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Cancer incidence in AIDS patients in Catalonia, Spain

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ARTICLE INFO

Article history:
Received 7 November 2006
Received in revised form 27 December 2006
Accepted 3 January 2007

Keywords:
AIDS
HIV
Record linkage
Cervical cancer
Kaposi's sarcoma
Lymphoma
Liver cancer
Incidence
Registries

ABSTRACT

HIV infected people and AIDS patients develop cancer more frequently than the general population. The objective of this study was to evaluate the risk of developing cancer among 15 to 69 year old AIDS patients from two geographic areas: Tarragona and Girona provinces, in north-eastern Spain. We have studied invasive and *in situ* cancers (for all sites) among 1659 AIDS patients from ±5 years around the date of their AIDS diagnosis by matching the population-based Cancer Registries with the AIDS Registry covering these populations. The periods used in the linkage were 1981–1998 for Tarragona and 1994–1999 for Girona. Sex and age-standardised incidence ratios (SIRs) of observed-to-expected cancers were calculated by type of cancer as a measure of risk. For selected types of cancers, SIRs were also calculated for HIV exposure category. Compared with the general population, incidence of cancer among AIDS patients (invasive and *in situ*) increased 22.9 fold in men ($n = 142$) and 21.0 fold in women ($n = 45$). High statistically significant SIRs were found for Kaposi's sarcoma (KS) (male, 486.4; female, 1030.0), non-Hodgkin's lymphoma (NHL) (male, 126.1; female, 192.8) and invasive cervical cancer (41.8). High risks were also found for Hodgkin's lymphoma (31.1), liver cancer (29.4) and lung cancer (9.4) in men, and *in situ* cervical cancer (24.4) in women. For all non-AIDS defining malignant neoplasms as a group SIRs were 3.4 in men and 2.5 in women. Among men, homo/bisexuality was strongly related to risk of KS and NHL. The rates of cervical cancer, Hodgkin's lymphoma, liver cancer and lung cancer were among the highest ever reported linked to HIV infection. For the cervical cancer this could be attributable to the low incidence of this cancer in the general population and to the high prevalence of intravenous drug users among HIV women and probably due to poor preventive strategies in this population.

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1. Introduction

Although human immunodeficiency virus (HIV) increases the risk of developing Kaposi's sarcoma (KS), non-Hodgkin's lymphoma (NHL) and invasive cervical cancer (ICC), several other cancers also occur at higher rates in patients with HIV infection and AIDS, such as Hodgkin's lymphoma (HL) and anal cancers, among others. The list of types of cancers than can

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doi:10.1016/j.ejca.2007.01.028

be linked to HIV is not well defined and the observed relative risks (RRs) vary widely across different studies. With the exception of KS and NHL, the RRs are generally of a moderate magnitude.

After Ukraine and Portugal, Spain is the third country with the highest rate of AIDS in Europe, being, in 2004, 4.3*1000 inhabitants. As in other western countries, the number of cases increased constantly until 1996 when Highly Active Antiretroviral Therapy (HAART) was widely introduced.[1] During the 1980s and the 1990s HIV parenteral transmission through needle sharing among intravenous drug users (IDU) has been the driving force of the epidemic, but during previous years the percentage of cases acquired through sexual contact has increased. While between 1981 and 1999 the male/female ratio was 4:1, and 58.3% of the cases were IDU, 19.2% homosexual or bisexual men, and 14.1% heterosexual cases, during the period 2000–2005 the sex ratio was 3:1 and the exposure category distribution was respectively 42.8%, 18.2% and 32.2%. Data from the HIV surveillance system implemented in Catalonia in 2001, shows that up to 2005, 19.1% of men and 16.5% of women were IDU, 36.8% of men and 78.8% of women were heterosexual and 38% of men were homo or bisexual.[2]

In order to fully evaluate the impact of HIV on the incidence of cancer in our population, we linked the records held in the Catalonia AIDS Registry and the Cancer registries of two geographically defined areas, Tarragona and Girona. The objective was to characterize the risk of cancer among the population with AIDS as compared to that reported for the general population in both areas.

