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# Evaluation of the Treatment of Childhood Cancers after Five Years of Activity by the Oncology Unit in Bangui

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## Abstract

Introduction: After five years of activity at the pediatric oncology unit in Bangui, with support from the Franco-African Pediatric Oncology Group (GFAOP), questions arise about the likelihood of diagnosing and treating cancer at this unit. The objective of this study was to assess the management of pediatric cancers at the CHUPB. Methodology: This was a descriptive and analytical cross-sectional study with retrospective data collection covering the period from January 1, 2018, to March 31, 2023, *i.e.*, five years. All patients diagnosed with cancer during the period were included. Epidemiological factors, diagnostic methods, and progression were studied. Results: During the five years of activity of the oncology unit, 265 children were monitored for any tumor or hematological problems, among whom 216 cases were diagnosed with a strong suspicion of malignant tumors, 84 of which were confirmed as malignant and included in the study. The hospital admission rate in the UHOPB was 31.69% and the probability of establishing a cancer diagnosis among suspected cases was 38.88%. The sex ratio (M/F) was 1.8, the average age was 7.7 years, with extremes of 2 and 15 years. Burkitt's lymphoma was represented in 29.76% of cases, followed by retinoblastoma in 22.62%, ALL in 11.90%, and nephroblastoma in 9.52%. Cytopuncture and myelogram were the main paraclinical tests performed in the unit. In this series, 36.90% of children were lost to follow-up, 15.48% had died, and 7.14% had achieved complete remission. Death was linked to disease progression. Conclusion: The

probability of cancer diagnosis at CHUPB remains low, with an unfavorable outcome for the majority of patients. What would be the situation by type of cancer?

## Keywords

Diagnosis, Cancer, Children, Bangui

## 1. Introduction

Cancer, or malignant tumor, is an uncontrolled proliferation of transformed cells [1]. It is a rare condition in both children and adults [2]. It represents a significant public health problem in developed countries, where notable progress has been made in screening and treatment [1] [3]. Cancer in children remains a major challenge for modern medicine, as it is generally associated with high mortality [3]. Globally, the incidence of cancer in children varies considerably from one region to another [4]. It is estimated to account for 1% - 3% of all cancers diagnosed. It is the second leading cause of death among children in developed countries, after road accidents [1] [5] [6].

In the United States, 160,000 new cases per year and 90,000 deaths have been reported in pediatrics [2]. In France, they account for less than 0.6% of all cancers, but are the leading cause of death in children after accidental causes [7] [8]. In developed countries, 80% of children with cancer often recover, unlike in developing countries, where the survival rate remains low and is often less than 30% [9]. In Africa, childhood cancers have been the subject of epidemiological research since the creation of the first care units [10]-[12]. Few epidemiological studies have been reported in Africa.

In the CAR, childhood cancer is not well known to the public and is often neglected by the Central African government in favor of infectious and communicable diseases. According to Koffi *et al.* [13], childhood cancers in the CAR account for 5% of all cancers and have been a major concern in recent years a major concern due to the continuous increase in its incidence and the high mortality rates recorded in pediatric hospitals, despite advances in diagnosis in this field and the country's membership in the Franco-African Pediatric Oncology Group (GFAOP) in 2000, which has enabled many children to access treatment. The difficulties in obtaining epidemiological and anatomopathological data on childhood cancer constitute a barrier to its management. This reality led to the completion of this study at the CHUPB with the aim of contributing to the improvement of pediatric cancer care at the CHUPB.

The objectives of this study are as follows: in general, to take stock of the management of pediatric cancers at the CHUPB, and more specifically to

- Describe the epidemiological aspects of childhood cancers;
- List the different diagnoses and how they are detected;
- Determine the progression profile according to cancer stages.

