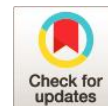


Effects of PDCA cycle management on patients with acute myelocytic leukemia receiving decitabine combined with low dose idarubicin and cytarabine

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Abstract

Acute myeloid leukemia (AML) is a hematologic neoplasm that occurs in adults, especially in the elderly. This study was performed to investigate the impact of a plan, do, check, act (PDCA)-based care management model on the clinical outcomes and quality of life of patients with AML receiving the decitabine (DCA) regimen in combination with low dose idarubicin + cytarabine (IA). Eighty-four patients with AML were enrolled in this study. Among them, 42 patients in the control group adopted DCA co-IA regimen and routine nursing, the other 42 cases in the observation group underwent the DCA co-IA regimen and PDCA nursing management. The immune function, hematopoietic function, clinical efficacy, quality of life, prognosis, and occurrence of adverse reactions were observed and compared between the two groups. After care, the observation group had higher CD4⁺ ($P < 0.0001$), CD4⁺/CD8⁺ ($P = 0.0022$), HGB ($P < 0.0001$) and PLT ($P < 0.0001$) level, clinical treatment efficiency ($P = 0.0189$), and nursing satisfaction ($P = 0.0066$) in relation to the control group. However, the CD8⁺ ($P < 0.0001$), WBC ($P < 0.0001$), incidence of adverse reactions ($P = 0.0189$, $P = 0.0347$ and $P = 0.0206$), SAS score ($P < 0.001$), SDS score ($P < 0.001$), and QLI score ($P < 0.01$) were lower in the observation group than those in the control group. In summary, the implementation of PDCA nursing management for AML patients undergoing DCA + IA chemotherapy treatment can improve patients' immune function, clinical efficacy, quality of life and psychological status, reduce the occurrence of complications, and improve nursing satisfaction, which has clinical promotion value.

KEYWORDS: Acute myelocytic leukemia; PDCA management model; Immune function; Hematopoietic function



1. Introduction

Acute myeloid leukemia (AML) is a hematologic neoplasm that occurs in adults, especially in the elderly [1]. AML is characterized by accumulation of immature myeloid cells in the bone marrow and suppression of bone marrow hematopoiesis [2]. The onset of AML is rapid, up to weeks or months, the main manifestations are anemia, bleeding, bone pain, fatigue, fever, and hepatosplenomegaly [3]. According to epidemiological statistics, AML accounts for more than 50% of acute leukemia, and the 5-year survival rate of patients is as low as 10% [4, 5]. Currently, the treatment of AML majorly includes remission induction and post-remission therapy, including chemotherapy, targeted therapy, and hematopoietic stem cell transplantation [4, 6]. For induction therapy, anthracyclines combined with standard doses of cytarabine are recommended for 7 to 10 days (“7 + 3” therapy) in newly diagnosed adult AML patients [7]. For older patients (> 60 years), the optimal chemotherapy regimen remains to be determined. The same remission induction regimen is recommended for most patients, except for those with adverse risk or severe commodities who are too fragile to tolerate high-intensity chemotherapy [8].

Idarubicin is a type of anthracyclines and an indispensable component of chemotherapy regimens used for the treatment of young and medically fit patients with AML [9]. Cytarabine is an effective drug in the treatment of hematologic malignancies [10]. The IA regimen (Idarubicin + cytarabine) is currently the standard induction regimen with internationally recognized efficacy in treating AML [11, 12]. The demethylating drug decitabine (DCA) is a specific DNA methylation transferase inhibitor that inhibits the proliferation of tumor cells and has cytotoxic effects at high concentrations and demethylating effects at low concentrations [13, 14]. DCA has been shown to have promising activity in various blood disorders. More importantly, it is also used as a single agent to treat elderly patients with AML [15].