2. Patients and methods

In order to evaluate the risk of cancer among AIDS patients in the Tarragona and Girona provinces, the incidence of patients with cancer was compared with the expected values obtained from the Tarragona and Girona general population by matching the Catalan AIDS Registry with the population-based Tarragona and Girona Cancer Registries, all of them official statistics of the Catalan Health Department (Generalitat de Catalunya). The population covered by the Tarragona Cancer Registry was 542,000 and that of Girona was 507,000 according to the 1991 census, which represents 2.7% of the Spanish population. This same year, the estimated proportion of AIDS patients in Girona and Tarragona in relation to the Spanish cases was 4.1%. The two cancer registries used the International Classification of Diseases for Oncology for coding the site and the histology.

2.1. Subjects and coding

For Tarragona, all cases of AIDS ($n = 838$) and cancer ($n = 43{,}632$) diagnosed between 1981 and 1998 were linked using an own software which runs with a probabilistic approach based on initials, sex, birth date and residency. A dissociated database was used for the purpose of this analysis. For Girona, the linkage was restricted to the period 1994–1999 (821 AIDS and 18,787 cancers cases).

When the cancer was detected by the AIDS registry only, the diagnosis was confirmed by means of a clinical record revision. This circumstance happened for nine KS, two NHL and one *in situ* cervical cancer (*in situ* CC).

Malignant disorders were grouped into types of cancer by using the International Classification of Diseases tenth revision (ICD-10). Non-invasive neoplasms (International Classification of Diseases for Oncology, behaviour code 2) are also presented.

2.2. Data analysis

Analysis of the incidence of cancer was limited to the same time periods used in the record linkage period of each province. Analysis was restricted to subjects in the 15–69 age group.

In order to make our results comparable with those from other studies, this study was limited to cancers diagnosed 60 months before and 60 months after a patient had been diagnosed with AIDS. To compute the person-time at risk, the period at risk for cancer was defined as beginning in 1981 for Tarragona (or 1994 for Girona) or 5 years prior to an AIDS diagnosis, whichever occurred later, and ending 5 years post-AIDS diagnosis, at the date of death or on 31 December 1998, for Tarragona (or 31 December 1999, for Girona), whichever occurred earlier. The observed number of cancer cases among people with AIDS was compared with the expected number of cases by computing standardised incidence ratios (SIRs). Expected incidence cases were calculated by multiplying age-, sex- and province-specific cancer incidence rates from the Tarragona and Girona cancer registries by the corresponding person-years at risk for these time periods.

Since HIV-infected subjects who develop cancer might die before progression to AIDS and therefore would never be recorded in the AIDS registry, to estimate the expected number of pre-AIDS subjects the expected cancer cases were adjusted by the survival probability by type of cancer. Therefore, the joint probability of both developing and surviving cancer was applied to the person-year distribution. Tarragona and Girona cancer incidence rates[3] and survival rates[4] for specific malignancies were used to calculate the expected number of cancer cases prior to AIDS diagnosis. All SIRs discussed in the results are the adjusted ones. Confidence intervals around the SIRs were calculated assuming that the observed cases follow a Poisson distribution.

To assess the association between risk factors and malignant disease, SIRs were calculated for groups according to the following HIV exposure categories: intravenous drug user (IDU), homo/bisexual contact and heterosexual contact. These categories are assigned following the hierarchical criteria used in the Catalan AIDS Registry, which gives priority, in case of conflict, to the parenteral pathway *versus* the sexual pathway.

SIRs were also estimated by the time period between a cancer and an AIDS diagnosis using five intervals: early pre-AIDS diagnosis (60–25 months before), late pre-AIDS diagnosis (24–7 months before), at AIDS diagnosis (6 months before to 3 months after), early post-AIDS diagnosis (4–27 months after) and late post-AIDS diagnosis (28 to 60 months after). No trend in relative risk was analysed over these periods.

The SIRs for the most frequent cancers are also presented for two separate time periods, 1981–1996 and 1997–1999, to see if differences in risk appeared between the two periods.

Population attributable fraction percentages (PAR%) were calculated for NHL and cervical cancers. All statistical analyses were performed by using the R software.

3. Results

Globally, the comparison included 1659 AIDS patients (1304 men (78.6%) and 355 women (21.4%)) and 62,419 cancer patients. After excluding the youngest and the oldest patients (<15 and >69 years old), the total number of person-years at risk of this study was 7049.5 with an average of 6.1 years per patient. Table 1 shows the demographic characteristics and the HIV exposure category in the AIDS/cancer matched cohort. The record linkage identified 192 malignant neoplasms among 185 patients. From these, 144 cancers were diagnosed in males (2 of them *in situ*) and 48 in females (30 invasive and 18 of cervix *in situ*). One third of all cases originated from Girona. In men, 68% of cases were aged 25–44 years old and in women 66% were aged 25–34 years old. Among men the commonest reported HIV exposure category was homo/bisexual contact and among women, intravenous drug use.

