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Original Research Article

Epidemiology and clinical aspects of hematological malignancies at the military hospital of Antananarivo

Valéry Refeno[1]*, Nomeharisoa R. E. Hasiniatsy[2], Andriatsioharana V. N. Ramahandrisoa[3], Fanomezantsoa A. Rakoto[4], Aimée O. Rakoto Alson[5], Florine Rafaramino[6]

[1]Department of of Oncology, Professor Zafisaona Gabriel Teaching Hospital, Faculty of Medicine of Mahajanga, Mahajanga, Madagascar
[2]Department of Oncology and Palliative Care, Military Hospital, Faculty of Medicine of Antananarivo, Antananarivo, Madagascar
[3]Department of Oncology, Joseph Ravoahangy Andrianavalona Teaching Hospital, Faculty of Medicine of Antananarivo, Antananarivo, Madagascar
[4]Military Hospital, Faculty of Medicine of Antananarivo, Antananarivo, Madagascar
[5]Department of Hematology, Joseph Ravoahangy Andrianavalona Teaching Hospital, Faculty of Medicine of Antananarivo, Antananarivo, Madagascar
[6]Faculty of Medicine of Antananarivo, Antananarivo, Madagascar

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***Correspondence:**
Dr. Valéry Refeno,
E-mail: refenovalery@gmail.com

ABSTRACT

Background: Malignant hemopathies constitute a group of pathologies having in common the anomalies of the bone marrow or of the lymphatic system cells. In developed countries, the number and actual distribution of cancers is provided by cancer registries. In Madagascar there is no effective cancer registry and only two studies on malignant hemopathies have been carried out to date, but neither has described their epidemiology and clinical aspects. Thus, we aimed to describe the epidemiology and clinical aspects of malignant hemopathies managed in the Medical Oncology Unit of the Military Hospital of Antananarivo.
Methods: It was a cross-sectional and descriptive study carried out at this unit from 1st December 2012 to 31st August 2015 (33 months). Authors included all patients followed, then excluded those without pathologic evidence, cases of monoclonal gammapathy of unknown significance and cases of solid cancers.
Results: We followed up 57 cases of malignant hemopathies. The mean age was 49.39±15.46 years and the sex ratio was 1.71. Superficial lymphadenopathy was the most frequent warning signs (31.58%) and lymphomas were most represented (52.63%). There was a significant association between warning signs and diagnosis (p value <0.001).
Conclusions: Present results are grossly similar to those of other African authors. Present results are distinguished by a low proportion of chronic myeloid leukemia and a very low proportion of chronic lymphocytic leukemia compared to literature data. The effectiveness of the cancer registry will allow us to improve the knowledge about frequency and current distribution of cancer in Madagascar.

Keywords: Clinical aspects, Epidemiology, Hematological malignancies, Military hospital, Madagascar

INTRODUCTION

Hematologic malignancies (HM) represent a heterogeneous group of pathologies that share the common involvement of bone marrow cells or the

lymphatic system.[1] According to the International Agency for Research on Cancer (IARC), there were 14,076,000 new cancer cases worldwide in 2012, including hematological malignancies.[2] In developed countries, the existence of cancer registries makes it possible to know the number of cases of hematological malignancies.[1,3] In developing countries where there is no cancer registry most often, epidemiological data are provided by descriptive studies in care and / or diagnostic services.[4-7]

In Madagascar, there is no effective cancer registry to know the real epidemiology of patients with hematological malignancies.[8] In the Malagasy literature, we found only two studies on hematological malignancies: the first was about their odontostomatological manifestations at Joseph Ravoahangy Andrianavalona Teaching Hospital (CHU JRA) and the second was about their therapeutic and evolutionary aspects at the Military Hospital of Antananarivo.[9,10] No previous studies have examined either the epidemiology or clinical manifestations of all hematological malignancies in one center in Madagascar. Thus, we aimed to describe the epidemiology and clinical aspects of malignant hemopathies observed at the Medical Oncology Unit of the Military Hospital of Antananarivo.