## 2. Patient and Method

This was a descriptive and analytical cross-sectional study with retrospective data collection covering the period from April 1, 2018, to March 31, 2023, *i.e.*, five years in the Pediatric Hemato-Oncology Unit of Bangui (UHOPB). The UHOPB is the only unit that treats cancer cases in children under 15 years of age in the CAR, using a well-defined protocol called "references." The unit is supported by the GFAOP with anticancer drugs at times. It should be noted that the anticancer drugs available were only for localized forms of Burkitt's lymphoma, nephroblastoma, and retinoblastoma. Treatments for other forms or types of cancer were not available in the country, so some parents had them brought in from abroad. Those who could not afford to bring in the drugs received palliative care. The study population consisted of all children under the age of 15 hospitalized at UHOPB during the study period with a strong suspicion of malignant tumor. The files of patients under the age of 15 who had been diagnosed with cancer on the basis of paraclinical evidence were included. Excluded were unusable clinical records, *i.e.*, those that did not include identification, clinical information locating the tumor, at least one paraclinical examination showing the appearance of a malignant tumor, and a confirmatory examination of the tumor. Sampling was exhaustive, with systematic inclusion of the files of children meeting the inclusion criteria. The variables studied were sociodemographic, diagnostic, paraclinical examinations, therapeutic, and evolutionary. Data collection began with obtaining research authorization from the dean of the Faculty of Health Sciences and the CHUPB, where we had access to the hospitalization registry, in which we listed the numbers of all cancer cases. Finally, in the archives department, files that met the inclusion criteria were selected for analysis. Data were collected using a pre-established survey form. Data entry was performed using Microsoft Office Excel software. Data analysis was performed using STATA software version 14. Qualitative variables. Qualitative variables were expressed as percentages and quantitative variables as means with standard deviations. For the demographic parameters reported, a p-value $< 0.05$ was considered statistically significant. The Kaplan-Meier curve was used to determine patient survival time, taking the total number of patients diagnosed and surviving for a given period of time out of the total number of patients diagnosed in the study. Certain terms used require explanation for a better understanding of this study. We refer to a strong suspicion of cancer when a patient presents the clinical signs of a malignant tumor, associated or not with paraclinical tests for guidance, but without paraclinical tests to confirm malignancy (anatomopathology, cytology, histology, myelogram). The clinical and paraclinical elements used in this study refer to the book by Mhamed Harif [14]. For the other terms used in the following paragraphs, we have based ourselves on the references by Meaghann *et al.* [15] and Kosh Komba *et al.* [16].

- Treatment discontinuation: This occurs when a patient has stopped their specific treatment at least one month or permanently before the end of treatment or before treatment has begun.

- Complete remission: This occurs when, at the end of treatment, there is at least an 80% reduction in the volume of the initial tumor.

- Lost to follow-up: This is when a patient has completed their specific treatment and is absent from their follow-up appointment.

- Relapse: This is when a patient develops a tumor after complete remission.

- Tumor progression: When the tumor increases in size.

- Unusable files: Files that do not contain any of the following information: identification, clinical details locating the tumor, at least one paraclinical examination showing the appearance of a malignant tumor, whether or not associated with a confirmatory examination of the tumor.

Ethical considerations were respected. To ensure confidentiality in the database, patient names were replaced with codes to guarantee anonymity. Data collection was retrospective, so it was not possible to obtain parental consent.

## 3. Results

During the study, problems with record keeping in the archives were noted, as some examinations had been omitted and some information was incomplete (tumor extension). All these difficulties are linked to poor record keeping by staff, as revealed by this retrospective study. However, this did not prevent us from obtaining reliable and interpretable data. During the first five years of the oncology unit's activity, 265 children were monitored for tumor and hematological problems, among whom 49 cases (18.49%) were diagnosed with benign tumors and other non-tumor pathologies. The remaining 216 cases were diagnosed with a strong suspicion of malignant tumors, of which 132 cases did not have confirmatory tests and 84 cases had confirmation of malignant tumors and were included in this study. The hospital frequency of confirmed cases in the UHOPB was 31.69%, and the probability of establishing a cancer diagnosis among suspected cases was 38.88%. Of the 84 patients with confirmed malignant tumors, 54 (64.29%) cases were male, giving a sex ratio of 1.8 (Table 1).

Table 1. Distribution of pediatric cancer cases by age.

| Age group | *Frequency* | |
|---|---|---|
| | staff | % |
| <5 | 25 | 29.76 |
| 5 - 10 ans | 34 | 40.48 |
| >10 ans | 25 | 29.76 |

The average age of confirmed cancer cases was 7.7 years, ranging from 2 to 15 years. Patients came from the eight districts of Bangui in 38.1% of cases and from the provinces in 61.9% of cases. The patients' companions were their parents in 88.10% of cases, family members in 7.14% of cases, and others in 4.76% of cases. The socioeconomic status of the parents was low in 84.52% of cases (Table 2).