The SIRs of invasive cancer were 22.9 for men and 19.5 for women with AIDS. The SIRs for KS were 486.4 for men and 1030.0 for women. The SIR of NHL was 126.1 in men and 192.8 in women and the one for ICC was 41.8-fold. Among men, a statistically significant increased SIR also appeared for cancer of the liver, lung and HL and among women for *in situ* cervical cancer (SIR = 24.4). Although the values of all adjusted SIRs are higher than the unadjusted ones, these are not-statistically different because of the small number of cases (Table 2). For oral cavity and pharynx, stomach, penis, urinary bladder and unspecified cancers in men and for non-melanoma skin, HL and colon cancers in women, one case was observed (data not shown).

For KS, male homo/bisexual condition was the exposure category most strongly associated with an increased risk (SIR of 3003.2). IDUs and heterosexual condition also presented a higher risk than the general population, in NHL and total invasive cancers, male homo/bisexual condition also presented the highest SIRs (240.6 and 53.9), but were

Table 1 – Demographic characteristics and HIV exposure category among patients aged 15–69 years in the AIDS/cancer matched cohort, Tarragona/Girona

Characteristics	Male Cases	%	Female Cases	%
Region and period				
Tarragona (1981–93)	42	30.4	9	19.1
Tarragona (1994–98)	46	36.3	21	44.7
Girona (1994–99)	50	32.2	17	36.1
All	138	100.0	47	100.0
Age at AIDS diagnosis				
<29	24	17.3	12	25.5
30–39	59	42.7	25	53.2
40–49	34	24.6	7	14.9
50–69	21	15.1	3	6.4
HIV exposure category				
Intravenous drug users	44	31.9	31	66.0
Homo/Bisexual contact	66	47.8	0	0.0
Heterosexual contact	17	12.3	12	25.5
Others	11	8.0	4	8.5
Total persons[a]	138		47	
Total cancers[a]	144		48	

a 192 cancers in 185 patients.

Table 2 – Observed and expected cancer cases and standardised incidence ratios (SIRs) of specific types of cancer among persons with AIDS aged 15–69 years in Tarragona/Girona cohort (60 months before to 60 months after AIDS diagnosis)

Type of cancer		Adjusted for differential survival			Unadjusted		
	O	E	SIR	95% CI	E	SIR	95% CI
Male							
Kaposi's sarcoma	71	0.15	486.39	379.83–613.75	0.22	323.21	252.40–407.85
Non-Hodgkin's lymphoma[a]	52	0.41	126.14	94.18–165.50	0.59	87.86	65.60–115.18
Invasive non-AIDS defining cancers[b]	19	5.63	3.37	2.03–5.28	8.18	2.32	1.40–3.63
Liver	2	0.07	29.43	2.77–108.24	0.15	13.13	1.24–48.30
Lung and bronchus	4	0.43	9.36	2.44–24.21	1.03	3.88	1.01–10.02
Other skin[c]	2	1.30	1.54	0.15–5.68	1.43	1.40	0.13–5.15
Hodgkin's lymphoma	6	0.19	31.07	11.18–68.08	0.21	28.44	10.23–62.30
Total invasive cancers	142	6.19	22.92	19.31–27.02	8.99	15.80	13.31–18.62
Female							
Kaposi's sarcoma	6	0.006	1030.00	370.70–2256.74	0.008	777.66	279.88–1703.86
Non-Hodgkin's lymphoma[a]	10	0.05	192.81	91.82–355.95	0.07	146.26	69.65–270.01
Cervix, invasive	10	0.24	41.76	19.89–77.09	0.30	33.99	16.19–62.75
Invasive non-AIDS defining cancers[d]	3	1.19	2.51	0.47–7.43	1.68	1.79	0.34–5.29
Total invasive cancers	29	1.49	19.46	13.02–27.98	2.05	14.15	9.47–20.34
Cervix, *in situ*	16	0.66	24.41	13.92–39.73	0.66	24.34	13.88–39.62

a Include brain primary Non-Hodgkin's lymphomas.
b Include all invasive cancers except Kaposi's sarcoma and Non-Hodgkin's lymphoma (1 oral cavity and pharynx, 1 stomach, 1 penis, 1 urinary bladder and 1 unspecified neoplasm).
c Exclude skin melanoma and Kaposi's sarcoma.
d Include 1 Hodgkin's Iymbhoma, 1 colon and 1 other skin neoplasm.

not statistically significant when compared to other HIV exposure categories. Among women, no differences were observed among the exposure categories and risks of KS, NHL or *in situ* cervical cancer but IDU exposure category was significantly associated to a high risk of ICC (Table 3).

