The evolving face of childhood cancer in Morocco: An epidemiological Overview of a five-year cohort in Rabat.

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Abstract

Childhood cancer represents a major public health challenge, particularly in low- and middle-income countries. This retrospective study aims to describe the epidemiological and clinical characteristics of pediatric malignant tumors within a national referral center in Morocco. We analyzed the records of **273 children (≤ 18 years)**diagnosed and treated at the National Institute of Oncology (INO) in Rabat between 2020 and 2024. Out of a total of **7,691 cancer cases** recorded, pediatric cases accounted for **3.55%**. A clear male predominance was observed (M/F sex ratio of **1.48**), with a mean age at diagnosis of **12 years**. The analysis reveals a steady increase in the number of cases over the study period. The distribution of cancers is dominated by central nervous system tumors, followed by hematologic malignancies and renal tumors. These data, among the first of their kind in Morocco, provide a crucial basis for developing targeted public health strategies and planning future national studies.

Keywords: Pediatric cancer, Epidemiology, Morocco, Central nervous system tumors, Malignant tumors, Retrospective study, National Institute of Oncology.

I. Introduction

Cancer is the leading cause of death by disease among children and adolescents in many parts of the world. Although survival rates have increased significantly, exceeding 80% in high-income countries, this success is far from universal [1]. It is estimated that more than 80% of pediatric cancers occur in low- and middle-income countries (LMICs), where survival rates are tragically lower, often below 40% due to limited access to early diagnosis, specialized treatments, and supportive care [2, 3]. In this context, studying the

epidemiology of childhood cancer is essential for understanding the disease burden and guiding health policies.

In Morocco, as in many developing countries, robust epidemiological data on pediatric cancer are scarce due to the absence of national population-based registries [4, 5]. Existing information is mainly based on monocentric studies or case series. The National Institute of Oncology (INO) in Rabat, as the largest cancer treatment center in Morocco, receives patients from various regions, thereby offering a valuable insight into the country's epidemiological reality. This study aims to provide a detailed analysis of this cohort over a five-year period, contributing to the establishment of a baseline for future research and public health planning.

2. Objectives

The primary objective of this study is to comprehensively describe the epidemiological profile and the demographic and clinical characteristics of a large cohort of pediatric cancer patients treated in the radiation oncology department of the INO in Rabat. Secondary objectives include determining the relative incidence of childhood cancer compared to adult cases, analyzing the distribution by age and sex, and identifying the most frequent tumor types within this population over a five-year period.

3. Materials and Methods

3.1. Study Type and Period

This was a retrospective, descriptive, and monocentric study conducted within the radiation oncology department of the INO in Rabat. Data were collected over a five-year period, from **January 1, 2020, to December 31, 2024**.

3.2. Study Population and Data Collection

The study population consisted of all patients aged 18 or younger who had been diagnosed with a malignant tumor. Data were comprehensively extracted from the institute's information system, ENOVA. For each patient, the following information was systematically collected: age at diagnosis, sex, histopathological diagnosis (based on histopathological, cytological, biological, and morphological evidence), and tumor location. The data were anonymized and treated confidentially. The study was conducted after validation by the institutional scientific committee.

3.3. Statistical Analysis

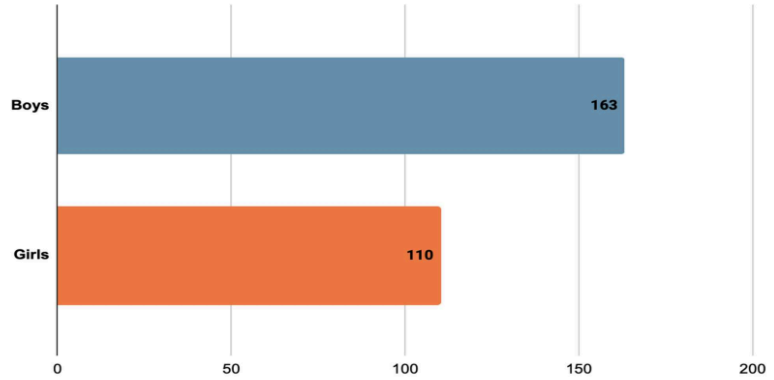
Data were analyzed using descriptive statistics. Qualitative variables are expressed as counts and percentages, while quantitative variables are presented as mean and range. The male-to-female sex ratio was calculated. No inferential statistical analysis was performed, as the study methodology was purely descriptive.

4. Results

4.1. Cohort Characteristics

During the five-year study period, **7,691 cancer cases** were recorded throughout the institute. Of this total, **273 cases (3.55%)** involved patients under 19 years of age. The cohort showed a clear male predominance, with **163 boys to 110 girls**, for a sex ratio of **1.48**. The mean age at diagnosis was **12 years**, with a range of 2 to 18 years.

