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Frequency of HIV and viral Hepatitis B co-infection in children aged 1 to 15 years attended in a hospital environment in Parakou (Benin).

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Abstract

Background: HIV and viral hepatitis B have the same mode of transmission in child dominated by vertical transmission.

Objective: The focus of this research work was to determine the frequency of HIV and viral hepatitis B co-infections in HIV-positive infants and children in a hospital environment and to identify the factors associated with that co-ïnfection.

Materials and methods: It was a descriptive and analytical cross-sectional study conducted in a pediatric hospital unit located in the North-Benin over the period from May to August 2014. Infants and children under 15 years at the time of screening attended for HIV infection care were included. Averages were compared with Student t-test or Pearson Chi-square test at 0.05 threshold limit and also by using prevalence reporter with OR as the case may be.

Results: A total of 104 infants and children were tested. Mean age was 8 years ± 4.03 years. Sex ratio was 1.03. Among them, 28.85% were immunized against hepatitis B, 24.04% had history of blood transfusion and 43.27% history of scarification. Mean CD4 count in children under 5 years of age was 19.8% ± 17.8%. HIV/HBV co-infection frequency was 9.62%. It was associated with maternal age (p=0.038), histrory of circumcision (p=0.019), presence of hepatomegaly (p=0.00) and with ALT value (p=0.001).

Conclusion: HIV and HBV co-infection should be investigated in followed up children. Screening for viral hepatitis should be on a regular basis during pregnancy in HIV-positive women so as to ensure better care for the infants exposed as from birth.

Keywords: HIV and HBV co-infection, HIV infection, Children, ART, Benin.

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Introduction

Human Immunodeficiency Virus (HIV) infection develops as a chronic infection. It develops as a pandemic for no continent is spared [1]. In 2013, according to WHO, the number of people newly infected with HIV globally was estimated to 2.1 million with 240, 000 new HIV infections among children and 1.5 million of deaths associated with HIV/AIDS [2].

Globally, 370 to 400 million people are chronic hepatitis B (HBV) virus carriers [3]. Contracted at an early age, hepatitis B virus infection represents a high risk of chronic disease with possible progression towards cirrhosis and primary liver cancer. The probability of developing a chronic disease is the same, whether infection is symptomatic or asymptomatic [4] and patients a progression towards fibrosis is noted in 20 to 25% after 8 years making viral hepatitis B a major public health issue [4,5].

Hepatitis B virus shares the same modes of infection as HIV and contributes to the possibility of co-infection. HIV/HBV co-infection seroprevalence is between 2 and 4 million people. Sub-Saharan Africa where hepatitis B prevalence exceeds 8% stands as a main concern with it [6]. This viral co-infection is significantly higher in HIV-positive children, thus adding to mortality as an important disease burden [7]. Indeed, hepatitis B prognosis is exacerbated by co-infection through the risk of transmission from acute hepatitis B to a chronic state, reactivation of HBV in asymptomatic HBV carriers, fast progression towards fibrosis, higher risk of hepatocellular carcinoma [8].

In Benin, studies conducted on those co-infections were mostly adults-focused. We found it interesting to investigate

about HIV and hepatitis B co-infection in HIV- infected children followed up in the CHD-Borgou pediatric unit of Parakou in order to determine the frequency of that co-infection and to identify the factors associated with it.

Material and Method

Study setting

The study had been conducted in the pediatric unit of the Borgou Regional Hospital (CHD-Borgou) and at the Information Center of Planning and Counseling (CIPEC) in Parakou (Benin).

The Pediatric Unit is a second referral ward dedicated to care and follow-up of HIV-infec-ted children as well as to follow-up of HIV-exposed children.

CIPEC is responsible for the planning and coordination of actions designed to fight sexually transmitted infections/ HIV-AIDS (STI/HIV-AIDS) in Borgou and Alibori regions. The two branches of activity of CIPEC are STI/HIV-AIDS Counseling and Screening and laboratory activities. It is a polyvalent laboratory where investigations like PCR and HIV infection impact on blood are conducted. The performance of regular blood test for people living with HIV follow-up is associated with these activities. This activity is carried out by two laboratory Engineers who perform virological (Plasma viral load quantification and HIV detection through real time PCR), immunological and serological tests including HIV serology mainly. HIV serology is done through rapid tests (Determine, Genie III, Immunocomb and Bioline) and Elisa method.

