Hindawi Publishing Corporation
Journal of Cancer Epidemiology
Volume 2012, Article ID 920468, 5 pages
doi:10.1155/2012/920468

Clinical Study

Retinoblastoma in the Democratic Republic of Congo: 20-Year Review from a Tertiary Hospital in Kinshasa

Aimé Kazadi Lukusa,[1] Michel Ntetani Aloni,[1] Bertin Kadima-Tshimanga,[1] Moïse Mvitu-Muaka,[2] Jean Lambert Gini Ehungu,[1] René Ngiyulu,[1] Pépé Ekulu Mfutu,[1] and Aléine Budiongo Nzazi[1]

[1] *Division of Paediatric Haematology and Oncology, Department of Paediatrics, University Hospital of Kinshasa, P.O. Box 123, Kinshasa, Democratic Republic of Congo*
[2] *Division of Ophthalmology, University Hospital of Kinshasa, University of Kinshasa, Kinshasa, Democratic Republic of Congo*

Correspondence should be addressed to Aimé Kazadi Lukusa, aimekaz@yahoo.fr

Received 17 November 2011; Revised 2 March 2012; Accepted 5 March 2012

Academic Editor: Carmen J. Marsit

Background. To determine clinical profile and management of retinoblastoma among children at Kinshasa in Democratic Republic of Congo. *Patients and methods.* The medical records of patients with a diagnosis of retinoblastoma seen at the University Hospital of Kinshasa from January 1985 till December 2005 were retrospectively reviewed. Demographic profile, clinical data, modes of treatment and outcome were analysed. *Results.* A total of 49 children, of whom 40 had adequate data on record were identified as retinoblastoma (28 males and 12 females). Nine cases had bilateral disease. The median age at the first symptoms was 9 months (range, 1 month to 6 years) for unilateral retinoblastoma and 18 months (range, 1 month to 3.5 years) for bilateral retinoblastoma. The median age at the first oncology consultation was 2.4 years (range, 6 months to 6 years) for unilateral retinoblastoma and 2.4years (range, 9 months to 4 years) for bilateral disease. Leukokoria was present in 67.5% of subjects. Seventy-five percent abandoned the treatment. The mortality was 92.5%. *Conclusion.* In Democratic Republic of Congo, retinoblastoma remains a life threatening disease characterized by late referral to a specialized unit and affordability of chemotherapy; all leading to an extension of the disease and high mortality.

1. Introduction

Retinoblastoma is the most frequent childhood intraocular tumour with an approximately incidence of one in 15,000–20,000 births in the world [1]. In Africa, it is the most important life-threatening ocular malignancy [2–4]. Management of retinoblastoma has been changing during years with a survival rate of more than 95% in developed countries [5, 6]. However, in developing countries these cures are less than 50%, primarily because of advanced disease at time of diagnosis [7–9]. Previous studies had reported epidemiological and clinical characteristics of the disease [10–12]. In the Democratic Republic of Congo (DRC), retinoblastoma represents 5/188 of malignant tumors in children [13], 8% of exophthalmos [14]. In other previous study, retinoblastoma was the most common histologic form representing 31.7% of all malignant of the eye [15]. However, there is still a paucity of information on clinical findings and on the outcomes of children with retinoblastoma. The last paper on presenting signs of retinoblastoma in Congolese patients gave a five-year ophthalmology view [16]. At the other side, it is necessary for health plan to have the main characteristics of all children with retinoblastoma followed in Democratic Republic of Congo. This information will give the whole view of patients and may serve to rule out general public health and in-hospital cancer politics in poor resources settings.

The aim of this study is to present data over two decades about clinical presentation and outcome of children with retinoblastoma treated at the University Hospital of

Table 1: First symptoms in 40 patients with retinoblastoma.

Symptom	No. of cases	%	Laterality	
			Unilateral	Bilateral
Leukocoria	27	67.5	21	6
Proptosis	6	15	5	1
Redness	3	7.5	2	1
Hyphema	2	5	2	—
Strabismus	1	2.5	1	1
Unknown	1	2.5	1	—
Total	40			

Table 2: Presenting signs in 40 patients with retinoblastoma.