The continuous development of society leads to a gradual increase of patients’ demand for nursing care, and the current routine care cannot effectively improve patients’ quality of life or reduce the incidence of complications [16]. PDCA cycle management is a scientific procedure of total quality management, which was first proposed by Deming, an American quality management expert [17]. In recent years, PDCA management system has been increasingly used in nursing [18]. It can help nurses accumulate nursing experience and improve the quality of nursing management [17, 18]. Plan (P): determine the policy and objectives and define the activity plan. Do (D): do it in the field and realize the plan’s contents. Check (C): check the effect, compare the actual work results with the expected objectives, and inspect the implementation of the plan. Action (A): process the results of the summary check, affirm the successful experience, and promote and standardize them appropriately, and summarize the failed lessons to avoid recurrence. Many studies have indicated that the clinical symptoms of patients can be obviously improved after PDCA home nursing, which is easier to be accepted by patients and their families than other nursing methods [19]. For instance, application of the FOCUS-PDCA procedure improves the self-care capacity of rectal cancer patients undergoing colostomy [20]. PDCA-based nursing intervention can enhance the daily living ability, neurological function, as well as self-management ability of patients with acute cerebral stroke [21]. This study was aimed to explore the effect of the PDCA nursing management model on AML patients receiving chemotherapy.

2. Materials and Methods

2.1. Patient enrollment

This was a retrospective study. Eighty-four patients with AML admitted to our hospital from May 2016 to December 2018 were selected for the study, and they were grouped according to the differences in the patients’ care regimens. Control group: 42 patients were treated with DCA combined with low-dose IA regimen, including 24 males and 18 females; age 28-74 years, average 59.27 ± 8.81 years. Observation group: 42 cases were treated with PDCA nursing model on the basis of the control group, including 23 males and

19 females; ages 31-73 years old, average 60.34 ± 9.24 years old. The differences between the general data of the two groups were not statistically significant and were clinically comparable ($P > 0.05$). The present study was approved by the hospital ethics committee and informed written consent was obtained from each participant. Inclusion criteria: (1) The clinical diagnosis of AML met WHO criteria based on bone marrow morphology, immunophenotyping, cytogenetics, and/or molecular biology; (2) The patients had different degrees of bone loss after chemotherapy; (3) Different degrees of myelosuppression and other adverse effects after chemotherapy; (4) No allergy to DCA and IA chemotherapy regimen; (5) receiving no other treatment 1 month prior to enrollment; Exclusion criteria: (1) Severe mental illness and poor compliance with treatment; (2) Organ failure of the heart, liver and kidneys. (3) Combination with other malignant tumors.

2.2. Treatment methods

DCA co-IA regimen: intravenous drip of DCA (Zhengda Tianqing Pharmaceutical Group Co., Ltd., State Drug Registration No. H20120067), 10 mg/day (day 1~5), Idarubicin (Pfizer Pharmaceutical (Wuxi) Co., Ltd., Drug Registration No. H20150313), 5 mg/m² (day 6~8), and cytarabine (Pfizer Pharmaceutical (Wuxi) Co., Ltd., Drug Registration No. H20160403), 75 mg, 1 time/12 h (day 6~12). Patients in the control group received DCA co-IA regimen and they were given routine nursing interventions, including health education, medication monitoring, monitoring of key indicators, and advice on precautions. Patients in the observation group underwent the DCA co-IA regimen and PDCA nursing. In brief, P was to formulate a nursing plan, summarize and analyze the clinical data of patient, make a preliminary assessment of the patient's mental state and actual condition, analyze the chance of occurrence and risk of adverse conditions after chemotherapy, provide health education on the relevant knowledge of disease treatment for patients, implement psychological care for the patient according to their psychological state, inform the patient of precautions during chemotherapy, and formulate a nursing care plan for the patient. D was to implement the nursing program, implement nursing interventions for patients according to the prepared nursing program, implement health education for patients to let patients grasp more knowledge about leukemia, chemotherapy and other diseases and treatments, explain the importance of nursing work to patients and encourage and comfort them, provide psychological care for them to relax and actively cooperate with treatment and observe and care for adverse reactions and complications of patients in the course of treatment. C was to check the nursing effect, a quality control team for acute leukemia nursing could be set to regularly check the effect of PDCA nursing management and make relevant records. A was to deal with problems in nursing in a timely manner and adjust the nursing plan in conjunction with the patient's conditions to improve the quality of surgical care further.