Methods

Type and period of study

It was a cross-sectional study with descriptive and analytical purposes. It was carried out over the period from May 5 to August 5, 2014.

Study population consisted of all the children attended in the CHD/Borgou pediatric unit for HIV infection care and received for medical consultation during the period of study.

Inclusion criteria: To be included in the study, children were aged from 1 to 15 years at the time of screening, HIV-infected, followed up in the unit, put on ARV therapy (ART) and whose parents had given their consent.

Non inclusion criteria: The infants exposed to HIV without evidence of the infection had not been included (i.e., children born to HIV positive mother without evidence of the infection).

Sampling: We carried out an exhaustive census of all children meeting inclusion criteria during the period of study. An active search helped add children who were lost to follow-up.

Study variables

The study main judgment criterion was HBV infection in HIV-infected children. The independent data were socio-demographic characteristics of children and parents (age, sex, educational levels), children's serologic characteristics (HIV status, status of immunization against HBV), children's clinical characteristics (medical history of jaundice, of blood transfusion, circumcision or excision, scarification, clinical stage of HIV infection, presence of hepatomegaly and nutritional status), and child biological characteristics (hepatitis B surface antigen (HbsAg), CD4 count, complete blood cells count (CBC), child ALT transaminases).

Data collection

Data had been collected by using medical records, and then an interview. The data collected were transferred to pre-drafted survey sheets. All the children observed in care and eligible were sensitized to take part in the study. For children under 12 years of age, the interview was conducted with parents or guardians during medical care. For those whose age was above 12 years, the interview was individual. During such interview, a verbal consent was obtained from the parents or guardians of the children. At the end of the recruitments, samples were collected and sent to the laboratory of Borgou/Alibori CIPEC for processing. Medical records helped to complete the needed informations.

During the interview, we have obtained general information and clinical history of children and parents. The child data on HIV infection clinical stage according to WHO, last CD4 count, commencement date of ART and molecules of the on-going treatment were obtained from their medical records. Child physical examination enabled us to get data on the presence of hepatomegaly or jaundice and on child nutritional status.

Materials

The collection material consists of 5 ml dried collection tubes, 5 ml syringes with needles and tourniquets. The laboratory equipment comprising MICROPOINT Diagnostics HBs Ag reagent was used to perform HBS antigen detection test in the child's serum.

Assisted by a nurse, blood samples were taken in the pediatric unit after each interview. In the CIPEC laboratory, we analyzed samples with the help of a laboratory technician.

Venous blood was collected on an empty stomach in a dried tube. The written code on the questionnaire was reported to the collection tube. At the end of the collection activity, samples were sent to laboratory for processing. After centrifugation, blood samples were tested for each of the analyses to be performed and identification of HBsAg.

A 25 µl volume of patient serum was deposited in the area dedicated to serum on the diagnostics kits used. Serum migration occurs and through Ag-Ac reaction, a red line appears in the marked area C (control) ; this certified that the test was successful. The results were classified into

two categories: absence of HBsAg, presence of HBsAg.

The patients who were positive for HBsAg have benefited from change in ART. Tenofovir+Lamivudine combination was associated to ARV treatment according to national standards. The children negative for HBsAg were sensitized to get vaccinated against HBV.

Data processing and analysis

Once collected, data were coded and analyzed with Epi info 7. 1. 1. 7 version software. Frequency tables and graphs were drafted by means of Word and Excel softwares. Analysis was first descriptive. For this purpose, quantitative data were presented in averages with standard deviations. Averages were compared by means of Student t test. Qualitative data were expressed as percentages. Frequencies of hepatitis B were estimated with their confidence interval. The relationships between variables were determined with *Pearson Chi-square* test at a 0.05 threshold and by means of prevalence ratio with an Odd Ratio (OR) as the case may be.

