Vertical transmission rate of human immunodeficiency virus amid formula-fed infants in a resource-constrained tertiary hospital in Jos, Nigeria

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Abstract

Background: Human Immunodeficiency Virus (HIV) can be transmitted from infected mother to her baby.

Objective: To assess transmission rate of HIV from seropositive mothers on highly active anti-retroviral therapy (HAART) to their formula-fed babies.

Method: A cross-sectional study of 65 paired mothers on HAART and their formula-fed babies was carried out. Polymerase chain reaction-deoxyribonucleic acid (PCR-DNA) of the babies was done at six weeks of age. Epi info was used to analyse data.

Results: Mean age of mothers was 30.26 ± 0.5 years. About 73.8% of the paired mothers were diagnosed with HIV before their current pregnancies and 69.2% initiated HAART before their current pregnancies. Duration of HAART use was between three months and two years. Modes of deliveries were caesarean section (15.4%) and vaginal route (84.6%). Only one (1.5%) of the babies was positive to PCR-DNA test at six weeks of age. There was no statistically significant association between the baby's PCR-DNA at six weeks of age and the mode of delivery (OR-0.0047, CI-95%, Fisher Exact=0.8461) as well as between the time of initiation of HAART by the paired mothers and the paired baby's PCR-DNA results (RR-0.9778, CI-95%, Fisher Exact=0.6923).

Conclusions: Overall mother to child transmission (MTCT) rate in this study was 1.5%. Use of HAART for more than three months, irrespective of delivery route, is capable of significantly reducing MTCT of HIV even in resource-constrained settings.

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Introduction

Ninety percent of human immunodeficiency virus (HIV) infections in children are attributed to mother-to-child transmission (MTCT). The science of prevention of mother to child transmission (PMTCT) has evolved over the years since the discovery of HIV. Before the advent of interventions, MTCT rate of HIV infection was 25-45%[1]. However, a number of obstetric interventions have been proven to have gradually eliminated MTCT of HIV in the United States of America and Europe[2,3]. These evolving interventions initially included supplementation of diet with vitamin A (especially antenatally), elective caesarean section and vaginal cleansing with antiseptic (0.2% chlorhexidine) or anti-viral agents[1,3,4]. Other interventions are: reducing the amount of time between rupture of membranes and delivery, avoiding unnecessary episiotomies, suction and other invasive procedures, drying maternal secretions and blood off the newborn, the use of highly active anti-retroviral therapy (HAART) and infant formula feeding[2,3].

Chama et al in University of Maiduguri Teaching Hospital, a resource-constrained setting in Nigeria, observed transmission rate at 1.1% via the instrument of polymerase chain reaction-deoxyribonucleic acid (PCR-DNA)[5]. Transmission rates of less than 2% have been reported with the use of HAART in the non-breastfeeding population[6]. This is mostly obtainable in the developed countries where access to antiretrovirals (ARVs) is enhanced and breast milk substitutes are accessible, feasible, affordable, acceptable and safe (AFAAS) unlike in the developing world. Numerous factors influence HIV perinatal transmission and these are responsible for the variability observed in transmission rates. The strongest predictor of transmission is the maternal viral load and lowered CD4 count. These factors are known to increase the risk of vertical transmission. Mode of delivery, nutritional deficiencies, use of addictive drugs like tobacco, cocaine, heroin and opiates, breastfeeding and failure to initiate nevirapine/zidovudine

(NVP/ZDV) prophylaxis in the exposed infants also affect transmission rate of HIV from mother to infant[7,8].

Although significant progress has been made in PMTCT, the absence of care for the mothers and their families has been identified as a challenge for women participating in current PMTCT programmes[3]. The treatment, prevention and care interventions offered in PMTCT are often targeted on individuals, and not families and communities[9]. The importance of this extended care is against the backdrop that a healthy family constitutes the foundation for a child's wellbeing and recently the importance of family-centred care and services for children is increasingly recognized[9]. This evolving knowledge eventually gave birth to the concept of PMTCT-Plus in 2002 which focused on a comprehensive maternal care and support needs to be provided throughout pregnancy, after delivery and beyond[10]. This care should be fully coordinated with on-going care and support for the children and family through fully integrated reproductive, maternal and child health services. The extended care in PMTCT-Plus is important because HIV is viewed as a family disease with each HIV-infected woman having potentially infected partner(s) and children[3,9,10]. Experiences with family models of care with HIV-infected pregnant women as the index patients are beginning to emerge especially from the developing world[3].

Objective

To assess transmission rate of HIV from HIV seropositive mothers on HAART to their formula-fed babies.