Presenting sign	No. of cases	%	Laterality	
			Unilateral	Bilateral
Proptosis	22	55	18	4
Leukokoria	10	25	6	4
Strabismus	4	10	3	1
Mass	4	10	3	1
Uveitis	3	7,5	2	1
Buphtalmos	3	5	2	1
Hyphéma	3	5	3	—
Convulsions	1	2.5	1	—

Kinshasa, which is a referral and tertiary care center in West of Democratic Republic of Congo and to compare the results with those reported in the literature.

2. Methods

The medical records of all patients with a diagnosis of retinoblastoma seen in the Pediatrics Oncology Unit at the University Teaching Hospital of Kinshasa, between January 1985 and December 2005 were reviewed retrospectively. We used hospital-based data from the records because there is no population-based cancer registry in Democratic Republic of Congo.

The diagnosis of retinoblastoma was based upon history, clinical examination at University Hospital of Kinshasa. Clinical examination with complete ocular examination including dilated ophthalmoscopy under general anaesthesia and physical examination by a paediatrician was systematically practiced. Ancillary studies consisted of ocular ultrasonography and computed tomography when affordable, which showed the presence of solid intraocular tumor with calcium deposits. The data collected included demographics features, reference, order among siblings, the initial sign noticed by the family, age at first symptom, clinical findings, age at diagnosis, laterality, different time lag, treatment modalities, treatment adherence, and outcome. Age at first sign means the age of the child when families noticed for the first time the abnormality (alarming sign). The clinical presentation report to what the physician had seen when examining the patient at our institution. Different lag times include four latency periods: (1) the time from the first sign to a referral service, (2) the time from the reference to the pediatrics oncology unit, (3) the time from pediatrics consultation to the initiation of treatment, and (4) the observational time from treatment (followup). We divided the study period in two parts considering the year 1998 as the limitation. After that year, the treatment had been systematised with at least 3 drugs. Chemoreduction regimen consisted in Vincristine, Adriamycin, Cyclophosphamide for a maximum of six cycles given every 3 weeks before and after enucleation) following the International Conference on Paediatric Oncology in Morocco in 1998 (http://www.smhop.org.ma/).

Statistical analysis was performed using the statistics software SPSS for windows (15.0 SPSS, Chicago). Data are represented as means±SD when the distribution was normal and median with range when the distribution was not normal.

3. Results

A total of 49 children were identified as retinoblastoma during the study period. Nine of them were excluded because of insufficient information, and data of 40 patients, including 28 males (70%) and 12 females (30%) were reviewed. We observed a male/female ratio of 2.3 : 1. Our patients were referred from the ophthalmology unit of the hospital (33 cases 82.5%) and other centres (7 cases 17.5%). Their median order among siblings was 4 (range 1 to 10). During the study period, 31 cases (77.5%) had unilateral disease [16 cases (40%) left and 15 cases (37.5%) right] and 9 cases (22.5%) had bilateral disease, resulting in 49 affected eyes. In unilateral retinoblastoma, there were 20 boys and 11 girls with sex ratio 2 : 1. In bilateral disease, there were 8 boys and 1 girl with sex ratio 8 : 1. The median age at the first sign noticed by families was 1.9 years (range one month to six years) for unilateral disease and 1.4 year (range one month to three years and half) for bilateral disease while the median age of the diagnosis in our institution was 2.8 years (range six months to six years) for unilateral disease and 2.4 years (range nine months to four years) for bilateral disease. None of the parents of the patients studied had previous child with retinoblastoma. Leukokoria ($n = 27$) and proptosis ($n = 6$) were the most frequent initial signs noticed by families (Table 1). At diagnosis in our institution (Table 2), the most frequent clinical findings were proptosis ($n = 22$) and leukokoria ($n = 10$). Four delaying time are listed. A median 9 months (range, 1 to 79 months) passed from detection of the first sign to referral (lag time), 1 month (range, 0 to 23 months) from referral to paediatric oncology unit, 9.5 months (range, 0 months to 3.3 years) from paediatric consultation to treatment, and 2.3 months (range, 0 to 18 moths) from treatment initiation to last followup. An average of 15 months passed between the detection of the first sign and the beginning of therapy if applied. At diagnosis, 36 (90%) patients had stage 4 of the Reese-Ellsworth classification. Four patients had localized disease, twenty six had locoregional disease, and ten had metastatic disease. The sites of metastatic disease were brain ($n = 4$), lymph nodes ($n = 3$), bone ($n = 2$),

Table 3: Regimens, courses, duration, and followup of chemotherapy for retinoblastoma over time.

