

Diagnosis of Early Infant HIV Infection among Sero-Positive Mother in Jimma Zone, Southern West Ethiopia, Jimma

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Abstract

Back ground: Ethiopia is among the country most affected by the HIV with adult prevalence of 1.5%; majority of children acquired HIV from their mother through vertical transmission. WHO estimate that about 3.2 million children were living with HIV at the end of 2013 worldwide. HIV-related mortality rates remain high in sub-Saharan Africa despite growing access to ART. Ethiopian government has launched fee based ART treatment in 2003 and free ART in 2005. The aim of current study is to determine the prevalence of HIV infection among HIV-exposed infant from their HIV positive mothers in Jimma zone. **Methods:** A retrospective study was carried out at JUSH on 225 infants born from HIV seropositive mothers. The relevant data were retrieved from molecular laboratory result record. Data were collected by the investigator. Collected data were tallied and processed by manually and computer tools. Data was entered in to excel sheet for statistical analysis. The quality of data was controlled. Ethical issue was taken into account. **Results:** The study revealed that 5.3% (12/225) of the infants born from HIV seropositive mothers were found to be HIV positive. From a total of 225 infants born from HIV seropositive mothers and had been tested for HIV by DNA PCR, 120(53.3%) were males and 105(46.7%) were females. With regard to the time of diagnosis of infants born from HIV positive mothers, the majority 210 (93.3%) had their DBS tested at or after 7 weeks. While only 15 (6.7%) infants were tested at the right time, which is at 6 weeks. **Conclusion:** The vertical transmission rate was (5.3%) in the present study, reflects the using of prevention of mother to child transmission (PMTCT) strategy needed to be strengthen and further activities has to be continued.

Keywords: HIV, Early infant diagnosis, HAART, DBS

1. Back ground

Human immunodeficiency virus (HIV) infection is a global crisis that represents a serious health treat, particularly among younger people(Hickel 2012). HIV virus transmitted from one-person to another through blood to blood contact, having unprotected sex with HIV infected person, sharing the sharp equipment with infected person, blood transfusion, and also transmitted from mother to children during pregnancy, or delivery, as well as breast feeding (HIV/AIDS 2006).

Globally, 35 million people were living with Human Immunodeficiency virus (HIV) worldwide at the end of 2013, among this most of people live in sub-Saharan Africa (SSA) accounting for nearly 71% of the people living with HIV(World Bank Group 2012). Ethiopia is among the countries most affected by the HIV, the HIV epidemic with an estimate adult prevalence of 1.5%. It has a large number of people living with HIV and 1 million AIDS orphans(Menna, Ali et al. 2014). The majority of children acquired HIV from their HIV infected mother during pregnancy, birth or breast feeding. Although the use of antiretroviral therapy (ART) for the prevention of mother – to- child transmission (PMTCT) is essential, effective programmer to achieve early infant diagnosis (EID) is critical when that prevention fails. There is strong evidence that the early initiation of ART in HIV – infected children can substantially reduce HIV related morbidity and mortality(Seidenberg, Nicholson et al. 2012). The world health organization (WHO) recommended the immediate initiation of ART upon diagnosis of HIV infection in infant and older children, irrespective of the children's CD4, T-lymphocyte counts(WHO 2010).

The Early initiation of ART in infants requires reliable early infant diagnosis (EID). This is usually based on the testing of blood sample collected from infant at least 45 days old, polymerase chain reaction (PCR) test for detection of HIV deoxyribonucleic acid (DNA), blood sample are usually spotted on to laboratory.

Since there was no study done to determine the prevalence of HIV among the exposed infant at this area, the purpose of this study is to determine the prevalence of HIV by dried blood spot (DBS) PCR among infant who exposed to HIV and to document the data for use in the intervention activities.

