Chapter 3

Value of Caesarian Section in HIV-Positive Women

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Additional information is available at the end of the chapter

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Abstract

The international main goal is to reduce mother-to-child HIV transmission. The appropriate birth delivery for seropositive woman has been analyzed since the beginning of the twenty-first century. Although at the beginning of HIV pandemic delivery by caesarian section (C-section) was considered mandatory in many studies and meta-analyses, recent information reveal limited benefits. Mother-to-child transmission is higher when mothers are diagnosed late during pregnancy, in advanced stages with a high HIV viral load, and labor with membranes ruptured for more than 4 h, especially when the antiretroviral treatment is not respected. During vaginal delivery, the risk of HIV transmitting to infant is due to microtransfusions during uterine contractions or by newborn exposure to cervicovaginal secretions or blood. Although the indication of C-section in HIV-positive women is controversial, there are some situations in which C-section remains mandatory. In mothers diagnosed late during pregnancy, in situation in which HIV viral load is not affordable in real time in the last trimester of pregnancy, and in mothers with poor adherence to antiretroviral treatment, C-section remains one of the most important measures of prevention for HIV mother-to-child transmission.

Keywords: HIV, delivery, C-section, newborn, HIV viral load

1. Introduction

Human immunodeficiency virus (HIV) continues to be an important European public health problem, especially in low-to-medium income countries, such as Romania. UAIDS declared in 2016 between 6100 and 7500 women aged 15 and over as being diagnosed with HIV in our country [1]. The medical system crisis and poverty are the two most important reasons of remaining underdiagnosed. Therefore, the unofficial number is much higher. Worldwide the number is significantly higher.

Pregnancy in HIV-positive females is a challenge due to its risk and fatal complications.

Mother-to-child transmission is particularly analyzed in preventing HIV spreading. The type of birth management in HIV-positive women makes the difference between healthy infants or future new HIV infection sources. Assessing the risks and benefits of every type of birth should be analyzed at the beginning of every pregnancy [2].

The proper method of delivery in HIV-positive female has been analyzed since the beginning of the twenty-first century [3]. Villari et al. in 1993 elaborated an important meta-analysis about six cohort studies regarding the elective caesarian benefits in HIV females. It underlined only a slight effectiveness of C-section in reducing vertical HIV transmission [3, 4]. Until 1999 the international literature was uncertain. A randomized clinical study providing certain information regarding the necessity of selective C-section in preventing HIV transmission was published [5].

In undiagnosed women the vertical transmission is evaluated at 30%. The risk could be higher, depending on the disease evolution/stage and treatment effectiveness [6].

Vaginal birth could lead to newborn infection, increased mortality, and morbidity, especially in undiagnosed or untreated females [6, 7]. To minimize the transmission risk, elective caesarian section (before labor settles or membrane ruptures) is considered the most important method [3].

A scheduled C-section, for the 38th week of pregnancy, to prevent mother-to-child transmission is recommended in women with unknown of high viral load near the delivery time [8]. HIV-positive pregnant women should start their antiretroviral treatment as soon as possible for their own health and to protect their baby [8].

2. Etiology

HIV could be induced in humans by two entities: HIV-1 (with three representative groups: M, major; O, outlier; and N, new) and HIV-2, both from the Retroviridae family. The enzymatic proteins and the most part of the structure are encoded by three genes (gag, pol, and env). HIV-1 is the most frequent. Regarding the expression and infectious release of the virus, there are other six genes involved (regulatory = tat and rev and accessory: vif, vpr, vpu, and nef). On the host cellular membranes, the envelope glycoprotein has contact with CD4, CD1, and CD2 major receptors. HIV-1, a RNA virus, during its replication, enzyme called reverse transcriptase transformed it into a DNA virus. Viral DNA is integrated as proviral DNA. Then, during transcription, proviral DNA is transformed in mRNA, which during translation synthesize immature viral proteins. Assembly viral proteins create mature viral particles and then during budding the new viral particles will be release and they will infect the new cells. HIV-2 is less encountered as HIV-1. It has a slower clinical course, but the outcome is similar to type 1 [9–11].

