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Prevention of Mother-to-Child Transmission of HIV: Experience of a Level 2 Health Center in Senegal

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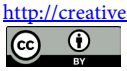

Abstract

The elimination of vertical transmission of HIV from mother to child is a major global goal. In Senegal, the transmission rate was estimated at 3.2% in 2017. To reduce or even eliminate this transmission, Senegal has implemented various strategies and programs adopted and applied nationally. Thus access to services for the prevention of mother-to-child transmission of HIV has been extended to the level of the health post (the lowest level of the country's health pyramid) with a delegation of tasks to paramedical staff (nurse, midwife) in the diagnosis and therapeutic management. **Objectives:** To describe the epidemiological profile of HIV (Human Immunodeficiency Virus)-positive mothers, to assess the care of children born to HIV-positive mothers, to determine the rate of HIV transmission from mother to child. **Patients and Method:** We carried out a retrospective, cross-sectional and descriptive study of all live newborns of HIV-positive mothers who gave birth at the Gaspard Kamara Health Center (a level 2 health center in Dakar, Senegal) between January 1, 2015 and December 31, 2018. The data were collected from prevention of mother-to-child transmission (PMTCT) prenatal follow-up registers and files, delivery files and registers, and neonatology and pediatric follow-up files, and exploited using the Epi info 7 software. **Results:** There were 98 children of seropositive mothers. The epidemiological profile of the HIV-positive woman was that of a young woman aged between 16 and 43 with an average of 31.31 years, pauciparous (>65% of cases) from Dakar center (>75% of cases), housewife with a low socio-economic level (63.1% of cases), married in almost all cases, with HIV profile (in almost all cases) and diagnosed before pregnancy (51.02%). The analysis of the children's data revealed a predominance of girls (52.04%) with a good birth weight (2964g on average) and a pregnancy carried to term in more than 95% of cases. ARV prophylaxis was almost entirely respected with triple therapy (AZT + 3TC + NVP) in a fixed combination as proto-

col. Protected breastfeeding (80.21%), including 6 months of exclusive protected breastfeeding, was the rule for the mode of feeding. Three children were diagnosed positive with PCR1 as with serology (3.06%). **Discussion and Conclusion**: the initiatives and strategies put in place in Senegal have enabled a significant reduction in mother-to-child transmission of HIV and deserve to be supported by insisting on primary prevention, programming and good follow-up of pregnancies, and a good support for HIV-positive women.

Keywords

Mother-to-Child Transmission, HIV Infection, Prevention, Antiretroviral Treatment

1. Introduction

Despite major advances in the epidemiological situation in recent years, HIV infection remains a concern. Globally, at the end of 2019, 81% of PLHIV knew their status, 67% of people who knew their status were on treatment, 59% of people on ARV treatment had been able to have viral suppression [1]. To curb this pandemic, various strategies have been implemented, including the prevention and then the elimination of mother-to-child transmission of HIV. In Senegal, the initiatives and strategies put in place and contained in the national strategic plan 2018-2022, such as the acceleration plan towards the elimination of MTCT and the catch-up plan, have contributed significantly to improving the reduction of the TME with a national vertical transmission rate of 3.2% in 2017 to 2.6% in 2019.

This work, carried out in the Gaspard Kamara health center, aimed to describe the epidemiological profile of mothers, evaluate the care of children born to HIV-positive mothers and to determine the rate of HIV transmission from mother to child.

2. Patients and Method

We carried out a retrospective, cross-sectional and descriptive study at the Gaspard Kamara Health Center based on the analysis of data from a collection sheet concerning mother-to-child transmission of HIV, over a period of 4 years, between January 1, 2015 and December 31, 2018. The study included all live newborns whose HIV-positive mothers delivered at the facility during the study period.