2. Methodology

2.1 Study area and study period

The study was conducted at Jimma University Specialized Hospital (JUSH) molecular laboratory, Jimma, from March 14, 2015 to Apr 7, 2015. Jimma Zone is located 352km southern west of Addis Ababa. The zone geographical coordinates are approximately 7°41' N latitude and 36° 50'E longitude. The zone is found in an area of average altitude of about 1780 meter above sea level. It lies in the climatic zone locally known as Woyna Daga. The zone is generally characterized by warm climate with a mean annual maximum temperature of 30°C and a mean annual minimum temperature of 19°C. The annual rainfall ranges from 1138 mm to 1690 mm. Based on the 2007 Census conducted by the central statistical Agency of Ethiopia (CSA), this Zone has a total population of 120,960, of whom 60,824 are men and 60,136 women. With an area of 50.52 square kilometers, Jimma has a population density of 2,394.30 all are urban inhabitants. A total of 32,191 households were counted in this Zone, which results in an average of 3.76 persons to a household, and 30,016 housing unit. JUSH ART clinics is comprises various departments offering multifaceted service including voluntary counseling and testing for HIV as well as initiation and monitoring of ART for eligible adult and pediatric HIV cases.

2.2 Study design, sampling techniques and sample size

A retrospective study was conducted to determine the prevalence of HIV in infants born from HIV sero-positive mothers. All infants (aged between 6 week to 18 months) born from HIV sero-positive mothers and tested for HIV- DBS- DNA- PCR at Jimma University specialized hospital during December 26, 2013 to April 4, 2015 were the study population.

Because of its high sensitivity and specificity DNA polymerase chain reaction (PCR) has been widely used for diagnosis of HIV amongst exposed infants. The technology allows for PCR to be performed using a small spot from a dried blood spot (DBS) sample, as well as identification of HIV infection.

Ethiopia has tried a laboratory network, which is a hierarchical or ladder-like system with the national reference laboratory at the top, followed by regional, referral and/or specialized hospital laboratories. Once DBS are collected it will be transported and tested in the regional laboratories and the results will be returned to the facilities where the samples were collected.

Being the Gold standard test to determine HIV infection, DNA PCR testing facilities have been expanded even in the region. Following the expansion of HIV DNA PCR testing facilities in the region, DBS samples have been collected and tested for all infants born to HIV positive pregnant women. Since the test is strong enough to determine the infection rate with a single test, we only used the results of PCR for HIV DNA antigen in DBS samples of HEIs.

2.3 Data collection technique

This study used only secondary data collected from medical record. To study the prevalence of HIV in infants born from HIV sero-positive mothers in Jimma zone, who tested for HIV DNA PCR at Jimma University, specialized hospital, a retrospective record review of pediatric HIV log book was retrieved. The variables included in the data collection format were identification and DNA PCR number of infants, sex of infant, and result of HIV test as obtained by employing dry blood spot DNA PCR test.

2.4 Quality assurance

To ensure the quality of data, checklist was prepared. Then, the required data was collected from the HIV log book by considering carefully all the variables stated in the checklist with due attention to avoid any redundancy of the study subjects. Completeness of the data was asserted through periodic supervision of data collectors. Finally data was analyzed employing appropriate statistical treatment following proper entry and cleaning.

2.5 Ethical considerations

Ethical clearance was secured from local research and ethics committee of the department of medical Laboratory Sciences, college of health sciences, Jimma University. Following that cooperation letter was written to Jimma University specialized hospital. Thus, the study was commenced after obtaining permission from JUSH. In addition, the whole objective of the study was briefly explained to the hospital authorities as well as for those working in the pediatric HIV subunit of Jimma University specialized Hospital, so that we got permission to use the secondary data.

3. RESULTS

3.1 prevalence of HIV among exposed infants from HIV-positive mothers

Early infant diagnosis of HIV is one of the most important challenges in the management of pediatric HIV infection in resource constrained settings. Significant challenges to the scale-up of pediatric care and treatment include: limited screening of HIV-infected children, lack of affordable simple diagnostic tests, lack of trained

human resources, insufficient advocacy and lack of understanding that ART is efficacious in children. Limited experience with simplified standardized treatment guidelines and lack of affordable pediatric ARV formulations further compound the situation. This study involves a retrospective of HIV exposed infants designed to determine the prevalence of HIV infection in infant and young children. A retrospective study was conducted in 225 infants who had been tested at Jimma University specialized Hospital, molecular laboratory from December 26, 2013 to April 4, 2015.

A total of 242 HIV-exposed infant were enrolled into HIV DNA PCR test during the study period. Among these, only 225 records were included in the final analysis. 17 records were incomplete and excluded (because some of them without sex and some of them without age). The time that infant enrolled to HIV-exposed infant enrolled into DBS DNA PCR test was 6 weeks.

