COVID-19 IN PATIENTS WITH CHRONIC LEUKEMIA

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Abstract

The global outbreak of COVID-19 has disproportionately affected individuals with pre-existing medical conditions, particularly those diagnosed with chronic leukemia—a hematologic malignancy associated with persistent immune dysfunction. The dual burden of chronic lymphocytic leukemia (CLL) or chronic myeloid leukemia (CML) and a COVID-19 infection presents significant clinical challenges due to the compounded immunosuppressive effects of the disease and its treatments. This thesis investigates the multifaceted impact of the COVID-19 pandemic on patients with chronic leukemia, aiming to evaluate how infection with SARS-CoV-2 influences disease progression, clinical outcomes, and access to care.

Adopting a mixed-methods research approach, the study integrates findings from contemporary scientific literature with data analysis from clinical case records and observational reports. Emphasis is placed on symptom severity, vaccine responsiveness, treatment continuity, and healthcare accessibility during the height of the pandemic. The research identifies patterns in morbidity and mortality among leukemia patients infected with COVID-19, noting that these individuals often experience more severe complications, including prolonged hospitalization, respiratory failure, and delayed recovery.

One of the most critical observations in this study is the markedly reduced immunological response to COVID-19 vaccination in patients with chronic leukemia, particularly those undergoing treatment with immunosuppressive agents such as BTK inhibitors or TKIs. These diminished vaccine responses necessitate alternative strategies for protecting this vulnerable group, including booster regimens, monoclonal antibody therapies, and strict infection prevention protocols.

The findings underscore the urgent need for healthcare systems to adopt flexible, patient-centered approaches tailored to immunocompromised populations. By contextualizing the experience of chronic leukemia patients within the broader framework of the COVID-19 pandemic, this study contributes valuable insights to both hematologic and infectious disease

disciplines. Ultimately, it advocates for the development of long-term strategies that enhance resilience in healthcare delivery for high-risk groups during ongoing and future global health crises

I. Introduction

The emergence of the COVID-19 pandemic has presented unprecedented challenges to the global health landscape, significantly impacting individuals across various spectrums of diseases. This thesis endeavors to explore a critical intersection within this paradigm: the repercussions of COVID-19 on individuals diagnosed with chronic leukemia. Chronic leukemia, a protracted form of blood cancer characterized by the excessive accumulation of abnormal white blood cells, poses ongoing medical complexities[1]. The interaction of this condition with COVID-19 further amplifies the vulnerabilities of affected patients due to their already compromised immune systems, demanding rigorous academic inquiry into this area.

The significance of this study is underscored by the urgent need to delineate the compounded health risks faced by chronic leukemia patients during the pandemic. Historically, chronic diseases have been identified as exacerbating factors that lead to more severe COVID-19 outcomes. Consequently, understanding these dynamics is not merely of academic interest but is crucial for developing tailored healthcare protocols and policies aimed at protecting this vulnerable population.

This research is guided by fundamental questions that aim to unravel how the dual burden of chronic leukemia and COVID-19 influences patient outcomes. The primary objectives include examining the extent to which COVID-19 aggravates pre-existing health conditions in chronic leukemia patients, evaluating the adequacy of current treatment regimens under pandemic constraints, and proposing evidence-based recommendations for healthcare interventions.

With the intent to foreground this exploration, an overview of the COVID-19 pandemic and its implications for chronic leukemia patients is necessary. COVID-19, caused by the SARS-CoV-2 virus, has rapidly evolved from a health crisis to a pandemic of exceptional magnitude, affecting millions globally. For patients with chronic leukemia, who inherently face challenges due to their immune-compromised status, the pandemic presents additional layers of complexity[2]. This intersection necessitates a comprehensive understanding of both conditions to formulate effective clinical strategies and improve patient prognosis during and beyond the pandemic era.

II. Methodology and Data Analysis Techniques

The transition from in-depth literature analysis to empirical investigation underscores the urgency of examining the nuanced challenges and vulnerabilities faced by chronic leukaemia patients during the Covid-19 pandemic. Addressing the research objectives, a mixed-methods approach, combining quantitative data analysis with qualitative insights has been adopted.