The key of infection with HIV is cellular dysfunction, humoral immune dysfunction, and aberrant lymphocyte turnover [9, 10].

The male-female ratio in acquiring HIV infection is 2:3, due to women particular anatomy. After unprotected sexual intercourse, envelope glycoprotein gp120 with the infected particles remains on mucosae surface for a period. Langerhans cells from the cervix have an important

affinity for some types of HIV serotypes. The lack of medical education or poverty could interfere with periodical gynecological examination. Females may present multiple entry points for HIV infection, such as ulceration or inflammation of the vaginal mucosae facilitating the entry and multiplication of the virus. Cofactors of transmission are considered the other sexually transmitted diseases (chlamydia, syphilis) [12–15].

Cultural or religious beliefs could make the women an easier target to sexually transmitted infections. In some communities women are discriminated, are not included in healthcare programs, and do not undergo to periodical gynecological examination. In some situation, women are regarded as "sinners" and blamed for being ill. Social status sometimes prevents women in asking and receiving proper treatment [12–15].

Due to poverty or sexual inequality, women are involved in illicit commercial sex work. Promiscuity is the main reason in HIV explosion, especially in poor, uneducated environments [15].

3. Epidemiology and risk factors

HIV pandemic has been intensely epidemiologically analyzed. The main purpose was to determine the viable method on reducing mother-to-child transmission. Since the beginning of the twenty-first century until the beginning of the twenty-second century, discussing the more effective method of birth offered contradictory data. In 1999 a European clinical trial underlined the benefits of elective caesarian section in transmitting vertical HIV [5, 11].

HIV could be acquired during blood transfusion or contact with contaminated fluids, dental extractions, vertical transmission, or unprotected sexual intercourse. It is one of the most severe sexually transmitted diseases.

Vertical transmission could occur before or in different stages of pregnancy or postpartum. Pregnancy, labor with membranes ruptured for more than 4 h, infected blood contact or cervicovaginal secretions, and breastfeeding are key points in preventing HIV. Premasticated food could be another method of contamination. In undiagnosed women, the vertical transmission is evaluated at 30% [6, 10].

Infants born from seropositive females should be tested immediately after birth, at 14–21 days, 1–2 months, and 4–6 months. International guidelines recommend viral assay—HIV RNA and HIV DNA. Detection of antibodies is not recommended in children less than 12–18 months due to the presence of residual mother's antibodies. Mothers diagnosed after birth or incompliant to treatment or with high viral load have a higher risk of HIV transmission. Their infants must be tested at 2–4 weeks from caesarian delivery or antiretroviral prophylaxis. At infants the positive diagnosis is established based on two consecutive positive virologic assays (>1 month and >4 months of life). In children >12–18 months, the HIV antibody tests will be used [16].

HIV genomes had been discovered in different fractions of human milk; therefore breastfeeding should be forbidden. Breastfeeding is not allowed even in women undergoing retroviral treatment because the infected genome could still be present. Replacement formulas are the recommended alternative. If the mother already breastfeeds the infant, without knowing

her health status, it is recommended to begin of prophylaxis. Infants born from HIV-positive mother are tested in the first 4–6 weeks of life. Complementary food is offered at 6 months, according to international guidelines [10, 11].

During vaginal delivery, the risk of transmitting HIV to infant is due to microtransfusions during uterine contractions or to exposure to cervicovaginal secretions or blood [3].

Risk factors in HIV vertical transmission were:

- Maternal viral load (a higher viral load reflects a lower CD4 T lymphocyte, therefore a more advanced clinical stage).
- Period of exposure (undiagnosed before or during the pregnancy, vaginal birth with labor and membranes ruptured, breastfeeding).
- Treatment compliance (incompliant mother to antiretroviral treatment has a higher viral load).
- Mother's nutritional and clinical status.
- Type of delivery, preterm delivery; membrane ruptures more than 4 h.
- Breastfeeding, premasticated food.
- Behavioral attitude [15].

