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Original article

Gender and Age differences in Leukaemia among Children in Tripoli University Hospital

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Abstract
Leukemia accounted for approximately 2.5% of all new cancer incidence and 3.1% of cancer-related mortality. The investigation of its risk factors and epidemiologic trends could help describe the geographical distribution and identify high-risk population groups. Thus, we examine the leukemia epidemiology and risk factors in children attended the University Hospital of Tripoli. A retrospective cross-sectional study was carried out based on patients' data which was obtained from the University Hospital of Tripoli for the period of Jan to Dec 2024. We extracted variables included age, gender, ethnicity, family history, and investigation from the hospital record. Data were analyzed using mean ± standard deviation of mean and percentages. Microsoft excels were used as a software to run the analysis. It was observed that, out of 182 cases, 140 (76.9%) were male and 42 (23.1%) were females which indicates male predominance in all types of leukemia. The median age of male was 5.6±2 while the median age of female was 8.3±1. Complete blood count results show increase in white blood cell count above normal level in both males and female (range 21.1×109/L). The analysis of cancer incidence rates could provide important information about risk factors and potential changes that could aid in the discovery of ways to reduce the incidence of cancer in infants.
Keywords. Leukemia, WBC, Cancer, Children.

Introduction

Leukemia is a diverse group of blood cancers that results from the abnormal growth of immature blood cells. It is divided into acute and chronic types, depending on how quickly the cells multiply, and further classified as myelocytic or lymphocytic based on their origin. Treatment varies by leukemia type, but it typically includes chemotherapy. Several genetic and environmental factors contribute to the development of leukemia. According to the SEER database, there were approximately 61,090 new leukemia cases in 2021, representing 3.2% of all new cancer cases, making it the 10th most prevalent cancer in the U.S. This information pertains to the assessment and management of leukemia, emphasizing the importance of an interprofessional team in enhancing patient care [1,2].

For adult leukemia, standard treatments include chemotherapy, radiation, and stem cell transplants. Over the past twenty years, targeted therapies have also emerged as a standard treatment for certain leukemia types, focusing on proteins that regulate cancer cell growth and division. Different leukemia types necessitate various treatment combinations. Despite advancements in treatment for some leukemia types, others still exhibit low survival rates. As the average age of the population increases, there is an increasing demand for less toxic treatment options [3].

The precise cause of leukemia remains unclear, but it is thought to involve both genetic and environmental risk factors. Known risk factors include smoking, exposure to ionizing radiation, certain chemicals like benzene, previous chemotherapy treatment, and conditions like Down syndrome. Individuals with a family history of leukemia have an elevated risk as well. The four primary leukemia types are acute lymphoblastic leukemia (ALL), acute myeloid leukemia (AML), chronic lymphocytic leukemia (CLL), and chronic myeloid leukemia (CML), in addition to several rarer forms. Leukemias and lymphomas are classified under hematopoietic and lymphoid tissue tumors, impacting the blood, bone marrow, and lymphatic system [4].

Treatment may involve various combinations of chemotherapy, radiation, targeted therapy, and bone marrow transplants, along with supportive and palliative care as required. In some cases, particularly certain leukemia types, watchful waiting may be appropriate. The success of treatment largely depends on the leukemia type and the patient's age. Survival rates have improved in developed countries, with an average five-year survival rate of 57% in the U.S. For children under 15, the five-year survival rate varies from over 60% to 90%, depending on the leukemia type. In children who are cancer-free after five years with acute leukemia, the likelihood of recurrence is low [5].

In 2015, leukemia affected 2.3 million individuals and was responsible for 353,500 deaths. The disease saw 352,000 new cases in 2012, making it the most prevalent form of cancer in children; approximately three-quarters of childhood leukemia cases are acute lymphoblastic leukemia [6]. However, over 90% of leukemia diagnoses occur in adults, with CLL and AML being the most common among them, and its occurrence is more frequent in developed nations. Consequently, the current study aims to assess the epidemiology,

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incidence, and risk factors associated with leukemia in children treated at the University Hospital of Tripoli during 2024.

Methods

Study design

A retrospective cross-sectional study was conducted using patients' records which was obtained from the University Hospital of Tripoli for the period of January to December 2024.

Data collection

Data was obtained from patient's file includes; age, gender, ethnicity, family history, location of residence, and investigation. Socio-demographic information was collected by using a structured, pretested questionnaire.

