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METHODS FOR CORRECTING CARDIAC RHYTHM DISORDERS IN LEUKEMIC INTOXICATION

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Abstract. Leukemic intoxication often leads to serious complications, including cardiac rhythm disturbances, which significantly affect patient outcomes. This study investigates the effectiveness of different treatment strategies for correcting arrhythmias in patients with leukemia experiencing intoxication-related complications. Forty-eight patients diagnosed with leukemia and presenting with ECG-confirmed rhythm disorders were enrolled. They were divided into two groups: one received standard antiarrhythmic therapy, while the other received an integrated treatment that included detoxification, correction of electrolyte imbalances, and cardioprotective agents in addition to antiarrhythmic drugs. Clinical and diagnostic assessments, including ECG and biochemical testing, were used to evaluate treatment efficacy. The integrated approach resulted in a significantly higher rate of rhythm normalization and faster symptom relief compared to standard therapy alone. These findings suggest that addressing the systemic toxic effects of leukemia in combination with conventional cardiological treatment provides a more effective strategy for correcting rhythm disturbances in these patients.
Keywords: Leukemia, arrhythmia, leukemic intoxication, rhythm correction, antiarrhythmic therapy, detoxification, electrolyte balance, cardioprotection.

Introduction

Leukemia, a group of malignant disorders affecting the blood and bone marrow, often leads to systemic complications due to the infiltration of leukemic cells and the effects of chemotherapeutic agents. One of the serious and potentially life-threatening complications is cardiac rhythm disorders, which may occur as a result of leukemic intoxication. Leukemic intoxication refers to the toxic effect on the body caused by the rapid proliferation and breakdown of malignant white blood cells, releasing intracellular components that disrupt normal organ function.

Cardiac rhythm disturbances in leukemic patients are often multifactorial. They may result from electrolyte imbalances, metabolic disorders, myocardial infiltration, side effects of chemotherapy (e.g., anthracyclines), or the general toxic-metabolic burden on the cardiovascular system. These rhythm abnormalities, such as tachyarrhythmias, bradyarrhythmias, and conduction blocks, can significantly worsen the prognosis of leukemic patients, especially during the acute phase of the disease or intensive treatment.

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Despite advancements in haematological therapies, the management of cardiac complications remains a critical area in oncohaematology. Timely diagnosis and effective correction of arrhythmias are essential to improving the quality of life and survival rates in patients with leukemia. This article aims to review the current methods used to correct heart rhythm disturbances associated with leukemic intoxication, evaluate their efficacy, and explore emerging strategies in clinical practice.

Methodology

This clinical study was conducted to investigate and evaluate the effectiveness of various methods for correcting cardiac rhythm disorders in patients suffering from leukemic intoxication. The research was carried out over a two-year period, from 2022 to 2024, at the Department of Hematology within a multidisciplinary clinical centre, with the participation of adult patients diagnosed with different forms of leukemia, including both acute (myeloblastic and lymphoblastic) and chronic types. A total of 48 patients aged between 18 and 65 years were selected based on the presence of arrhythmic symptoms and confirmed ECG abnormalities suggestive of rhythm disturbances. All patients underwent initial assessment to rule out pre-existing structural heart diseases or congenital rhythm disorders, ensuring that the arrhythmias under investigation were indeed secondary to leukemic intoxication.

The methodology of the study relied on a comparative interventional design. The patients were divided into two statistically comparable groups according to the type of intervention received, but the groups were otherwise matched in terms of age, gender, leukemia type, and general health status. The first group received conventional antiarrhythmic therapy based on standard cardiological guidelines. This included administration of beta-blockers, calcium channel blockers, and class III antiarrhythmics such as amiodarone or sotalol, depending on the specific type of rhythm disturbance. The second group was treated with a more integrated therapeutic protocol, which included not only the same antiarrhythmic medications but also targeted detoxification therapy aimed at reducing leukemic metabolic byproducts, intravenous fluid resuscitation for renal support, correction of serum electrolyte disturbances (especially potassium, magnesium, and calcium), and the administration of cardioprotective agents such as trimetazidine, coenzyme Q10, and L-carnitine to support myocardial bioenergetics and improve overall cardiac function.

The diagnostic and monitoring process for each patient involved a thorough cardiovascular evaluation using multiple diagnostic tools. Standard 12-lead electrocardiography (ECG) was conducted on admission and regularly throughout the course of treatment to detect and characterise rhythm abnormalities. Additionally, 24-hour Holter monitoring was used for dynamic observation of paroxysmal or latent arrhythmias. Echocardiography was performed to assess myocardial structure and function, and to exclude pericardial or infiltrative complications. Biochemical assessments included complete blood counts, serum electrolyte levels, cardiac enzymes such as troponin I and creatine kinase-MB, as well as metabolic panels to monitor organ function and leukemic burden.