The actual data sustain that vertical transmission could be encountered at any maternal viral load, but the risk is lower <1000 copies/ml. The risk is higher when CD4+ count is under 700/mm^3 [9, 15].

Establishing the exact moment of contamination is essential in minimizing the risk of vertical transmission. The longer the mother is left untreated, the higher the risk of transmission to her child. In utero contamination had been observed after histological analysis of fetal or placenta tissue. The presence of p24 antigen in fetal tissue represents in utero transmission of the HIV infection [15].

In mother-to-child transmission, the minimum period until clinical manifestations are present is between 12 and 18 months. However, exceptions are frequently encountered, but rarely the diagnosis is established in adolescents [10].

4. Pregnancy planning in HIV-positive women

HIV-positive women are as fertile as healthy ones. The difference is made by the impact of the active virus on the female organism. Therefore, subfertility, underweight, associated diseases (sexually transmitted diseases, respiratory infections), and illicit drug abuse are the reasons of fertility problems or abortion in this social category [17].

HIV-positive women should be guided through a correct contraceptive method (male or female condom, diaphragms, vaginal cups, progesterone injections, transdermal implants,

and intrauterine devices). An important discussion subject is represented by the effectiveness of every contraceptive method. There are still uncertain data regarding oral or injectable contraceptive. International studies have not established exactly a connection between hormonal changes—vaginal flora—and mucosae modification and an increased risk of HIV transmission. The Mombasa study underlined a higher predisposition of HIV infection in women undergoing oral or injectable contraceptive therapy, but Beaten et al. in a different cohort could not establish a certain connection. Mombasa study revealed that other sexual transmitted diseases (chlamydia) had a higher incidence and the viral load was higher [17–20].

The international guidelines underline the necessity of thorough blood evaluation in women who desire to conceive before pregnancy. The same indication is recommended to male partners. The purpose is to eliminate any transmitted diseases to the future child. HIV diagnosis as early as possible before pregnancy or during pregnancy leads to a proper antiretroviral treatment and a close follow-up, reducing the risk of vertical transmission [21]:

Step 1: Complete medical checkup for both parents. Viral load determination is essential.

Step 2: Establishing the correct antiretroviral treatment. Respecting the doses and clinical follow-up.

Step 3: Gynecological evaluation, ultrasound, and cervicovaginal cultures should be done periodically, as the medical team recommends.

Step 4: Discussing and analyzing the prober birth method to prevent or minimize mother-to-child HIV transmission.

5. Pregnancy evolution in HIV-positive women

HIV infection is characterized by cellular and immune dysfunction and aberrant lymphocyte turnover. Pregnancy is regarded as period of decreased immunity due to reduced levels of immunoglobulin or complement. Viral load remains the main tool of viral turnover. Concerns were induced by the impact of pregnancy on HIV progression. Evidence of pregnancy influencing the HIV evolution was noticed in untreated patients or in advanced/complicated stages of disease. Bordeaux University Hospital (France) issued a prospective cohort study on 57 pregnant women that are HIV positive. It revealed that pregnancy had not influence the natural immunosuppression evolution [15, 17–19, 22]. Madeline Y. Sutton et al. analyzed the immune response (Interleukin-2 low levels secondary determines CD4+ T lymphocyte levels to drop exposing the HIV-positive organism to opportunistic infection) at HIV patients. Sixty-one women were divided in four large groups: 39 pregnant women (20 HIV positive and 19 HIV negative) and 22 nonpregnant equal HIV positive and negative. There were some differences regarding IL-2 production between HIV-positive and HIV-negative pregnant women, but during the third trimester, the differences were insignificant. Therefore, pregnancy does not influence the natural evolution of HIV [15, 22–24].

Preexisting diseases in HIV-positive women could alter the natural pregnancy evolution. Tuberculosis or other pulmonary infections (*Pneumocystis carinii*), urinary tract infections, and parasite infections (*Toxocara canis*) should be mandatorily evaluated or registered in the

personal history of the patients. Immunosuppression induced both by the HIV and pregnancy could lead to certain complications that are life-threatening for the mother and fetus [15, 25].