2.3. Observation indicators

2.3.1. Immune function

Before and 4 weeks after treatment, 10 ml of fasting venous blood was collected from patients after 8 h fasting. The T-lymphocyte subsets (CD4⁺ and CD8⁺) were measured by flow cytometry (Beckman Coulter, USA) [22]. The CD4⁺/CD8⁺ values were calculated.

2.3.2. Hematopoietic function

Before and 4 weeks after treatment, 10 ml of fasting venous blood was collected from each patient after 8 h fasting. The white blood cell (WBC) count, hemoglobin (HGB) level, and platelets (PLT) count were measured by automatic biochemical analyzer (Thermo Fisher Scientific, USA).

2.3.3. Clinical efficacy

The remission status was assessed 7–14 days after the treatment. The response criteria were established according to the criteria set by the National Comprehensive Cancer Network (NCCN) [23]. Complete remission (CR): the PLT count and absolute neutrophil count improved, with the former above $100 \times 10^9/L$ and the latter above $1.5 \times 10^9/L$, and the bone marrow primitive cells did not exceed 5% in AML patients; partial remission (PR): the bone marrow primitive cells exceeded 5% but did not exceed 20% in AML patients; no remission (NR): the platelet count and absolute neutrophil count did not change and the AML primitive cells exceeded 20%. The sum of CR and PR was the clinical treatment efficiency of AML patients.

2.3.4. Adverse reactions

Patients were counted for the occurrence of adverse reactions, including pulmonary infections, gastrointestinal reactions, heart failure, and impaired liver function.

2.3.5. Quality of life

Quality of life was assessed using the Quality of Life Index (QLI), which included 5 domains: ability to live, daily living, feeling healthy, family social support, and perception of outlook. Each domain is scored on a 3-point scale, with scores ranging from 0 to 2. The higher the score, the higher the quality of life was [24].

2.3.6. Mental state assessment

The anxiety self-assessment scale (SAS) and depression self-assessment scale (SDS) were used to evaluate the patients' anxiety and depression status. [25]. The cut-off value of SAS standard score was 50 points, in which 50-59 was classified as mild anxiety, 60-69 was classified as moderate anxiety, and more than 69 was severe anxiety. The cut-off value of the SDS standard score was 53 points, of which 53-62 was classified as mild depression, 63-72 was classified as moderate depression, and 72 or more was classified as severe depression.

2.3.7. Patient satisfaction with treatment

The survey included the dimensions of chemotherapy comfort, effectiveness, timeliness, and safety. The score was 100 out of 100, and the patients with AML rated themselves. 0-59 indicated that the patients with AML were not satisfied; 60-74 indicated that the patients with AML were relatively satisfied; 75-100 indicated that the patients with AML were highly satisfied, and the treatment satisfaction of the patients with AML was the sum of the latter two.

2.3.8. Statistical analysis

Data were organized and analyzed with SPSS 21.0 software, and figures were drawn using GraphPad 7.0 software. The measurement data were expressed as mean \pm standard deviation ($\bar{x} \pm s$) using student's t-test. The statistical data were expressed as (n, %) using the χ^2 test. $P < 0.05$ indicated a statistically significant difference.

3. Results

3.1. The immune function in AML patients before and after treatment

As shown in Table 1, the CD4+, CD8+ and CD4+/CD8+ levels in two groups had no significant differences before treatment ($P>0.05$). However, after treatment, the CD4+ and CD4+/CD8+ levels were prominently increased while CD8+ level was reduced in observation group in relation to the control group ($P<0.0001$ and $P=0.0022$). Collectively, the immune function was remarkably improved by PDCA nursing in the observation group in comparison with the control group.