A narrative literature analysis study was performed. The scientific medical publications were searched via Google Scholar, PubMed, NCIB, Web of Science, Medscape, Hinari database.
This approach effectively allows for the comprehensive evaluation of clinical outcomes while also capturing the subjective experiences and emerging perspectives of healthcare providers and patients dealing with this dual health crisis.

For quantitative data analysis, descriptive and inferential statistical methods will be utilized. Descriptive statistics will provide an overview of patients' demographics and clinical characteristics, while inferential statistics, including regression analyses, will be employed to identify factors associated with COVID-19 outcomes in chronic leukaemia patients. Qualitative data from interviews will be transcribed verbatim and analysed using thematic analysis to identify key themes and patterns that elucidate the lived experiences and management of COVID-19 in this patient population

By employing these methodological strategies, the study aims to systematically investigate the intersection of COVID-19 and chronic leukaemia, addressing the critical research gaps identified in the literature review. This comprehensive approach will contribute valuable insights into optimizing clinical care and developing targeted public health interventions for this vulnerable population amidst the ongoing pandemic. Transitioning from the methodology, the results section presents the detailed findings from the study, focusing on the demographic and clinical characteristics of the study population, the incidence and severity of COVID-19 in chronic leukaemia patients, and the observed treatment responses and complications. This section offers an in-depth analysis of the collected data, advancing our understanding of how COVID-19 impacts individuals with chronic leukaemia.

A comprehensive review of over 64 references were conducted, from which 41 relevant primary sources were selected based on their impact score, scientific rigor and transparency in addressing the topic. The selection process involved systemic data extraction, evaluation and interpretation to ensure the reliability of findings.
The references were screened using the following key terms: “Covid 19 in patients with chronic leukemia”, “pathophysiology of covid and leukemia”, “symptoms of covid19 in leukemia”,
“Complications of covid 19 in leukemia”, “covid vaccines in leukemia”. The
selection criteria were as follows:
Inclusion criteria:

1. Type of articles: Meta-analysis, literature synthesis, controlled clinical trials and cross-sectional studies, case reports.
2. Studies published in the last 10 years, but bibliography of the respective studies was analyzed as well.
3. Publications in the Indexed journals and professional websites

4. References not older than 10 years is less than 50 percentage

Exclusion criteria:

1. Study published older than 10 years ago.
2. Translational studies.
3. Published research materials
4. Preliminary publications of clinical trials without short- and long-term results
5. Predator-listed sources.

III. Data Collection Technique

For the quantitative aspect, a structured survey was developed, comprising both closed-ended and Likert-scale questions designed to elicit specific information about the impact of the COVID-19 pandemic on chronic leukemia patient outcomes. The survey was distributed electronically to reach participants across various geographical locations, maximizing response rates while adhering to social distancing protocols.[3]

The qualitative data collection involved semi-structured interviews conducted either via video conferencing or telephone, depending on participant preference and availability. An interview guide was developed to ensure consistency and comprehensiveness, encompassing themes such as healthcare access, treatment adaptations, and personal coping mechanisms during the pandemic. Interviews were audio-recorded and transcribed verbatim, ensuring accurate capture of participant narratives.

IV. Result and Discussion

Impact of SARS-CoV-2 Vaccines on Patients with Chronic Lymphocytic Leukaemia

The essential clinical studies assessing the efficiency and safety of SARS-CoV-2 vaccines have shown effectiveness rates between 67% and 95% in preventing SARS-CoV-2 infection, with mRNA vaccines exhibiting 94–95% efficacy. Nonetheless, these studies omitted immunocompromised individuals, including those with hematologic malignancies, hence demanding the assessment of vaccination effectiveness and safety within this particular demographic. This is especially significant since it is well-documented that CLL patients have a compromised serological response to many vaccinations, including hepatitis B, zoster, pneumococcal, and others.