Tuberculosis is considered the most frequent coinfection in seropositive females. Halichidis et al. presented a case report of a 21-year-old pregnant HIV-positive female presenting at admission severe infection signs (fever, right cervical and submandibular painful adenopathy persistent, dry cough). After sputum analysis it established the diagnosis of acute miliary TB. Adequate therapy for both pathologies was implemented. Mother refused abortion, the treatment, and admission. After 20 days she was again admitted but with more severe symptoms. After undergoing emergency caesarian at 30 weeks, she gave birth to a male child (1000 g, small for gestation age) who lived 5 days. One week later the mother died. After biopsy the following diagnosis was established: acute disseminated miliary TB with meningoencephalitis, tuberculoma of the brain, pulmonary edema, acute interstitial nephritis, cardiomyopathy, and atrophic gastritis. The association between these two pathologies has a poor prognosis. It affects the mother and the child; furthermore the drug therapy side effects are multiple and could lead to morbidity or mortality in a high percentage [26].

Spontaneous abortion is higher in HIV seropositive women than in healthy population. It is link to opportunistic infections, anogenital contamination with other sexually transmitted diseases, drug abuse, smoking, and alcohol use [25].

HIV infection can predispose the human host to opportunistic infections and comorbidities. Reitter et al. evaluated 312 pregnant HIV-positive females (Frankfurt HIV cohort) and monitored them over an 11-year period. Complications encountered gestational diabetes mellitus, preeclampsia, and preterm delivery [27].

The type of delivery is also influenced by coexisting urogenital infections. HIV-seropositive females come from promiscuous environments, with unprotected sexual activity, poverty, and lack of medical healthcare systems or medical education. HIV induces an important immunosuppression predisposing to severe forms of sexual transmitted diseases, especially trichomoniasis, gonorrhea, syphilis, and bacterial or fungus vaginitis. The risk of coexisting infections is the same as in healthy women, but its evolution is more severe making it difficult to be eradicated. Group B *Streptococcus* dominates bacterial urogenital infections. Preinvasive lesions such as different types of neoplasia or inflammatory pelvic disease could be tied to the immunosuppression. Evaluating CIN incidents in 305 HIV-positive females, Ahr et al. underlined its higher prevalence than in healthy women. Human papilloma virus is the frequent responsible agent [24, 28, 29].

A Romanian study evaluated 98 unpregnant HIV-positive female undergoing antiretroviral therapy for cytological modification. Babes-Papanicolau test was performed to determine if there was a connection between immunosuppression and cervical lesions. 73.58% had cervical cytology abnormal results, estimating that squamous cell lesions in seropositive females with peripheral viral load lower than 500 cell/μl are more often encountered than in healthy population ($p < 0.02$) [30].

Preterm delivery (<37 weeks) and premature birth are two important risk factors in transmitting HIV from mother to child. Kjersti et al. analyzed 219 seropositive pregnant women from

Birmingham. It concluded that under the antiretroviral treatment and preterm delivery with ruptured membranes over 4 h, the risk of vertical transmission is minimal. Only two infants whose mother did not receive antiretroviral therapy were seropositive. To reduce to zero, the risk of HIV transmission from mother to child, elective caesarian is the proper attitude [15, 31].

6. Antiretroviral therapy

The main purpose of antiretroviral therapy is to minimize the transmission and to decrease HIV evolution. Diagnosis timing is essential. Seropositive women antepartum should undergo strict blood count and antiretroviral therapy. Intrapartum or postpartum HIV infection benefits on the same medical steps, underlining that the second category could have a better evolution if the diagnosis is established soon after contamination. Seropositive female may present antiretroviral resistance and lower CD4+ levels [32, 33].