Regimen	Years	n	Mean n° of chemotherapy courses (ranges)	Followup from start of treatment (months)
C/wk	1995–1990	8	3.6 (2–6)	1
VC-enu-VC	1991	1	12	9
VC/wk	1991–1996	8	5.5 (5–6)	3
VC-Prednisolone	1992	1	1	21 days
VC-VAC+M	1996	2	24.5 (6-43)	10
VAC+M/3 wks	1997–2000	4	5.25 (1–12)	5
VAC/3 wks	1998–2005	14	3.1 (1–6)	6
VMC-VAC-enu-	2003	1	16	15
VAC+VMC/3 wk	2004	1	1	13

C: cyclophosphamide; V: vincristine; A: Adriamycine; M: methotrexate; enu: enucleation.

Table 4: Characteristics of 7 patients who died of retinoblastoma.

N°	Age (months)	Sex	Years	Regimen	Chemotherapy course	Followup (months)	Laterality
1	44	M	1986	C	3	1.3	Unit
2	41	F	1990	C	5	2.3	Unit
3	29	M	1996	VCVACMTX	6	3.5	Unit
4	15	F	1996	VCVACMTX	43	17	Unit
5	80	M	1996	VC	5	3.5	Unit
6	27	F	2004	VAC	3	4	Unit
7	42	M	2005	VAC	0	1	Unit

C: cyclophosphamide; V: vincristine; A: Adriamycine; M: methotrexate.

and bone marrow ($n = 1$). From 1985 to 1998, 23 patients (57.5%) have been treated and 17 (42.5%) from 1998 to the 2005. Different chemotherapy regimens had been used. No local conservative treatment was applied. The Table 3 shows chemotherapy protocols to be used and those effectively applied to patients.

The outcomes of our patients were as follows: 30 (75%) children were lost from followup, 7 (17.5%) died among which 5 had proptosis with an orbital extension, 2 had protruded mass development after enucleation (characteristics presented in Table 4), one was referred abroad for treatment, and two were alive at the time of final data entry. Assuming that cases lost to followup worsened and died, the mortality would be 92.5%.

4. Discussion

Our study is the first to look at the outcome and the limitations to management of retinoblastoma in Democratic Republic of Congo. The study spanned 20 years and 49 cases of retinoblastoma were identified during that time. From mid 1998 to 2005, 17 patients were identified. This is an extremely small number. The calculation based on incidence of retinoblastoma in Africa, data from Index Mundi available for 2005 (http://www.indexmundi.com/g/g.aspx?c=cg&v=25/), and estimate population in 1999, we can give an estimate o incidence of retinoblastoma in Democratic Republic of Congo approximately of 976–1098 cases and the the total number of children in this study indicates that only a tiny fraction of Congolese children with retinoblastoma benefited from treatment in our tertiary referral center. It is common for some children with retinoblastoma to be taken to herbalist or prayer houses instead of hospital. This situation is due to cultural beliefs, stigma, and ignorance [17, 18]. The male-female ratio in our study is 2.3 : 1. Many authors reported similar observations [14, 16, 19, 20], but in others the occurrence of retinoblastoma is almost the same in both sexes [11, 21, 22]. The fact of sex ratio in the present study had been reported to be related to environmental factors or to bias referral.

The main referral to paediatric oncology was the ophthalmology unit of our institution with 82.5% of patients. In a previous study from the Ophthalmology Unit of the University Hospital of Kinshasa, half of patients are referred by surroundings ophthalmologists [16]. This may be explained by some obstacles outside University Hospital of Kinshasa as lack of paediatrician and ophthalmologist. In-hospital reference from ophthalmologist to paediatrician could help in the early management because it was reported in Argentina that the paediatrician underestimated the complaints in half patients while the diagnosis was suspected by the ophthalmologist on the first visit [23].

The frequency of bilateral disease of retinoblastoma was 22.5% of patients. This frequency varies from 10 to 50% in different studies [1, 19, 24–26]. It might be that some bilateral cases are lost to followup before second eye involvement appears, leading to misclassification as unilateral in our context.