Since the commencement of the COVID-19 immunization initiative, multiple research projects have been

published investigating the response of hematological malignancy and chronic lymphocytic leukemia patients to SARS-CoV-2 vaccinations. The majority of these investigations have concentrated on evaluating humoral responses and have consistently shown significantly lower seroconversion rates in CLL patients compared to healthy controls, ranging from 39% to 67%.[23]

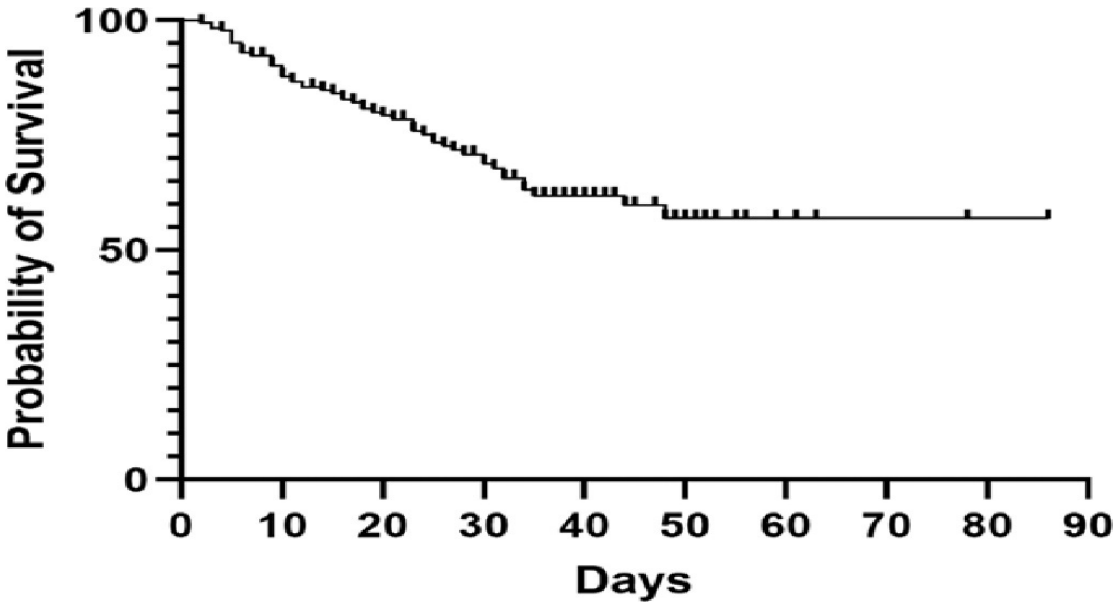
In a substantial prospective trial including 500 CLL patients, immunization response rates were 67%, in contrast to 100% in healthy controls. Substantial multicenter research in Israel including 373 CLL patients indicated humoral response rates of 43% after two doses of the BNT162b2 mRNA vaccine. Herishanu et al. reported a seroconversion rate of 39.5% among 167 CLL patients who underwent a comparable vaccination protocol. A comparison of 52 CLL patients with 52 age- and sex-matched healthy controls showed a substantial decrease in response rate among CLL patients (52% vs. 100%, $p < 0.001$). Other extensive cohort studies have shown humoral response rates between 52% and 64%. Recent meta-analyses have shown seroconversion rates in CLL patients between 40% and 67%, in contrast to 97% to 100% in healthy individuals.

Manifestation and Management of covid-19 patients with CLL

In the paper"COVID-19 severity and mortality in patients with chronic lymphocytic leukemia: a joint study by ERIC, the European Research Initiative on CLL, and CLL Campus" A study is conducted on patients with chronic lymphocytic leukemia (CLL) and COVID-19 exhibited fever in 87% of cases (165/190), along with respiratory symptoms such as cough (49%, 93/190) and dyspnea (48%, 92/190). Anosmia/ageusia (5/190, 3%), nausea and vomiting (5/190, 3%), and stomach pain (3/190, 2%) were uncommon signs, whereas tiredness (32/190, 17%), diarrhea (22/190, 12%), myalgias/arthralgias (19/190, 10%), and headache (13/190, 7%) were among the most prevalent manifestations [3-10].