**Table 2.** Distribution of warning signs of cancer leading patients to the UHOPB.

| Reasons for consultation | *Fréquency* | |
|---|---|---|
| | staff | % |
| Anasarca | 5 | 5.95 |
| Asthenia | 6 | 7.14 |
| Abdominal bloating | 18 | 21.43 |
| Pallor | 8 | 9.52 |
| Cervical swelling | 5 | 5.95 |
| Swelling of the limbs | 5 | 5.95 |
| Facial swelling | 37 | 44.03 |

With regard to the nutritional status of patients, 32.14% were severely malnourished, 55.95% were moderately malnourished, and 11.90% had a satisfactory nutritional status (Table 3 and Figure 1).

**Table 3.** Distribution of different types of confirmed cancers.

| Types of tumors | *Fréquency* | |
|---|---|---|
| | staff | % |
| Burkitt lymphoma | 25 | 29.76 |
| Retinoblastoma | 19 | 22.62 |
| Acute lymphoblastic leukemia | 10 | 11.9 |
| Nephroblastoma | 8 | 9.52 |
| Acute myeloblastic leukemia | 5 | 5.95 |
| Hodgkin lymphoma | 5 | 5.95 |
| Osteosarcoma | 3 | 3.57 |
| Rhabdomyosarcoma | 3 | 3.57 |
| Hepatoblastoma | 2 | 2.38 |
| Anaplastic large cell lymphoma | 2 | 2.38 |
| Sacrococcygeal teratoma | 1 | 1.19 |
| Germ cell tumor | 1 | 1.19 |

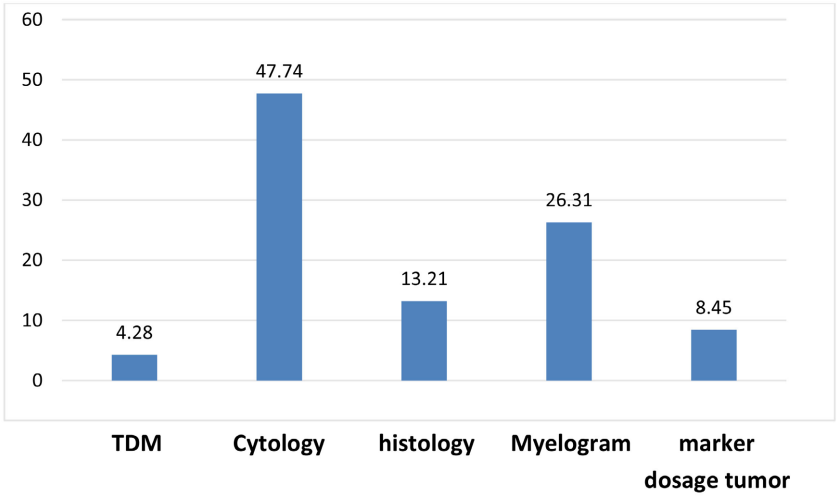



**Figure 1.** Distribution of paraclinical tests confirming the diagnosis of cancer.

Cytopuncture (45.24%), followed by myelogram (23.81%), were the main paraclinical tests performed to confirm the diagnosis of cancer. CT scans were used for hidden tumors (cerebral, thoracic, and other locations) (Table 4).

Table 4. Distribution of cases according to tumor spread.

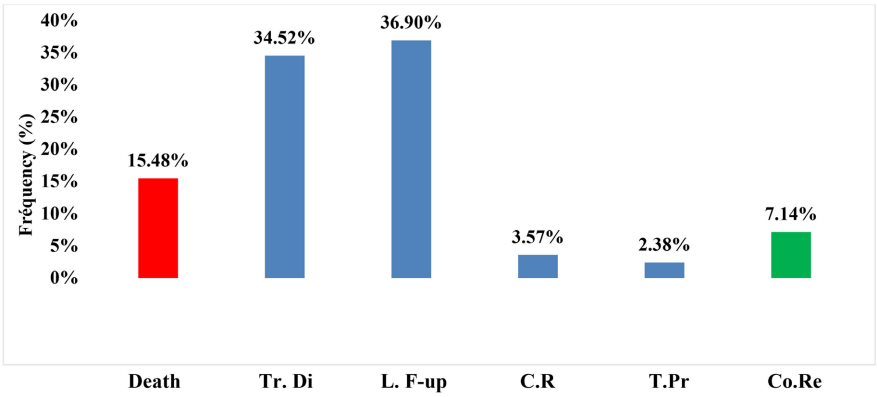
| Stage of the disease | *Fréquency* | |
|---|---|---|
| | staff | % |
| Limited to the organ | 33 | 39.28 |
| Locoregional spread | 34 | 40.47 |
| Metastases | 17 | 20.23 |
| Not specified | 5 | 5.95 |