METHODS

We conducted a descriptive and transversal study at the Medical Oncology Unit of Antananarivo Military Hospital during the period from December 1st, 2012 to August 31st, 2015 (33 months). We did not include cancer patients in other centers and patients who did not have cancer. Authors have comprehensively included all patients followed in the Medical Oncology Unit for confirmed cancer (solid or haematological) or suspected cancer. Next, we excluded patients without anatomopathological or biological evidence of cancer, patients followed for monoclonal gammopathy of undetermined significance, and patients followed for solid cancers. In the end, we selected patients with haematological malignancies.

Authors defined three subgroups: acute leukemia (AL) including acute myeloid leukemia (AML) and acute lymphoblastic leukemia (ALL); lymphoproliferative syndrome (LPS) including non-Hodgkin's lymphoma (NHL), Hodgkin Lymphoma (HL), multiple myeloma (MM), and chronic lymphocytic leukemia (CLL); and myeloproliferative syndrome (MPS) including chronic myeloid leukemia (CML) and primary myelofibrosis or myeloid splenomegaly.[1,11]

For the preparation of the manuscript, authors used the checklist of STROBE as it is an observational study. Data collection was done on patient paper records of patients. Data was collected and analyzed on Microsoft Excel 2007 and SPSS Version 20 software. We used chi-square test to research significant association between qualitative variables and ANOVA test to research significant difference between three means. P values of <0.05 was considered statistically significant.

RESULTS

Authors collected 57 cases in 33 months or 20.7 new cases per year (NC/year). Hematologic malignancies accounted for 7.8% of patients followed in the Medical Oncology Unit and 12.4% of patients with pathological or biological confirmation of malignancy. Note that one third of the patients (271 / 732) didn't have proof of cancer and were excluded. Figure 1 represents our study population.

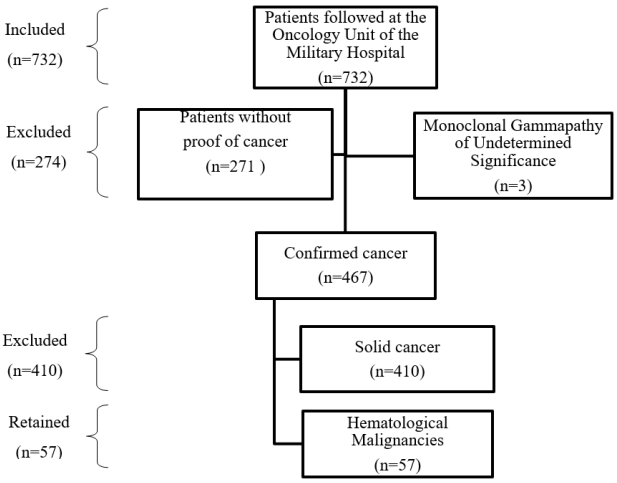

Figure 1 The study population.

The mean age of all patients combined was 49.4±15.5 years (48.5±14.5 for men and 50.9±17.2 years for women) and the sex ratio (SR) was 1.7. The median age of the patients was 54 years-old range [12; 76]. Note that only two patients were under 18-years old.

The main warning signs of MH were superficial lymphadenopathy (n= 18 or 31.6%), medullary insufficiency syndrome (n= 9 or 15.8%) and pain syndrome (n= 8 or 14%). Fewer patients presented as warning signs: deep lymphadenopathy, splenomegaly and neurological disorders (n = 5 or 8.8% each). Alteration of general condition (n=3 or 5.3%) and other warning signs were even less represented.

According to diagnosis

Non-Hodgkin's malignant lymphoma was the most represented HM (n = 23 or 40.4%), followed by myeloma (n = 11 or 19.3%), acute myeloid leukaemias (n = 7 or 12.3%), and Hodgkin lymphoma (n = 7 or 12.3%). CML were less represented (n=6 or 10.5%) and we reported only one case of CLL, one case of ALL and one case of primitive myelofibrosis (1.8% each). The most represented nosological subgroup was that of

lymphoproliferative syndromes (n = 42 or 73.7%) followed by the subgroup of acute leukemias (n=8 or 14%) and that of myeloproliferative syndromes (n= 7 or 12.3%) (Table 1).

Table 1: Repartition of hematological malignancies according to the diagnosis at the military hospital of Antananarivo.