Establishing the correct antiretroviral therapy should be guided by:

- Age of the mother and immunity/clinical status
- Treatment compliance
- Comorbidities associated
- HIV viral load
- Possible teratogenic effects [32, 33]

The goal of antiretroviral treatment during pregnancy is to drop viral load to undetectability and to maintain it. Secondary risk of transmitting HIV to fetus is minimum. Through the placenta, the antiretroviral drugs are transported to child. In year 2005, in France, a prospective multicenter perinatal cohort, evaluated 8075 HIV+ mother/infant couples over a period of 11 years. Mothers received treatment during pregnancy, they did not breastfeed and viral load was determined. It concluded that the risk of vertical transmitting HIV is zero if antiretroviral therapy is started before pregnancy and the viral load is suppressed [33, 34].

Establishing the moment of HIV contamination is essential in preventing mother-to-child transmission. An English retrospective multicenter cohort study (Read et al.) evaluated 378 pregnancies undergoing retroviral therapy. After analyzing age of gestation, the start of drug therapy, CD4+ count, and viral load, it underlined the following data: if the viral load was under 10,000 copies/ml until a gestational age of 26.3 weeks, the purpose to achieve 50 copies/ml could be reached. When the viral load was more than 10,000 copies/ml before 20.4 weeks of gestation, the purpose to obtain less than 50 copies/ml until birth was compromised. The level of 50 copies/ml was obtained in 292 pregnancies from a total number of 378 [35].

Zidovudine (dideoxynucleoside reverse transcriptase inhibitors) is the most used antiretroviral drug during pregnancy. Even if there are other types of dideoxynucleoside reverse transcriptase inhibitors (didanosine, zalcitabine, stavudine, lamivudine) with the same action

mechanism, they are differentiated by the intracellular phosphorylation and kinetics which lead to other types of side effects/toxicity [36].

Conner et al. evaluated 477 pregnant women seropositive undergoing antiretroviral therapy with zidovudine (antepartum, 100 mg, orally for 5 days; intrapartum 2 mg/kg intravenously until birth). The infant received Zidovudine as well (2 mg/kg, orally for 6 weeks daily). The conclusion is the reducing risk of vertical transmission by 2/3 (70%) of the cases [15, 32, 33, 37].

7. Caesarian vs. natural birth

At the beginning of the twenty-first century, international study tries to evaluate the adequate pathways to minimize the risk of mother-to-child transmission. In an epidemic period in low-income countries, death prevalence due to HIV was increasing.

Previous study results had yield contradictory results. Caesarian section after 4 h since the membranes are ruptured could lead to microtransfusion with mother's blood to fetus, increasing the risk of HIV transmission. Ignoring the antiretroviral treatment or late diagnosis made it difficult to affirm that caesarian section could or would drop the risk of HIV transmission [2, 38–40].

The idea of caesarian as method of reducing the risk of transmitting started in France. Duliege et al. observed that in twin pregnancies, the first child to be born has a higher risk of being infected than the second child. One hundred and fifteen twin pairs from HIV-positive females born vaginally or through caesarian section had developed HIV in the following order: vaginal birth, twin A 35% and twin B 15%, and caesarian section, twin A 16% and twin B 8%. The first born from vaginal birth is passing through birth canal in a longer period that the second one. Caesarian section eliminates the risk of contact with blood and vaginal secretions. The main conclusion was that caesarian is a safer method to give birth, preventing the mother-to-child transmission of HIV [36, 40].

International Perinatal HIV Group after analyzing 8533 mother-child pairs established that delivery through caesarian section dropped the risk of HIV transmission with 50% compared with other types of delivery. The percentage was even higher if the seropositive female followed antiretroviral therapy correctly. The combination antiretroviral therapy plus caesarian section before or shortly after membrane ruptures had dropped the transmission with 87% [3].

European Mode of Delivery Collaboration in 1999 after evaluating 370 infants from mothers without any type of delivery indication underlined an 80% reduction of the risk of transmitting HIV in females who gave birth through elective caesarian section [5].

