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Mother-to-Child HIV Transmission Factors in Exposed Children at University Hospital Center of Treichville (Abidjan, Cote d'Ivoire)

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Abstract

Background: The elimination of HIV transmission from mother to child is currently possible. Côte d'Ivoire, which has a 4.6% HIV prevalence among women, is one of 22 pilot countries for the elimination of mother-to-child transmission of HIV. Since 2015, Côte d'Ivoire has adopted new strategies according to the WHO B+ guidelines. **Objective:** To identify factors associated with mother-to-child HIV transmission in children born of seropositive mothers managed at Treichville university hospital. **Material and methods:** A case-control study was conducted in the obstetrics department at Treichville university hospital, between January 2013 and December 2015. It involved children born to mothers infected with HIV, whose first PCR (Polymerase Chain Reaction) result was available during this period. A standardized questionnaire on data related to exposed children and their mother was used. Factors associated with mother-to-child HIV transmission were investigated using logistic regression. **Results:** A total of 214 HIV-exposed children were included in the study with a sex ratio of 0.9. The majority of the children were born by vaginal route (52.8%) and received post-exposure prophylaxis (88.3%) and replacement feed (51.9%). Their mothers received antiretroviral therapy during pregnancy in 45.3% of the cases. The first PCR was performed at the sixth week of life in 52.3% of cases. The prevalence of HIV infection in exposed children was 7.5% (95% CI = 4.5% - 11.8%). In multivariate analysis, the absence of antiretroviral prophylaxis in children [aOR = 4.3, 95% (1.2 to 15.6), p = 0.03], the mixed feed [aOR = 3.8, 95% (1.1 - 13.1), p < 0.03], the failure to take antiretroviral regimen during pregnancy [aOR = 8.0, 95% CI (1.9 - 32.4), p < 0.003], were associated with mother-child HIV transmission. **Conclusion:** The mother-to-child HIV transmission rate remains high in our practice. Strategies to reduce situations that do not comply with current

recommendations should be considered to prevent mother-to-child HIV transmission.

Keywords

HIV-Exposed Children, Mother-to-Child Transmission, DBS/PCR

1. Introduction

Mother-to-child HIV transmission remains a major public health issue in sub-Saharan Africa. Indeed, according to UNAIDS, 160,000 children have been newly infected with HIV in 2016, mainly through mother-to-child transmission. And these infections occurred in 85.6% of cases in sub-Saharan Africa [1].

Moreover, HIV infection is more aggressive in children since half of infected children die before their second birthday in absence of adequate treatment [2].

In developed countries, the elimination of mother-to-child HIV transmission has been effective since the early 2000s, thanks to wide distribution of antiretroviral therapy during pregnancy. In fact, studies from Europe and the US reported mother-to-child transmission rates of HIV less than 1% [3] [4]. However, the majority of studies in our subregion reported generally high rates of mother-to-child transmission. These rates were 12.3% in the Saizonou study in Benin [5] and 16.9% in the Imade study in Nigeria [6].

In resource-limited countries, significant efforts have also been made in recent years towards the elimination of mother-to-child HIV/AIDS transmission. Concerning Côte d'Ivoire, the culmination of these achievements was the adoption of Option B+ of WHO in 2015 [7]. The implementation of this new strategy justifies updating the epidemiological data on the mother-to-child transmission of HIV. The objective of this work was to report, in our practice, the prevalence and factors associated with mother-to-child HIV transmission in exposed children.

2. Materials and methods

2.1. Materials

- Type and site of study

This is a single-center case-control study conducted over a period of three years, from January 2013 to December 2015. It was conducted in the obstetrics and gynecology department at Univeristy Hospital Center of Treichville (CHUT) which is one of the three level 3 maternities of reference of Abidjan. This service has a screening and medical managementunit for people living with HIV. This unit is run by a team including obstetrician-gynecologists, pediatricians, pharmacists, laboratory technicians, midwives, social workers, community counselors and data managers. The pediatricians essentially carry out the medical follow-up of children exposed to HIV until knowledge of their

definitive HIV status.

- Study population

The study focused on HIV exposed children (born to HIV positive mothers) who were followed in our department during the study period. Were included all the exposed childrenwhose follow up was effective until they got their definitive HIV status.