Difficulties encountered

During this research work, the main difficulties encountered were failure to keep appointments. Regarding the search for those lost to follow-up, the telephone contacts of some parents were inaccessible or mistaken. And dealing with the mothers who were found, their transportation costs was paid. The opinion of the parents who refused to take part in the study was respected.

Ethical considerations

To perform this research work, the authorization of the institutional ethical committee was obtained. Besides, we got the authorizations of the physician-Head of the Pediatric Unit, of the CIPEC medical officer and the Hospital Managing Director. The parents (father and/or mother) or guardians of the children were informed of the survey objectives and their consent was obtained. The results were rendered to them. Anonymity was preserved and respected. The information collected within the framework of this research work was kept confidential.

Results

General characteristics of the study population

In total, 104 children had been selected according to survey criteria. The flow chart of study population is specified in **Figure 1**.

Socio-demographic characteristics of children and mothers

Mean age was 8 years ± 4.03 years with extremes ranging from 2 to 15 years. The age group most represented was the one of those aged 10 to 15 years (41.35%). The sex ratio of 1.03. More than half of the sample of children followed was at primary school level or more: 58.65% of primary school and 12.5% of secondary school. Among the 104 children, 83 had their mothers alive. Concerning mothers,

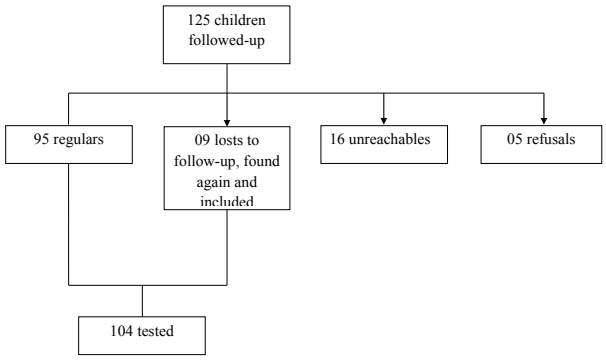

***Figure 1**. Flow chart showing the study population.*

the mean age was 35 years ± 6 years with extremes from 22 to 50 years. All these characteristics are detailed in **Table I**.

Medical history, clinical and biological characteristics of the children

Among the 104 children involved, 28.85% were immunized against hepatitis B; 24.04% had a history of

***Table I**. Distribution of the children and their mothers according to their socio-demographic characteristics.*

	Number (n)	Frequency (%)
Age		
[2-5]	30	28.85
[5-10]	31	29.81
[10-15]	43	41.35
Sex		
Male	51	49.04
Female	53	50.96
Childrens' educational level		
Uneducated	24	23.08
Pre-school	6	5.77
Primary	61	58.65
Secondary	13	12.50
Mothers' vital status		
Mothers alive	83	79.81
Deceased mothers	21	20.19
Socio-demographic characteristics of mothers (n=83)		
Age		
22-30	21	25.30
30-40	44	53.01
40-50	18	21.69
Socio-economic status		
Low	65	78.31
Average	18	21.69
Educational level of mothers		
Uneducated	24	28.92
Primary school	40	48.19
Secondary school	14	16.87
Higher education	5	6.02
Occupation		
Civil servant	15	18.07
Trader	22	26.51
Housewife	33	39.76
Craft worker	13	15.66

blood transfusion, 44.23% with history of circumcision/ excision and 43.27% with history of scarification. **Table II** shows children's distribution according to their clinical, immunological and biological characteristics. Mean CD4 count was 19.77% ± 17.77 %. Most children under 5 years had a very severe immune deficiency (52%). Mean CD4 number was 608.24 ± 334. Children above 5 years had had a normal CD4 count, thus higher than 500 (63.03%).

HIV/HBV co-infection frequency and factors associated with HIV/HBV co-infection in children followed up

Among the 104 children followed up, 10 were HIV/HBV co-infected (9.62%). Among the 10 co-infected children, 7 had their mothers alive. Jaundice was found in one child over the ten and 7 of them had liver enlargement. All of the ten children co-infected were at the WHO clinical stage 3.

