanding of AML genetics and classifications are essential for tailoring treatment to individual patients. The identification of genetic mutations can provide insight into prognosis and guide therapeutic decisions. As such, nurses must stay abreast of emerging research and treatment strategies to ensure they provide the most effective care. Overall, the complex nature of AML care underscores the need for skilled, compassionate nursing that addresses the physical, emotional, and psychological challenges faced by patients. This multifaceted approach is crucial in improving patient outcomes and enhancing quality of life for individuals living with AML.

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18. لتحديات التمريض في إدارة الحالات الدموية النادرة: مراجعة الأدلة لحالة اللوكيميا النقوية الحادة.

الملخص:

خلفية: اللوكيميا النقوية الحادة (AML) هي أكثر أنواع اللوكيميا شيوعًا لدى البالغين، حيث تشكل 80% من حالات اللوكيميا. تتميز بالانتشار غير المنضبط للخلايا غير الناضجة "الخلايا الانفجارية"، مما يؤدي إلى فشل نخاع العظم، وفقر الدم، والعدوى المتكررة. على الرغم من التقدم في العلاج، فإن التشخيص لدى المرضى كبار السن لا يزال ضعيفًا، مع معدلات شفاء تبلغ حوالي 15% لدى من هم فوق 60 عامًا. تشمل التحديات التمريضية الرئيسية إدارة الأعراض مثل التعب، والعدوى، والتزيف، وآلم العظام، مع تقديم الرعاية الشاملة أثناء العلاجات المعقدة.

الهدف: تهدف هذه المراجعة إلى تقييم التحديات التمريضية في إدارة اللوكيميا النقوية الحادة، مع تسليط الضوء على الأعراض السريرية، وعوامل الخطر، وأنظمة العلاج، ودور التمريض في تحسين نتائج المرضى.

الأساليب: تم إجراء مراجعة شاملة للأدبيات، والإرشادات السريرية، والممارسات المبنية على الأدلة فيما يتعلق بالرعاية التمريضية لمرضى اللوكيميا النقوية الحادة. شملت المصادر المجالات العلمية المحكمة، ودراسات الحالة، وبروتوكولات العلاج التي تركز على إدارة الأعراض، والسمية الناتجة عن العلاج، وثقافة المرضى .

: تشمل التحديات التمريضية في إدارة اللوكيميا النقوية الحادة معالجة المضاعفات الناتجة عن العلاج الكيميائي، وإدارة الآثار الجانبية مثل التعب والتزيف، وضمان الرعاية الداعمة في الوقت المناسب للعدوى. تظل العلاج التحريضي "3+7" هو المعيار، ولكنه سام للغاية ويتطلب مراقبة مكثفة. يؤثر تصنيف اللوكيميا النقوية الحادة، بناءً على التشوهات الجينية، بشكل كبير على التوقعات والعلاج. تركز التدخلات التمريضية على السيطرة على الأعراض، ومنع العدوى، وإدارة الاحتياجات الغذائية، وتقديم الدعم العاطفي.

الخلاصة: يتطلب الإدارة التمريضية الفعالة للوكيميا النقوية الحادة فهماً دقيقاً لفيزيولوجيا المرض المرضية، وآثار العلاج الجانبية، واحتياجات المرضى المعقدة. يجب على الممرضات معالجة التحديات الجسدية والعاطفية التي يواجهها المرضى المصابون باللوكيميا النقوية الحادة، وتعزيز جودة الحياة والبقاء. هناك حاجة ماسة إلى التعليم المستمر والدعم لإدارة مشهد العلاج المتطور وتحسين نتائج المرضى.

الكلمات المفتاحية: اللوكيميا النقوية الحادة، الإدارة التمريضية، العلاج التحريضي، الأورام الدموية، السيطرة على الأعراض، رعاية المرضى، التمريض السرطاني، لعلاج

الكيميائي، تصنيف اللوكيميا النقوية الحادة.