



Infant delivery mode of HIV - positive mothers and its impact on mother-to-child transmission (MTCT) of HIV infection

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Abstract

Mother - to - child transmission (MTCT) of HIV infection is known to occur during labor and delivery of infants by HIV positive mothers with the vaginal delivery mode associated with higher potential for this transmission than the surgical modes like caesarian section. This study was designed to ascertain the infant delivery modes of HIV positive mothers and its impact on mother - to - child transmission of HIV infection in Southeast Nigeria. One hundred and four pregnant HIV positive mothers attending the PMTCT ante-natal clinic were counseled and recruited for the study after obtaining their consent. The study found that 87% of the infants were delivered through safe vaginal delivery (SVD) while 13% of them were delivered through caesarian section (CS). Also 94% of the babies had negative HIV PCR test result while 6% of them had positive results. All the HIV PCR positive infants were delivered by safe vaginal delivery (SVD) while all the infants delivered through the caesarian mode tested negative. The study concluded that most of the HIV positive mothers in southeast Nigeria deliver their babies through the vaginal delivery mode and this was strongly associated with the six MTCT cases observed in the study.

Keywords: Vaginal delivery mode, caesarean section, Mother-to-child transmission (MTCT), HIV/AIDS, Nigeria

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1. Introduction

The human immune deficiency virus (HIV) is a virus (retrovirus) which causes acquired immune deficiency syndrome (AIDS). AIDS is characterized by vigorous viral replication, CD4+ lymphocyte depletion and profound immune deficiency making the infected individual highly susceptible to all manner of infections which the individual hitherto could resist (Nwaozuzu and Aguwa, 2012). HIV/AIDS is possibly the biggest challenge facing the global health care system today.

One of the global strategies for controlling, and preventing the spread of HIV/AIDS is the prevention of mother - to - child transmission of HIV/AIDS (PMTCT) program. PMTCT aims at preventing HIV infection of the infant during pregnancy, labor and breastfeeding and has been very successful since its inception. It remains the best way of preventing paediatric HIV infection (Mukhtar-Yola et al., 2009).

One of the PMTCT methods is the regulation of the mode delivery by HIV – positive mothers. This is because of the association of the vaginal mode of delivery with higher risks of HIV transmission though the other mode of delivery – caesarean section has some risks (though less) of HIV transmission too. The expert recommendation is the caesarean delivery mode especially in HIV – positive women with high viral loads and those with unknown viral loads.

This study is therefore designed to determine the infant delivery modes of HIV – positive women in southeast Nigeria and to correlate this with the HIV transmission rate among them so as to establish the possible relationship existing between these two variables among these class of women.

2. Methods

This is part 3 of 3 presentations from a study carried out using the method described below. The other parts had been submitted previously for review and consideration.

The study is both prospective and retrospective in nature. Ethical approval for the study was sought for and obtained from the management of FMC Owerri (Appendix 1). About 104 HIV-positive mothers who just delivered their babies (during the month the study was carried out) were individually counseled on the importance of the new PMTCT guidelines of exclusive breastfeeding of the infant under ARV prophylactic cover for both mother and infant during pregnancy, delivery and breastfeeding. They were then recruited into the study after seeking and obtaining informed consent from them to use data collected from them, their medical records and laboratory test results for the study. A copy of the consent form is shown in Appendix 2. A proforma (data collection form – Appendix 3) was also designed and used to collect/ document relevant information from the HIV-positive mothers participating in the study and from their hospital records. Then, the new mother-child pairs were now followed up with ARVs and nutritional support and counseling. At three (3) months of age, dry blood samples (DBS) of the infants were prepared and screened for HIV using the HIV Ribonucleic Acid Polymerase Chain Reaction test (HIV - RNA PCR Test).

The data collected was then collated and analyzed. Two methods were used in the analysis of the data were the method of percentage and the Pearson test of goodness fit / chi-square. The method of percentage

was used to show the extent of relationship among variables. The Chi-square (X^2) was used to determine the probability that differences in the expected and deserved number of cases falling in each cell of the table occurred because of sampling variations (Thirkette, 1976). It is a non-parametric inferential statistical method used in the analysis of frequencies of nominal data (Nnadozie, 1980).