Associated socio-demographic factors

The identification of associated factors is about the 10 co-infected children. **Table III** shows in detail the socio-demographic factors associated with HIV and HBV co-infection.

HIV and HBV co-infection was significantly associated with maternal age (p=0.038) and with history of circumcision (p=0.019).

Clinical, immunological and biological factors associated with HIV and HBV co-infection

Table II. *Distribution of children according to their personal medical history and clinical, immunological and biological characteristics.*

Variables	Numbers (n)	Frequency (%)
Hepatitis B vaccination		
Yes	30	28.85
No	74	71.15
Personal history of blood transfusion		
Yes	45	24.04
No	59	75.96
Personal history of Circumcision		
Yes	46	44.23
No	58	55.77
Personal history of scarification		
Yes	45	43.27
No	59	56.73
WHO clinical stages of children at their enrollement in the cohort		
1	14	13.46
2	18	17.31
3	64	61.54
4	08	07.69
WHO clinical stages at the moment of the study		
1	64	61.54
2	27	25.96
3	13	12.50
Jaundice		
Yes	8	7.69
No	96	92.31
Hepatomegaly		
Yes	17	16.35
No	87	83.65
CD4 count in under 5-year children (n=25)		
Moderate deficiency	3	12
Severe deficiency	3	12
Very severe deficiency	13	52
No deficiency	6	24
CD4 count in children above 5 years of age (N=79)		
350	18	22.78
350-500	12	15.19
500	49	63.03
ALT Value in followed-up children (IU/L)		
Normal	90	86.54
49–98	13	12.50
>98	1	0.96

Table III. *Socio-demographic factors and medical history associated with HIV/HBV co-infection*

	HBS$^+$		HBS$^-$		OR [95% IC]	p
	n	%	n	%		
Socio-demographic factors						
Age						
2-5	2	6.45	29	93.55		
5-10	2	4.65	41	95.35	-	**0.070**
10-15	6	20.00	24	80.00		
Sex						
Male	7	13.21	46	86.79	**2.43 [0.52-12.76]**	**0.175**
Female	3	5.88	48	94.12		
Educational level of the children						
Uneducated Enrolled in school	2	8.33	22	91.67		
Pre-school	0	0.00	6	100.00	-	**0.316**
Primary school	5	8.20	56	91.80		
Secondary school	3	23.08	10	76.92		
Socio-demographic factors of mothers						
Maternal age						**0.038**
22–30	0	0.00	21	100.00		
30–40	3	6.82	41	93.18		
40–50	4	22.22	14	77.78		
Mothers' socioeconomic status						
Low	5	7.69	60	92.31	**0.67 [0.10-5.51]**	**0.474**
Average	2	11.11	16	88.89		
Personal medical history of the children						
Immunization against hepatitis B						
Yes	1	3.33	29	96.67	0.25 [0.01-2.09]	**0.154**
No	9	12.50	65	87.50		
Personal history of blood transfusion						
Yes	5	12.00	40	88.00	1.35 [0.31-5.87]	**0.449**
No	5	8.47	54	91.53		
Personal history of circumcision						
Yes	8	17.39	38	82.60	5.89 [1.07-42.72]	**0.019**
No	2	5.17	56	94.83		
Personal history of scarification						
Yes	7	15.56	38	84.44	3.44 [0.73-18.08]	**0.072**
No	3	5.08	56	94.92		

HIV and HBV co-infection was significantly associated with the presence of hepatomegaly (p=0.00) OR 19.60 [3.69-117.37]. WHO HIV infection stage (p=0.337) and jaundice (p=0.56) were not associated with HIV/HBV co-infection. At biological level, HIV/HBV co-infection was significantly associated with ALT value (p=0.001). HIV/HBV co-infection was not associated with the immune status of children under or above 5 years (p=0.333and p=0.497) (Table IV).