Out of 190 patients, 21 (11.1%) were managed at home, whereas 169 (88.9%) required hospitalization. Among those hospitalized, 112 needed oxygen suppleme

ntations, and 39 were admitted to the intensive care unit. A majority of patients (168 out of 187, with data absent in 3 instances) underwent at least one pharmacologic intervention for COVID-19, comprising hydroxychloroquine or analogous treatments (76%), antivirals (50%), azithromycin (47%), and anti-IL6

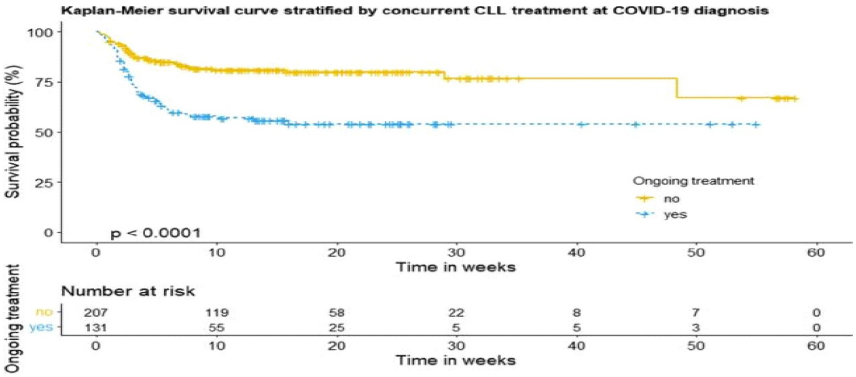


and/or anti-IL6R monoclonal antibodies (23%)

Probability of survival according to the study conducted

In a cohort of 65 patients undergoing treatment for chronic lymphocytic leukemia (CLL) during the COVID-19 pandemic, 54 patients (83%) discontinued their treatment. The breakdown of treatment cessation included acalabrutinib (4 out of 4), ibrutinib (30 out of 39), ibrutinib (1 out of 1), idelalisib (2 out of 3), venetoclax ± rituximab (9 out of 9), and combination immunotherapy (CIT) and/or steroids (8 out of 9). Of the patients who adhered to the treatment regimen, nine were administered ibrutinib, one was treated with idelalisib, and one received steroid therapy for autoimmune hemolytic anemia. Among 45 patients with severe COVID-19 undergoing CLL-specific treatment, 31 were administered BTK inhibitors. The infection outcomes for these 31 patients included resolution in 14 cases, unresolved in 4 cases, and death in 13 cases. Among 13 patients with less severe COVID-19 receiving BTK inhibitors, outcomes included resolution in 7 cases, unresolved status in 4 cases, and 1 death, with 1 case missing data.

Following a typical follow-up period of 23 days (range 2–86), 96 patients achieved complete recovery (median time to recovery 22.5 days, range 2–86), 37 remained under medical care, and 56 patients died; infection outcome data was absent in only one instance (Table 2). The median overall survival (OS) has not been reached, with 69% of patients remaining alive at 30 days.[11-16]



V. Conclusions

- Research on the COVID-19 pandemic's impact on chronic leukemia patients highlights a range of challenges exacerbated by the combination of complex health conditions. Key findings include healthcare access issues, symptomatology variations, and comorbid conditions' increased risks. These findings highlight systemic vulnerabilities exposed during the pandemic and the need to improve patient care and healthcare delivery.

- Chronic leukemia patients report significant delays in medical consultations and treatments. This disruption highlights gaps in our healthcare frameworks, emphasizing the need for more flexible delivery models. Telemedicine and remote care protocols can ensure continuous patient management during large-scale health crises. This adaptation may help maintain care continuity and warrants further study in clinical practice and healthcare policy.

- The difference in COVID-19 symptoms between CLL and CML patients sheds light on the pathophysiological mechanisms behind these conditions. Immune dysfunction is crucial to disease outcomes, as CLL patients have more severe symptoms. To reduce risks and improve care, clinicians must add these details to patient management strategies and use targeted pharmacological and non-pharmacological interventions.

- The findings that diabetes and hypertension worsen COVID-19 outcomes highlight the vulnerability of multimorbid patients. This new understanding supports epidemiological trends and recommends risk assessment and personalized care. This approach should improve patient support and reduce serious

complications.

- The study also emphasizes the positive impact of adaptive treatment strategies, with findings indicating stable disease management through the transition to alternative medication forms and telehealth consultations. These innovative responses underline the importance of healthcare adaptability, charting a path for continued development in flexible care models that can effectively respond to future public health challenges.

- While the study provides valuable insights, it also acknowledges limitations. Self-reported data may bias responses, and the cross-sectional survey limits causal inferences. The diverse sample may not capture all demographic variations in chronic leukemia. To better understand COVID-19's effects on chronic leukemia, longitudinal designs and larger participant demographics should be used in future research.

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