

Factors Associated with Mother-to-Child Transmission of HIV at the Maternity Unit of the Castors Urban Health Center in Bangui

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Abstract

Introduction: In spite of significant progress towards eliminating mother-to-child transmission (MCT) of HIV by 2025, trends in vertical mother-to-child transmission are still worrying in sub-Saharan African countries. This study aims to take stock of the factors associated with HIV MCT at the level of peripheral health training. **Patients and Methods:** This was a descriptive and analytical retrospective study, over a five-year period from January 1st, 2017 to December 31st, 2021. The study population was represented by HIV-positive women and their cared infants in the Parent-Child Transmission Prevention Unit (PCTP) of the Castors Urban Health Center (CUHC). **Results:** 288 medical records were selected out of a total of 347 HIV-positive mothers followed. HIV seroprevalence in the population of women who received PreNatal Consultation (PNC) during the study period was 8.2%. The HIV MCT rate was 3.7%. HIV+ mothers followed were mostly young (average age of 28), not living in a couple (96.9%), poorly educated (58.7%) and not engaged in income-generating activity (58.4%). They had all received triple therapy and the period of initiation of antiretroviral (ARV) therapy was in the majority of cases during the first trimester. Factors associated with MCT were: primiparity (OR = 18.4 [5.55 - 61.05]; $\text{Khi}^2 = 32.61$; $p < 0.001$), late discovery of infection during large or after childbirth (OR = 0.03 [0.007 - 0.10]; $\text{Khi}^2 = 55.22$; $p < 0.001$), WHO Clinical Stage 2 and 3 (OR = 0.007 [0.001 - 0.03]; $\text{Khi}^2 = 108.73$; $p < 0.001$), CD4 count 200/mm³ (OR =

14.12 [4.03 - 57.20]; $\text{Khi}^2 = 21.68$; $p < 0.001$), viral load > 1000 copies/mm³ (OR = 8.85 [2.33 - 43.20]; $\text{Khi}^2 = 10.46$; $p = 0.001$), prolonged labor (OR = 12.33 [3.45 - 57.25]; $\text{Khi}^2 = 18.47$; $p < 0.001$), premature rupture of membranes (OR = 24.03 [6.97 - 96.01]; $\text{Khi}^2 = 40.60$; $p < 0.001$), low birth weight (OR = 4.67 [1.42 - 17.88]; $\text{Khi}^2 = 5.96$; $p = 0.014$), and artificial or mixed breastfeeding (OR = 0.01 [0.002 - 0.043]; $\text{Khi}^2 = 97.65$; $p < 0.0001$). **Conclusion:** Taking into account the risk factors for PCTP is essential if we want to achieve the goal of “Zero New Infections in Children by the year 2025”.

Keywords

Factors, Transmission, Mother-Child, HIV, Bangui

1. Introduction

Human immunodeficiency virus (HIV) infection is a major public health and development problem in sub-Saharan African countries [1]. It is estimated that nearly two-thirds of people living with HIV reside in the African region [2]. In the Central African Republic (CAR), where there is a generalized HIV epidemic with a prevalence of around 3.7% in 2015, including 4.3% among women of childbearing age [3] [4], indicators for the prevention of mother-to-child transmission (PMTCT) are still alarming. According to UNAIDS estimates in 2020 [5], the number of new infections among children under 14 years old from 940 in 2015 to 510 in 2019. Similarly, the percentage of pregnant women with access to ARVs is increased from 32% in 2010 to 94% in 2019. This remarkable increase is however still associated with an overall high rate of MTCT of 12%, well above the acceptable threshold less than 5% of the WHO [5]. In order to achieve the objectives for eMTCT, the CAR has an emergency plan since 2017 to accelerate access to ARVs for HIV-positive pregnant women [6]. This study aims to make an inventory of the implementation of the main recommendations for ETMC at the level of a peripheral health facility through a review of five years of activity of the PMTCT service.