For cytochemical research, peripheral morphology assessment, and complete blood count (CBC) analysis, approximately 4 milliliters of venous blood were drawn from each patient. The CBC, peripheral morphology examination, and bone marrow aspiration were the tests that were performed in the laboratory in accordance with the standard operating procedures (SOPs) provided by the diagnostic material provider. Sysmex Corporation Kobe, Japan's XS-500i and XT-1800 CBC analyzers were automated for CBC.

Statistical analysis

Data were analyzed using mean ± standard deviation of mean and percentages. Microsoft excels were used as a software to run the analysis.

Results

A total of 182 patients were diagnosed with leukemia and were then analyzed based on their morphology and other relevant parameters. Out of 182 cases, 140 (76.9%) were male and 42 (23.1%) were female, indicating that males outnumber females in all types of leukemia. Males had a median age of 5.62, while females had a median age of 8.31.

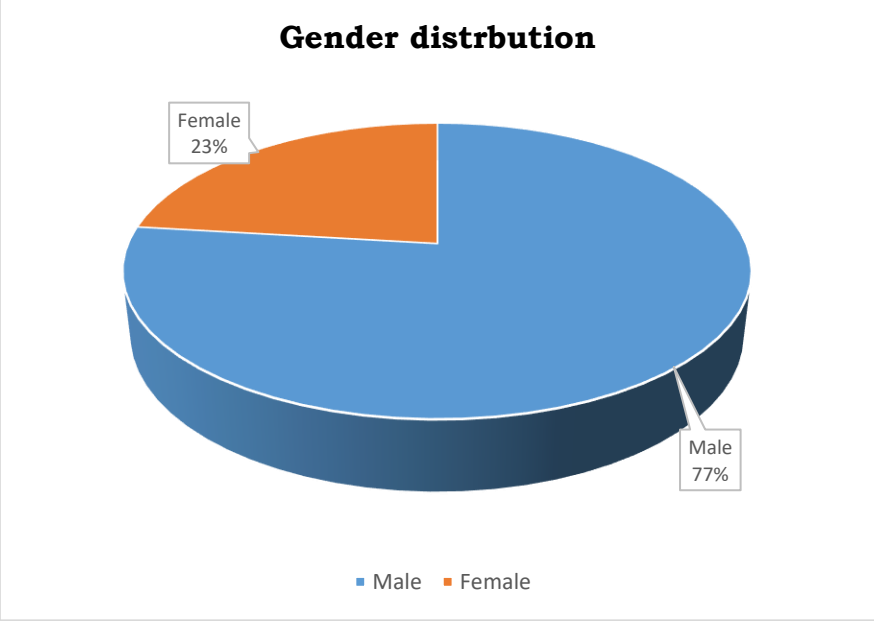

Figure 1. Gender wise distribution

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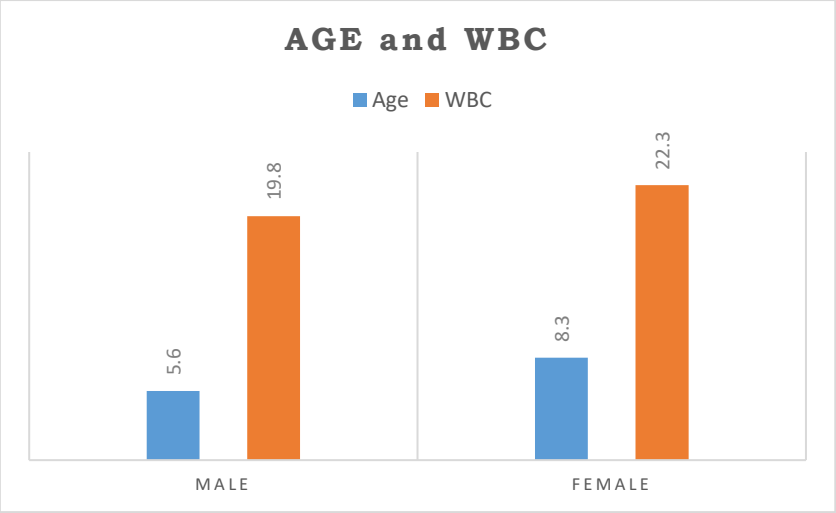

Figure 2. Age and WBC results among male and female patients

Figure 3 demonstrates that 88% of leukemia patients were Libyan, while 12% of patients did not identify as Libyan.