In relation to the RRs by time period around the AIDS diagnosis, consistently elevated post-AIDS RRs were observed only for NHL and in all cancers as a whole in men. Among women, consistent elevated RRs from the late pre-AIDS diagnosis period were observed for *in situ* cervical cancers and for all cancers as a whole (data not shown).

By calendar period, NHL and all cancers as a whole in both sexes, KS in men and ICC and *in situ* cervical cancer in women showed elevated SIRs in the two study periods, 1981–1996 and 1997–1999. KS in women only showed an elevated SIR in the period 1981–1996 (Table 4). The same results were observed with and without adjustment for differential survival.

The PAR% of HIV/AIDS for NHL was 7.82% (11.5% in men and 2.7% in women). For ICC, the PAR% was 1.33% (0.26% in the period 1981–93 and 2.44% in the period 1994–99). For *in situ* cervical cancer the PAR% was 1.48% (1.09% in the period 1981–93 and 1.84% in the period 1994–99).

Table 3 – Observed and expected cancer cases and adjusted for differential survival standardised incidence ratios (SIRs) of cancer among persons with AIDS aged 15–69 years in Tarragona/Girona cohort for sex and HIV exposure category (60 months before to 60 months after AIDS diagnosis)

Type of cancer	Male				Female			
HIV exposure category	Observed	Expected	SIR	95% CI	Observed	Expected	SIR	95% CI
Kaposi's sarcoma								
Homo/bisexual contact	55	0.018	3003.23	2262.0–3911.2	0			
Intravenous drug users	7	0.100	69.77	27.66–144.57	4	0.004	1031.79	268.34–2667.72
Heterosexual contact	5	0.017	285.87	90.20–672.45	2	0.002	1067.51	100.64–3925.89
Non-Hodgkin's lymphoma[a]								
Homo/bisexual contact	14	0.058	240.66	131.10–404.85	0			
Intravenous drug users	26	0.241	107.66	70.26–157.96	3	0.030	100.32	18.91–296.95
Heterosexual contact	8	0.071	112.15	47.90–222.06	5	0.018	272.34	85.93–640.61
Cervix, invasive								
Homo/bisexual contact					0			
Intravenous drug users					8	0.145	55.18	23.57–109.25
Heterosexual contact					1	0.085	11.81	0–67.72
Cervix, *in situ*								
Homo/bisexual contact					0			
Intravenous drug users					11	0.429	25.63	12.72–46.02
Heterosexual contact					5	0.192	26.06	8.22–61.31
Total, invasive cancers								
Homo/bisexual contact	70	1.30	53.94	42.05–68.18	0			
Intravenous drug users	45	2.14	21.05	15.35–28.19	28	1.219	22.97	15.25–33.24
Heterosexual contact	17	1.73	9.84	5.72–15.79	13	0.792	16.41	8.70–28.14

a Including brain primary Non-Hodgkin's lymphomas.

Table 4 – Observed and expected cancer cases and adjusted for differential survival standardised incidence ratios (SIRs) of specific types of cancer among patients with AIDS aged 15–69 years in Tarragona/Girona cohort in the periods 1981–1996 and 1997–1999 (60 months before to 60 months after AIDS diagnosis)

	1981–1996				1997–1999			
	Observed	Expected	SIR	95% CI	Observed	Expected	SIR	95% CI
Men								
Kaposi's sarcoma	63	0.129	490.2	376.6–627.4	8	0.017	457.8	195.5–906.4
Non Hodgkin's lymphoma	37	0.276	134.1	94.4–185.0	15	0.137	109.4	61.1–180.9
Total	116	4.695	24.7	20.4–29.6	26	1.519	17.1	11.2–25.1
Women								
Kaposi's sarcoma	5	0.004	1135.2	358.2–2670	1	0.002	626.7	0.3–3593
Non Hodgkin's lymphoma	8	0.038	210.1	89.7–416.0	2	0.014	143.6	13.5–528.1
Cervix, invasive	8	0.191	41.9	17.9–82.9	2	0.053	37.4	3.6–138.8
Cervix, in situ	11	0.462	23.8	11.8–42.7	5	0.175	28.5	9.0–67.2
Total invasive cancers	23	1.137	20.2	12.8–30.4	6	0.374	16.0	5.8–35.2