The data listed on the survey sheet was collected from PMTCT prenatal follow-up registers and files, delivery files and registers, and neonatology and pediatric follow-up files, and the exploitation was made using the Epi info 7 software. The variables studied were socio-demographic characteristics (age, marital status, profession), obstetrical data (gesture, parity, number of children living, number of deceased children, HIV status, ARV treatment, term of pregnancy, mode of delivery), parents' serological status (maternal HIV profile, time of HIV

diagnosis, start of ARV treatment, becoming of the mother, father's HIV status), neonatal and pediatric data (sex, birth weight, resuscitation at birth, prematurity, admission to neonatology, ARV prophylaxis and protocol, mode of breastfeeding, cotrimoxazole prophylaxis, future of infected children), pediatric biological and therapeutic follow-up (PCR1, PCR2, retroviral serology, early diagnosis, final diagnosis, viral load of infected children).

The categorical variables were described by the number and frequency in each class, and the quantitative variables by the mean and the standard deviation after verification of normality (graphical evaluation of the distribution).

3. Results

We collected 98 children of HIV-positive mothers during the study period from 2015 to 2018. Table 1 summarizes the sociodemographic characteristics.

The age was given in 92 patients with an average of 31.31 ± 6.83 years and extremes of 16 and 43 years. The mode and the median were 33 years and 55.43% of the patients (n = 51) were aged between 20 - 34 years.

More than 3/4 of the patients 76.53% (n = 75) came from central Dakar. The profession was given in 95 patients and more than half of the patients 63.16% (n = 60) were housewives, and almost all of the patients 93.88% (n = 92) were married.

Table 1. Socio-demographic characteristics of the mother.

Socio-demographic characteristics	Number (n)	Percentage (%)
Age (years)		
<20	6	6.52
20 - 34	51	55.43
35 - 44	35	38.04
Place of origin		
Dakar	75	76.53
Suburb	15	15.31
Region	8	8.16
Professional activity		
Household	60	63.16
Employee	6	6.32
Informal	29	30.53
Marital status		
Bride	92	93.88
Single	4	4.08
Divorcee	1	1.02
Widow	1	1.02

Table 2 summarizes the gestational age at diagnosis.

Slightly more than half of the patients 51.02% (n = 50) had been diagnosed positive before pregnancy. Almost all of the patients 91.84% (n = 90) had an HIV 1 serological profile.

Table 3 specifies the duration of ARV treatment according to the time of diagnosis.

The average parity was 2.42 pares with a standard deviation of 1.43 and extremes of 1 and 8 pares. The mode and the median were 2 pares. Eight patients (8.5%) had a history of deceased children and three (3.2%) HIV-positive children were all on ARV treatment.

Table 4 shows the distribution of patients according to obstetric history.

The age of pregnancy was given in 92 patients and 95.65% (n = 88) of pregnancies were full term. The mode of delivery had been informed in 94 patients and the vaginal route was predominant (77.66%).

Data on the child revealed a majority female sex (52.04%) with a sex ratio of 0.92; an average birth weight was 2964 ± 454 grams with extremes of 1850 grams and 4190 grams. Six newborns (6.12%) were premature; four were admitted in neonatology (4.08%) whose reasons were the hospitalization of the mother in 2 newborns and 2 cases of neonatal infection. Most newborns 89.80% (n = 88) were put on prophylactic ARV treatment and triple therapy (AZT + 3TC + NEV) was the main protocol 77.27% (n = 68).

Table 5 shows the distribution of patients according to the newborn ARV

Table 2. Distribution of patients by time of diagnosis.

Diagnosis age	Pregnancy age	Frequence	Percentage
Before pregnancy		50	51.02
During pregnancy	1st trimester	8	8.16
	2nd trimester	19	19.39
	3rd trimester	15	15.31
	Not specified	3	3.06
After childbirth		3	3.06
Total		98	100.00

Table 3. ARV duration according to time of diagnosis.