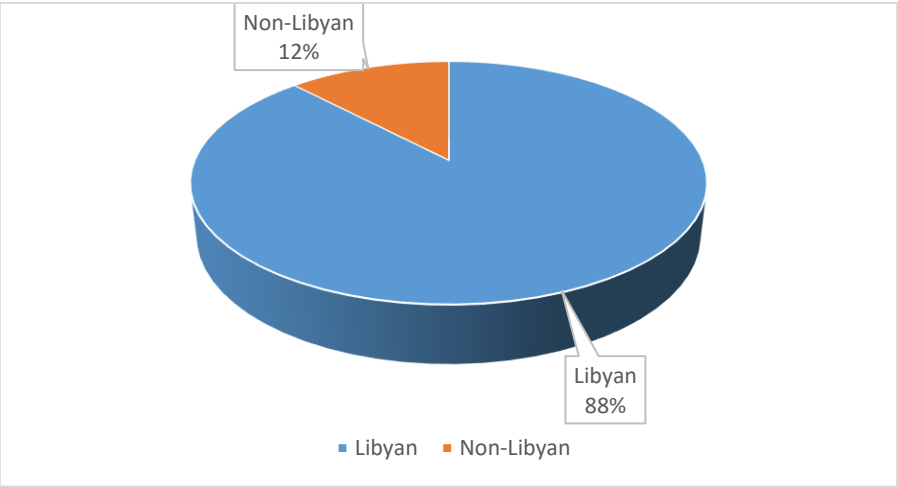

Figure 3. Nationality distribution of leukemia patient

It was observed from our results that 93% of leukemia patients reported that they had family history of disease, while 7 % exhibited no history to leukemia.

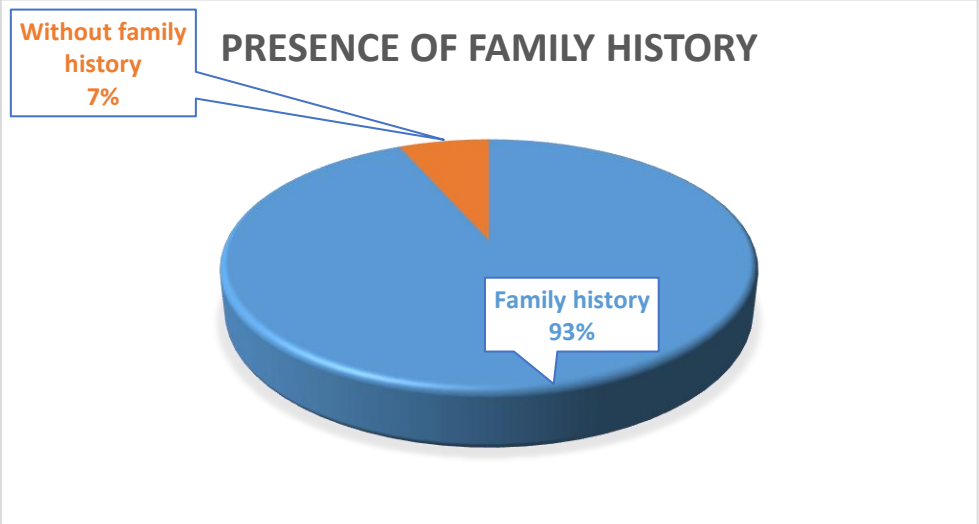

Figure 4. Family History of leukemia

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Complete blood count results show increase in white blood cell count above normal level in both males and female (Range 21.1 × 109/L).

Table 1. WBC result based on gender

Investigation	Male	Female	Total	*P* value
WBC	19.8	22.3	21.1	0.45

Discussion

Leukemia is the most common cancer in children, accounting for a significant proportion of pediatric cancers worldwide. It is a heterogeneous disease, with different subtypes that vary in their epidemiological patterns, including differences in gender and age. Understanding how gender and age influence the incidence, presentation, and outcomes of leukemia in children is crucial for developing better diagnostic, treatment, and prevention strategies.

Over the past decade, there has been a general decline in leukemia incidence and mortality rates. Factors contributing to this positive trend may include: 1) advancements in leukemia treatments and their related prognoses; 2) reduced exposure to environmental risk factors and smoking; 3) a drop in childhood leukemia cases; 4) increased intake of folate and vitamin supplements during pregnancy; and 5) broader genetic screening for high-risk hereditary mutations [7]. Despite this, we have noted a significant rise in leukemia cases within our sample, likely due to improved technology and detection methods, leading to more diagnosed and recorded cases [8]. Conversely, the rising mortality rates in less developed countries are concerning, potentially due to growing risk factors for leukemia in those areas. Therefore, stronger risk modification strategies are needed in these regions [9].