Subgroup of hematological malignancies	Hematological malignancies	Number (n)	Percentage (%)
Lymphoproliferative syndrome	Non-hodgkin lymphoma	23	40.4
	Myeloma	11	19.3
	Hodgkin lymphoma	7	12.3
	Chronic lymphoblastic leukemia	1	1.8
	Subtotal	42	73.7
Acute leukemia	Acute myeloid leukemia	7	12.3
	Acute lymphoblastic leukemia	1	1.8
	Subtotal	8	14
Myeloproliferative syndrome	Chronic myeloid leukemia	6	10.5
	Primitive myelofibrosis	1	1.8
	Subtotal	7	12.3
Total		57	100.0

Table 2: Repartition of mean age and sex-ratio according to the diagnosed hematological malignancy at the military hospital of Antananarivo.

Subgroup of hematological malignancies	Hematological malignancies	Mean age	Sex-ratio
Lymphoproliferative syndrome	Non-hodgkin lymphoma	51.30±16.04	1.09
	Myeloma	58.36±5.88	2.67
	Hodgkin lymphoma	38.71±13.68	1.33
	Chronic lymphoblastic leukemia	48	-
	Subtotal	50.98±14.64	1.47
Acute leukemia	Acute myeloid leukemia	49.57±16.04	6
	Acute lymphoblastic leukemia	12	-
	Subtotal	44.88±19.92	7
Myeloproliferative syndrome	Chronic myeloid leukemia	44.17±16.68	1
	Primitive myelofibrosis	50	-
	Subtotal	45.00±15.38	1.33
Total		49.39±15.46	1.71

The mean age at diagnosis varied according to the nosological subgroup: 50.98±14.64 years for LPS, 44.88±19.92 years for AL and 45.00±15.38 years for MPS. There was no significative difference between the mean age of the three subgroups (p value=0.438). The mean age also varied according to the diagnosis: from 58.36 +/- 5.88 years for myeloma to 12 years for the only case of ALL. With the exception of CML (SR = 1), we found a male predominance of HM: from SR = 6.00 for AML to SR = 1.09 for NHL (Table 2).

There was a significative correlation between the main warning signs and the diagnosis (p value <0.001). For NHL, it was superficial lymphadenopathies (n= 11 or 47.8%), deep lymphadenopathy (n=5 or 21.7%) and neurological disorders (n=3 or 13.0%). For myeloma, pain syndrome was the most frequent warning sign (n=6 or 54.5%) followed by medullary insufficiency syndrome (n=3 or 27.3%) and neurological disorders (n=2 or 18.2%). For AML, the main warning signs were medullary insufficiency syndrome (n=4 or 57.1%), alteration of general condition (n=2 or 28.6%) and pain syndrome (n=1 or 14.3%). All cases of Hodgkin lymphoma were revealed by superficial lymphadenopathy (n= 7 or 100%) (Table 3).

DISCUSSION

The hematological malignancies accounted for 12.45% of confirmed cancer patients in present study. This result is comparable to those found by Ranaivomanana at CHU JRA and by Hasiniatsy previously at the Medical

Oncology Unit where HM constituted respectively 10.75% and 13.25% of all cancers.[8,11] It is also comparable to that found by Errahhali et al, in Morocco for which HM constituted 10% of cancers treated in 3 cancer centers.[12] Nevertheless, the proportion of HM in relation to all cancers is lower than that found by few studies in developing countries for which it was 18.91% for Al-Kahiry et al, and 24.80% for Ba Saleem et al, in Yemen.[13,14] The proportion of HM is closer to that found in developed countries, which is around 8% in Europe according to Rodriguez-Abreu et al, and 9.3% in the United States according to Siegel et al.[1,15] Thus, further studies could be made to know the actual proportion of HM in Madagascar.

hg

Table 3: Repartition of warning signs according to the diagnosed hematological malignancy at the military hospital of Antananarivo.

Diagnosis	Deep lymphadeno pathy	Superficial lymphadenopathy	Alteration of general condition	Medullary insuffiency syndrome	Spleno megaly	Algic syndrome	Neuro-logical disorders	Other	Total
NHL[1]	5	11	1	1	0	1	3	1	23
HL[2]	0	7	0	0	0	0	0	0	7
AML[3]	0	0	2	4	0	1	0	0	7
CLL[4]	0	0	0	1	0	0	0	0	1
Myeloma	0	0	0	3	0	6	2	0	11
ALL[5]	0	0	0	0	0	0	0	1	1
CML[6]	0	0	0	0	5	0	0	1	6
PM[7]	0	0	0	0	0	0	0	1	1
TOTAL	5	18	3	9	5	8	5	4	57