The diagnosis of cancer in patients was made when the tumor was locally advanced (40.47%).

Table 5. Distribution of cases according to therapy.

| Thérapy | *Fréquency* | |
|---|---|---|
| | staff | % |
| Chemotherapy alone | 59 | 69 |
| Surgery + Chemotherapy | 8 | 9.52 |
| No treatment | 26 | 31 |

Chemotherapy alone is the treatment method used in 69% of patients (Table 5).




**Legend:** Treatment discontinuation: **Tr. Di**; Lost to follow-up: **L. F-up**; Cancer recurrence: **C.R**; Tumor progression: **T.Pr**; Complete remission: **Co.Re**.

Figure 2. Patient outcomes.

In this series, 36.90% of children were lost to follow-up, 15.48% had died, and 7.14% had achieved complete remission (Figure 2).

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**Survival curves**

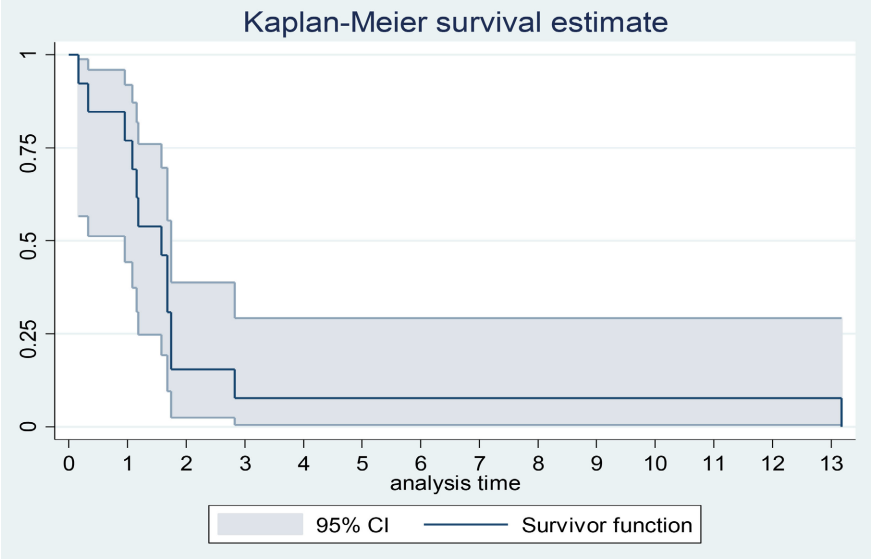


Figure 3. Overall survival curve.

Of the 84 (100%) patients diagnosed, we note their gradual disappearance over time, explaining the staircase-shaped curve. This explains why the overall survival probability of patients is 20% at 2 years and after 3 years, overall survival is around 12.5% (Figure 3).