2. Materials and Methods

The study took place at the Centre de Santé Urbain des Castors (CSU-C), created in 1955. This is a cross-sectional study over a period of five years from January 01, 2017 to December 31, 2021. The study population was represented by HIV-positive women and exposed infants cared for in the PCTP Unit of the CSU-C. Were Included in our study: All HIV-positive women attending prenatal care with an updated medical record; all exposed infants who received ARV prophylaxis and early HIV screening with an updated medical record. Were excluded: All HIV-positive pregnant women followed who miscarried or died; Exposed newborns who died before having carried out early HIV screening according to national recommendations (PCR1 at 6 weeks, PCR 2 at 9 or 12 months

and HIV serology at 18 months of life). The sample consists of all exposed women and infants meeting the inclusion criteria. Our study received the favorable opinion of the ethics committee. Data were entered and analyzed using Epi info software 7. The statistical tests used for the comparison were Yates' Chi-square and Fisher's test. The difference was significant if $p < 0.05$. The texts and tables were entered with Microsoft Office 2013, Word and Excel software. Anonymity was required. The various information has been treated with respect for confidentiality.

3. Results

3.1. Prevalence of PMTCT

During the period, 4276 pregnant women were followed in the unit of prenatal care of CSU-C in which 4236 realized a HIV serology between the prenatal care. A total of 288 were selected for the study taking into the study criteria. Thus, HIV prevalence was 6.7% among pregnant women. Thus 13 newborns tested positive. The rate of HIV transmission from mother to child was 4.5%.

3.2. Sociodemographic Characteristics of Mothers

The average age of the patients was 28 years \pm 6 with extremes of 15 and 41 years. The age group of 25 to 29 years old was the most represented (**Table 1**).

Level of education and profession

More than half of the patients had not reached the secondary level and most of them did not have an income-generating activity (**Table 2**).

Table 1. Distribution of patients by age.

| Age range | Numbers | Percentage |
|---------------------|------------|------------|
| ≤ 19 years old | 14 | 4.9 |
| 20 to 24 years old | 61 | 21.2 |
| 25 to 29 years old | 108 | 37.5 |
| 30 to 34 years old | 73 | 25.3 |
| ≥ 35 years old | 32 | 11.1 |
| Total | 288 | 100 |

Table 2. Distribution of patients according to level of education and profession.

| Parameters | Number (n = 288) | Percentage |
|--------------------------|------------------|------------|
| Educational level | | |
| None | 13 | 4.5 |
| Primary | 156 | 54.2 |
| Secondary | 90 | 31.2 |
| University | 29 | 10.1 |

Continued**Profession**

| | | |
|-------------|-----|------|
| Tradeswoman | 108 | 37.5 |
| Student | 101 | 35.1 |
| Household | 67 | 23.3 |
| Officer | 12 | 4.1 |

Matrimonial statut

Singles were the most represented.

3.3. Factors Associated with Mother-to-Child Transmission of HIV

| Risk factors | HIV positive infant | HIV negative infant | odds ratio 95% CI | P |
|--|---------------------|---------------------|-----------------------|--------|
| Maternal age | | | | |
| Maternal age < 35 years | 9 | 247 | 1 | |
| Maternal age > 35 years | 4 | 28 | 0.25 [0.07 - 0.88] | 0.043 |
| Parity | | | | |
| Primiparous | 8 | 22 | 1 | |
| Multiparous | 5 | 253 | 18.4 [5.55 - 61.05] | <0.001 |
| Education level | | | | |
| Low level of education | 10 | 159 | 1 | |
| Secondary and University level | 3 | 116 | 2.43 [0.65 - 9.03] | 0.14 |
| Period of discovery of HIV status | | | | |
| Antenatal Discovery | 4 | 259 | 1 | |
| Discovery during labor or postnatal | 9 | 16 | 0.03 [0.01 - 0.10] | <0.001 |
| Maternal WHO HIV clinical stage | | | | |
| Clinical stage 1 | 2 | 265 | 1 | |
| Clinical stage 2 and 3 | 11 | 10 | 31.45 [16.04 - 64.73] | <0.001 |
| Maternal CD4 count (n = 162) | | | | |
| CD4 < 200/mm ³ | 9 | 20 | 1 | |
| CD4 > 200/mm ³ | 4 | 129 | 14.51 [4.08 - 51.59] | <0.001 |
| VL of the mother (n = 95) | | | | |
| VL > 1000 copies/mm ³ | 10 | 22 | 1 | |
| VL < 1000 copies/mm ³ | 3 | 60 | 9.09 [2.28 - 36.12] | <0.001 |
| Labor time | | | | |
| Prolonged labor (>12 h) | 10 | 58 | 1 | |
| normal hours of Labor | 3 | 217 | 12.47 [3.32 - 46.79] | <0.001 |