Table 1. Comparison of CD4+, CD8+, CD4+/CD8+ levels before and after treatment between

Grouping	N	CD4 ⁺		CD8 ⁺		CD4 ⁺ /CD8 ⁺	
		Before	After	Before	After	Before	After
Observation group	42	44.34 ± 2.56	62.38 ± 4.34	53.65 ± 4.89	43.78 ± 3.12	0.83 ± 0.34	1.42 ± 0.28
Control group	42	43.95 ± 3.14	57.65 ± 5.21	54.79 ± 4.21	48.43 ± 4.08	0.80 ± 0.36	1.19 ± 0.38
t value		0.6239	4.521	1.145	5.867	0.3926	3.158
P value		0.5344	<0.0001	0.2556	<0.0001	0.6956	0.0022

3.2. *The hematopoietic function in AML patients before and after treatment*

As depicted in Table 2, the WBC, HGB and PLT count had no significant differences in two groups before treatment ($P>0.05$). However, after treatment, the observation group presented lower WBC, higher HGB and PLT count as compared with the control group ($P<0.0001$).

Table 2. Comparison of routine blood indicators between two groups (x±s)

Grouping	N	WBC (×10 ⁹ /L)		HGB (g/L)		PLT (×10 ⁹ /L)	
		Before	After	Before	After	Before	After
Observation group	42	35.75 ± 4.34	23.54 ± 3.65	28.35 ± 4.23	63.68 ± 6.54	22.46 ± 1.85	62.45 ± 2.64
Control group	42	36.29 ± 5.48	28.55 ± 4.27	27.69 ± 4.26	54.43 ± 3.59	22.65 ± 1.74	54.87 ± 4.33
t value		0.5006	5.780	0.7125	8.035	0.4848	9.687
P value		0.6180	<0.0001	0.4782	<0.0001	0.6291	<0.0001

3.3. *The mental state, quality of life, and incidence of adverse reactions of AML patients after treatment*

As demonstrated in Figures 1-3, the SAS and SDS scores were markedly decreased ($P<0.001$), while QLI scores were increased in the observation group in comparison with the control group ($P<0.01$). Also, Table 3 revealed that the incidence of pulmonary infection, gastrointestinal reaction and liver injury was lower in the observation group compared with the control group ($P=0.0189$, $P=0.0347$ and $P=0.0206$). The incidence of heart failure was lower in observation group than in control group, but there was no statistically significant difference between the two groups ($P=0.3423$). Comprehensively, compared with control group, PDCA care in the observation group could effectively alleviate anxiety and depression in AML patients, reduce the emergence of adverse complications, and improve the quality of life of patients.

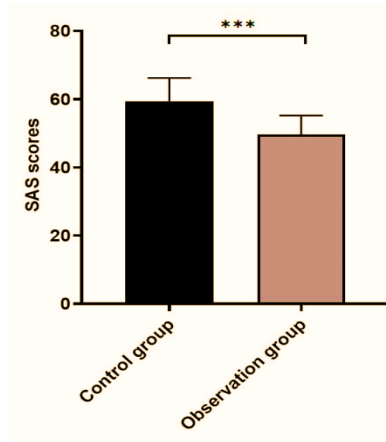


Figure 1. Comparison of SAS scores in two different groups. ***P<0.001, observation group vs. control group.

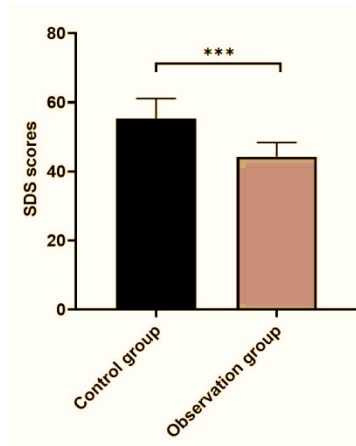


Figure 2. Comparison of SDS scores in two different groups. ***P<0.001, observation group vs. control group.

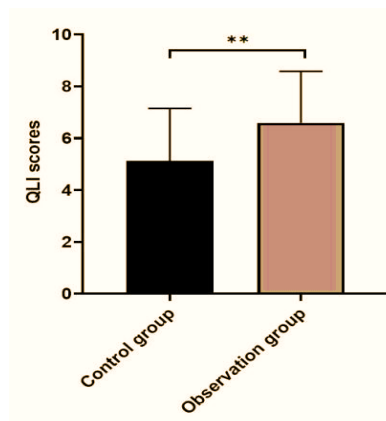


Figure 3. Comparison of QLI scores in two different groups. **P<0.01, observation group vs. control group.