Method

A cross-sectional study was conducted for four months from April to July in 2010 in the PMTCT clinic of Plateau State Specialist Hospital (PSSH), Jos. The study population included paired HIV seropositive mothers on HAART with their formula-fed babies. Sixty five were enrolled to ensure a 95% confidence of estimating a prevalence of HIV seropositive women accessing HAART in Nigeria (44%) in the study population with 5% margin of sampling error. Consecutively, 65 babies met the inclusion criteria and were recruited for at least three months. These babies received ARV prophylaxis (NVP/AZT) for six weeks and were on exclusive breast milk substitutes (formula feeds). Those excluded were twins, babies whose mothers were smokers or drug addicts (e.g. cocaine, marijuana, nicotine) and had other co-morbid medical conditions e.g. sickle cell anaemia, heart diseases, endocrinopathies and cancers. Others were babies whose mothers missed HAART for a week or more, those who had prolonged/obstructed labour or assisted delivery and babies whose mothers delivered elsewhere other than PSSH, Jos. Bio-data and information concerning the mothers were captured on a questionnaire and the babies' PCR-DNA was done at six weeks of age.

Ethical clearance was obtained from the hospital's ethical committee and written informed consent was also obtained from the mothers. Data analysis was done using Epi info 3.3.2 (CDC, Atlanta Georgia, USA). This study was self-funded with technical support from Institute of Human Virology of Nigeria.

Results

The bio-data, time of HIV diagnosis, time of initiation of HAART and the duration of administration of HAART were also noted as well as their duration of pregnancy and the mode of delivery. The parameters considered in the babies were their birth weights and HIV status at six weeks of age by PCR-DNA biotechnology. Maternal age distribution at the time of delivery is shown in Table 1.

Table 1
Maternal age distribution at time of delivery

Maternal age (years)	Frequency (%)
25-29	28 (43.08)
30-34	29 (44.62)
35-39	08 (12.30)
Total	**65 (100.0)**

Mean age =30.26 ± 0.5 years

Maternal time of HIV diagnosis is shown in Table 2.

Table 2
Maternal time of HIV diagnosis

Time of HIV diagnosis	Frequency (%)
Before current pregnancy	48 (73.8)
During current pregnancy	17 (26.2)
Total	**65 (100.0)**

Maternal time of initiation of HAART is shown in Table 3.

Table 3
Maternal time of initiation of HAART

Time of initiation of HAART	Frequency (%)
Before current pregnancy	45 (69.2)
During current pregnancy	20 (30.8)
Total	**65 (100.0)**

Duration of administration of HAART among the mothers before delivery is shown in Table 4.

Table 4
Duration of administration of HAART among the mothers before delivery

Duration of HAART (months)	Frequency (%)
< 12	30 (46.15)
13-25	13 (20.00)
26-38	09 (13.85)
39-41	06 (09.23)
42-55	04 (06.15)
> 56	03 (04.62)
Total	**65 (100.0)**

Baby's mode of delivery is shown in Figure 1.

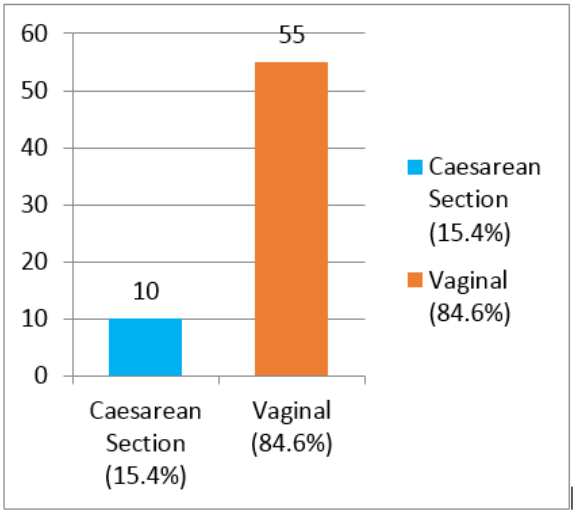

Figure 1: ***Baby's mode of delivery***

Baby's PCR-DNA results at six weeks of age are shown in Figure 2.

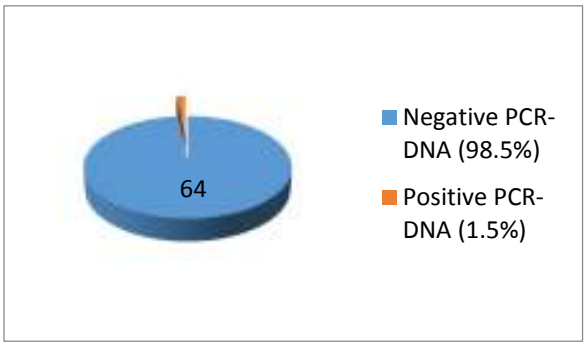

Figure 2: ***Baby's PCR-DNA results at six weeks of age*** *n=65*

Association between baby's PCR-DNA at six weeks of age and mode of delivery is shown in Table 5.