Time of diagnosis	Duration of ARV treatment in months				
	N	Minimum	Mean standard	Deviation	Maximum
Before pregnancy	50	11.57	58.07	32.43	171.47
During pregnancy	43	0.17	6.82	12.57	79.93
After childbirth	1	0.03	0.03	-	-

Table 4. Distribution of patients according to obstetric history.

Obstetric history		Frequence	Percentage
Gesture	Primigest	20	21.28
	Paucigest	62	65.96
	Multigesture	7	7.45
	Great multigesture	5	5.32
Parity*	Primiparous	21	22.34
	Pauciparous	61	64.89
	Multiparous	5	5.32
	Great multiparous	7	7.45
Deceased child	1	7	7.45
	4	1	1.06
HIV positive child	1	3	3.19

*Parity: Pauci (gesture, parous) = 2 - 3; multi (gesture, parous) = 4 - 5 and great multi (gesture, parous) = 6+.

Table 5. Distribution of patients according to ARV protocol for newborns.

Newborn ARV protocol	Frequence	Percentage
AZT + 3TC + NEVIRAPINE	68	77.27
NEVIRAPINE	11	12.50
AZT + NEVIRAPINE	1	1.14
AZT + 3TC + LPVR	7	7.95
AZT	1	1.14
Total	88	100.00

protocol.

The mode of feeding was informed in 96 children: 80.21% (n = 77) were under protected breastfeeding. Almost all of the children 87.91% (n = 80) were on prophylactic treatment with cotrimoxazole.

Biological examinations were carried out almost all the children. The positivity rate was 3.06% (n = 3) on PCR1 and 3.06% (n = 3) on serology. The characteristics of the 3 children are summarized in Table 6.

The average age at PCR1 was 2.39 ± 2.28 months and extremes of 1.5 and 5 months. The mode and median were 1.5 months (6 weeks). PCR2 was performed at 3 months. The age of serology was given in 86 children with an average of 19.26 ± 8.9 months and extremes of 14 and 66 months. The mode and median were 15 months.

4. Discussion

The average age of the mothers was 31.31 years. This young age, found in other

Table 6. Summary of the history and particularities of the 3 HIV-infected children.

	Case 1: sex M born on 17/05/2015 Mother G1 P1; HIV1 profile	Case 2: sex M born on 20/10/2015 Mother G5 P6; HIV1 profile	Case 3: sex F born on 13/02/2017 Mother G3 P2; HIV1 profile
Mother's age	16 years	35 years	34 years
Time of mother diagnosis	3rd trimester	Day 1 after childbirth	3rd trimester
ARV treatment	Yes	No	Yes
Compliance	No	N A	No
Joint status	HIV positive/refusal of treatment	HIV positive	Unspecified
Mode of delivery	Vaginal delivery	Vaginal delivery/twins	Vaginal delivery
Term pregnancy	No (34 weeks + 5 days)	Yes	Yes
Birth weight	2600 g	Twin 2: 2400 g	2750 g
Supply mode	Mixed	artificial	protected
Newborn chemoprophylaxis	Yes	Yes	Yes
Becoming of the mother	Lost to sight after 6 months postpartum/found in November 2020 returned to treatment	Died on D5 postpartum in structure for severe decompensated anemia	Alive on ART, regularly monitored in the structure
Becoming of the newborn	PCR1 made at 6 weeks positive Serology done at 66 months positive On ART since November 2020 VL 11/11/2020: 25, 729	PCR1 made at 6 weeks positive (PCR1 of Twin1 negative) Serology done at 14 months positive (Twin 1 seronegative) On ART since 04/28/2016 at 6 months but compliance problem VL 09/12/2020: 18983	PCR1 made at 6 weeks positive serology done at 14 months positive On ART since 05/28/2018 at 15 months VL 03/7/2018: 9873 VL 01/16/2019: 97823 VL 04/10/2019: 16780 VL 02/12/2020: 7590

African series: between 24 and 31 years for Tonwe-Gold [2] in West Africa, an average age of 28.7 ± 5.9 years according to Diagne-Gueye in Dakar [3], would be explained by marriage at a young age, not yet sufficient accessibility and unmet needs for contraception.