3. Results

The results of the fore-going study are summarized as follows:

- About 54% of the infants involved in the study were males while 48% of them were females.
- About 87% of the infants were delivery through safe vaginal delivery (SVD) while only 13% of them were delivered through caesarian section (CS).
- About 97% of the mothers knew their HIV status before the delivery of their infants while only 3% of them did not know their status before their babies' delivery.
- About 94% of the babies had a negative HIV PCR test result while only 6% of had a positive result.
- About 67% of the HIV positive infants were females while only 33% of them were males.
- All the HIV PCR positive infants were delivered by safe vaginal delivery (SVD).

These findings are summarized in the tables below;

TABLE 1. GENDER DISTRIBUTION OF THE INFANTS INVOLVED IN THE STUDY

GENDER	NO. OF INFANTS	% OF INFANTS
Male	54	52
Female	50	48
Total	104	100

Table 1 shows that the number male infants involved in the study [54%] was slightly more than the number of females involved in the study [48%].

TABLE 2. DISTRIBUTION OF MOTHERS' DELIVERY MODE

GENDER	NO. OF INFANTS	% OF INFANTS
Safe Vaginal Delivery [SVD]	90	87
Caesarian section [CS]	14	13
Total	104	100

Table 2 shows that most of the mothers [87%] delivered their babies through the natural vaginal delivery mode while fewer numbers of the mothers [13%] delivered through caesarian section.

TABLE 3. DISTRIBUTION OF THE INFANTS' HIV PCR TEST RESULTS AFTER 3 MONTHS OF DELIVERY

INFANT HIV PCR TEST RESULTS	NO OF INFANTS	% OF INFANTS
Positive result	6	6
Negative result	98	94
Total	104	100

Table 3 above shows that only 6% of the infants involved in the study seroconverted to HIV-positive status after 3 months of delivery while 98% remained HIV-negative after the same period.

TABLE 4. GENDER DISTRIBUTION OF THE HIV PCR POSITIVE INFANTS

GENDER	NO OF INFANTS	NO OF PCR HIV POSITIVE INFANTS	% OF POSITIVE INFANTS	% OF CORRESPONDING GENDER POPULATION
Male	54	2	33	4
Female	50	4	67	8
Total	194	6	100	

Table 4 above shows that most of the infants [67%] that seroconverted to HIV-positive status were females while 33% of them were males.

TABLE 5. DISTRIBUTION OF FACTORS RELATED TO THE HIV PCR POSITIVE INFANTS

INFANTS	MOTHER STATUS KNOWN		MOTHER TOOK ARV PROPHYLAXIS		MOTHERS MODE OF DELIVERY		INFANT FEEDING CHOICE			INFANT TOOK PROPHYLAXIS		INFANT GENDER	
	YES	NO	YES	NO	SVD	CS	EBF	EFF	MF	YES	NO	MAL E	FEM ALE
1	✓	X	✓	x	✓	X	✓	X	X	✓	X	✓	X
2	✓	X	X	✓	✓	X	✓	X	X	✓	X	X	✓
3	x	✓	X	✓	✓	X	X	✓	X	X	✓	✓	X
4	✓	X	X	✓	✓	X	X	✓	X	X	✓	X	✓
5	✓	X	X	✓	✓	X	✓	X	X	X	✓	X	✓
6	✓	✓	X	✓	✓	X	X	X	✓	X	✓	X	✓
Totals	4	2	1	5	6	0	3	2	1	2	4	2	4

Table 5 shows that all the infants that seroconverted to HIV-positive status were delivery by safe vaginal delivery (SVD). It also shows that only 1 out of the 6 mothers involved here took ARV prophylaxis. It also shows that only 3 out of the 6 mothers breastfed their infants exclusively. It also shows that 2 out of the 6 infants were males while 4 of them were females.