The age at diagnosis of retinoblastoma in developing countries varies from 24 months to 3 years [16, 24, 27, 28]. In this study, the age of our patients ranged from 6 months

to 6.6 years and averaged 32 months. The mean age when first sign had noticed by parents was 20, 4 months, meaning a year average lost of time before reaching a hospital due to lake of information, education, or poor socioeconomic level. Different studies reported similar observations in developing countries [12, 20, 24, 28]. Leukokoria (67.5%) had been the first sign noticed by parents. In medical consultation, proptosis and leukokoria were the most common clinical presentation, similar to that from other developing countries [4, 20, 23, 26, 28, 29]. Computer tomography is generally avoided in bilateral retinoblastoma because radiation may increase risk of second cancers. The use of computer tomography in our study reflects scarce magnetic resonance imaging resources. The diagnosis or presentation of retinoblastoma in Kinshasa is delayed. Similar observations were reported in other studies in developing countries [20, 23, 26, 30]. The predominance of proptosis is due to the delay in consultation and the development of the tumour because there is a link between the lag time and the expansion of the tumour [31]. However, in other settings leukokoria still remains the presenting sign at the hospital [32, 33]. Another explanation rises as been reported from the use of self-treatments or traditional healers' treatments before reaching a hospital or during the period between a health centre and the pediatrics oncology unit [34, 35]. So, retinoblastoma is diagnosed late with extraocular dissemination, and there is tremendous scope for improvement in its managements as performed in developed countries [20]. This should lead to set up an informational program for careful screening and referral of "white pupil" for early diagnosis and treatment as proposed elsewhere [36, 37].

The chemotherapy of retinoblastoma in Kinshasa evolved from one drug to a 3 drugs combination therapy every 3 weeks during the study period. The Chemotherapy regimen (Vincristine; Adriamycine Cyclophosphamide) had been systematically applied since 1998. Chemotherapy was not given regularly according to established standard treatment guidelines. The major reason for this is resource deficiency. Most of the parents of our patients are poor and because a free health care facility is not available in most developing countries, these drugs are not affordable to many of the patients. An additional factor is the unavailability and high cost of some drugs in Democratic Republic of Congo. This situation contributes to lack of treatment adherence and patients being lost to followup. In our series, the number of treatment abandonment and lost of followup is high. This high treatment abandonment may be the result of late presentation as well as poor compliance with chemotherapy regimen. Treatment abandonment as well as loss to followup has also been reported from other developing countries [20, 24, 30]. We think that it derives from complex factors such as ignorance, poverty without health insurance system, financial constraint regarding investigations and procurement of drugs, lack infrastructure resources, poor communication between medical teams and patients, and deep lack of financial and infrastructure resources. In our study, limited management for above reasons and lack of an accurate tracing system are factors predicting a worse prognosis.

During these 2 decades, retinoblastoma remains a life-threatening disease in Democratic Republic of Congo characterized by advanced intraocular disease, late referral to a specialized unit, delay in treatment, important lost to followup, and affordability of chemotherapy. Early educational detection program, prompt referral to specialized centers, use of current methods treatment, and an implementation of a health insurance system particularly for cancers will improve outcomes for children with retinoblastoma in our settings.

Acknowledgments

The authors would like to appreciate all students and nurses of the Paediatric Oncology Unit of the University Hospital of Kinshasa for their assistance in collecting the data.

References

[1] J. A. Shields and C. L. Shields, "Retinoblastoma," in *Intraocular Tumors- A Text and Atlas*, C. L. Shields and J. A. Shields, Eds., pp. 294–318, Lippincott Williams and Wilkins, Philadeplhia, Pa, USA, 2nd edition, 2007.

[2] T. Kivelä, "The epidemiological challenge of the most frequent eye cancer: retinoblastoma, an issue of birth and death," *British Journal of Ophthalmology*, vol. 93, no. 9, pp. 1129–1131, 2009.

[3] A. S. Ka, P. Imbert, C. Moreira et al., "Epidemiology and prognosis of childhood cancer in Dakar, Senegal," *Medecine Tropicale*, vol. 63, no. 4-5, pp. 521–526, 2003.

[4] J. Freedman and L. Goldberg, "Incidence of retinoblastoma in the Bantu of South Africa," *British Journal of Ophthalmology*, vol. 60, no. 9, pp. 655–656, 1976.