We excluded from the study children having incomplete files, children whose PCR/DBS (Polymerase Chain Reaction by Dried Blood Spot) was not yet available, and children born out of the service.

2.2. Methods

- Diagnosis of HIV status of children

The diagnosis of HIV infection in exposed children was based on the realization of a PCR/DBS from the sixth week of life.

- Data collection and variables studied

To carry out this work, we developed a standardized questionnaire including the different variables needed for our study. Follow-up records of HIV-exposed children, delivery records, and care records for people living with HIV from mothers were used as a basis for data collection.

The data collection was made on a standardized questionnaire from the follow up records of children exposed to HIV, birth registers, and the mother management sheets. The data were collected from trained investigators who were all doctors.The main variable studied was the HIV status of exposed children which has been defined in two classes: "HIV positive" or "HIV negative". The other variables studied concerning children were: mode of delivery, birth weight, sex, age of PCR, antiretroviral prophylaxis, cotrimoxazole prophylaxis and the type of foodIn the mothers the variable studied were: age, profession, level of education, marital status, parity, number of antenatal consultation, timing of HIV testing, revelation of HIV status to the spouse and the antiretroviral treatment during pregnancy.

- Statistical analysis

Data analysis was performed using the SPSS.22 software. A descriptive analysis was first performed. A logistic regression was used to identify risk factors for mother-to-child HIV transmission (dependent variable). In univariate analysis the variables were compared using the chi 2 test or Fischer test (when recommended). We have included in the multivariate model independent variables associated with the mother-child HIV transmission in the univariate analysis with a significance level of < 0.20. A value $p < 0.05$ was used as the threshold of significance. Odds ratios with a confidence interval of 95% were calculated for each of the risk factors for mother-child HIV transmission.

3. Results

3.1. Description of Study Population

Of the 358 HIV-exposed children recorded during the study period, 214 were

included in the study, representing a response rate of 59.8% (Figure 1).

Out of the 214 children, 114 (53.3%) were female. The first PCR was performed at the sixth week of life in 52.3% of cases. With a median birth weight of 2925 g (interquartile: 2600 - 3200 g), more than half of them (52.8%) were born vaginally. Overall, 88.3% of children had antiretroviral prophylaxis and replacement feeding for 51.9% of them (Table 1).

The characteristics of mothers of HIV exposed infants are shown in Table 2. The median age of the mothers was 34 years (interquartile: 31 - 37 years), HIV seropositivity was known prior to pregnancy in less than half of the cases (42.5%). The majority of them did not reveal their HIV status to their spouses (53.7%), and hadn't received antiretroviral tritherapy during pregnancy (54.7%).

3.2. Prevalence of HIV Infection in Exposed Children

Of the 214 children in our series, 16 were infected with HIV. The prevalence of HIV infection in exposed children was therefore 7.5% with a 95% confidence interval (CI) between 3.9% - 11.0%.

3.3. Factors Associated With Mother-to-Child Transmission

The multivariate analysis showed that the absence of antiretroviral prophylaxis in children [aOR = 4.3, 95% CI (1.2 - 15.6), p = 0.03], the mixed feeding [aOR = 3.8, 95% CI (1.1 - 13.1), p < 0.03], p < 0.009] and the failure of an antiretroviral regimen during pregnancy [aOR = 8.0, 95% CI (1.9 - 32.4), p < 0.003], were significantly associated with mother to child HIV transmission (Table 3).

4. Discussion

The prevalence of HIV infection in children exposed in our series was very high (7.5%) compared to the rate of transmission from mother to child of HIV