As summarized in table below, from a total of 225 infants born from HIV seropositive mothers and had been tested for HIV by DNA PCR, 120(53.3%) were males and 105(46.7%) were females. The study revealed that 12(5.3%) of the infants born from HIV seropositive mothers were found to be HIV positive. Of these, 7(5.83%) were males and 5(4.76%) were females.

Table 1. Prevalence of HIV among exposed infants with Age-distribution

| Age (weeks) | No of positive (%) | No of negative (%) | Total |
|-------------|--------------------|--------------------|-------|
| 0-6 | 0 | 15 | 15 |
| 7-25 | 7(4%) | 167(96%) | 174 |
| 25-52 | 4(13.3%) | 26(86.7%) | 30 |
| 52-72 | 1(16.7%) | 5(83.3%) | 6 |
| Total | 12(5.3%) | 213(94.7%) | 225 |

A total of 174 (77.3%) HIV exposed infant were tested at age of (7-25 week olds) for HIV DNA PCR, of whom 7 (4%) were found to be HIV infected, among infants (25 – 52 weeks olds), 30 infants exposed of which 4(13.3%) were found to be HIV infected. In the age range between (52-72 weeks old) 6 infants exposed and only 1 (5.3%) was found to be infected with HIV (Table 1).

Table 2. Prevalence of HIV among exposed infants in gender

| Sex | No of positive (%) | No of negative (%) | Total |
|--------|--------------------|--------------------|-------|
| Male | 7(5.83%) | 113(94.17%) | 120 |
| Female | 5(4.76%) | 100(95.24%) | 105 |

In the depicted table 120 male and 105 female HIV exposed infants and children were tested for HIV DNA. There were 7 (5.83%) of male infants/ children infected and 5(4.76%) female infants/children infected, respectively (Table 2).

Early Infant Diagnosis (EID) was defined as infant access to or enrollment into HIV DNA-PCR at 6 weeks of birth and thereafter. With regard to the time of diagnosis of infants born from HIV positive mothers, the majority 210 (93.3%) had their DBS tested at or after 7 weeks. While only 15 (6.7%) infants were tested at the right time, which is at 6 weeks. The prevalence of DNA-PCR positivity among infant born to HIV positive mothers was 5.3% (12 out of 225 HIV-exposed infants).

With the initiation of EID there was no systemic transportation of DBS from the health facility (HF) to the referral laboratories; samples were given to the health personnel travelling to the regions where referral laboratories were located. The Jimma University specialized Hospital utilize through phone calling for the return of the results to the respective HF.

DISCUSSION

The major aim of this study was to assess the prevalence of HIV infection among infants born to HIV infected mothers in Jimma Zone, southern west Ethiopia.

In this study, the prevalence of HIV infection among HIV exposed infants was 5.3%, which is comparable with study conducted in Botswana which reported 7.0 % (Creek, Tanuri et al. 2008). This finding reflects the use of mother to child transmission interventions such as using of Antiretroviral (ART) drugs among HIV infected pregnant women, safe delivery practices and safe infant feeding have helped reduce the risk of transmission to infants (from 40% to 5%) (Berhan, Abebe et al. 2014). The HIV infection rate reported in the present study varies with that reported from south Gondar zone, Amhara region which reported 10.1% HIV prevalence in infants born from HIV sero-positive mothers (Berhan, Abebe et al. 2014). Since both studies utilized DNA PCR for infant diagnosis, methodological variations could be explained for the observed differences. These differences in prevalence, however, may be due to the socio-economic status and educational background of the families of the infants participating in the two studies. This finding agrees with the study conducted in rural African setting (Smith, Nimmo et al. 2014), but not with other (Cook, Ciampa et al. 2011;

Chiduo, Mmbando et al. 2013).

Timely and accurate determination of infection in exposed infants is critical and highly beneficial (Hanna, Siromany et al. 2015). But this study shows that there is a delay of early infant diagnosis (6.7% at 6 weeks which is the right time). According to WHO one early HIV virological detection test at or after 6 weeks of age for all HIV-exposed children identifies most children infected before, during and immediately after delivery, and therefore identifies most babies who will progress rapidly and who will need life-saving ART. Virological testing at 6 weeks of age gives a good sensitivity (>98%) with the various methods and is considered programmatically more efficient.