TABLE 6. DISTRIBUTION OF MOTHERS' KNOWLEDGE OF THEIR HIV STATUS PRIOR TO PREGNANCY OR DELIVERY

KNOWLEDGE OF HIV STATUS	NO OF MOTHERS	% OF MOTHERS
Yes	101	97
No	3	3
Total	104	100

Table 6 shows that most of the mothers involved in the study (97%) knew their HIV status prior to their pregnancies and deliveries while only few of them (3%) did not know their status.

4. Test of hypothesis

Here we conduct statistical analysis using the chi-square method to validate some of the above results that are related to our hypotheses.

Hypothesis 1

HO₁: The vaginal mode of infant delivery is not the most frequent mode of delivery by HIV-positive mothers in Southeast Nigeria.

HA₁: The vaginal mode of infant delivery is the most frequent mode of delivery by HIV-positive mothers in Southeast Nigeria.

For this hypothesis, we use table 2 for the analysis and adjust the options in the table to give the following table;

Here the expected frequency (F_e) is 50/50 since the chance probability is half (1/2).

As such,

$$X^2_{cal} = \frac{(F_o - F_e)^2}{F_e} = \frac{(90 - 50)^2}{50} = \frac{(14 - 50)^2}{50} = 32 + 25.92 = 57.92 \quad (1)$$

Now, degree of freedom

$$\begin{aligned} (DF) &= (R-1) (C-1) \\ &= (2-1) (2-1) \\ &= 1 \times 1 \\ &= 1 \end{aligned}$$

Then from Chi-Square table,

DF 1 at 95% confidence level = 3.84.

i.e. $X^2 \text{ Cal} = 57.92$ and

$X^2 \text{ Tab} = 3.84$

Therefore based on our decision rule, we reject H_0 and accept H_a since $X^2 \text{ Cal} (57.92)$ is $> X^2 \text{ Tab} (3.84)$ and conclude that the vaginal mode of infant delivery is the most frequent mode of delivery by HIV-positive mothers in Southeast Nigeria.

Hypothesis 2

HO₂: The vaginal mode of infant delivery by HIV-positive mothers does not result in an increase in the MTCT rates of HIV in Southeast Nigeria.

HA₂: The vaginal mode of infant delivery by HIV-positive mothers results in an increase in the MTCT rates of HIV in Southeast Nigeria.

For this hypothesis, we use table 5 for the analysis using the delivery mode column of the table.

GENDER	NO. OF INFANTS	% OF INFANTS
Safe Vaginal Delivery [SVD]	90	87
Caesarian section [CS]	14	13
Total	104	100

Here the expected frequency (F_e) is 50/50 since the chance probability is half (1/2).

As such,

$$X^2_{\text{cal}} = \frac{(F_o - F_e)^2}{F_e} = \frac{(6 - 50)^2}{50} + \frac{(0 - 50)^2}{50} = 38.72 + 50 = 88.72 \quad (1)$$

Now, degree of freedom

$$(DF) = (R-1) (C-1)$$

$$= (2-1) (2-1)$$

$$= 1 \times 1$$

$$= 1$$

Then from Chi-Square table,

DF 1 at 95% confidence level = 3.84.

i.e. $X^2 \text{ Cal} = 88.72$ and

$X^2 \text{ Tab} = 3.84$

Therefore based on our decision rule, we reject H_0 and accept H_a since X^2 Cal (65) is $> X^2$ Tab (3.84) and conclude that the vaginal mode of infant delivery by HIV-positive mothers results in an increase in the MTCT rates of HIV in Southeast Nigeria.

5. Discussion

The results of the fore-going study shows a near equal number of male infants and females infants delivered by the HIV positive mothers involved in the study. The results also reveal that out of the 104 infants born to the HIV positive women involved in the study, 90 (87%) of them were delivered by the vaginal delivery mode (SVD) while only 14(13%) were delivered by caesarean section (CS). The SVD method is associated with higher likelihood of HIV transmission to infants (Emem, 2006) which the result of the present study also seem to confirm as all the PCR positive infants were delivered by SVD.