Figure 1: Distribution by sex.



4.2. Temporal Trend of Cases

The number of new pediatric cancer cases showed a progressive and sustained increase over the study period.

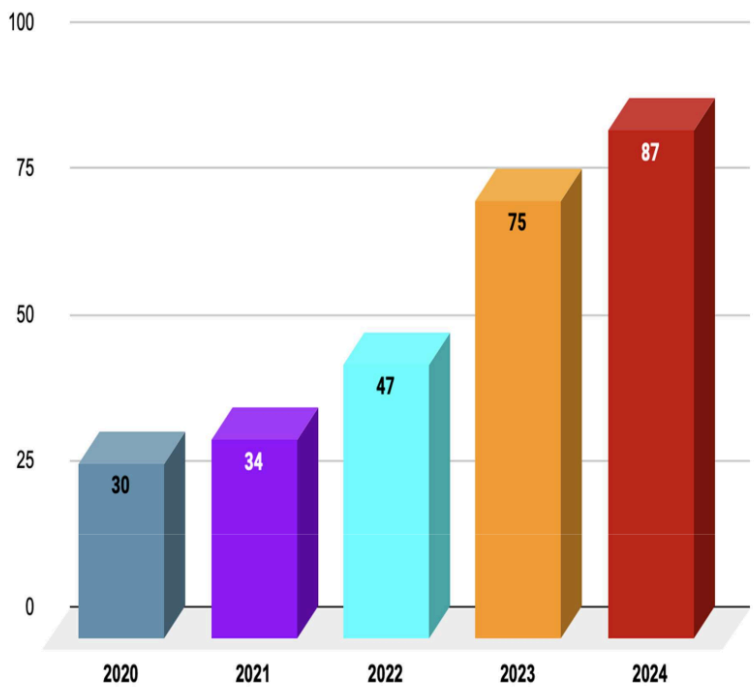


Figure 2: Distribution of childhood cancers by year.

4.3. Distribution by Age and Tumor Types.

The age distribution showed that cancer significantly affects young children and adolescents. The most frequently affected ages were 6, 17, and 18 years (20 cases each). Age 9 was the least represented (6 cases).

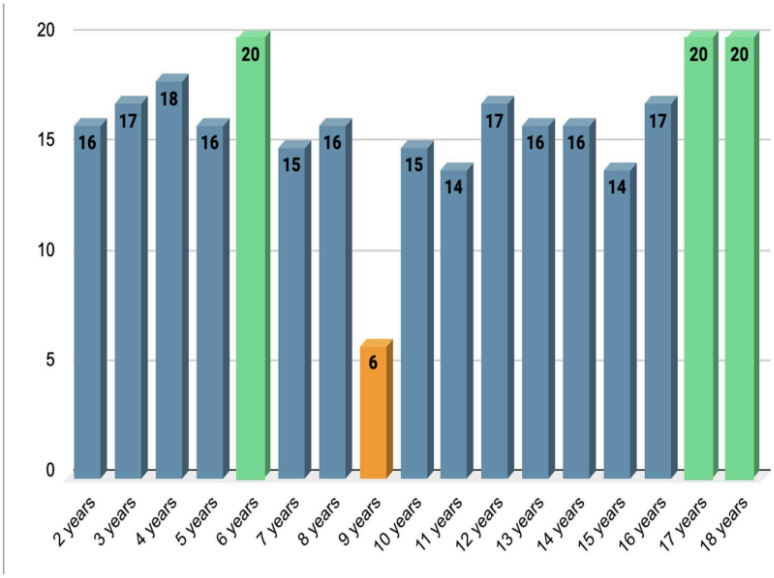


Figure 3: Distribution by age.

Regarding tumor typology, the distribution across the entire cohort of 273 cases shows that the profile of pediatric cancers was dominated by central nervous system tumors, hematologic malignancies, and renal tumors.

- **CNS tumors**, with 90 cases, represented the most frequent category (**33%**). Within this category, **medulloblastoma** was the most common subtype, accounting for 79 cases.
- **Hematologic malignancies** ranked second with 38 cases (**14%**). **Hodgkin's disease** was the most prevalent subtype, with 28 cases.
- **Renal tumors** accounted for 31 cases (**11%**), including 13 cases of **nephroblastoma**.
- **ENT tumors** (27 cases, or **10%**) were dominated by **nasopharyngeal carcinoma** (17 cases).
- Finally, **bone tumors** (20 cases, or **7%**) were exclusively composed of **osteosarcomas**.