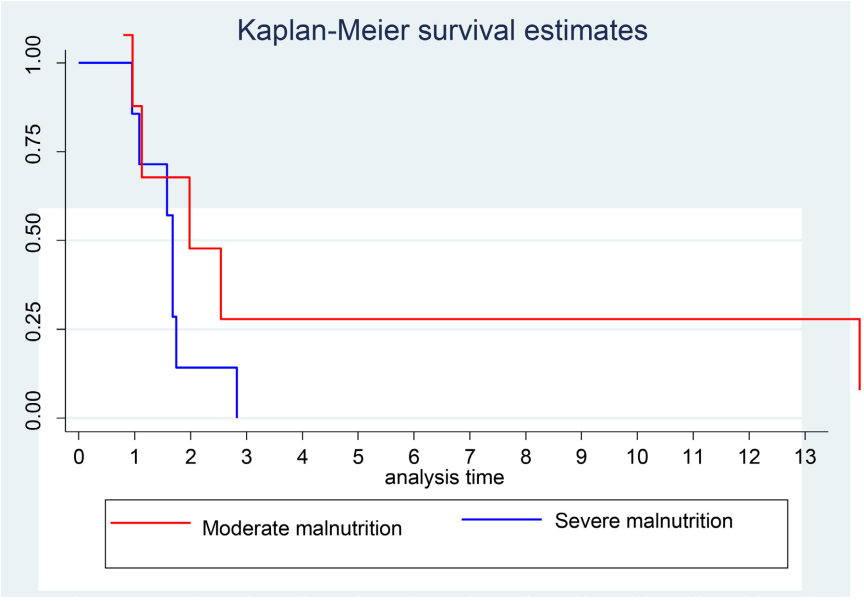


Figure 4. Survival curve according to nutritional status.

The survival rate for the 29 cases of severe malnutrition is approximately 20% at 20 months, however, for the 42 cases of moderate malnutrition, the survival rate is 25% at close to 3 years (Figure 4).

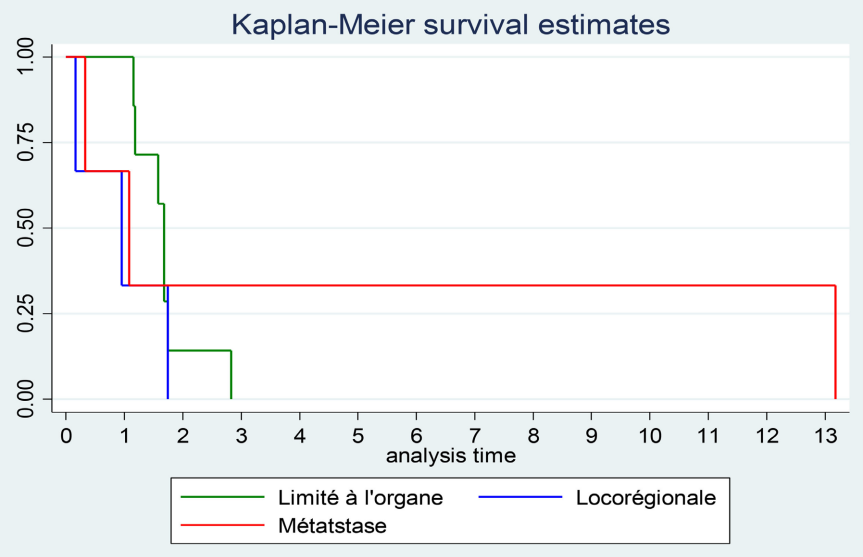


Figure 5. Diagnosis of extension and death.

Of the 17 (100%) patients with metastasis, 30% remained alive after 1 year of disease progression; however, patients whose tumor is confined to the organ have a survival rate of 75% at 1 year out of 33 (100%) (Figure 5).

Table 6. Breakdown by death and different age groups.

| | Death | Mortality rate (%) | Confidence Interval to 95% Létality Rate | RR | Chi2 | p-value | Confidence Interval to 95% de RR |
|---|---|---|---|---|---|---|---|
| 0 - 4 ans | 4 | 95.11 | [35.69 - 253.43] | | | | |
| 5 - 9 ans | 3 | 73.63 | [23.75 - 228.32] | 0.45 | 4.3 | 0.03 | [0.21 - 0.95] |
| 10 - 15 ans | 6 | 28.58 | [12.84 - 63.61] | | | | |

Table 6 shows that there is a significant correlation between patient age and death, with a p-value of 0.03.

**Relationship between origin and death**

The mortality rate appears to be higher for patients from Bangui (75%) than for those from the provinces (25%), but the difference was not significant (p = 0.05) (Table 7).