4. Discussion

This is the first AIDS-cancer record linkage reported for the Spanish population. Our data cover a 19 year period and two well-defined geographical areas within the country. We identified 192 cancers among HIV subjects. Compared to the general population a very high risk of KS, NHL, HL and, particularly, cervical carcinoma were estimated.

Relatively few linkage studies between population-based AIDS and cancer registries have been conducted in order to assess the risk of AIDS patients or HIV infected people developing a cancer, and almost all of them have been in western countries (USA, Italy, Australia, England and Scotland),[5–10] although the first results have already been published from an African match study.[11] In the Mediterranean area of Europe there has only been an Italian linkage study published[6,7] but a non-population based Swiss study has been published recently.[12] The present study has been carried out in an area with one of the highest rates of AIDS in Europe, a high proportion of them infected through parenteral exposure.

4.1. *Limitations of the study*

Although this type of study is a good tool for evaluating the risk of AIDS patients developing cancer, some possible weaknesses must be taken into account that would produce erroneous incidence estimates. For example, incompleteness of cancer registration, especially for some types of cancer (i.e. KS) can be a source of underestimation of risk as could inaccuracy of diagnosis in, for instance, brain tumours or problems in following up AIDS patients who may have moved away.

A certain degree of underestimation of risk is produced by the fact that the number of expected cases is calculated taking in consideration the incidence of the period with AIDS which includes cases with AIDS. In our study, the incidence for each year of study in the general population was used to compare the observed cases with the expected ones.

People with AIDS may be subject to a closer medical surveillance than the general population. This could particularly increase the detection of the generally asymptomatic pre-neoplastic cervical lesions as is the case for the *in situ* cervical cancer. Therefore this must be taken into account when evaluating this increased risk. It is unlikely that tumours such NHL or HL could be affected by a closer surveillance.

In this study, cancers detected only by AIDS Registry were included if confirmed after clinical record revision (9 KS, 2 NHL and 1 ICC). So, the inclusion of these cases in the estimation of the RRs do not significantly affect the results.

Although unclear, the heterogeneity of AIDS case definition during the whole period of the study could be another source of bias. Changes in the definition of AIDS will also affect the moment of presentation of cancer in relation to the AIDS diagnosis.

4.2. *Relative frequency by type of cancer*

As expected, KS and NHL represented the majority of cancers found in the Tarragona–Girona male AIDS patient cohort (86%). In females, KS and NHL only represent 33% of cases, whereas the majority of cases corresponded to cervical cancers (ICC (21%) and *in situ* CC (38%)).

4.3. *Risks by type of cancer*

In interpreting these data it must be taken into account that, with the exception of KS and NHL, the RRs are generally of a moderate magnitude, susceptible to effects from uncontrolled confounding factors. Therefore, an increased risk of a specific cancer in patients with HIV/AIDS does not necessarily indicate a causal relationship but may simply represent shared risk factors between HIV infection and that cancer.

The Tarragona Cancer Registry registered an average of only one case of KS per year between 1980 and 1987. In 1988, the frequency of these malignancies began to increase, especially in males, while the average age at diagnosis decreased. A joint-point regression analysis showed that the incidence rates of KS in men between 1980 and 1992 increased 99% annually. From 1992 to 1998 a non-significant decreasing trend was observed. In women, the annual percentage of change in incidence rates from 1980 to 1998 was 27%, this not being statistically significant (data not published). The incidence of KS in our study population was similar to that reported in other studies.[5,7,8,10,12,13] Homo/bisexuality was the most important HIV exposure category for KS in men. In men, SIR was not statistically different between the periods 1981–1996 and 1997–1999.

In this study, NHL was the second most frequent malignancy in men and in women after KS and ICC, respectively. In all countries, NHL was the second, or even the first, most common malignant disorder associated with HIV infection.[5,7–10,12] In the late 1990s, however, NHL became more common than KS in some areas. In Tarragona–Girona, NHL represented 29% of all AIDS-related cancers before 1994 and 35% during the period 1994–1999.