Other types of cancers observed included bronchopulmonary cancers (19 cases), soft tissue neoplasms (17 cases), skin tumors (16 cases), digestive

cancers (14 cases, including 10 cases of rectal cancer), and a single case of gynecological cancer (breast cancer).

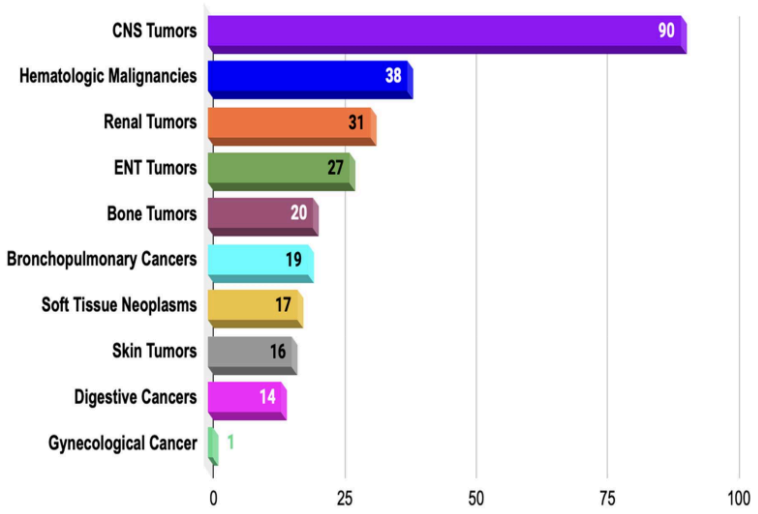


Figure 4: Distribution of different cancer locations.

5. Discussion

5.1. Comparison with Global and African Epidemiological Data

The results of our study confirm observations from the international scientific literature, where childhood cancer represents a small proportion of all cancer cases. Our rate of **3.55%** is comparable to that reported in many LMICs, although it is lower than WHO estimates, which suggest a higher proportion, potentially reflecting under-diagnosis or referral bias [2, 3]. The observed male predominance (sex ratio of 1.48) is a well-documented epidemiological phenomenon worldwide, particularly for cancer types like leukemia and brain tumors [6, 7]. The mean age at diagnosis of 12 years is also consistent with international trends, where cases often concentrate in early childhood and adolescence [8].

The predominance of **CNS tumors** (33% of cases) in our cohort is a major point of interest. According to the International Classification of Childhood Cancer (ICCC), leukemias are the most frequent tumors globally, followed by CNS tumors [13]. The predominance of CNS tumors, primarily due to **medulloblastoma** (79 cases), is a unique characteristic of our cohort. This differs from studies conducted in other regions of Africa, where hematologic malignancies are generally the most frequent. For example, a study in Senegal reported a prevalence of hematologic malignancies (31%), while Burkitt lymphoma is the leading childhood cancer in some sub-Saharan African regions, accounting for over 80% of solid tumors in Nigeria [10]. In contrast, an Egyptian study indicates a predominance of leukemias, which is more in line with Western trends [9]. This variability could be explained by a later diagnosis that favors the detection of slow-growing but clinically manifest tumors, or by etiological and risk factors that are still under investigation.

The high prevalence of **Hodgkin's disease** (28 cases, or 73.7% of hematologic malignancies) and **osteosarcoma** (20 cases, or 100% of bone tumors) is also consistent with literature data for adolescents [8]. The prevalence of **nephroblastoma** (Wilms tumor) (13 cases, or 41.9% of renal tumors) is typical of younger children and is frequently found in African cohorts [11].

5.2. Interpretation of the Upward Trend

The steady increase in the number of cases over the study period is a notable finding. It is unlikely to reflect a real increase in incidence. More plausibly, this trend is the result of improved public and healthcare professional awareness, better diagnostic capacity in peripheral structures, and improved patient referral mechanisms to specialized centers.

5.3. Strengths and Limitations of the Study

The main strength of this study is that it provides epidemiological data on a large cohort and over a long period in a country where such information is rare. However, as a monocentric study, it has inherent limitations: the data cannot be generalized to the entire Moroccan territory due to a potential referral bias. The retrospective nature of the study also limited access to certain clinical information, and we were unable to analyze etiological factors, therapeutic modalities, or survival rates.

6. Conclusion

This study provides an essential epidemiological overview of pediatric cancer at a major referral center in Morocco. The key findings, including male predominance, the annual upward trend in the number of cases, and the distinct tumor profile dominated by CNS cancers, confirm observations from similar contexts and highlight the specificity of the Moroccan pediatric oncological profile. This data serves as a crucial starting point for public health policies, advocating for better resource allocation, specialized personnel training, and the development of tailored treatment protocols. It underscores the urgent need to create a national pediatric cancer registry for a more complete understanding of the disease's incidence and distribution nationwide.

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