(p value < 0.001); [1] NHL : Non-hodgkin lymphoma, [2] HL : Hodgkin lymphoma, [3] AML : Acule Myeloid Leukemia, [4] CLL : Chronic Lymphoblastic leukemia, [5] ALL : Acute Lymphoblastic Leukemia, [6] CML : Chronic Myeloid Leukemia, [7] PM : Primitive Myelofibrosis

Authors collected 57 cases over a period of 33 months or 20.7 New Cases per year (NC/ year). Compared to the Malagasy data, our data are in agreement with those of Hasiniatsy et al who collected 24 NC/year over the period from January to December 2013 in this same unit.[8] On the other hand, the frequency of our HMs was lower than that found by Rakoto Alson et al, and Ranaivomanana et al, at CHUJRA for which they were respectively 60 NC/year from January to March 2007 and 80 NC/year from January 2009 to December 2010.[9,11] The lower incidence of HM can be explained by the fact that until 2011 CHU JRA was the only cancer center in Madagascar that it received all cases of HM (Whereas in 2013, Madagascar had 4 oncology centers including 3 in Antananarivo).

Compared with the data from other studies carried out in a single center, the frequency of our HM (20.7 NC/year) is similar to that found by Koulidiati, in Burkina Faso and Thiam, in Senegal which were respectively 22.13 and 22.14 NC/year.[5,16] This result is also consistent with the overall incidence of HM found in African studies, which was 5.28 NC/year for Mahboub et al, 16.8 NC/year for Weldetsadik et al, 16.9 NC/year for Kagu et al, 22.1 NC/year for Koulidiati et al, and Thiam et al, 29 NC/year for Ouédraogo et al, 33 NC/year for Diallo et al and 43.2 NC/year for Tea et al.[4,5,7,16-21]The frequency of our HM is nevertheless lower than that found in the Asian monocentric studies for which the frequency of HM which was 27.1 NC/year for Kusum et al, 30 NC/year for Idris et al, 69.7 NC/year for Al-ghazali et al, and 75 NC/year for Al-Kahiri et al.[6,13,22,23] The frequency of our HM is far lower than that found in multicenter studies such as those of Errahhali et al, in Morocco and Hossain et al, in Bangladesh for which it was respectively 132 and 1002.6 NC/year.[12,24] The frequency of our HM is also far lower than that found in the cancer registries of countries possessing these tools: HM frequency was 363.2 NC/year for Broccia et al, in Sardinia (Italy), 2,700 NC/year for McNally et al, in United Kingdom and 230,000 NC/year for Rodriguez-Abreu in Europe.[1,25-27] Present data were obtained in one center and do not reflect the reality of HM in the capital and in the country. Next, authors considered only patients who met the diagnostic criteria for MH. As a result, patients with high presumption of HM but not confirmed were not taken into account. Thus, the frequency of our HM could be underestimated.

The average age at diagnosis of our patients with all HM was 49.39±15.46 years. The average age of patients was higher than that found by many authors for whom it was 32.2 years for Errahali et al, 42 years for Weldetsadik et al, and Ouedraogo et al, and 51,96 years for Errahali et al.[7,12,18,28] Similarly, the median age (54 years) was also higher than that found by Hossain, in Bangladesh and by Kagu in Nigeria for whom it respectively was 22.5 and 42.[19,24] Present study differs from those above in the very small proportion of pediatric population in the sample (2 cases out of 57). The average age of patients is closer to those found by Al-Kahiry, in Yemen (45.3 years) ,and Errahhali in Morocco (54 years) who also had almost exclusively adult samples because their pediatric cases