Meanwhile scheduled caesarean section is the recommended infant delivery mode for HIV – positive women with HIV RNA levels of more than 1000 copies per milliliter of blood near the time of delivery and for those with unknown HIV RNA levels (AIDSinfo, 2012). It is defined as caesarian delivery performed before the onset of labor and before the rupture of membranes. This recommendation was based on the findings from a multicentre randomized clinical trial (European mode of delivery collaboration, 1999) and that from a large individual patient data meta – analysis (International perinatal HIV group, 1999). The results of the randomized clinical trial showed that only 1.8% of infants born to HIV – positive women randomized to undergo caesarean section got infected with HIV compared with 10.5% (that got infected) of the infants born to the women randomized to undergo vaginal delivery ($p < 0.001$). The large meta – analysis of individual patient data from 15 prospective cohort studies also demonstrated the benefits of scheduled caesarean delivery with a 50% reduction in the risk of mother – to – child transmission of HIV infection. These two data sets were the basis for the recommendation of scheduled caesarean delivery for HIV positive women by the American college of obstetricians and gynecologists (ACOG) since 1994 (American college of obstetricians and gynecologists, 1999).

An analysis of the HIV PCR test results reveal a very low incidence of HIV transmission to the infants involved in the study as only 6% of them tested positive while 94% of them tested negative. A further analysis of the HIV PCR positive results show that 67% of HIV PCR positive infants were females while 33% of them were males. Also all of the six (6) HIV PCR positive infants were delivered by the SVD method and this could be a contributing factor to their infection. Also all the infants delivered through the caesarean mode tested negative.

6. Conclusion

Most of the mothers involved in the study delivered through the vaginal mode of delivery, Out of the 104 infants delivered, only 6 of them got infected with HIV. All the six (6) infants that got infected from the study were delivered through the vaginal mode of delivery and this may be responsible for their infection as vaginal delivery is associated with higher risks of perinatal transmission of HIV infection. All the infants delivered through the caesarean mode tested negative.

Therefore the vaginal mode of infant delivery by HIV – positive mothers in southeast Nigeria is associated with higher risk of HIV transmission than the caesarean mode of infant delivery.

7. Recommendations

Based on the results of the fore-going study we recommend that scheduled caesarean sections be considered for the delivery of HIV – positive women especially the ones with high viral loads of more than 1000 HIV RNA copies per ml of blood.

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APPENDIX (From next page)

Appendix 1. Ethical approval for the study

FEDERAL MEDICAL CENTRE
P. M. B. 1010, Orlu Road Owerri, Imo State, Nigeria

Medical Director/CEO
Dr. A. C. Uwakwem
MBBS, FWACS, FICS, FICA, BMAAG
Chief Consultant Ophthalmologist

Head of Clinical Services
Dr. E. C. Osuagwu
MBBS, FWACS
Chief Consultant (Obstetrics & Gynaecology)

Chairman of Board
Prof. Ivora Ejemot Esu, OFR
B.Sc. (Hons) M.Sc. (Microbiology) PhD (ABU)
Fellow, Soil Science Society of Nigeria

Head of Administration Services
Mrs. Nnenna Onyegbula
B.Sc. MPA, AHAN


e-mail: fmcowerri@yahoo.com
Phone: 08191365566, 08033411575 (MO), 08033362578 (HAS), 08035631242 (HCS)

00631

19th October 2012

FMC/OW/P/910/pg209A

Pharm. Nwaozuzu Ezeudo E.
Pharmacy Department
Federal Medical Centre
Owerri

U.f.s:
Head of Pharmacy Department

Dear Pharm. Nwaozuzu,

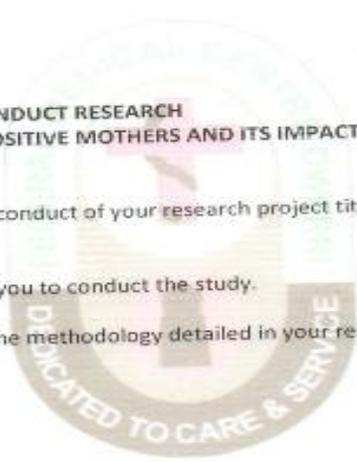
**APPLICATION FOR APPROVAL TO CONDUCT RESEARCH
RE: BREAST FEEDING AMONG HIV-POSITIVE MOTHERS AND ITS IMPACT ON MOTHER-TO- CHILD (MTC)
TRANSMISSION OF HIV INFECTION.**