Table 7. Distribution by origin and death.

| **Provenance** | Death | Mortality rate (%) | Confidence Interval to 95% mortality rate | RR | Chi2 | p-value | Confidence Interval to 95% de RR |
|---|---|---|---|---|---|---|---|
| Bangui | 8 | 0.75 | [0.37 - 1.51] | 0.35 | 3.63 | 0.05 | [0.11 - 1.08] |
| Province | 5 | 0.26 | [0.11 - 0.64] | | | | |

## 4. Discussions

Childhood cancer is a rare condition among all the conditions observed at the

CHUPB. There are few studies on this topic, yet it is a serious public health problem worldwide, particularly in developing countries. An initial three-year study was conducted while the unit was still receiving support from the GFAOP. After five years of activity, it is important to review the efforts made and, as this is a rare chronic disease, we believe that a retrospective study is the appropriate choice. However, the methodology used has certain limitations, such as the absence of certain data on tumor spread in some patients. The absence of certain data is sometimes due to poor record keeping. Despite these shortcomings, this study presents reliable and interpretable data and deserves to spark reflection on cancer care in the CAR.

The study population identified according to the inclusion criteria was 84 out of 265 patients followed up in the unit during the same 5-year period, representing a hospital frequency of diagnosed cancers of 31.69%. This frequency differs from those reported by Kosh *et al.* in Bangui in two different years (2018 and 2022), which found frequencies of 64% and 64.29%, respectively [17] [18]. Although both studies were conducted in the same unit, this difference can be explained by the duration of the study, which is not the same, and especially by the inclusion criteria, which only include confirmed cancer cases. This contrasts with the findings of Sando in Cameroon (12.4%) [19] and Garga *et al.* in Niger (5.5%) [8]. This disparity in results could be explained by the duration of the study and the diagnostic criteria used in the different studies. The probability of establishing a cancer diagnosis in 216 cases of high suspicion of malignant tumors is 38.88%. This rate explains the number of patients who are fortunate enough to be treated in the unit based on their test results, and it also explains why many types of pediatric cancers are not known in CAR.

The average age of patients was 7.7 years, with extremes of 2 and 15 years observed by Kosh *et al.* in the Central African Republic [17], Sando Zacharie *et al.* in Cameroon [19], Gnassigle *et al.* in Togo [20], Togo B *et al.* in Mali [21] found an average age of 24 months with extremes ranging from 6 to 15 years. This difference could be explained by the triggering factors for malignant tumors, which vary from one region to another. This may be related to eating habits or socio-cultural behavior. For example, in sub-Saharan Africa, lymphomas, which are virus-induced cancers, are predominant. The study reported a sex ratio favoring boys, which has been demonstrated in the literature and in several studies [22]-[24]. The same is true for Gnassingle [20] and Maylis Telle-Lamberton [11]. According to the content of the various literature reviews, there is no proven scientific explanation. The majority of affected children, 61.9%, lived in rural areas, compared to 38.1% in urban areas. This result confirms the data in the literature, which reveal that rural areas have an influence on the occurrence of cancer in children [25] [26]. In sub-Saharan Africa, rural areas are known for their impoverished populations and unfavorable socioeconomic conditions. In addition, some people do not have easy access to healthcare for routine care. These situations lead to acute or chronic malnutrition in children, promoting underlying immunosuppression,

which creates opportunities for the development of cancers such as lymphoma. In this study, the fact that more than half of the Central African population lives in rural areas, combined with difficulties in accessing quality medical care and exacerbated by socio-economic crises in rural communities, would favor the emergence of viral infectious diseases, which are often the cause of certain cancers. The reasons for consultation, known as warning signs (facial swelling (44.05%) followed by abdominal bloating (21.43%)), could be explained by the facial location of the two types of cancer predominant in our cohort, namely Burkitt's lymphoma and retinoblastoma. Similarly, at least three types of cancer are located in the abdomen, namely nephroblastoma, lymphomas, and primary liver cancers, which explains why abdominal bloating is also a common reason for consultation. This observation was made by LEMERLE.J in his review [10] and Samaké K. [27]. All 84 patients registered had at least one indication of cancer based on the tests performed. Estimating the annual frequency, we find a maximum of 17 cases per year. This is much lower than the expected incidence. Ultrasound and CT scans, which are not confirmatory tests, were often accompanied by histological or cytological evidence. Only in the case of brain tumors was the CT scan not supplemented by another test. It is recommended that the diagnosis of a solid malignant tumor be made on the basis of histology or histochemistry and, for liquid tumors (leukemia), on the basis of a myelogram. In this study, the most commonly requested paraclinical examinations were cytology in 47.74% of cases, followed by myelogram in 26.31% of cases. This finding is similar to that of KOSH *et al.* [17]. The choice of cytology could be explained by the unavailability of biopsy needles to remove core samples, the accessibility of tumor masses with a predominance of suspected Burkitt's lymphoma in this cohort, given that the diagnosis of Burkitt's lymphoma can be easily made by cytology. These data are contrary to those of Darré T *et al.* [7]. phoma is easy and quick to diagnose cytologically (in less than a week) in Bangui, rather than by biopsy, which can take up to a month to produce results. The most common cancers were Burkitt lymphoma (29.76%), reticuloblastoma (22.62%), and leukemia (11.9%). This result is similar to that of Kosh *et al.* in CAR [17], Peko *et al.* in Congo [28], and Samaké in Ivory Coast [27], but contrary to those of Asian countries such as India and Pakistan, where leukemia is the most common cancer according to Badar F *et al.* [29]. Studies have already proven the coexistence and link between Plasmodium and Burkitt's lymphoma endemic in sub-Saharan Africa. The CAR is one of the countries where malaria is endemic. This high number of Burkitt's lymphoma cases could be explained by poorly treated or untreated malaria in these children. According to Zongo *et al.* [30], chronic malaria is a factor that promotes the development of Burkitt lymphoma. The disparity in data with other countries or continents could be explained by the influence of sociodemographic factors, which vary from one region to another. Added to this is the lack of technical facilities, which prevents the detection of certain malignant tumors in some poor countries [14]. *i.e.*, beyond the primary organ. Adding the number of cases of metastasis (20.23%), we can say