were treated in centers specialized in pediatric oncology.[12,13] The presence of a reference pediatric oncology unit working in cooperation with the French-African group for pediatric oncology in the capital explains the lower proportion of children seen in consultation in the unit and the older age of our patients.[29] The median age of all HM combined was lower than that found in European literature, especially in the United Kingdom where it is 70.6 years old.[30] This could be explained by the higher life expectancy of patients in these affluent countries.8The mean age at diagnosis of AML was 49.57±16.04 years. This is comparable with the mean age at diagnosis of AML found by Errahhali et al, in Morocco (42.5 years).[12] The average age of our AML was higher than that reported by other Malagasy authors including Ranaivomanana and Harioly Nirina, which was respectively 33.08 years and 38.3 years.[11,31] The mean age of our AML was also higher than that reported by other African and Asian authors for which it was 26 years for Idris et al, 35 years for Hossain et al, and 36.1 years for Koulidiati et al.[16,23,24] It is necessary to update Madagascar's cancer registry to know the real epidemiological situation of Madagascar in terms of haematological malignancies.[8] The average age of our CML patients was 44.17±16.68 years. This is consistent with the average ages of CML found by Hossain et al, in Bangladesh and Al-Ghazali in Yemen for whom the average age of CML was around 40.[6,24] The average age of CML in the center is higher than that found by Ranaivomanana and Rakotonarivo at CHU JRA, which was respectively 21.30 years and 37 years.[11,32] This mean age was also higher than that found by Koulidiati, in Burkina Faso and Idris in Pakistan, for whom the average ae at diagnosis of CML was respectively 38.5 years and 22 years.[16,23] The median age at diagnosis of our CML (50.50 years) is lower than that of European countries for which it is 60 years old.[1]

The mean age at diagnosis of our LMNH was 51.30± 16.04 years. Present results are similar to those of Hossain in Bangladesh and Errahhali, in Morocco who respectively found a mean age at diagnosis of 48 and 55 years.[12,24] This average age of LMNH is higher than that found by Ranaivomanana (34.31 years) in another center in Antananarivo from 2009 to 2010.11It is also higher than that found by Koulidiati, in Burkina Faso (39.5 years) and Idris in Pakistan (22.5 years).16,23The mean age at diagnosis of our MDH was 38.71±13.68 years. This is consistent with the mean age of MDH found by Koulidiati et al, in Bukina Faso which was 36.69 years.[16] The mean age of our MDH is higher than the one found by Ranaivomanana et al, at CHU JRA which was 29.56 years old.[11] The mean age at diagnosis of our myelomas was 58.36±5.88 years. This is comparable with the average age of diagnosis of myeloma found by Koulidiati et al, in Burkina Faso which was 59.2 years.[16] The median age of Myeloma in our study (57 years) was also consistent with the median age found by Hossain et al, in Bangladesh (55 years) and by E,rrahhali et al, in Morocco (63.5 years).[12,24] The average age of myeloma is also slightly lower than that found in developed countries between 60 and 75 years of age.[1] The average age at diagnosis of HM is grossly comparable if not higher than that found by authors in developing analogue countries and below that of developed countries. The later average age could be explained on the one hand by the sample almost exclusively composed of adults. Nevertheless, the existence of specific factors that can influence the age of onset of HM in Madagascar could be the subject of subsequent etiological studies.

Authors found a slight male predominance in the sample for all HM combined (sex ratio = 1.71). This is consistent with the sex ratio found by many authors in developing countries, which was 1.1 for Errahhali et al, 1.2 for Al-Kahiri et al, 1.37 for Sawadogo et al, 1,42 for Ouédraogo et al, 1.9 for Diallo et al, and 2 for Kagu.[7,12,13,17,19,20,28] The slight predominance of male HM combined is also found in the literature of developed countries, especially in the Troussard et al, study in France and Smith in the United Kingdom for which the sex ratio was respectively 1.2 and 1.3.[30,34]

Authors found a very strong male predominance of AML in the sample (Sex-ratio = 6). This male predominance has also been found by other Malagasy autors, but with a lower sex ratio compared to the sex-ratio found by Harioly Nirina et al, (1.83) and Ranaivomanana et al, (2.25).[11,31] The sex ratio of our AML is also significantly higher than that reported in the literature for both developing and developed countries for which a slight male predominance is noted like in the studies of Al-Ghazali et al, (SR=1.18), Smith et al, (SR=1.25), Koulidiati et al (SR=1.5) and Hossain et al, (SR=1.9).[6,16,24,30,34] This discrepancy with the literature data could be explained by our sampling (its monocentric nature and the small size of the sample). Nevertheless, further studies should be made to investigate possible factors that may explain this very strong male predominance of AML. Authors found a slight male predominance of LMNH (sex ratio = 1.09). This was also found by Ranaivomanana et al, at another center in Antananarivo.[11] This slight male predominance is also consistent with African and developed country data like those reported by Errahhali et al, (SR=1.3), Rodriguez-Abreu et al, (SR=1.47) and Koulidiati et al, (SR=1.9).[1,12,16] Authors found a slight male predominance of our MDH (sex ratio = 1.33). This was also found in a study conducted in another center in Antananarivo where the sex ratio was 1.29.[11] This result is consistent with data from developed countries.[35] This slight male predominance of MDH was not unanimously found by African authors for whom the sex ratio ranged from 0.9 for Errahhali et al, in Morocco to 8 for Koulidiati et al, in Burkina Faso.[12,16] The sex ratio of MDH was also lower than that found by Hossain et al, in Bangladesh of 3.4.[24] Authors found a male predominance of our patients with myeloma (sex ratio = 2.67). This is consistent with the results found by most authors in developing countries and in the world like Cartwright et al (SR=1.16), Errahhali et