The central position of our health structure at the level of the health map of the Dakar region and its reference character in the care of HIV-positive pregnant women would justify the majority of mothers coming from Dakar center.

The low income of housewives was found in more than half of the cases, explaining their difficulties in accessing information and awareness-raising and socio-educational and medical services.

Marriage, the marital status most found among mothers in our series and in that of Cartoux in Burkina Faso [4], although not implying risky sexual behavior, is not a protective factor of vulnerability for mothers against HIV infection.

The positive retroviral serology of most women before pregnancy who were

on ARVs would be an important factor in preventing mother-to-child transmission of HIV.

The preponderant proportion of pauciparous (more than 65%) in our series, superimposable on that of Azoumah [5], could be explained by the young age of the mothers, the follow-up before pregnancy which made it possible to program it, and the fear of to have infected children.

Almost all deliveries took place at term (more than 95%) proving good prenatal monitoring and constituting a lower risk of per-partum contamination (prematurity being a risk factor).

Caesarean section (<25% of cases) was always for obstetrical indication, therefore not practiced as a means of preventing mother-to-child transmission of HIV. In fact, in countries like Denmark where surgery is practiced as a means of preventing MTCT of HIV, the cesarean section rate could reach 88% [6]. Similar rates of vaginal delivery (>75% in our series) were found by Azoumah (72.7% in Togo) [5] and Millogo-Traoré (88.9% in Burkina Faso) [7].

HIV 1 is almost exclusively found in our cohort (91.84%) and in most series: 96% for Diagne-Gueye [3], 100% for Tall [8]. Indeed, HIV 1 is the predominant profile in Africa and in the world, the rarer HIV 2 mainly concerns people from West Africa [9].

Management by ARV treatment in almost all the mothers (97.96%) complies with the recommendations: systematic and lifelong treatment after screening regardless of the stage and the CD4 count.

The good birth weight of children (average weight of 2964 g) is partly explained by term births (95% of cases), the majority of women being under treatment before pregnancy, the lack of negative influence of HIV infection on pregnancy. Our results can be superimposed on the series of Diagne-Gueye (2900 g of average weight) in Senegal [3] and Azoumah (average weight of 2982 g) in Togo [5]. Fourteen children were born weighing less than 2500 g (14.29%), similar rates in Togo (16.8%) [5] and Burkina-Faso (16.3%) [7]; and a little higher in Dakar (20%) [3].

ARV prophylaxis with fixed combinations in the form of dispersible tablets (with AZT + 3TC + NVP triple therapy as the main protocol for HIV1) has been the national recommendation in Senegal since 2015. For HIV2 the fixed combination used was (AZT + 3TC) dispersible tablet associated with the syrup form (Lopinavir + ritonavir). Our figures (90%) are superimposable to the 99% reported in South Africa [10], and lower than those of Senegal (66%) [3]. The proportion of the remaining 10% could not benefit from a chemoprophylaxis protocol because the mothers gave birth without disclosing their status and/or the newborns were cared for beyond 72 hours.

Protected breastfeeding for 12 months, including 6 months of exclusive breastfeeding followed by diversification with local products from 6 months, recommended by the WHO, is practiced in various ways: 80.21% in our series, 85.5% for Diagne Gueye [3], and 41% for Azoumah [5]. Indeed, several trials have shown the effectiveness of triple therapy in the mother to reduce the risk of

transmission during breastfeeding, hence the need to encourage weaning of the child at 12 months to minimize the risk of contamination; this risk is increased in the event of prolonged breastfeeding [11] [12]. This practice of ART seems to be favored in our study by the low purchasing power of the mothers, the avoidance of the curiosity of others, the need not to raise questions about the absence of breastfeeding, and also the good counseling of care staff on the necessity and the possibility of ART without increasing the risk of MTCT.