Your application for approval for the conduct of your research project titled as stated above and dated 14th September, 2012 refers.

I am directed to convey approval for you to conduct the study.

It is hoped that you would abide by the methodology detailed in your research proposal.


Dr E. C. Osuagwu
HEAD OF CLINICAL SERVICES
For MEDICAL DIRECTOR



Appendix 2. Consent form for study participants

I,.....of.....hereby consent to this study; I acknowledge that I have been fully counseled on the purpose and benefits of the study. I also acknowledge that I have been informed on the confidentiality of any information given by me.

I understand that the study is to be carried out solely for that purpose on the understanding that I shall be entitled to withdrawal of my consent ant time.

Date.....Signed.....

(Patient)

I confirm that I explained to the patient the purpose and nature of the study and the fact that refusal to participate will not in any way affect his/her normal care by me or any member of this institution. I know the consequences of any false declaration on this or any other form.

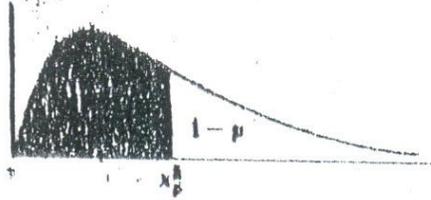
Date.....Signed.....

(Pharmacist/Research).

Appendix C. Chi – square distribution table

APPENDIX C

Percentile Values (χ^2)
for the
Chi-Square Distribution
with ν Degree of Freedom



ν	$\chi^2_{.995}$	$\chi^2_{.99}$	$\chi^2_{.975}$	$\chi^2_{.95}$	$\chi^2_{.90}$	$\chi^2_{.85}$	$\chi^2_{.80}$	$\chi^2_{.75}$	$\chi^2_{.70}$	$\chi^2_{.65}$	$\chi^2_{.60}$	$\chi^2_{.55}$	$\chi^2_{.50}$	$\chi^2_{.45}$	$\chi^2_{.40}$
1	.0000	.0008	.0016	.0039	.0158	.102	.455	1.92	2.71	3.84	5.02	6.63	7.88	10.8	
2	.0100	.0201	.0506	.108	.211	.575	1.89	2.77	4.01	5.09	7.88	9.21	10.6	18.6	
3	.0717	.115	.210	.352	.584	1.21	2.37	3.11	4.26	7.81	9.35	11.3	12.8	18.8	
4	.207	.297	.484	.711	1.00	1.92	3.36	5.89	7.78	9.49	11.1	13.8	14.9	18.5	
5	.412	.564	.891	1.15	1.61	2.37	4.35	6.63	9.24	11.1	12.8	15.1	16.7	20.6	
6	.708	.872	1.24	1.64	2.20	3.45	5.85	7.84	10.6	12.6	14.4	16.8	18.5	22.6	
7	.989	1.24	1.60	2.17	2.89	4.25	6.35	9.04	12.0	14.1	16.0	18.5	20.8	24.8	
8	1.34	1.66	2.18	2.73	3.49	5.07	7.34	10.8	13.4	15.5	17.5	20.1	22.0	26.1	
9	1.78	2.09	2.70	3.38	4.17	5.90	8.34	11.4	14.7	16.9	19.0	21.7	23.9	27.9	