Continued

| | | | | |
|---------------------------------------|----|-----|------------------------|--------|
| Premature rupture of membranes | | | | |
| Presence of a PrM | 9 | 20 | 1 | |
| Absence of a PRM | 4 | 255 | 24.94 [7.12 - 87.30] | <0.001 |
| Birth weight | | | | |
| Weight less than 2500 g | 9 | 89 | 1 | |
| Weight of 2500 g and more | 4 | 186 | 4.70 [1.40 - 15.68] | 0.014 |
| Newborn breastfeeding method | | | | |
| Strict Breastfeeding | 3 | 266 | 1 | |
| Mixed or artificial breastfeeding | 10 | 9 | 98.51 [23.08 - 420.49] | <0.001 |

4. Discussion

MTCT rate

In our study, all the mothers were on triple therapy during pregnancy, in accordance with the guidelines of option B+ which has been implemented at the country level since 2013 [7] [8] [9] [10]. Several studies have shown the benefit of this method in reducing vertical transmission of HIV [11] [12] [13] [14]. We found a rate of MTCT of 4.5%, which is in line with WHO recommendations which set a threshold of <5% for HIV+ mothers benefiting from option B+ [12]. Our results can be left on those of several countries in the African series that have adopted option B+. Indeed, Gabouga et coll. in Bangui [15], Njom et coll. in Cameroon [16] and Girma et coll. in Ethiopia [17] found respectively in their series, MTCT rates of 4.1%, 4.8% and 4.9%. However, our findings are significantly lower than those of Diemer et coll. [18] and Ngbale et coll. [19], both in Bangui. Indeed, these authors in 2013 and 2017 had noted a slightly higher transmission rate of 7% and 8.3%, in the PPTPE sites in Bangui as well as at the Centre hospitalier universitaire communautaire of Bangui. This difference could be explained by the fact that in 2013-2014, HIV+ mothers were still in option A. These results corroborate the undeniable benefit of implementing option B+ compared to option A, for PMTCT of HIV. Indeed, it must be said that in several studies conducted in African countries on the use of option A for PMTCT, MTCT rates varied between 8% and 23% [20]. Nevertheless, it is necessary to underline the insufficiencies as regards the follow-up of infants exposed. Indeed, while 95.5% of infants completed PCR1 on time, only 1.8% came back on time for PCR2. This observation could be linked to the feeling of security for the mothers when the PCR1 is negative, and therefore, she thinks that it is not necessary to repeat a PCR2. It should also be noted that the average delay in reporting results of 2 to 3 months is also a limiting factor for the follow-up of exposed infants.

Factors associated with mother-to-child transmission of HIV

MTCT and maternal characteristics

Statistically in our study, univariate analysis showed that MTCT is not signif-

icantly related to maternal sociodemographic characteristics (maternal age, level of education, occupation and marital status) ($p > 0.05$). This observation is similar to that of Hoffmann who finds that maternal age and social status are not risk factors for vertical transmission [21]. On the other hand, for some authors, marital status was associated with MTCT [22] [23]. For the latter, mothers who are not married were 8 times more likely to have an HIV-infected child compared to those who are married. We also noted that seropositive primiparous women have an 18 times higher risk of MTCT than multiparous women (OR = 18.4 [5.55 - 61.05]; $p < 0.001$). Bucagu in Rwanda made the same observation [24].

MTCT and maternal factors related to HIV status

Advanced immunosuppression translates clinically into an advanced clinical stage according to the WHO and the occurrence of opportunistic infections; and biologically by increasing viral load and decreasing CD4 count. The more advanced the immune suppression, the higher the transmission rate [13] [24] [25]. High maternal plasma viral load also remains the main biological predictor of both early and late MTCT [26].