[5] E. L. Berman, C. E. Donaldson, M. Giblin, and F. J. Martin, "Outcomes in retinoblastoma, 1974–2005: the Children's Hospital, Westmead," *Clinical and Experimental Ophthalmology*, vol. 35, no. 1, pp. 5–12, 2007.

[6] A. MacCarthy, J. M. Birch, G. J. Draper et al., "Retinoblastoma: treatment and survival in Great Britain 1963 to 2002," *British Journal of Ophthalmology*, vol. 93, no. 1, pp. 38–39, 2009.

[7] R. J. C. Bowman, M. Mafwiri, P. Luthert, J. Luande, and M. Wood, "Outcome of retinoblastoma in east Africa," *Pediatric Blood and Cancer*, vol. 50, no. 1, pp. 160–162, 2008.

[8] Y. Bhurgri, S. Muzaffar, R. Ahmed et al., "Retinoblastoma in Karachi, Pakistan," *Asian Pacific Journal of Cancer Prevention*, vol. 5, no. 2, pp. 159–163, 2004.

[9] B. De Camargo, M. De Oliveira Santos, M. S. Rebelo et al., "Cancer incidence among children and adolescents in Brazil: first report of 14 population-based cancer registries," *International Journal of Cancer*, vol. 126, no. 3, pp. 715–720, 2010.

[10] C. P. Yang, I. J. Hung, T. H. Jaing, and W. H. Chang, "Cancers in the infancy: percent distribution and incidence rates," *Acta Paediatrica Taiwanica*, vol. 47, no. 6, pp. 273–277, 2006.

[11] R. Saiju, J. Thakur, P. C. Karmacharya, and D. N. Shah, "Retinoblastoma in Nepal: a clinical profile of 30 cases," *Nepal Medical College Journal*, vol. 8, no. 3, pp. 171–175, 2006.

[12] H. Ozdemir, N. Tacyildiz, E. Unal, G. Yavuz, H. Ugur, and K. Gunduz, "Clinical and epidemiological characteristics of retinoblastoma: correlation with prognosis in a Turkish Pediatric Oncology Center," *Pediatric Hematology and Oncology*, vol. 24, no. 3, pp. 221–231, 2007.

[13] P. R. Fischer, L. O. Ahuka, P. B. Wood, and S. Lucas, "Malignant tumors in children of northeastern Zaire: a comparison of distribution patterns," *Clinical Pediatrics*, vol. 29, no. 2, pp. 95–98, 1990.

[14] D. K. Kaimbo, J. Kilangalanga, and L. Missoten, "Exophthalmias in zaire," *Bulletin de la Société Belge d'Ophtalmologie*, vol. 259, pp. 199–204, 1995.

[15] M. Y. Poso, J. C. K. Mwanza, and D. L. Kayembe, "Malignant tumors of the eye and adnexa in Congo-Kinshasa," *Journal Francais d'Ophtalmologie*, vol. 23, no. 4, pp. 327–332, 2000.

[16] W. K. Kaimbo, M. M. Mvitu, and L. Missotten, "Presenting signs of retinoblastoma in Congolese patients," *Bulletin de la Societe Belge d'Ophtalmologie*, no. 283, pp. 37–41, 2002.

[17] T. Mambu Nyangi Mondo, M. Malengreau, P. Kayembe Kalambayi, and B. L. Dimomfu, "Delays in seeking and getting care, in seriously ill women of childbearing age in Kinshasa," *Revue d'Epidemiologie et de Sante Publique*, vol. 58, no. 3, pp. 189–196, 2010.

[18] L. P. Sabuni, "Dilemma with the local perception of causes of illnesses in central Africa: muted concept but prevalent in everyday life," *Qualitative Health Research*, vol. 17, no. 9, pp. 1280–1291, 2007.

[19] L. Kayembe, "Retinoblastoma: review of a 21 year follow-up," *Journal Francais d'Ophtalmologie*, vol. 9, no. 8-9, pp. 561–565, 1986.

[20] C. O. Bekibele, A. I. Ayede, O. O. Asaolu, and B. J. Brown, "Retinoblastoma: the challenges of management in Ibadan, Nigeria," *Journal of Pediatric Hematology/Oncology*, vol. 31, no. 8, pp. 552–555, 2009.

[21] J. F. Owoeye, E. A. Afolayan, and D. S. Ademola-Popoola, "Retinoblastoma—a clinico-pathological study in Ilorin, Nigeria," *African Journal of Health Sciences*, vol. 13, no. 1-2, pp. 117–123, 2006.