Prophylaxis of children with cotrimoxazole was carried out in most cases according to WHO guidelines. It is started from six weeks until the definitive diagnosis of the child. It helps prevent digestive infections that contamination of the child could promote [11].

In our study, no child was contaminated via breast milk, the three cases were positive from early diagnosis (PCR1) at 6 weeks. This diagnosis was confirmed by definitive serology.

Our vertical HIV transmission rate (3.06%) is low compared to that of Azoumah in Togo (9%) [5], is close to the national rates of 3.20% in 2015, 3.15% in 2017 and 2.6% in 2019. In the absence of preventive measures, the transmission rate is estimated at 30% to 40% [13] [14].

Our rate could be explained by the fact that the majority of women were put on ARVs before pregnancy (>50%), with a sharp drop in viral load, even undetectable during pregnancy or childbirth. During our study period we had not started to systematize the measurement of the viral load (VL) at the end of pregnancy. More than 60% of women screened and put on treatment during pregnancy were screened between the first and second trimester of pregnancy. This low rate could also be explained by compliance with childcare protocols (virtually all newborns, *i.e.* 90%, were on ARV prophylaxis at birth and on cotrimoxazole (more than 80%) from 6 weeks of life), by maintaining women in follow-up until the definitive diagnosis of the child thanks to the commitment of community actors with the "Ndèye Dické" strategy which established an interview between the midwife and the seropositive patient, during which his follow-up file is drawn up with all his contact details, the mode of breastfeeding, the choice of the place of delivery, and ARV prophylaxis are discussed. The midwife "Ndèye Dické" sends the HIV-positive woman to the pediatrician from the 8th month of pregnancy. ARVs for the future newborn are delivered, allowing the patient to give birth in the health facility of her choice, and to return after delivery for follow-up. The majority had given birth in our structure, allowing us to considerably increase the rate of ARV prophylaxis at birth, with better adherence to ART.

For the 3 infected children, the identified risk factors were:

- late screening: for case 2, with the mother screened postpartum. It was a twin pregnancy, carried to term, with vaginal delivery. Twin 2 was infected and twin 1 was HIV-negative. Their mother died on D5 postpartum, she could not start ARV treatment. Cases 1 and 3 were detected in the 3rd trimester;
- the problem of therapeutic compliance: case 1 was "non-compliant" with

treatment, and her HIV-positive husband refused to take ARVs. Case 3 had started ARVs outside Senegal, and her ARV intake was irregular until the last month of pregnancy;

- prematurity: for case 1, the term was 34 weeks + 5 days, vaginal birth;
- the method of vaginal delivery: for the 3 cases, especially for case 2, the sero-positive status was unknown at delivery (twin), and for the other two detected late, they were non-compliant;
- the advanced clinical stage: case 2, detected postpartum, had a severe deterioration in general condition;
- the mode of breastfeeding: which was mixed for the case1, despite all the explanations provided to the woman and her husband.

In addition, it should be noted that for the 3 cases, the early diagnosis of the children was made with the PCR1 carried out at 6 weeks, immediately positive then confirmed by serology, therefore probably contaminations during pregnancy, labor or delivery. No cases of contamination of children under ART have been noted.

Concerning the 3 infected children, the viral loads were high. For case 1, the results of the PCR1, for which the sample was taken at 6 weeks, were only received at 6 months, so the child started taking ARVs after the PCR2 sample was taken at the 6th month. The results of this PCR2 have still not been received. Subsequently, the mother and the child were lost to sight because they would be forced by the husband to go live outside Dakar without notifying the care team. Their search as lost to sight was in vain and they returned in November 2020 with the 66-month-old child in very poor general condition (child's serology done at 66 months positive with a very high starting VL: 25729 copies/ml) and has been on treatment ever since.