10	2.16	2.56	3.25	4.04	4.87	6.74	9.34	12.5	16.0	18.3	20.5	23.2	25.2	29.6	
11	2.60	3.05	3.82	4.57	5.58	7.68	10.3	13.7	17.3	19.7	21.9	24.7	26.8	31.8	
12	3.07	3.57	4.40	5.28	6.30	8.44	11.8	14.8	18.5	21.0	23.3	26.2	28.8	32.9	
13	3.57	4.11	5.01	5.80	7.04	9.30	12.9	16.0	19.8	22.4	24.7	27.7	29.8	34.6	
14	4.07	4.68	5.63	6.57	7.79	10.2	13.8	17.1	21.1	23.7	26.1	29.1	31.8	36.1	
15	4.60	5.28	6.26	7.20	8.56	11.0	14.3	18.2	22.3	25.0	27.5	30.6	32.8	37.7	
16	5.14	5.81	6.91	7.90	9.31	11.9	15.3	19.4	23.5	26.8	28.8	32.0	34.9	39.8	
17	5.70	6.41	7.50	8.67	10.1	12.8	16.3	20.5	24.8	27.6	30.2	33.4	35.7	40.8	
18	6.26	7.01	8.23	9.39	10.9	13.7	17.3	21.6	26.0	28.9	31.5	34.8	37.2	42.3	
19	6.84	7.63	8.91	10.1	11.7	14.6	18.3	22.7	27.2	30.1	32.9	36.2	38.0	43.8	
20	7.43	8.26	9.59	10.9	12.4	15.5	19.3	23.8	28.4	31.4	34.2	37.6	40.0	45.3	
21	8.03	8.90	10.3	11.8	13.2	16.3	20.3	24.9	29.6	32.7	35.5	38.9	41.4	46.8	
22	8.64	9.54	11.0	12.3	14.0	17.2	21.3	26.0	30.8	33.9	36.8	40.3	42.8	48.3	
23	9.26	10.2	11.7	13.1	14.8	18.1	22.3	27.1	32.0	35.2	38.1	41.6	44.2	49.7	
24	9.89	10.9	12.4	13.8	15.7	19.0	23.3	28.2	33.2	36.4	39.4	43.0	45.6	51.2	
25	10.6	11.6	13.1	14.6	16.5	19.9	24.3	29.3	34.4	37.7	40.6	44.8	46.9	52.8	
26	11.2	12.2	13.8	15.4	17.4	20.8	25.3	30.4	35.6	38.9	41.8	45.6	48.3	54.1	
27	11.8	12.9	14.6	16.2	18.1	21.7	26.3	31.5	36.7	40.1	43.2	47.0	49.6	55.6	
28	12.5	13.6	15.3	16.9	18.9	22.7	27.3	32.6	37.9	41.3	44.5	48.3	51.0	56.9	
29	13.1	14.3	16.0	17.7	19.8	23.6	28.3	33.7	39.1	42.6	45.7	49.6	52.3	58.3	
30	13.8	15.0	16.8	18.5	20.6	24.5	29.3	34.8	40.3	43.8	47.0	50.9	53.7	59.7	
40	20.7	22.2	24.4	26.5	29.1	33.7	39.3	45.6	51.8	55.8	59.8	63.7	66.8	73.4	
50	29.0	30.7	33.4	35.8	39.7	42.9	49.9	56.8	63.2	67.5	71.4	76.2	79.5	86.7	
60	38.5	40.5	43.8	46.2	50.8	52.8	59.9	67.0	74.4	79.1	83.8	88.4	92.0	99.6	
70	48.3	50.4	54.8	57.1	61.8	64.7	71.9	79.1	86.6	91.5	96.2	100	104	111	
80	58.2	60.4	64.9	67.2	72.1	75.0	82.1	89.5	97.0	102	107	112	116	125	
90	68.2	70.5	75.1	77.4	82.3	85.2	92.3	99.8	107	112	118	124	128	137	
100	78.3	80.6	85.2	87.5	92.4	95.3	102.4	110	118	124	130	136	140	149	

Source: E. S. Pearson and H. O. Hartley, *Biometrika Tables for Statisticians*, Vol. 1 (1966), Table 8, pages 187 and 188.