In our series, the main factors related to MTCT in relation to maternal HIV status are WHO clinical stage, CD4 count at treatment initiation and VL, with a statistically significant difference ($p < 0.05$). Also, those with a CD4 count $< 200/\text{mm}^3$ are 14 times more likely to transmit HIV to their child. Similarly, those who have a detectable viral load before delivery are 8 times more likely to transmit HIV to their child.

Labor flow factors associated with MTCT

By observing the factors related to the course of labor in the HIV+ mothers of our study, it appears that two main factors are incriminated for the MTCT of HIV. These are the existence of a PRM and prolonged labor, all with a statistically significant difference ($p < 0.05$). These findings are superimposed on those of the literature. Indeed, premature rupture of membranes is associated with vertical transmission of HIV [27] [28] because prolonged rupture of the membranes before delivery would favor the transmission of HIV during labor and delivery [27]. A study carried out in Bangkok had found the presence of HIV in genital secretions. It has thus been postulated that these virions could access the uterine cavity during pregnancy, more particularly during labour. Perinatal TME would then take place by the ascending route [26]. Mode of delivery did not show a statistically significant difference with respect to MTCT. This observation is also made by other African authors [21] [29] [30]. The lack of association between the mode of delivery and MTCT could be explained by the fact that, in countries with limited resources, elective caesareans are rarely performed and the indications for caesarean in general are guided mainly by the necessities of obstetrics rather than HIV infection [30]. Several studies have shown that an elective caesarean section is a protective factor, and would lead to a significant reduction in the risk of MTCT compared to vaginal delivery [13] [24] [31]. Therefore, as a result of this evidence, the American College of Obstetricians and Gynecologists and the Department of Health and Human Services Panel on Treat-

ment of HIV-Infected Pregnant Women and Prevention of Perinatal Transmission has developed guidelines recommending childbirth by elective caesarean section for HIV-infected women with a plasma viral load of more than 1000 copies/mL.

Newborn factors that are associated with MTCT

With regard to birth weight, our study reports that children with low birth weight had a 4 times higher risk of being infected (OR = 4.67 [1.42 - 17.88]; $p = 0.014$). Contrary to our results which are comparable to those of other authors [32] [33], Hoffmann finds no significant association between low birth weight and MTCT [21]. This susceptibility of low birth weight newborns could be attributed to the fact that these newborns are more exposed to neonatal pathologies. This would favor their infection with HIV.

The question of breastfeeding remains a dilemma for many HIV-positive mothers, at the risk of being rejected or stigmatized, as Oladokun shows in her study [28]. This ultimately leads to inappropriate infant feeding practices as evidenced by the rate of mixed feeding practiced by HIV-positive mothers in this study. Many women, after having chosen formula feeding, practice mixed feeding, which is the riskiest method in vertical transmission. We found that HIV infection was significantly associated with mixed feeding. This observation is similar to those reported in several studies [28] [34] [35] [36] [37]. There is evidence that mixed feeding, compared to exclusive breastfeeding and strict artificial feeding, is associated with an increased risk of HIV transmission [28] [34] [35] [36] [37]. During mixed feeding, the beneficial immune factors in breast milk are likely outweighed by damage to the child's gut wall, contaminants or allergens in the mixed feed [37]. On the other hand, exclusive breastfeeding promotes the maintenance of the integrity of the child's gastrointestinal barrier (considered as the main mode of infection). It is also established that immunological factors in breast milk are likely to reduce viral activity in human milk [37].

5. Conclusion

Preventing mother-to-child transmission of HIV is essential to reducing the spread of infection within families. Its main objective is to reduce the vertical transmission of HIV from mother to child. Admittedly, the rate of MTCT of HIV is satisfactory at the level of the CSU-C, but insufficiencies remain as regards the biological monitoring of the mothers as well as in respecting the deadlines for early detection according to the recommendations at the national level. If we want to achieve the objective advocated by the WHO which is "Zero New Infections", especially among children from the year 2025, it is necessary to strengthen the PMTCT service offer at all levels of the health pyramid.

Conflicts of Interest

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

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