This delay in reporting the PCR results is also noted in the 2 other cases. For case 2, the PCR1 came back positive at 6 months for twin 2, who was put on ARVs. However, there was a problem of compliance and irregular follow-up due to a lack of response from the parents (deceased mother, paternal aunt guardian of the children who were not cooperating, and therefore shortages in the supply of ARVs). Indeed, the father, his current wife, their 6-year-old daughter, HIV-positive are followed in the center with undetectable viral load's for the couple and low for the daughter.

For case 3, the results of the PCR1, arrived after the positivity of the serology at 14 months, ART was started around 15 months, because the mother refused to accept the diagnosis. There were compliance problems at the beginning, then a slight improvement with a good evolution of the VL results.

The proportion of lost sight was 7.14%, our rate of loss is low compared to those of Togo [5], Ivory Coast [15] and India [16] respectively of 9%, 28.4% and 21%. This could be explained by the acceptance and adherence of mothers to the national care and PMTCT policy, the efforts made by the care teams in raising awareness, psycho-social and medical support, and the major role of the media-

tor in supporting HIV-positive women, in the organization of support groups, the search for those lost to follow-up and home visits.

5. Conclusions

To curb HIV infection in children, various strategies have been implemented, including the prevention and then the elimination of mother-to-child transmission of HIV.

The initiatives and strategies put in place in Senegal have led to a significant reduction in mother-to-child transmission of HIV and deserve to be supported by insisting on primary prevention, programming and good monitoring of pregnancies, and good support for women. HIV positive.

Limitation of the Study

Our study is limited by its retrospective nature which explains the incompleteness of the data.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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Data Collection Sheet

Order number_____

QUESTIONS	ANSWERS
Characteristics of women	
1. Last and first names	
2. Age	|___|___| years
3. Residence (specific address)	Dakar ····1 Suburb ····2 Region····3 Others……..... (specify) ····4
4. Occupation	Employee····1 Housewife ····2 Informal····3
5. Marital status	Married····1 Divorced····2 Widow ····3 Single····4
6. Socio_economic status	Low standard of living····1 Average standard of living····2 High standard of living ····3
7. Time of HIV diagnosis	Before pregnancy ····1 During pregnancy····2
8- If diagnosis made during pregnancy, specify age of pregnancy at time of diagnosis	1st trimester ····1 2nd trimester ····2 3rd trimester ····3
Obstetric history	
1. Number of children	Number of abortions ····|___|___| Number of currently alive ····|___|___| Number of deceased (after birth) ····|___|___| Fetal death in utero····|___|___|
2. HIV status of children	Number of positive····|___|___| Number of negative ····|___|___|
3. ARV treatment positive children	Yes····1 No····0
4. Gesture – Parity	····|___|, |___|
Method of admission	
1. came by itself	Yes····1 No : (a- evacuated by ambulance ……b- referred……)….0
Obstetric examination	
1. Term of pregnancy in week of amenorrhea	premature····1 term····2 post term ····3

Continued

2. Number of prenatal consultations	..... |___|
Obstetrical treatment	
1. Vaginal delivery	Yes 1
	No 0
2. Cesarean section	Yes 1
	No 0
Child prognosis	
1. Apgar score	a. 1 mn ..... |___|
	b. 5 mn ..... |___|
2. Birth weight	a. Eutrophic 1
	b. Hypotrophic 2
3. premature	Yes 1
	No 0
4. Reanimated	Yes 1
	No 0
5. Admitted in Neonatology	Yes 1
	No 0
6. Newborn ARV prophylaxis	Yes 1
	No 0
7. Breastfeeding method	Exclusive protected breastfeeding 1
	Artificial breastfeeding 2
	Mixed breastfeeding 3
8. PCR 1	Yes 1
	No 0
9. Result PCR 1	Positive 1
	Negative… 0
10. Cotrimoxazole prophylaxis	Yes 1
	No 0
11. PCR 2	Yes 1
	No 0
12. Retroviral serology	Yes 1
	No 0
13.Becoming of the newborn	Alive 1
	Deceased 0