Discussion

Attainment of survey objectives

HIV/HBV co-infection frequencies on infected children attended in CHD-Borgou were calculated. The socio-demographic, clinical and biological characteristics of the children co-infected by HIV and viral hepatitis B attended in CHD-Borgou were described. The factors associated with HIV and viral hepatitis B co-infection in HIV-positive children followed up in CHD-Borgou were identified. Therefore, the set objectives have been achieved. This survey is a preliminary study which helps get baseline data on the topic. In addition, the study contributed to strengthen care management for children living with HIV and put into practice recommendations relating to HIV/HBV co-infection according to available resources; thus HBsAg is systematically required from all children and ART is adjusted when HBsAg is positive.

Validity and relevance of the study

It was a cross-sectional descriptive study conducted in CHD/Borgou of Parakou. The hospital setting was compatible with the research topic. All the patients were

Table IV. *Clinical and immunological factors associated with HIV/VHB co-infection.*

Variables	HBS$^+$		HBS$^-$		OR [IC à 95%]	P
	n	**%**	**n**	**%**		
WHO HIV stage						
1	0	0,00	14	100,00		
2	0	0,00	18	100,00	**-**	**0,074**
3	10	15,63	54	84,38		
4	0	0,00	8	100,00		
Jaundice						
Yes	1	12,50	7	87,50	1,38	**0,56**
No	9	9,38	87	90,63		
Hepatomegaly						
Yes	7	41,18	10	58,82	**19,60 [3,69-117,37]**	**0,000**
No	3	3,45	84	96,55		
CD4 (age<5 years)						
Moderate deficiency	1	33,33	2	66,67	**-**	**0,333**
Severe deficiency	0	0,00	3	100,00		
Very severe deficien	1	7,69	12	92,31		
No deficiency	0	0,00	6	100,00		
CD4 (age>5 years)						
<350	2	11,11	16	88,89	**-**	**0,446**
350-500	0	0,00	12	100,00		
>500	6	12,24	43	87,76		

selected within the same setting. Most authors who had dealt with this topic operated in the same setting. However, to statistically enhance the quality of the research work, the survey could have been also carried out in other specialized centers in care for HIV-positive children in other towns of Benin.

The choice of cross-sectional approach and descriptive type was appropriate for this study. They helped collect data at a specific time and once in each survey respondent. It is a method that enables to calculate the frequencies and description of affected subjects' characteristics. The sampling technique used is exhaustive given the reduced number of children followed-up on a regular basis in CHD-B. Like many authors, we took a census of all the patients.

As far as hepatitis B screening is concerned, we only searched for HBsAg like many authors in the works consulted through review of published literature. As regards hepatitis B, HBsAg is the first intention marker. It had been recommended at the 1st European consensus conference on hepatitis and HIV that HBsAg and Ac (anti-HBc) be systematically tested in all patients [9]. Due to limited technical support and financial resources, more often that recommendation is not implemented in the field, especially in limited resource settings. The same reasons explain why we did not associate with HBsAg the search for other markers (HBe Ag, HBeAc and HBV DNA). This implies a risk of minimization of hepatitis B frequency due to occult hepatitis B which represents about 5% of hepatitis cases [10]. Moreover, in this research work, we had not examined mother-to-child transmission of viral hepatitis B. This should have been an important qualitative factor in this work.

In short, the methodological approach applied is appropriate for the research topic and consistent with the one identified in literature. Therefore, the results achieved are acceptable and interpretable within the limits of progression of the study. However, due to purposive sampling, results generalize to the pediatric population of Parakou will not be possible.

Analysis and comparison of results

Socio-demographic characteristics of children and mothers in the study population

On admission, the mean age of the children was 8 years ± 4.03 years with extremes ranging from 2 to 15 years. The age group most represented was the one from 10 to 15 years. In our survey, the mean age was higher than the one found in other studies. In their research work, Sadoh and *al*. had estimated child mean age at 6.76 years ± 3.8 years with extremes from 10 months to 17 years [11]. For his part, Ademola had found a mean age of 7 years ± 4.2 years with extremes from 8 months to 15 years. According to that study, most children were under 5 years of age [12]. The reason for this may be that most children involved in our survey had not been followed up within the framework of the prevention of mother-to-child transmission (PMTCT) program but were diagnosed rather late at an older age during their hospitalizations for various diseases.