Table 3. Comparison of the occurrence of adverse reactions in the two groups (n, %)

Grouping	N	Pulmonary infection	Gastrointestinal reaction	Heart failure	Liver injury
Observation group	42	5	3	7	13
Control group	42	14	7	11	19
χ^2 value		5.509	4.459	0.9017	5.357
P value		0.0189	0.0347	0.3423	0.0206

3.4. Treatment efficacy and treatment satisfaction in two groups

From the results in Table 4 and Table 5, the treatment efficacy and treatment satisfaction were better in observation group than the control group (P=0.0189 and P=0.0066).

Table 4. Comparison of treatment effectiveness between the two groups (n, %)

Grouping	N	CR (n)	PR (n)	NR (n)	Treatment efficacy (%)
Observation group	42	6	31	5	88.10
Control group	42	3	25	14	66.67
χ^2 value					5.509
P value					0.0189

Table 5. Comparison of treatment satisfaction between the two groups (n, %)

Grouping	N	Satisfaction	Moderate	Dissatisfaction	Satisfaction rate (%)
Observation group	42	21	19	2	95.24
Control group	42	15	16	11	73.81
χ^2 value					7.372
P value					0.0066

4. Discussion

At present, DCA co-IA regiment is the most commonly used chemotherapy method in the clinical treatment of AML patients, although this method can play a certain effect, but patients in the treatment process will also appear adverse reactions such as pulmonary infection, gastrointestinal reaction, heart failure, and liver injury [26]. Besides, studies have shown that negative emotions can greatly reduce the immunity of AML patients undergo chemotherapy, which will negatively affect the ability of the patient’s immune system to recognize and destroy cancer cells [27]. Therefore, it is necessary to take high-quality nursing services to intervene in AML patients receiving chemotherapy, to provide them with comprehensive, scientific, high-quality physical and mental health care, so as to improve their treatment cooperation and compliance, improve their physical discomfort and psychological conditions.

The PDCA cycle is a scientific quality management method with standardization and scientific characteristics. In recent years, since the introduction of PDCA cycle management into the medical field, it has been widely used in the postoperative nursing management of various diseases [17]. Studies have shown that it has achieved good results in the care of different diseases and improved the prognosis and treatment quality of patients [28]. For example, PDCA procedure improves self-care ability of patients undergoing colostomy for rectal cancer [20]. Besides, PDCA cycle can improve the nutritional level of patients with nasopharyngeal carcinoma [29]. In this study, we explored the influence of PDCA cycle on AML patients underwent chemotherapy. The control group was given traditional nursing interventions, and the observation group implemented the PDCA cycle method for nursing interventions.

The immune function of AML patients is low, chemotherapy is a routine means of clinical treatment of AML, but chemotherapy has obvious inhibitory effect on the immune function of cells [30]. CD4+ is the representative of helper T cells, CD8+ is the representative of suppressive T cells [31]. CD4+/CD8+ value is

an important hub of the body's immune regulatory network, and the dynamic balance between CD4+ and CD8+ is always maintained in physiological state to regulate the body's immune state [32]. In our study, the results displayed that the indexes of hematopoietic function, immune function, treatment effect, adverse reactions in the observation group were better than those in the control group. The reason may be that the PDCA management model focuses on the quality of care for AML patients in all aspects and multiple dimensions and can meet patients' physical and psychological care needs [16]. Therefore, it can reduce more adverse events induced by leukopenia due to myelosuppression and facilitate the recovery of the body's immune and hematopoietic function. Consistently, it has been reported that PDCA circulation nursing can effectively improve the quality of care of hemodialysis patients with internal arteriovenous fistula and reduce the occurrence of complications [33]. Besides, Bai et al have indicated that PDCA circulation nursing promotes the immune and hematopoietic function of patients with severe pneumonia [34]. AML patients often suffer from anxiety and depression, which are the most common psychological stress reactions of patients and predict unfavorable survival in patients [35].

