

Trends of HIV infection in infants tested at the National HIV Reference Laboratory of Ethiopia using DNA PCR technique

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Abstract

Introduction: Disease progression in children who acquire HIV infection from their mothers is more rapid in Africa including Ethiopia than in developed countries.

Objective: This study was aimed to examine the magnitude and trends of HIV infection in infants born from HIV seropositive mothers and tested by DNA PCR technique.

Methods: Retrospective data of Ethiopian Public Health Institute National HIV Reference Laboratory from 2012 to 2016 were utilized. All the available 5,062 data of infants and children under two years were included in the study. Descriptive statistics were used to present the findings.

Results: Among the total of 5,062 infants and children less than 2 years tested, 256 (5.1%) were HIV infected. Improvement was observed in the trends of HIV infection in infants from year to year as follows; in 2012, 2013, 2014, 2015, and 2016, HIV infected infants were 10.9%, 4.6%, 3.8%, 4.8% and 4.0%, respectively.

Conclusion: In this study, the average positivity rate of HIV infection in infants and children less than 2 years was decreasing by half within five years period. Although the trend of infection indicated improvement from year to year, the finding is far from the target which required to be achieved (<1%). To address other determinants, further prospective study should be conducted for program direction and to enhance intervention strategy.

Keywords: Early infant diagnosis, HIV, PMTCT, Polymerase Chain Reaction, Ethiopia

Introduction

Globally, 2.1 million children were living with HIV, 120,000 AIDS-related deaths and 160,000 new infections among children in 2016. New HIV infections among children have been declined by 47% since 2010 (Ubesie 2012; UNAIDS 2017). Sub-Saharan Africa (SSA) has the largest burden of pediatric HIV in the world. Global target has been set for the eradication of pediatric HIV by 2015 but there are still so many complex issues facing HIV infected and affected children in the sub-continent (Ubesie 2012; UNAIDS 2017).

Disease progression in children who acquire HIV infection from their mothers is more rapid in Africa than in developed countries, probably since African children are exposed to early and multiple infections, have high rates of malnutrition and micronutrient deficiencies and have limited access to health care (Inters and Gray 2001; Shearer et al. 1997). Mother-to-child transmission of HIV accounted for the vast majority of the world's 2-3 million children under the age of 15 years living with HIV and the high number of death is encountered. Early diagnosis and effective treatments are very crucial for the benefit of infant health. Most infants who are HIV infected will die before reaching their second birthday, and about 33% will die before reaching one year of age (Inters and

Gray 2001; Shearer et al. 1997). In endemic HIV infection, Sub-Saharan Africa (SSA), where in many countries more than 20% of pregnant women are HIV seropositive leads to a diagnostic problem in the evaluation of their infants without intervention, more than 25% of infants born to seropositive women will acquire HIV infection in the first year of life (Cunningo et al. 1999).

According to FMOH 2011 and 2007, Ethiopia is one of the low-income countries hit by the HIV pandemic. Besides the dominant heterosexual transmission, vertical virus transmission from mother to child accounts for more than 90% of pediatric AIDS (FMOH 2011 and 2007). The presence of HIV antibodies do not suggest that the child is infected, due to the persistence of maternal antibody in HIV exposed children in rare cases up to 18 months of age. Therefore, virological testing is the most accurate HIV infection diagnostic method in infants and children aged less than 18 months (Shearer et al., 1997 and Cunning et al. 1999). HIV DNA polymerase chain reaction (PCR) is the most widely used assay in developed countries for early infant diagnosis (Rub et al. 1997; Zhang et al. 2008 and Tibotec 2008).

Early diagnosis of HIV infection helps in prompt initiation of comprehensive HIV/AIDS Care. The delay in confirmation of diagnosis of HIV infection in

infants results in setback of initiation of comprehensive HIV/AIDS care resulting in potential loss of life of infants, acquisition of postnatal HIV and loss from follow up of those exposed Children (Rub et al. 1997; Zhang et al. 2008 and Tibotec 2008).

The national HIV reference laboratory provides HIV DNA PCR testing service and periodic review of the early infant diagnosis (EID) program is essential to assess its performance in the country and to identify areas that need strengthening to maximize the benefits of the program. This study enables assessment of trends of HIV infection among infants and children under two years, and highly important to improve the understanding of the diagnostic modalities and prevalence of HIV infection in infants born from HIV positive mothers tested using Dried blood spot (DBS) and DNA PCR technique. The finding might also important to understand the utilization of option B+ in the health care facilities.

Materials and Methods

The study was conducted in Ethiopian Public Health Institute, National HIV reference laboratory. More than seventy health facilities including hospitals and health center were incorporated in the study. Five federal hospitals; St. Paul's Hospital Millenium Medical College, Black Lion specialized hospitals, St. Peter, Emanuel specialized hospitals and ALERT hospitals in Addis Ababa, and the rest of health facilities networked to EPHI for routine HIV molecular laboratory for viral load and early infant diagnosis using Abbott M2000sp/rt and CobasAmpliprep /CobasTaqman platforms were participated. The COBAS Ampliprep/COBAS TaqMan HIV-1 Qual test is a qualitative nucleic acid amplification test for the detection of HIV-1 RNA in plasma and Proviral DNA in EDTA whole blood and dry blood spots (DBS). The test uses COBAS Ampliprep instrument for automated sample processing and COBAS TaqMan analyzer for automated amplification and detection. The test has four major processes: Sample pre-extraction and incubation which is executed by use of a separate reagent kit containing specimen pre-extraction reagent, specimen preparation to isolate HIV-1 RNA and Proviral DNA, Reverse transcription of the target RNA to generate complementary DNA (cDNA), and simultaneous PCR amplification of target cDNA and detection by use of a cleaved dual-labeled oligonucleotide detection probe specific to the target.