There was no gender dominance in this work, sex ratio being 1.03. This result is different from the one reported by Sadoh and *al*. in Nigeria who found a sex ratio of 1.42

whereas Jafri and *al*. in Pakistan found 1.04 similar to ours [11,13]. By contrast, in Brazil, Villar had found a sex ratio of 0.93 [14].

In this work, 83 children (79.81%) had their mothers alive. Those mothers had a lower socioeconomic status in 78.31% of the cases. In Nigeria, Sadoh and *al*. had also found in 56.3% of the cases a low socioeconomic status in mothers. This may be due to the higher frequency of disadvantage and vulnerable classes among HIV-positive women. Indeed, HIV would have a negative impact on the infected subjects' productivity. In fact, HIV-associated morbidity and opportunistic infection outbreaks sometimes reduce the output of those patients [11].

Almost half of mothers (48.19%) had primary school level while 28.92% of them were not enrolled in schools. In Benin, as in other African countries, the enrollment rate for young girls is low with elevated school dropout rate. Lower level of education could induce failure to properly manage modes of transmission and risk behaviors to be avoided while addressing the challenge of HIV.

Medical history of the children

Immunization coverage rate for hepatitis B is still low in the HIV-positive children of our cohort (28.85%). Although immunization against HBV had been included in the Expanded Programme on Immunization (EPI) in Benin, few mothers have met immunization appointments. This explains that lower rate of immunized children was found in our study population.

Among the 53 male children diagnosed, 46 had a personal history of circumcision (86.79%). In Nigeria, Sadoh and *al.* had reported in their study that 73.1% of HIV infected children were circumcised; this may be due to the fact that circumcision is a culturally accepted practice in Africa [11]. Almost one in every four (04) children had a personal history of blood transfusion. Our results are identical to those of Sadoh and *al*. who had reported a slightly higher rate of 37.4% [11]. Scarification personal history was found in 43.27% of children for various reasons such as tribal marks and its use for exorcism or cure. Scarification, circumcision and blood transfusion are all risk factors for transmission of both HIV and hepatitis.

Clinical, immunological and virological characteristics of the children

Most cases in our study were WHO clinical stages 1 and 2 whereas Sadoh and *al.* had reported that most children were in stage 3. The difference is based on the fact that these children had been diagnosed on admission prior to the start of ART while in our cohort children were already followed up and under treatment; this has certainly improved their clinical status.

A very severe immune deficiency was found in 52% of the children under 5 years while 63.03% of those above 5 years had normal CD4 count (> 500). The longer duration of ART in children above 5 years and HIV detection among hospitalized children thereby enabling their inclusion in the follow-up cohort could explain these results.

The children in our cohort had a normal ALT value in 86.54% of the cases as also reported by Toussi and *al* in New York [15].

Frequency of HIV/HBV co-infection

The 9.62% frequency found in our research is close to the one reported by Sadoh and *al.* in Benin City (7.7%), Ademola and *al.* in Benue State in Nigeria (7.8%) and Mutwa in Rwanda (7%) [11,12,16]. Bhargava and *al*. in India and Rouet in Côte d'Ivoire found a frequency higher than ours (12.1% and 29.70%) [7,17]. Other authors found much lower rates oscillating between 1.2% and 3.6% [14,15,18,19]. Most of the different risk factors are risk factors for transmission of both infections. HIV infection and HBV infection do not spare any continent and their coexistence is increasingly found in HIV-infected children. Actually, in West Africa, according to some authors and CDC in 2012, hepatitis B prevalence among the general population was > 8% [6,20]. This prevalence providing background information could well account for such higher prevalence of childhood HIV/HBV co-infection in Benin. Hepatitis B screening should thus be systematic in all those infected children.

Factors associated with HIV/HBV co-infection

HIV/HBV co-infection was more found within the age group from 10 to 15 years (20%). This result may be due to the fact that introduction of hepatitis B vaccine in the Expanded Programme on Immunization (EPI) in Benin was effective in 2003. Thus, all the children of that age group would be more exposed to infection risk since they would have not received vaccine against HBV. However, there was no associated significant statistics between child age and HIV/HBV co-infection (p=0.070). The same observation had been made by Sadoh and *al*. in Nigeria and Villar in Brazil [11,14]. On the contrary, Ademola in Nigeria and Zhou and *al*. in China concluded that children above 11 years were significantly more HIV/HBV co-infected [12,19].