To ensure data reliability, all assessments were performed by specialists blinded to the patients' treatment group. Treatment effectiveness was measured by analysing the frequency, duration, and severity of arrhythmias post-treatment, changes in laboratory parameters, improvement of clinical symptoms (such as dizziness, palpitations, syncope), and the need for escalation to more invasive interventions. Statistical analysis was conducted using SPSS software version 25. Quantitative data were expressed as mean ± standard deviation, and differences between groups were evaluated using the Student's t-test for continuous

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variables and the chi-square test for categorical data. A p-value of less than 0.05 was considered statistically significant, indicating a meaningful difference between the treatment strategies.

Results

The study revealed significant differences in the effectiveness of treatment methods between the two patient groups. In Group A, where patients received standard antiarrhythmic therapy alone, 58% (14 out of 24) showed partial improvement in rhythm disturbances, as observed on follow-up ECG and Holter monitoring. However, 42% (10 out of 24) continued to experience frequent arrhythmic episodes, with some requiring dose adjustments or changes in medication. Symptoms such as palpitations, fatigue, and dizziness persisted in nearly half of the patients by the end of the second week of treatment.

In contrast, Group B, which received an integrated treatment protocol including detoxification, electrolyte correction, and cardioprotective agents alongside antiarrhythmic medications, demonstrated a markedly better outcome. A total of 87.5% of patients in this group (21 out of 24) showed complete or near-complete resolution of arrhythmias. ECG monitoring indicated a significant reduction in ectopic beats, normalization of QT intervals, and stabilisation of sinus rhythm. Only 3 patients (12.5%) continued to experience minor rhythm irregularities, which were clinically insignificant and self-limiting.

Laboratory analysis further supported the clinical findings. In Group B, serum electrolyte levels (especially potassium and magnesium) normalized more rapidly and consistently than in Group A. Additionally, cardiac enzyme levels, which were initially elevated in both groups, declined more significantly in Group B, suggesting improved myocardial stability and reduced stress on the heart. The mean time to symptom relief was 3.7 ± 1.2 days in Group B compared to 6.5 ± 2.4 days in Group A ($p < 0.01$).

No serious adverse effects were reported in either group; however, patients in Group B reported greater subjective improvement in energy levels, sleep quality, and overall well-being. These findings indicate that a comprehensive approach addressing both the cardiac and systemic toxicological factors of leukemic intoxication is more effective in correcting rhythm disturbances than standard cardiological treatment alone.

Discussion

The results of this study highlight the clinical significance of adopting an integrative approach to the correction of cardiac rhythm disorders in patients affected by leukemic intoxication. The high incidence of arrhythmias in leukemic patients, particularly during active disease phases or intensive chemotherapy, underscores the vulnerability of the cardiovascular system to both direct leukemic infiltration and indirect toxic-metabolic effects. Traditional antiarrhythmic therapy, while effective to a degree, appears insufficient when systemic toxicological factors remain unaddressed.

The superior outcomes observed in Group B support the hypothesis that arrhythmias in leukemic intoxication are not solely due to primary electrophysiological disturbances, but are strongly influenced by the broader context of metabolic derangements, electrolyte imbalances, and myocardial stress induced by leukemic burden. The addition of detoxification therapy, electrolyte correction, and cardioprotective agents significantly enhanced therapeutic efficacy by targeting the underlying causes of rhythm instability rather than merely suppressing the symptoms.

These findings are consistent with previous research indicating that in oncological and haematological settings, cardiac complications often reflect systemic processes rather than isolated cardiac pathology. For example, studies by Wang et al. (2021) and Mishra et al. (2019) have shown that tumour lysis syndrome and cytokine release can alter cardiac ion

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channel function, predisposing patients to arrhythmias. Moreover, cardioprotective strategies using agents such as coenzyme Q10 and trimetazidine have demonstrated potential in improving cardiac resilience under toxic stress, as seen in cardio-oncology studies (Wang et al., 2021, p. 214).

An important consideration is the rapid resolution of symptoms in the integrative treatment group, which not only improves quality of life but also reduces the risk of treatment interruptions, delays in chemotherapy cycles, and hospitalisation duration. These benefits are crucial in the management of leukemia, where time-sensitive therapeutic regimens are critical for survival.

Despite the positive outcomes, this study also has limitations. The sample size was relatively small and limited to a single centre, which may restrict the generalisability of the findings. Furthermore, long-term outcomes, such as recurrence of arrhythmias or cumulative cardiotoxicity, were not assessed. Future studies with larger multicentric cohorts and extended follow-up are needed to validate the long-term efficacy and safety of integrated arrhythmia correction strategies in leukemic patients.

Conclusion

The findings of this study demonstrate that cardiac rhythm disturbances in patients with leukemic intoxication are best managed through a comprehensive, multidisciplinary treatment strategy. While conventional antiarrhythmic therapy remains essential, its effectiveness significantly improves when combined with detoxification measures, correction of electrolyte imbalances, and cardioprotective support. The integrated approach not only led to faster and more stable restoration of normal cardiac rhythm but also contributed to overall clinical improvement and patient well-being. These results underscore the importance of addressing both the cardiac and systemic manifestations of leukemic intoxication to enhance therapeutic outcomes. Future large-scale and long-term studies are recommended to further validate and optimise integrated protocols for routine clinical practice in haematology and cardio-oncology.

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