American College of Obstetricians and Gynecologists recommended caesarian section as a prompt intervention in diminishing the mother-to-child transmitting HIV, especially when the peripheral blood count is greater than 1000 copies/ml. The intervention should be established at exact 38 weeks (1 week earlier as in healthy pregnancies), preventing labor or ruptured membranes. Viral load would be analyzed at every 3 months or every time the therapy is changing. Amniocentesis should be avoided in HIV pregnant women [41].

8. Personal contribution

Romania continues to have a high percentage of HIV infection. In June 2017 UNAID reported a total number of 9074 seropositive women. Data were collected between 1985 and 2017. The group age 15–39 years is presenting the higher incidence—2147 cases. Regarding mother-to-child transmission, there were 480 cases reported [42].

We conducted a 10-year (January 2008–December 2017) retrospective study on 203 pregnant seropositive women, ages between 15 and 41 (average age 24 years), under surveillance at the Hospital for Infectious Diseases, Constanta County. The HIV rate of transmission was 5.8%. From all HIV-positive children, 11 were birth by vaginal delivery and just 1 by caesarian section.

The main purpose was to establish new ways of preventing mother-to-child transmission and to encourage HIV testing as a normal routine screening during pregnancy, even in healthy women. Health status was compromised in all females included in evaluation; 100% had anemia (laboratory inferior limit is 11.7 mg/dl); 32 had values under 8 mg/dl. Coinfection with human papilloma virus (14) and toxoplasmosis (1) was detected in 7.02%. During the third trimester, only four women had undetectable peripheral blood viral load. Levels of CD4+ had values under 500 copies/ml in 116 cases. The HIV stage during pregnancy had been A1, 14 cases; A2, 15 cases; A3, 2 cases; B1, 16 cases; B2, 26 cases; B3, 5 cases; C1, 40 cases; C2, 51 cases; and C3, 27 cases. Seventy-five percent underwent triple antiretroviral therapy, 20% double, and 3% single, and 2% have never received treatment.

Not all patients had reported to the scheduled evaluation; therefore, only in 188 pregnant seropositive females we collected concrete data. Delivery management was divided in caesarian 160 cases and vaginal birth 28 cases.

Analyzing our patients regarding coinfections, we noticed one HIV pregnant women with syphilis, other three with genital warts, six with HCV, and 24 with HBV.

Caesarian section was elected in 28 seropositive women with HCV or HBV coinfection. Two HIV-positive women with coinfection elected vaginal birth. All 30 children were healthy with no viral infections. Caesarian was elected as the proper method of delivery in genital warts and syphilis coinfection. In order to minimize the risk of syphilis transmission, the newborn and mother received Penicillin G treatment. After receiving the correct treatment, mother and child were declared healthy.

In eight cases children were breastfed after delivery. One was HIV negative and the other seven were HIV positive.

As we analyzed in the previous discussions, preterm delivery is frequently encountered. In our study in 60 cases, the delivery was under 37 weeks. Fifty four had weight under 2500 g (the normal inferior weight limit), 28 were preterm, and 26 were declared small for gestational age (it represents the infants born over 37 weeks but with weight under the inferior normal limit). Nine mothers had died due to HIV complications and lack of treatment compliance, after a medium period of 32 months after birth. Nine infants had died (one at 1 day,

one at 12 days, four at 1 month, two at 27 months, and one at 7 months). In eight cases of vaginal birth, the infants' viral load was >10,000 copies/ml. In caesarian section the medium viral load was <50 copies/ml. In two cases we encountered values over 500 copies/ml. In those two situations, mother presented vaginal coinfections, and compliance to treatment is doubtful. In four cases infants were breastfed; three of them were born vaginally, and their mother even if they underwent triple antiretroviral therapy had peripheral viral load over 10,000 copies/ml.

In a study performed between January 2008 and August 2013, we analyze 124 HIV-positive mothers and their newborns. In the studied period, the maternal-fetal rate of HIV transmission was 4.8%.

The mortality rate for children was 5.6% and for mothers was 7.2%. Around 97.5% of the children received antiretroviral treatment after birth, and 93.1% of the mothers received antiretroviral treatment during pregnancy.