A recent study has revealed that PDCA nursing has a good blood pressure control effect on hypertension patients in home care, which can improve their quality of life and nutritional status and also relieve their bad emotions [36, 37]. In our study, it was found that the SAS and SDS scores of the observation group were significantly lower than those of the control group, indicating that the PDCA-based care management model could reduce patients' anxiety and improve their mental and emotional state, which was consistent with previous literatures [38]. Furthermore, QLI scores of AML patients in the observation group were elevated compared to the control group, which further proved that PDCA nursing management could promote the quality of life AML patients. Likewise, it has been documented that PDCA-based nursing management model can improve the quality of life of patients with diabetic nephropathy [39]. Moreover, the results of this study showed that the nursing satisfaction of the observation group were higher than those of the control group. The reasons for this were that health education in the PDCA cycle of care could improve patients' awareness of AML, thus improving their nursing satisfaction; psychological care could improve patients' negative emotions and motivate them to face the disease and treatment with a positive attitude to enhance further their quality of life [40, 41].

Consistent with our results, previous studies have also proved that PDCA home nursing can improve the nursing quality and patients' satisfaction in patients with diabetic nephropathy [39]. There are some limitations in our study. First, due to the small population of this study, there may be some deviation in grouping. We need a larger sample size to confirm this conclusion. In addition, the study did not look at negative emotions in primary caregivers. A large-sample long-term care effect study is required in the later stage to verify the feasibility and importance of PDCA-based nursing management model in AML patients.

5. Conclusion

PDCA nursing interventions are clinically effective in AML patients undergoing chemotherapy, resulting in a reduced risk of patient-related adverse effects, improved psychological status, hematopoietic and immune function, and a better quality of life.

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Data availability statement

Original data analyzed in this study are available from the corresponding author under reasonable requests.