In the current study, male patients were found to have a higher prevalence of leukemia than females, with a median age of 6.9 years among the patients, predominantly of Libyan nationality. These findings align with many studies conducted in other countries, which also report that leukemia primarily affects males (63%) and that it is diagnosed at a median age of 10.5 years [10]. Overall, males tend to have a slightly higher incidence of leukemia compared to females. Studies have shown that male children are more frequently diagnosed with leukemia, particularly in the case of acute lymphoblastic leukemia (ALL), the most common type of leukemia in children. The male-to-female ratio is often around 1.3:1 for ALL [11].

The age of onset of leukemia in children is an important factor in determining the type of leukemia and its prognosis. Leukemia is relatively rare in infants and toddlers. However, when leukemia does occur in this age group, it is often more aggressive. The peak incidence of leukemia typically occurs between the ages of 2 and 5 years, particularly for ALL. This is the age group where ALL is most frequently diagnosed, and it is often associated with a better prognosis, especially if the child is diagnosed before the age of 5 [12]. Similar findings were observed in our study (Males had a median age of 5.62, while females had a median age of 8.31). In younger children, particularly those aged 2 to 5 years, the gender difference in leukemia incidence is more apparent, with boys being more likely to develop ALL. The exact reasons for this are still being researched, but it may be due to hormonal influences, genetic differences, or environmental factors that affect boys more than girls [13].

In leukemia, the bone marrow produces large numbers of abnormal white blood cells that crowd out normal cells, leading to a lower count of healthy blood cells (including red blood cells and platelets). This results in symptoms such as fatigue, infections, and bleeding tendencies. In the current study, CBC results show increase in white blood cell count above normal level in both males and female (Range 21.1 × 109/L). The abnormal WBCs in leukemia compromise the body's ability to fight infections, lead to organ damage, and disrupt normal blood cell production. Monitoring WBC counts and understanding their role is critical for diagnosing, managing, and predicting the prognosis of leukemia. With advancements in treatment, many forms of leukemia can now be managed more effectively, and outcomes have improved for many patients [14-16].

Conclusion

According to the current study, male predominance was observed in all types of leukemia. Age was a significant factor. A family history of leukemia does not appear to be a significant risk factor for disease occurrence. Understanding these differences is critical for tailoring treatment approaches, improving early detection, and identifying risk factors specific to different age and gender groups. Continued research into the underlying biological, genetic, and environmental factors driving these disparities will hopefully lead to more personalized and effective treatment strategies for childhood leukemia.

Conflicts of Interest

The authors declare no conflicts of interest.

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المستخلص

شكلت اللوكيميا ما يقرب من 2.5٪ من جميع حالات الإصابة بالسرطان الجديدة و 3.1٪ من الوفيات المرتبطة بالسرطان. يمكن أن يساعد التحقيق في عوامل الخطر والاتجاهات الوبائية في وصف التوزيع الجغرافي وتحديد مجموعات السكان المعرضة للخطر. وبالتالي، فإننا نفحص وبائيات اللوكيميا وعوامل الخطر لدى الأطفال الذين حضروا إلى مستشفى طرابلس الجامعي. أجريت دراسة مقطعية استرجاعية بناءً على بيانات المرضى التي تم الحصول عليها من مستشفى طرابلس الجامعي للفترة من يناير إلى ديسمبر 2024. استخرجنا المتغيرات بما في ذلك العمر والجنس والعرق والتاريخ العائلي والتحقيق من سجل المستشفى. تم تحليل البيانات باستخدام متوسط ± الانحراف المعياري للمتوسط والنسب المئوية. تم استخدام Microsoft Excels كبرنامج لتشغيل التحليل. لوحظ أنه من بين 182 حالة، كان 140 (76.9٪) من الذكور و 42 (23.1٪) من الإناث مما يشير إلى غلبة الذكور في جميع أنواع اللوكيميا. كان متوسط عمر الذكور 5.6 ± 2 بينما كان متوسط عمر الإناث 8.3 ± 1. تظهر نتائج تعداد الدم الكامل زيادة في عدد خلايا الدم البيضاء فوق المستوى الطبيعي لدى كل من الذكور والإناث (نطاق 21.1 × 109 / لتر). يمكن أن يوفر تحليل معدلات الإصابة بالسرطان معلومات مهمة حول عوامل الخطر والتغيرات المحتملة التي يمكن أن تساعد في اكتشاف طرق للحد من الإصابة بالسرطان عند الرضع.

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