[22] T. Mouratova, "Retinoblastoma in Uzbekistan," *Bulletin de la Societe Belge d'Ophtalmologie*, no. 289, pp. 63–69, 2003.

[23] G. Chantada, A. Fandiño, J. Manzitti, L. Urrutia, and E. Schvartzman, "Late diagnosis of retinoblastoma in a developing country," *Archives of Disease in Childhood*, vol. 80, no. 2, pp. 171–174, 1999.

[24] A. A. E. Ali, S. M. A. Elsheikh, A. Elhaj et al., "Clinical presentation and outcome of retinoblastoma among children treated at the National Cancer Institute (NCI) in Gezira, Sudan: a single institution experience," *Ophthalmic Genetics*, vol. 32, no. 2, pp. 122–125, 2011.

[25] M. P. Shanmugam, J. Biswas, L. Gopal, T. Sharma, and S. H. M. Nizamuddin, "The clinical spectrum and treatment outcome of retinoblastoma in Indian children," *Journal of Pediatric Ophthalmology and Strabismus*, vol. 42, no. 2, pp. 75–113, 2005.

[26] B. Badhu, S. P. Sah, S. K. D. Thakur et al., "Clinical presentation of retinoblastoma in Eastern Nepal," *Clinical and Experimental Ophthalmology*, vol. 33, no. 4, pp. 386–389, 2005.

[27] I. Alnawaiseh, I. Jaradat, Y. A. Yousef et al., "Retinoblastoma in Jordan: an epidemiological study (2006–2010)," *Hematology/Oncology and Stem Cell Therapy*, vol. 4, no. 3, pp. 126–131, 2011.

[28] V. Essuman, C. T. Ntim-Amponsah, S. Akafo, L. Renner, and L. Edusei, "Presentation of retinoblastoma at eye clinic in Ghana," *Ghana Medical Journal*, vol. 44, no. 1, pp. 10–15, 2010.

[29] T. Boubacar, S. Fatou, T. Fousseyni et al., "Thirty months prospective study on the treatment of retinoblastoma in Gabriel Touré Bamako Mali: 55 cases," *British Journal of Ophthalmology*, vol. 94, no. 4, pp. 467–469, 2010.

[30] A. U. Mukhtar and K. Kagame, "Pathological study of retinoblastoma in Mbarara, Uganda," *Central African Journal of Medicine*, vol. 46, no. 1, pp. 13–16, 2000.

[31] C. B. Antoneli, F. Steinhorst, K. C. Ribeiro et al., "The Pediatrician's ability to recognize the presenting signs and symptoms of retinoblastoma," *Revista da Associação Médica Brasileira*, vol. 50, no. 4, pp. 400–402, 2004.

[32] B. S. Menon, J. Alagaratnam, E. Juraida, M. Mohamed, H. Ibrahim, and N. N. Nyi, "Late presentation of retinoblastoma in Malaysia," *Pediatric Blood and Cancer*, vol. 52, no. 2, pp. 215–217, 2009.

[33] C. Y. Chang, T. J. Chiou, B. Hwang, L. Y. Bai, W. M. Hsu, and Y. L. Hsieh, "Retinoblastoma in Taiwan: survival rate and prognostic factors," *Japanese Journal of Ophthalmology*, vol. 50, no. 3, pp. 242–249, 2006.

[34] J. Mselle, "Visual impact of using traditional medicine on the injured eye in Africa," *Acta Tropica*, vol. 70, no. 2, pp. 185–192, 1998.

[35] J. C. K. Mwanza, "Corneal complications of local ocular traditional treatment in the Democratic Republic of Congo," *Medecine Tropicale*, vol. 61, no. 6, pp. 500–502, 2001.

[36] S. O. Ekenze, H. Ekwunife, B. I. Eze, A. Ikefuna, C. C. Amah, and I. J. Emodi, "The burden of pediatric malignant solid tumors in a developing country," *Journal of Tropical Pediatrics*, vol. 56, no. 2, pp. 111–114, 2009.

[37] C. Leander, L. C. Fu, A. Peña et al., "Impact of an education program on late diagnosis of retinoblastoma in Honduras," *Pediatric Blood and Cancer*, vol. 49, no. 6, pp. 817–819, 2007.