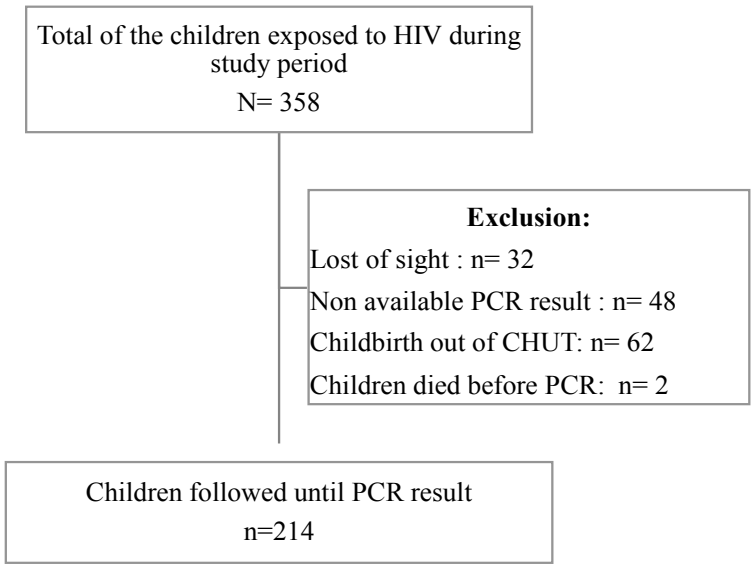

Figure 1. Diagram explaining the enrollment process in the study.

Table 1. Characteristics of HIV exposed children in the study.

Characteristics	Population	Percentage (%)
Age at first PCR test		
• At 6 weeks	112	52.3
• 7 weeks to 6 months	83	38.8
• After 6 months	19	8.9
Sex		
• Female	114	53.3
Male	100	46.7
Birth weight (grams)		
<2500	42	19.6
2500 - 3999	165	77.1
≥4000	7	3.3
Childbirth mode		
• Vaginally	113	52.8
• Elective caesarean section	84	38.8
• Caesarean section in emergency	17	7.9
Antiretroviral (ARV) prophylaxis of children		
• Yes	189	88.3
• No	25	11.7
Cotrimoxazoleprophylaxis		
• Yes	164	76.6
• No	50	23.4
Feeding pratice		
Feeding replacement	111	51.9
Exclusive Breastfeeding	54	25.2
Mixed feeding	49	22.9

reported in the western series that are less than 1% [8] [9].

There are some studies in sub-Saharan Africa that have reported rates of mother-to-child transmission of HIV close to those of industrialized countries. Thus, Martin [10] in Angola and Technau [11] in South Africa, reported in their studies, the respective mother-child transmission rates of 4.1% and 1.8%. It should be noted that the reported rates in the majority of studies conducted in countries with limited resources, are generally higher than 10% [12] [13] [14]. These differences are certainly related not only to low rates of antiretroviral treatment coverage in pregnant women in our countries with limited resources but also to the inhomogeneity of antiretroviral regimens for mother-to-child transmission of HIV in these studies. In our series, only 43.5% of pregnant women underwent antiretroviral tritherapy.

Table 2. Characteristics of mothers of HIV exposed children during the study.

Characteristics	Population	Percentage (%)
Maternal age (years)		
• 20 - 29	35	16.4
• 30 - 39	159	74.3
• ≥40	20	9.3
Number of children		
• 1	76	35.5
2 - 3	108	50.5
≥4	30	10
Profession		
Liberal	108	50.5
Employee	47	21.9
Household	35	16.4
Students	24	11.2
Level of school education		
None and primary	33	15.4
• Secondary and higher	181	84.6
Marital status		
• Single	63	29.4
• In a relationship	151	70.6
Number of antenal consultation		
• 1 - 3	10	4.7
≥4	204	95.3
Period of HIV testing		
Before pregnancy	91	42.5
During Pregnancy	101	47.2
Maternity	22	10.3
Revealing HIV status to spouse		
Yes	99	46.3
No	115	53.7
ARV regimen during pregnancy		
No	22	10.3
Antiretroviral prophylaxis	95	44.4
Antiretroviral tritherapy	97	45.3

Our study also showed that a number of factors were associated with an increased risk of mother-to-child transmission of HIV in exposed children.

Thus, in our work, the risk of being infected with HIV was 8 times higher in

Table 3. Logistic regression analysis of factors associated with mother to child HIV transmission.