Infants having their DBS test done after 6 weeks of their age were more likely to be HIV positive than infants tested at the age of 6 weeks. This observation may be due to the latter infants appearing for diagnosis; the more likely they would be exposed to HIV infection as transmission through breastfeeding is common. The risk might have coupled if a mother is not enrolled in HIV care and support during pregnancy or post-partum or if mixed feeding would be practiced. Maternal ART and infants' ARV prophylaxis are effective interventions to curb MTCT of HIV during this time (Berhan, Abebe et al. 2014). The interruptions of HIV transmission from mother to child are important. Appropriate prevention strategies, including antiretroviral agents administered to the mother and/or child should be encouraged. Avoidance of breastfeeding (when possible) or the administration of antiretroviral agents to the mother while she continues breastfeeding is another strategy.

LIMITATION OF THE STUDY of the Study

As this study was conducted using secondary data, it was impossible to obtain some essential information in the charts, such as infant feeding practice, maternal viral load during pregnancy and whether she was infected before or during the last pregnancy. Therefore, generalization of the findings may not be possible. Although this study might suffer from its lower precision, it would be valuable evidence to evaluate program effectiveness and provide a foundation for future intervention.

CONCLUSION AND RECOMMENDATION

The vertical transmission rate of 5.3% observed in the present study reflects the using of prevention of mother to child transmission (PMTCT) is very important. Therefore, we recommend that the ongoing prevention of Mother to child prevention (PMTCT) has to be further encouraged. Moreover, administration of antiretroviral therapy while she is breast feeding is another strategy.

Competing interests

We declare that there is no interest conflict of interest among the authors.

Authors' contributions

AM, DE and TK participated from the very beginning study design, data collection and analysis of the data. DE participated in Designing of the study, interpretation of the finding, reviewing the manuscript and draft write up.

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References

- Berhan, Z., F. Abebe, et al. (2014). "Prevalence of HIV and Associated Factors among Infants Born to HIV Positive Women in Amhara Region, Ethiopia." *International Journal of Clinical Medicine* 2014.
- Chiduo, M. G., B. P. Mmbando, et al. (2013). "Early infant diagnosis of HIV in three regions in Tanzania; successes and challenges." *BMC public health*, 13(1): 910.
- Cook, R. E., P. J. Ciampa, et al. (2011). "Predictors of successful early infant diagnosis of HIV in a rural district hospital in Zambesia, Mozambique." *Journal of acquired immune deficiency syndromes*, 56(4): e104.
- Creek, T., A. Tanuri, et al. (2008). "Early diagnosis of human immunodeficiency virus in infants using polymerase chain reaction on dried blood spots in Botswana's national program for prevention of mother-to-child transmission." *The Pediatric infectious disease journal*, 27(1): 22-26.
- Hanna, L. E., V. A. Siromany, et al. (2015). "Challenges in the early diagnosis of HIV infection in infants: Experience from Tamil Nadu, India." *Indian pediatrics journal*, 52(4): 307-309.
- Hickel, J. (2012). "Neoliberal plague: the political economy of HIV transmission in Swaziland." *Journal of Southern African Studies*, 38(3): 513-529.
- HIV/AIDS, J. U. N. P. o. (2006). "Report on the Global AIDS Epidemic (*Joint United Nations Programme on*

- HIV/AIDS, Geneva).*"
- Menna, T., A. Ali, et al. (2014). "Prevalence of "HIV/AIDS related" parental death and its association with sexual behavior of secondary school youth in Addis Ababa, Ethiopia: a cross sectional study." *BMC public health*, 14(1): 1120.
- Seidenberg, P., S. Nicholson, et al. (2012). "Early infant diagnosis of HIV infection in Zambia through mobile phone texting of blood test results." *Bulletin of the World Health Organization*, 90(5): 348-356.
- Smith, S.-J., C. Nimmo, et al. (2014). "Early infant diagnosis of HIV and fast initiation of anti-retroviral therapy in a rural African setting: how well are we doing?" *Paediatrics and international child health*, 34(3): 203-207.
- WHO, w. h. o. (2010). Antiretroviral therapy of HIV infection in infants and children: towards universal access: recommendations for a public health approach-2010 revision, *World Health Organization*.
- World Bank Group (2012). World development indicators 2012, *World Bank Publications*.