Table 5: ***Association between baby's PCR-DNA at six weeks of age and mode of delivery***

Baby's PCR-DNA at 6 weeks of age	Caesarean section	Vaginal	Total	Fisher exact value
Negative	10	54	64	0.8461
Positive	00	01	01	0.8461
Total	10	55	65	

n=65, 95% CI, OR-0.0047, Fisher Exact-0.8461

There was no statistical significant association between the baby's PCR-DNA at six weeks of age and the mode of delivery (95% Confidence Interval, Fisher Exact >0.05).

Association between time of initiation of HAART in paired mothers & baby's PCR-DNA results is shown in Table 6.

Table 6: ***Association between time of initiation of HAART in paired mothers & baby's PCR-DNA results***

Time of Initiation of HAART	Negative	Positive	Total	Fisher exact value
Before current pregnancy	44	01	45	0.6923
During current pregnancy	20	00	20	0.6923
Total	64	01	65	

n=65, CI-95%, RR-0.9778, Fisher Exact-0.6923

There was no statistical significant association between the time of initiation of HAART by the paired mothers and the paired baby's PCR-DNA results (CI-95%, Fisher Exact>0.05).

Discussion

The transmission rate of HIV from mother-to-child in this study among formula-fed infants born to HIV seropositive mothers was observed to be 1.5% by PCR-DNA bio-technology. The study observed that only one baby was reported to have tested positive to the PCR-DNA test carried out at six weeks. Following the major breakthrough with ZDV in PMTCT with the Paediatric AIDS Trials Group (PACTG) 076 trial, higher rates of 8% were reported[11]. Another study by Tahe used only sd-NVP as an intervention and observed transmission rate of 12%[1]. Townsend et al in the United Kingdom observed similar rate of 1% using similar interventional strategies[12]. Even though there was a racial difference in the two populations, use of HAART and breast milk substitutes may have played a role in the similar transmission rate observed in the two studies. Chama et al in Nigeria also reported similar transmission rate of 1.1%[5]. This study had similar intervention strategies as the index study except for the varying feeding options and the timing of the PCR-DNA testing which was at 12 weeks of age. Transmission rate in other studies involving a non-breastfeeding population of HIV exposed infants whose mothers were on HAART was 2%[6]. This rate was similar to the 1.5% reported in the index study because the two studies have similar intervention strategies.

Interestingly, transmission rates of 0% were reported in Uganda and Burkina Faso by Homsy et al and Kouanda et al respectively[2,13]. The babies studied in the Ugandan study were exclusively breastfed for 3-6 months. The researcher only recruited pregnant HIV mothers who were 18 years and above. This group excluded had a tendency of influencing the results and its conclusion. This might explain the 0% transmission rate reported. Contrary to the overwhelming transmission results of less than 2% with the use of ART, infant prophylaxis and use of breast milk substitutes, a study in Jos, North Central Nigeria reported a transmission rate of 5.8%[14]. Varying regimen of ART used in the study including HAART would have been responsible for this high rate reported even when the other interventions were similar to the index study.

Of the sixty five recruited mothers, 10 (15.4%) delivered via caesarean section while 55 (84.6%) delivered vaginally. Irrespective of the method of delivery, only one (1.5%) of these babies was confirmed to have HIV via PCR-DNA at six weeks of age. This study further observed that there was no statistical significant association (CI-95%, Fisher Exact >0.05) between mode of delivery and the baby's PCR-DNA results at six weeks of age. These results agreed with studies done by Shah in Mumbai which also found that vaginal delivery was as effective as caesarean section for prevention of MTCT of HIV when combined with ARV prophylaxis and no breastfeeding[15]. The similar conclusions reached by these studies could be that the two studies used similar interventions. Another factor thought to influence transmission rate was the time HAART was initiated. The recruited paired women were at least three months on HAART and more than half the number of subjects started ARVs (HAART) before their current pregnancy in the study. The women who initiated HAART during their current pregnancy were likely to have been diagnosed during their current pregnancy. There was no significant association between the time of initiation of HAART by the paired mothers and their baby's PCR-DNA results (CI-95%, Fisher Exact >0.6923). It therefore means that, irrespective of when HAART is initiated in HIV seropositive pregnant women (at least three months) it has the potential of significantly reducing MTCT of HIV especially when the babies receive ART prophylaxis and are fed with breast milk substitutes. This is an area that will need further research.

Conclusions

The study has demonstrated the overall vertical transmission rate of 1.5% among HIV seropositive mothers on HAART. It also shows that the use of HAART for more than three months and irrespective of the delivery route is capable of significantly reducing MTCT of HIV even in resource-constrained settings.

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