	PCR Result		Univariate analysis		Multivariate analysis	
	Positive (n = 16)	Negative (n = 198)	OR [95% CI]	p	aOR [95% CI]	p
Age at PCR						
At 6 weeks	12	90	1			
>6 weeks	4	108	3.6 [1.1 - 11.5]	0.02		
ARV prophylaxis						
Yes	9	180	1		1	
No	7	18	7.8 [2.6 - 23.3]	<0.01	4.3 [1.2 - 15.6]	27
Cotrimoxazoleto child						
Yes	8	156	1			
No	8	42	3.7 [1.3 - 10.5]	9		
Mixed feeding						
No	8	157	1		1	
Yes	8	41	3.8 [1.3 - 10.8]	7	3.8 [1.1 - 13.2]	31
Birth weight (g)						
≥2500	11	161	1			
<2500	5	37	1.9 [0.6 - 6.0]	0.37		
Elective caesarean section						
Yes	3	80	1			
No	13	118	2.9 [0.8 - 10.6]	0.15		
Occupation with income						
Yes	10	145	1			
No	6	53	1.6 [0.5 - 4.7]	0.35		
Level of education						
Secondary and higher	11	170	1			
None and primary	5	28	2.7 [0.9 - 8.5]	0.14		
Marital status						
Single	6	57	1			
In a relationship	10	141	1.5 [0.5 - 4.3]	0.46		
Number of prenatal consultation						
≥4	13	191	1			
<4	3	7	6.3 [1.4 - 27.2]	0.03		
ARV for the prevention of mother-to-child HIV transmission						
Yes	9	183	1		1	
No	7	15	9.5 [3.1 - 29.1]	<0.01	8.0 [1.9 - 32.4]	0.003
HIV status revealed to the spouse						
Yes	10	105	1			
No	6	93	1.5 [0.5 - 4.2]	0.46		

OR: odds ratio; CI: confidence interval; p: P-value; aOR: adjusted odds ratio.

children whose mothers had not received any antiretroviral regimen during pregnancy. Our results are consistent with data from the literature. The impact of antiretroviral therapy during pregnancy on the prevention of mother- to-child HIV transmissionis important [14] [15]. In fact, maternal plasma viral load detectable in the vicinity of delivery is by far the most important risk factor of mother to child transmission [8] [16]. Antiretroviral combination therapy by lowering maternal viral load reduces the risk of mother-to-child transmission.

This risk is even almost zero when this antiretroviral tritherapy is initiated from the beginning of pregnancy [3] [8] [17].

Moreover, several observations had shown the need for a minimum of 12 weeks of effective antenatal antiretroviral treatment to control maternal viral load [18] [19].

As in most studies, our series had found a significant association between the lack of antiretroviral prophylaxis in exposed children and mother-to-child transmission. The risk of HIV infection was 4.3 times higher among children who had not received antiretroviral prophylaxis than those who had received antiretroviral prophylaxis. In fact antiretroviral prophylaxis in children exposed minimizes the risk of transmission of HIV during labor and childbirth [12].

Our analysis also showed that the risk of being infected with HIV was significantly higher in the exposed children who had a mixed feeding. Our observation is consistent with those of several previous studies on the role of mixed feeding in increasing the risk of mother to child transmission of HIV infection [20]. The authors converge on the hypothesis that a mixed feeding causes damage to the intestinal wall favoring passage of virus in the blood [21]. Unlike the mixed feed, exclusive breastfeeding and replacement feeding respect the integrity of the intestinal wall of the child [22]. Besidesexclusive breast feeding provides protective immune factors to the child [22].

Unlike other African series, our analysis found no significant association between the mother-child transmission and the age of HIV infection screening by PCR/DBS in exposed children [12] [13].

Study Limitations

In this study, it is possible that the actual number of infected children is underestimated because PCR/DBS screening of children has still not been done at the end of exposure, ie after weaning for children who were breastfed.

Moreover, the fact that the study is carried out in a CHU, where access to caesarean section, antiretrovirals and PCR is easier (unlike the other healthcare centers in the country), may lead to selection bias, making difficult the extrapolation of our results the general population.

In addition, the retrospective nature of the study may lead to information biases related mainly to missing or incomplete records.

5. Conclusions

Despite the remarkable evolution of the recommendations for the prevention of

mother-to-child transmission of HIV infection, the rate of mother-to-child transmission in our resource-constrained countries remains high. The main factors associated with this mother-to-child transmission of HIV were the absence of antiretroviral therapy during pregnancy, the absence of antiretroviral prophylaxis in the post-natal infant and mixed breastfeeding.

If mother-to-child transmission of HIV is to be eliminated, remedial action should be initiated to address these situations that are not consistent with the recommendations. Thus, it seems important to us to develop strategies to increase the coverage of activities of prevention of mother-to-child HIV transmission.

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Conflict of Interest

None.

Ethical Considerations

Due to the retrospective nature of the study, patients' consent was not required. However, the confidentiality of patients' records was respected.

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