References

1. Issa, G.C. and C.D. DiNardo, Acute myeloid leukemia with IDH1 and IDH2 mutations: 2021 treatment algorithm. *Blood Cancer J*, 2021. 11(6): p. 107. <https://doi.org/10.1038/s41408-021-00497-1>
2. Narayanan, D. and O.K. Weinberg, How I investigate acute myeloid leukemia. *Int J Lab Hematol*, 2020. 42(1): p. 3-15. <https://doi.org/10.1111/ijlh.13135>
3. Saleh, K., N. Khalifeh-Saleh, and H.R. Kourie, Acute myeloid leukemia transformed to a targetable disease. *Future Oncol*, 2020. 16(14): p. 961-972. <https://doi.org/10.2217/fon-2019-0670>
4. Thol, F. and A. Ganser, Treatment of Relapsed Acute Myeloid Leukemia. *Curr Treat Options Oncol*, 2020. 21(8): p. 66. <https://doi.org/10.1007/s11864-020-00765-5>
5. Kantarjian, H.M., et al., Acute myeloid leukemia: Treatment and research outlook for 2021 and the MD Anderson approach. *Cancer*, 2021. 127(8): p. 1186-1207. <https://doi.org/10.1002/cncr.33477>
6. Medinger, M., et al., [Diagnosis and Therapy of Acute Myeloid Leukemia]. *Ther Umsch*, 2019. 76(9): p. 481-486.
7. Murphy, T. and K.W.L. Yee, Cytarabine and daunorubicin for the treatment of acute myeloid leukemia. *Expert Opin Pharmacother*, 2017. 18(16): p. 1765-1780. <https://doi.org/10.1080/14656566.2017.1391216>
8. Estey, E.H., Acute myeloid leukemia: 2019 update on risk-stratification and management. *Am J Hematol*, 2018. 93(10): p. 1267-1291. <https://doi.org/10.1002/ajh.25214>
9. Döhner, H., et al., Diagnosis and management of AML in adults: 2017 ELN recommendations from an international expert panel. *Blood*, 2017. 129(4): p. 424-447.
10. Salehi, B., et al., Liposomal Cytarabine as Cancer Therapy: From Chemistry to Medicine. *Biomolecules*, 2019. 9(12).
11. DiNardo, C.D., et al., Venetoclax Combined With FLAG-IDA Induction and Consolidation in Newly Diagnosed and Relapsed or Refractory Acute Myeloid Leukemia. *J Clin Oncol*, 2021. 39(25): p. 2768-2778. <https://doi.org/10.1200/jco.20.03736>
12. Kadia, T.M., et al., Venetoclax plus intensive chemotherapy with cladribine, idarubicin, and cytarabine in patients with newly diagnosed acute myeloid leukaemia or high-risk myelodysplastic syndrome: a cohort from a single-centre, single-arm, phase 2 trial. *Lancet Haematol*, 2021. 8(8): p. e552-e561. [https://doi.org/10.1016/s2352-3026\(21\)00192-7](https://doi.org/10.1016/s2352-3026(21)00192-7)
13. Yu, J., et al., DNA methyltransferase expression in triple-negative breast cancer predicts sensitivity to decitabine. *J Clin Invest*, 2018. 128(6): p. 2376-2388.
14. Uddin, M.G. and T.E. Fandy, DNA methylation inhibitors: Retrospective and perspective view. *Adv Cancer Res*, 2021. 152: p. 205-223. <https://doi.org/10.1016/bs.acr.2021.03.007>
15. Welch, J.S., et al., TP53 and Decitabine in Acute Myeloid Leukemia and Myelodysplastic Syndromes. *N Engl J Med*, 2016. 375(21): p. 2023-2036.
16. Zhou, J., et al., Effect of PDCA-based nursing management model on the quality of life and complications of patients with acute leukemia undergoing chemotherapy. *Am J Transl Res*, 2021. 13(4): p. 3246-3253.
17. Qiu, H. and W. Du, Evaluation of the Effect of PDCA in Hospital Health Management. *J Healthc Eng*, 2021. 2021: p. 6778045.
18. Chen, Y., et al., Application of the PDCA cycle for standardized nursing management in a COVID-19 intensive care unit. *Ann Palliat Med*, 2020. 9(3): p. 1198-1205. <https://doi.org/10.21037/apm-20-1084>
19. Lv, Q., et al., Research on the Construction of a Nursing Education Management Model Based on a Small Data-Driven Model and Its Application. *Comput Intell Neurosci*, 2022. 2022: p. 3099794.
20. Jin, Y., et al., Effect of FOCUS-PDCA procedure on improving self-care ability of patients undergoing colostomy for rectal cancer. *Rev Esc Enferm USP*, 2021. 55: p. e03729. <https://doi.org/10.1590/s1980-220x2020012503729>
21. Huang, L., et al., Effect of PDCA-based nursing intervention on activities of daily living, neurological function and self-management in acute cerebral stroke. *Am J Transl Res*, 2021. 13(5): p. 5315-5321.