There were no differences in risk between the period 1981–1996 and the period 1997–1999, either in males or in females. For KS, NHL, ICC and total cancers as a whole, SIR were lower in the period 1997–1999 than in the period 1981–1996, but not statistically significant in any of them. HAART has been introduced and used similarly than other countries in Europe. Our results may be explained by an insufficient number of follow up years after HAART.

There were no significant differences in risk among HIV exposure categories in NHL. Elevated post-AIDS RRs were observed in NHL both in males and females, probably reflecting that the risk of developing NHL in these patients is associated to a decrease in the immune status.

The proportion of cases with lymphomas associated with HIV/AIDS (Burkitt's, immunoblastic, primary effusion, large B-cell diffuse and primary brain lymphomas) is higher in our cohort than in the non-AIDS patients in Tarragona (data not shown) and Girona. It must be noted that none of the seven primary brain lymphomas had a histological verification of diagnosis.

We found the highest risks for ICC and *in situ* cervical cancer compared with those obtained in previous match studies between cancer and AIDS/HIV registries.[7–10,12,14] The

inclusion of results on *in situ* cervical cancer was considered feasible and reliable enough because both cancer registries used the same criteria of inclusion of these cases.

By HIV exposure category groups, only IDUs showed a significant RR for ICC. For *in situ* CC, both the heterosexual contact and IDUs presented a significant RR.

In the context of western countries, Tarragona and Girona have low incidence rates of ICC and this fact could explain at least in part the high reporting of SIRs. But, in Europe, the high prevalence of ICC as an AIDS-defining illness seems to be a marker of two major features:

- the predominance of IDUs among AIDS patients and
- the failure of cervical screening programs in southern and central Europe to reach under-privileged groups of women.[15]

During the early years of the epidemic in Spain, AIDS in women was closely linked to IDUs because of personal consumption and sexual intercourse with male IDUs.[16]

It has been suggested that HIV is a cofactor in the association between HPV and cervical neoplasia and that this effect seemed to vary according to the level of immune function. HPV clearance is less reduced in HIV positive women with levels of CD4+ $\geqslant$ 200 cells/μl than in women with levels <200 cells/μl.[17] The biggest study on the association between AIDS and HPV related cancers reported high RRs for both *in situ* and invasive cervical and other anogenital cancers.[14] Sun et al.[18] concluded that HIV-seropositive women have a high rate of persistent HPV infections with the types of HPV that are strongly associated with the development of HSIL and ICC. CIN may even recur despite multiple treatments in HIV-infected women[19] and recurrence could be related to immune status in this high-risk group.[20]

In our study, we found not only very high global SIRs for both *in situ* and invasive CCs, but also high RRs for *in situ* CC from 24 months before AIDS diagnosis to 60 months after. The different RRs observed for both the women as a whole and the HIV exposure groups are compatible with some of the hypotheses generated in other studies. Such high risks could be explained, first of all by the low incidence of CC in the general population, and secondly by the high prevalence of IDUs among the female AIDS cohort which, at the same time, could be associated with a more promiscuous sexual behaviour than that in the general population, thus involving the combination of HIV infection together with a persistence of HPV infection. Further, the larger proportion of IDUs among women that developed ICC may also be linked to poorer screening strategies in this population.

As in others studies, HL is one of the most common cancers found in this cohort. In our study, the SIRs were higher than the SIRs found in all other studies, USA,[5] Italy,[7] Australia,[8] South East England[9] and Switzerland.[12] Due to the low number of patients with HL in our series, we did not analyse the risk of HL by the period of diagnosis. Recent studies show that the risk of HL in the post HAART period has not decreased.

Similarly our data was consistent for an increased risk of lung cancer as observed in USA,[5] Australia[8] and Switzerland[12] and liver cancer as in Scotland[10] and United States.[5] Although for these two cancer sites it is likely that the association is mainly due to an increased prevalence of risk factors, such as smoking or hepatitis infection, our set of data was too small to fully evaluate at which time this occurred in relation to AIDS diagnosis. Furthermore, we did not have any information on the relevant risk factors.

In summary, in a country with moderate incidence rates of AIDS, high relative risks in *in situ* and invasive cancer were detected in AIDS patients. The rates of CC were among the highest ever reported linked to HIV infection, probably attributable to the low incidence of this cancer in the general population and also to the high prevalence of IDUs among HIV women.

Conflict of interest statement

None declared.

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