that the majority of patients (60.70%) arrive at an advanced stage of the disease. This observation was made by Sando *et al.* [19] in their study, and Kosh *et al.* [18] in 2022 also found that most patients in the same unit were at an advanced stage at the start of hospitalization. This trend can be explained by the fact that patients initially stay at home for a variety of reasons, including a lack of financial means to go to the hospital, but are content with traditional treatments, mystical-religious interpretations by some relatives who believe in witchcraft, and also the problem of road infrastructure, where means of evacuation pose a problem for some health facilities far from Bangui. There is also the problem of competence among certain healthcare personnel who are unaware of certain warning signs of certain cancers and delay treatment for patients. The majority of treatments are based on chemotherapy alone (69%) because most cancers are Burkitt's lymphomas, which do not require surgery.. The untreated patients (31%) can be explained by the advanced stage of the disease, which the unit is unable to treat given the use of high doses of chemotherapy with heavy protocols. Sometimes, when there is a shortage of anticancer drugs provided by GFAOP, parents cannot afford to buy them. The current overall survival rate for patients is significantly lower than that recorded in 2018 in the same unit. The overall survival rate in 2018 was 25% at 3 years, and in 2024 the overall survival rate is 20% at 2 years and after 3 years the overall survival rate is around 12.5%. This difference can be explained by the chronic unavailability of anticancer drugs over the last two years and also, no health insurance to encourage the purchase of products that are expensive for a middle-class civil servant. Among the cases treated, complete remission was 7.14% and 15.48% died. There was a statistically significant link between the age group of 5 to 10 years and death, as well as a significant link between place of origin (province) and patient death. The former could be explained by the type of tumor predominant in this cohort. Burkitt lymphoma is a cancer that usually appears in children aged 5 to 10 years old. In addition, the majority of patients hospitalized for nephroblastomas reach an advanced stage around the age of 5. Regarding the link between origin and death, we can say that the further away from Bangui the patients are, the more likely it is that delays in diagnosis will lead to death. We also know that the state of the roads and the low socioeconomic status of the population would exacerbate the delay in diagnosis. Before 2021, thanks to the support of the GFAOP, there was a favorable trend in the treatment of cancer patients. Over the past five years, the oncology unit has been in decline due to a lack of therapeutic resources. Burkitt lymphoma is a cancer that usually appears in children aged 5 to 10 years old. In addition, the majority of patients hospitalized for nephroblastomas reach an advanced stage around the age of 5. Regarding the link between origin and death, we can say that the further away from Bangui the patients are, the more likely it is that delays in diagnosis will lead to death. We also know that the state of the roads and the low socioeconomic status of the population would exacerbate the delay in diagnosis. Before 2021, thanks to the support of the GFAOP, there was a favorable trend in the treatment of cancer patients.

Over the past five years, the oncology unit has been in decline due to a lack of therapeutic resources.

## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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