22. Nordström, S., B. Andersson, and C. Malmeström, Cerebrospinal fluid CD4(+) /CD8(+) ratio in diagnosing neurosarcoidosis. *Acta Neurol Scand*, 2020. 142(5): p. 480-485. <https://doi.org/10.1111/ane.13297>
23. O'Donnell, M.R., et al., Acute myeloid leukemia, version 2.2013. *J Natl Compr Canc Netw*, 2013. 11(9): p. 1047-55.
24. Kovacs, F.M., et al., Spanish adaptation of the Quality of Life Index-Spinal Cord Injury version. *Spinal Cord*, 2016. 54(10): p. 895-900. <https://doi.org/10.1038/sc.2015.200>
25. Yue, T., et al., Comparison of Hospital Anxiety and Depression Scale (HADS) and Zung Self-Rating Anxiety/Depression Scale (SAS/SDS) in Evaluating Anxiety and Depression in Patients with Psoriatic Arthritis. *Dermatology*, 2020. 236(2): p. 170-178. <https://doi.org/10.1159/000498848>
26. Dou, L., et al., Clinical efficacy of decitabine in combination with standard-dose cytarabine, aclarubicin hydrochloride, and granulocyte colony-stimulating factor in the treatment of young patients with newly diagnosed acute myeloid leukemia. *Onco Targets Ther*, 2019. 12: p. 5013-5023. <https://doi.org/10.2147/ott.s200005>
27. Wang, Z., Application of High-Quality Nursing Intervention Based on Humanistic Care Combined with the Project Teaching Method in Patients with Acute Leukemia Undergoing Chemotherapy. *J Healthc Eng*, 2022. 2022: p. 2972037. <https://doi.org/10.1155/2022/2972037>
28. Liu, C., et al., Application of the PDCA cycle for standardized nursing management in sepsis bundles. *BMC Anesthesiol*, 2022. 22(1): p. 39. <https://doi.org/10.1186/s12871-022-01570-3>
29. Zeng, X., et al., The application of the PDCA cycle in the nutritional management of patients with nasopharyngeal carcinoma. *Support Care Cancer*, 2023. 31(5): p. 251.
30. Tang, L., et al., Characterization of Immune Dysfunction and Identification of Prognostic Immune-Related Risk Factors in Acute Myeloid Leukemia. *Clin Cancer Res*, 2020. 26(7): p. 1763-1772. <https://doi.org/10.1158/1078-0432.ccr-19-3003>
31. Huang, J., et al., A skewed distribution and increased PD-1+Vβ+CD4+/CD8+ T cells in patients with acute myeloid leukemia. *J Leukoc Biol*, 2019. 106(3): p. 725-732. <https://doi.org/10.1002/jlb.ma0119-021r>
32. Yavaşoğlu, İ., CD4+CD8+ Double-Positive T-Lymphocytes: Pitfalls. *Turk J Haematol*, 2020. 37(3): p. 216-217.
33. Sun, J., et al., Plan, Do, Check, Act (PDCA) Cycle Nursing Model Reduces the Risk of Hemangioma in Hemodialysis Patients. *Iran J Public Health*, 2021. 50(12): p. 2560-2566. <https://doi.org/10.18502/ijph.v50i12.7939>
34. Bai, L., et al., Effect of PDCA circulation nursing intervention on prognosis of patients with severe pneumonia. *Am J Transl Res*, 2022. 14(1): p. 252-263.
35. Ding, T., et al., Anxiety and depression predict unfavorable survival in acute myeloid leukemia patients. *Medicine (Baltimore)*, 2019. 98(43): p. e17314. <https://doi.org/10.1097/md.00000000000017314>
36. Yi, C., X. Feng, and Y. Yuan, Study on the Influence of PDCA Cycle Nursing Based on Network Service on the Quality of Life and Nutritional Status of Hypertension Patients in Home Care. *Evid Based Complement Alternat Med*, 2021. 2021: p. 6068876. <https://doi.org/10.1155/2021/6068876>
37. Li, Y., M. Hong, and G. Liu, Changes in the Quality of Life, Psychological Status, Medication Compliance, and Prognosis of Patients with Acute Myocardial Infarction after PCI by Applying PDCA Cycle Management Model. *Evid Based Complement Alternat Med*, 2021. 2021: p. 7318653. <https://doi.org/10.1155/2021/7318653>
38. Gao, Y., X. Chen, and L. Kang, The effect of Plan-Do-Check-Act cycle nursing management of gynecological surgery: a systematic review and meta-analysis. *Ann Palliat Med*, 2021. 10(7): p. 8072-8081. <https://doi.org/10.21037/apm-21-1590>
39. Du, Q., et al., Evaluation of Functional Magnetic Resonance Imaging under Artificial Intelligence Algorithm on Plan-Do-Check-Action Home Nursing for Patients with Diabetic Nephropathy. *Contrast Media Mol Imaging*, 2022. 2022: p. 9882532. <https://doi.org/10.1155/2022/9882532>

40. Nakazawa, Y., et al., A Self-Check Program Targeting Quality Improvement in a Hospital-Based Palliative Care Consultation Team, Japanese Society for Palliative Medicine: Issues Regarding Team Activities Identified through the Plan-Do-Check-Act Cycle. *J Palliat Med*, 2020. 23(3): p. 359-367.

<https://doi.org/10.1089/jpm.2019.0236>

41. Wei, W., et al., The application of 6S and PDCA management strategies in the nursing of COVID-19 patients. *Crit Care*, 2020. 24(1): p. 443. <https://doi.org/10.1186/s13054-020-03124-w>