As regards sex, we did not note a significant association with HIV/HBV co-infection (p=0.205). Many authors made the same remark [11-14,18].

HIV/HBV co-infection was significantly associated with maternal age (p=0.038) based on a higher proportion of co-infected children for mothers aged from 40 to 50 years. If the absence of immunization was pointed out above as a cause, the hypothesis of vertical transmission of hepatitis B in those children should not be excluded. Screening for HBsAg in mothers could have given us further insight into this mode of hepatitis B transmission.

The socioeconomic status was average or low in the mothers of co-infected children without significant association with HIV/HBV co-infection (p=0.474). A similar result was found in the research work conducted

by Sadoh in Nigeria but without significant difference [11].

Almost all the co-infected children in this study were not or were incompletely immunized against hepatitis B (9 out of 10). A statistical significant association had not been found (p=0.154) unlike Jafri who had found in Pakistan an association between HIV/HBV co-infection and immunization against HBV [13].

Histories of blood transfusion and scarification were not significantly associated with HIV/HBV co-infection; by contrast it was significantly associated with history of circumcision (p=0.033). This association with circumcision may be due to traditional methods of circumcision most often performed at home with high risk of both HIV and HBV infection.

All the co-infected children were in clinical stage 3 without significant association with co- HIV/HBV infection. The same result had been reported by Sadoh and al [11]. On the contrary, Ademola had noted that most co-infected children were in stages 1 and 2 without statistically significant association [12]. The main clinical signs had found associated with hepatitis were jaundice and hepatomegaly. HIV/HBV co-infection was statistically associated with the presence of hepatomegaly (p=0.00). Hepatomegaly is traditionally frequent in both HIV infection and HBV infection as a result of the cytopathic effect of HBV and even of HIV on hepatocytes, but also as a result of ART toxicity.

As regards the immune status of co-infected children, (7 out of 10) were without immune deficiency. The same observation had been made by Mutwa and al in Rwanda who had found in his study that most co-infected children had a healthy immune status [16]. In the studies conducted by Ademola and Toussi, most children were characterized by a severe immune deficiency; this was due to the fact that those children had been diagnosed for HBV at the time of HIV infection diagnosis and before starting antiretroviral therapy [12; 15].

HIV/HBV co-infection was significantly associated with ALT rate (p=0.001). These results show that most infected children had probably viral hepatitis during the active phase with higher cytolysis. These results are similar to those obtained by Toussi and *al*. in New York and Telatela in Tanzania [15,18]. By contrast, Ademola in Nigeria and Zhou in China had noted that although ALT rate was slightly high or sometimes normal in the co-infected, it was not associated with co-infection [12,19]. Nevertheless, ALT normality in the co-infected does not exclude high virus replication.

Besides all these results, we consider that in any HIV-infected child, screening for hepatitis B should be systematic and in the case of positive status, the treatment schedule should consist of two active molecules on HBV. Beyond treatment, immunization against hepatitis B is the best option for preventing HBV infection in children whether they are HIV-infected or not by simply modifying the immunization strategy of the current Expanded Programme on Immunization.

Conclusion

Among the 104 screened children, less than three out of ten children were vaccinated against hepatitis B, with history of blood transfusion and four out of ten had history of circumcision and scarification. Nearly one child among ten was HIV/HBV co-infected. HIV/HBV co-infection was associated with maternal age (p=0.038), history of circumcision (p=0.019), presence of hepatomegaly (p=0.00) and with rate of ALT (p=0.001).

In the light of these results, HIV/HBV co-infections should systematically be diagnosed in children adequately followed up during care practice. This careful management must be ensured through the screening of those co-infections in HIV-positive women and serovaccination at birth of exposed children for their protection. It must be ensured by an active ART on both HIV and hepatitis B virus.

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