al, (SR=1.2), Rodriguez-Abreu et al, (SR=153) and Hossain et al (SR=2.11).[1,12,24,35] Authors have not found any predominance of gender in our CML patients (sex ratio = 1). This differs from the results by other Malagasy authors like Rakotonarivo et al, and Ranaivomanana et al, who respectively found a sex-ratio of 1.22 and 1.25.[11,32] This sex ratio is close to that of Al-Ghazali in Yemen for which the sex ratio was 0.98.6However most authors find a male predominance of CML like Rodriguez-Abreu et al, (SR=1.75), Hossain et al, (SR=2.1), and Koulidiati et al, (SR=2.3).[1,16,24] This difference could be explained by our recruitment.

The most common warning signs in the study for all HM combined were superficial lymphadenopathy (31.58%), bone marrow failure syndrome (15.79%) and pain syndrome (14.04%). These are different from the main warning signs of HM found by Idris in a medicine Department in Pakistan, the most represented of which were spinal cord injury syndrome, general condition deterioration and pruritus. This difference can be explained by the fact that in the study, lymphomas accounted for 52.63% of our HM and acute leukaemias only 14.04%, while in Idris' study, acute leukemias accounted for 55.05%. of his HM.[23] Main aim of the present study was tp warning signs of HM all together are also different from those found by Mahboub et al, in a pneumology department in Morocco that were dyspnea, chest pain, and general impairment.[17] This difference could be explained on the one hand by the fact that the study was done in an oncology department while that of Mahboub et al, was done in a department of pneumology. On the other hand, the difference in the warning signs could be explained by the fact that lymphomas, although the most represented in the study (52.7%) constituted a smaller proportion of the HM compared to that reported in Mahboub et al, study (78%).[17] Our warning signs are also different from those reported by Koulidiati et al, in a clinical hematology unit in Burkina Faso for which the most reported warning signs were deterioration of general condition and abdominal masses followed by abdominal pain. Our different warning signs could be explained by the fact that in this last study, CML, myeloma and CLL were the most represented HMs, while conversely, lymphomas constituted more than half of our HM.16The main warning signs of HM all appear to vary according to the type of service and the most represented HM.

For NHL, superficial lymphadenopathies and deep lymphadenopathies were the main warning signs (69.56%). This is consistent with the results of Koulitiati et al, in Burkina Faso and Rodriguez-Abreu in European for which lymphodenopathy represented respectively 41.2% and 70% of the warning signs of NHL.[1,16,18] For our myelomas, bone pain accounted for 54.55% of the warning signs, which is similar to the result found by Koulidiati et al, for whom 62% of myelomas were found with this warning sign.[16] Our AML was revealed in more than half of the cases with medullary insufficiency syndrome, comparable to Weldetsadik et al, finding in Ethiopia.[18] The warning signs we found were consistent with the literature for the corresponding HMs. Thus, Madagascar practitioners should explore persistent lymphadenopathy, which is not obvious or progressive because it can be indicative of NHL. Similarly, the practitioner should also be aware to untagged pains, particularly bone pains and conduct their explorationbecause they can reveal many HM, especially myeloma.