A retrospective study was conducted to determine the magnitude and trends of HIV infection in infants tested by DNA PCR technique from 2012 to 2016. All infants and children (<2 years) who are born from HIV positive mothers and tested for HIV at the National

Reference Laboratory were included in the study. A convenient sampling technique was applied and all available five years data were taken. Available data from Polytech Software were generated and taken into an excel spreadsheet and exported into SPSS version 20 for descriptive analysis. The findings are depicted in the table.

Ethical consideration

Ethical approval for the study was obtained from Ethiopian Public Health Institute, Institutional review board (EPHI_IRB). Details of the study including programmatic impact for policymakers and stakeholders are described and permission was obtained timely to access raw data and generate research finding valid for the community and the public in general.

Results

A total of 5,062 DNA PCR tests were performed for infants and children born from HIV seropositive mothers within five years from 2012 to 2016. Accordingly, in 2012 a total of 622 tests were performed of those 68 (10.9%) were DNA PCR test positive, in 2013 a total of 520 tests were performed of those 24 (4.6%) were DNA PCR test positive, in 2014 a total of 906 tests were performed of those 34 (3.8%) were DNA PCR test positive, in 2015 a total of 1,079 tests were performed of those 52 (4.8%) were DNA PCR test positive, and also in 2016 a total of 1,935 tests were performed of those 78 (4.0%) were DNA PCR test positive as shown in table 1.

Table1: DNA PCR test performed in five years from 2012 to 2016 in national HIV reference laboratory, EPHI-Ethiopia

Year	DNA PCR test result in frequency and percentage			
	Invalid	Negative	Positive	Total
2012	0	554 (89.1%)	68 (10.9%)	622
2013	0	496 (95.4%)	24 (4.6%)	520
2014	0	872 (96.2%)	34 (3.8%)	906
2015	2 (0.2%)	1025 (95.0%)	52 (4.8%)	1079
2016	48(2.5%)	1809 (93.5%)	78 (4.0%)	1935
Total	50(1.0%)	4756 (94.0%)	256 (5.1%)	5062

Overall HIV positive infants in five years period were 256 (5.1%). As shown in the table, the number of tests performed is somewhat higher year to year while positivity rate is decreased indicating that PMTCT follow up or option B+ might be enhanced in the health care facilities. Of the tested infants 2,821 were males and 2,241 were females. Of which 146 of the males and 110 of the females were found DNA PCR test result positive. Invalid test results were observed in the years 2015 and 2016, because a fully automated PCR platform is available at EPHI starting from 2015, and also proper documentation for accreditation was conducted starting from the specified year.

Discussion

According to the current finding, overall HIV infection among infants born from HIV-Sero positive mothers

was 5.1%. This indicated great improvement compared with the previous study conducted in eastern Ethiopia showed that among 382 HIV- exposed infants enrolled into care, 60 (15.7%) became HIV positive which is higher than the current finding (Wudineh and Damtew 2016). The study conducted in Nigeria revealed that over all seroprevalence rate among pediatrics was 25.8% (Alikor1 and Erhabor, 2006) which is higher than the current finding and somewhat lower than the study conducted by Amare et al.2014 who reported 32.1% of infants born from HIV seropositive mothers were found to be HIV positive. This might be due to sample size difference and awareness on PMTCT follow up.

According to Nigerian study, trends in seroprevalence of HIV in Pediatrics (1999- 2004) was increasing from 23.4% in 1999 to 25.3% in 2004 (Alikor1 and Erhabor, 2006) which is different from the current study indicating decreased positivity rate from 10.9% in 2012 to 4.0% in 2016. This difference might be because the study period is different, sample size difference and current utilization of option B+ in the health care facilities. The study conducted in Amhara region South Gondar Zone revealed that the prevalence of HIV among exposed infants was 10.1% (Berhan et al. 2014) and similar study conducted in North Gondar Zone, Gondar university hospital indicated 10% of infants were infected with HIV (Koye and Zeleke, 2013) somewhat similar with one of the current trend analysis of infants with HIV in 2012 which is 10.9%. The study conducted at Bishoftu Hospital, Ethiopia (Olana et al. 2016) showed that 4.3 % of infants were infected with HIV somewhat nearer to the current finding (4.0%).

The rate of MTCT is about 15%-25%among non-breastfeeding populations in North America and Europe, and 25%-40% among breastfeeding populations in resource-limited countries (Malyuta et al. 2006). However, with intervention, the MTCT rate can be reduced to as low as 2% (Malyuta et al. 2006). It becomes obvious that the burden of new pediatric HIV infection that will continue to see in Nigeria and other Sub-Saharan countries are due to failure in accessing the PMTCT interventions. According to the guideline for PMTCT in Tanzania (2003), proper utilization of triple ARV regardless of CD4 count in pregnancy can reduce MTCT by up to 1%.

Limitation

Laboratory information system did not capture additional variables and some of the existing variables had never been entered in the system. Therefore, conducting further analysis to estimate predictors of outcome variable was not possible. To identify positive test result with age range, the majority of age

is not properly entered during creating data in polytech. The invalid result is observed from backup laboratories since they sent insufficient sample with one spot not fully circled after they repeatedly tried to test due to failure.

Conclusion

In this study, the average positivity rate of HIV infection in infants and children less than 2 years was decreasing by half within five years period. Although the trend of infection indicated improvement from year to year, the finding is far from the target which required to be achieved (<1%). To address other determinants, further prospective study including all PMTCT sites is recommended to be conducted for program direction and to enhance intervention strategy.

Availability of data and materials: All data generated or analysed during this study are included in this manuscript.

Competing interest: All authors declare that there is no any competing interest.

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