The most represented HM group in the study was LPS (73.7%). This is consistent with data from Hasiniatsy et al, previously obtained in this same unit for which lymphoid hemopathies were more frequent than myeloid hemopathies (8.28% versus 4.97% of all cancers followed in this unit).[8] This is also consistent with the datafrom Ranaivomanana et al, in a study done at CHU JRA in which LPS represented 76% of HM.[11] This predominance of LPS is consistent with data from African authors : The proportion of LPS within HM were 61.02% for Koulidiati et al, 67.58% for Errahhali et al, 68.56% for Diallo et al, 70.44% for Téa et al, 68.96% for Kagu et al, and 89.78% for Al-Kahiry.[4,5,7,12,13,16-21] The proportion of LPS is also similar to that found by Rodriguez-Abreu et al, in Europe for which LPS represented 77.64% of all HM.[1]

The most represented HM in the study were lymphomas (NHL + HL) which accounted for 52.63% of the sample followed by Myeloma (19.30%) and AML (12.30%). The predominance of lymphomas is consistent with Ranaivomanana data from another Malagasy center according to which lymphomas accounted for 72.33% of their HM.[11] This predominance of lymphomas has also been reported by most authors in developing countries like Koulidiati et al, Errahhali et al, Diallo et al, Téa et al, Kagu et al, and Al-Kahiry for which the proportion of lymphomas were respectively 21.47%, 48.31%, 53.03%, 55.35%, 78.30% and 86.67%.[7,12,13,16,19-21] This predominance of lymphomas is also consistent with data of Rodriguez-Abreu in Europe for which lymphoma represented 54.77% of all HM.[1] The second most common hematopathy in the unit was myeloma, which accounted for 19.30% of the sample. Some African authors had found a similar result with a proportion of myeloma of 10.71% for Sawadogo et al, 13.16% for Errahhali et al and 21.47% for Koulidiati et al.[12,16,28] Nevertheless, in the study done by Ranaivomanana et al, CML constituted the second most represented HM (11.32%) and myeloma accounted for only 5.03% of its sample.[11] Moreover, the majority of African and Asian authors report that CML was the second most represented HM in their sample, representing a proportion of 5.53% for Kagu et al, 11.35% for Babatunde et al, 15% for Ouedraogo et al, 16.67% for Diallo et al, 18.06% for Hossain and 25.37% for Weldetsadik et al.[4,5,7,18-20,24] The less frequent proportion of CML in the sample could be explained by the existence of a reference center for the treatment of CML in the capital.[36] In addition, all living patients diagnosed with CML were transferred to this

center for subsequent management. Subsequent epidemiological studies could be done to confirm the increased frequency of myeloma in the center. AML was the third most represented HM in the study representing 12.30% of the sample. This is consistent with Ranaivomanana results at CHU JRA.[11] Some authors have reported that AML is the third most represented HM with variable proportion : 4.00% for Al-Kahiry et al, 4.26% for Kagu et al, and 6.29% for Téa et al.[13,19,21]

Nevertheless, most authors in developing and developed countries report that their third most-represented HM were CLLs, with variable proportions: 3.39% for Sawadogo et al, 9.85% for Diallo et al, 11.32% for Broccia et al in 2004, 11,44% for Broccia et al, in 2005, 18.08% for Koulidiati et al and 18.40% for Weldetsadik et al. [16,18,20,25,27,28] In the study, only one patient had CLL. This low frequency of CLL draws attention to the particular situation in Madagascar because according to Western literature CLL is the most common leukemia in adults and accounts for 25-30% of leukemias.[1,6]

However, the results we found are consistent with those found by Ranaivomanana et al who had reported no case of CLL at CHU JRA from January 2009 to December 2010, when it was still the only cancer center in Madagascar.11These results are also consistent with those of Rakoto Alson et al, who reported no case of CLL at CHU JRA from January to March 2009.[9] This finding makes us wonder whether CLLs are under-diagnosed in Madagascar or whether there are factors that explain their low frequency.

CONCLUSION

In conclusion, the proportion of HM is consistent with data from Malagasy literature and tends to be close to that found in developped countries.The average age and sex-ratio is comparable to those reported in similar studies. The large proportion of lymphoproliferative syndrome, particularly of non-Hodgkin lymphomas, is also consistent with data from the literature. Attention is retained about the small proportion of chronic myeloid leukemia as well as the very low proportion of chronic lymphocytic leukemia compared to literature data. There are particular points that need to be explored. The creation of the cancer registry would make it possible to know the frequency and actual distribution of cancer in Madagascar.

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