The proper health status evaluation in children is by growth charts. It provides information regarding the weight, length, and cranial perimeter. In this study, 22.76% were under the tenth percentile for length and weight, underlying the improper development during in utero life—small for gestational age. In 11.38% we encountered a symmetrical intrauterine delay, represented by weight, length, and cranial perimeter positioned under the tenth percentile.

In this study, we performed a linear regression to find if some parameters of the mothers correlate with difficulties in intrauterine growth appreciate below the level of tenth percentile. We found that the cranial perimeter of children under the percentile of tenth correlates with the hemoglobin value in pregnancy ($p = 0.027$), the CD4 value in the last trimester of pregnancy ($p = 0.003$), and the Apgar score ($p < 0.0001$). The weight of children under the tenth percentile correlates with the CD4 value in the last trimester of pregnancy ($p = 0.011$), as well as the Apgar score ($p < 0.0001$). The height of children under the percentile of tenth correlates with the hemoglobin value in pregnancy ($p = 0.05$), the CD4 value in the last trimester ($p = 0.05$), and the Apgar score ($p < 0.0001$). In this study cART duration in pregnancy, duration of gestation, type of delivery (C-section or vaginal delivery), and HIV viral load value do not influence the newborn parameters: weight, length, and cranial perimeter related with tenth percentiles of growth.

Intrauterine growth restriction is often encountered in seropositive females. Our data are sustained by the international literature. Cailhol and Dreyfuss obtained the same results [43–45].

The study performed on 124 children (66 males and 58 females) underlined a mean hemoglobin level of 10.37 mg/dl in male children, with a 1.33 mg/dl standard deviation. In female children, the mean hemoglobin was 10.32 mg/dl with a standard deviation of 1.32 mg/dl (**Figure 1**).

There are significant differences between the mean hemoglobin values of the two groups [$p = 0.196$; $df = 122$; $p = 0.845$; the 95% confidence interval (IC) for the average is $(-0.42; 0.51)$].

The mean CD4 value in male children was 421.15 cells/mmc with a standard deviation of 27.83, and in female children, the mean CD4 was 414.46 cells/mmc with a standard deviation

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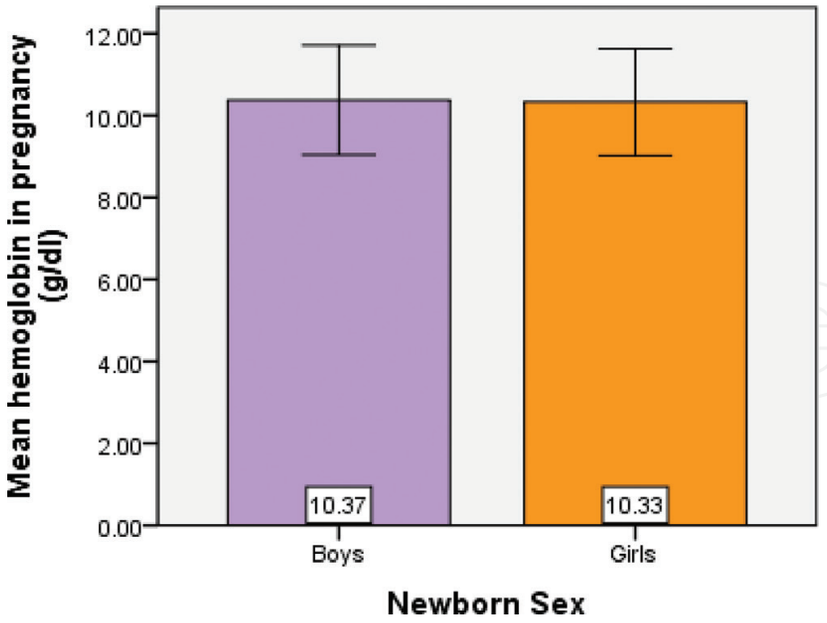

Figure 1. Mean hemoglobin level in pregnancy according with newborn sex.

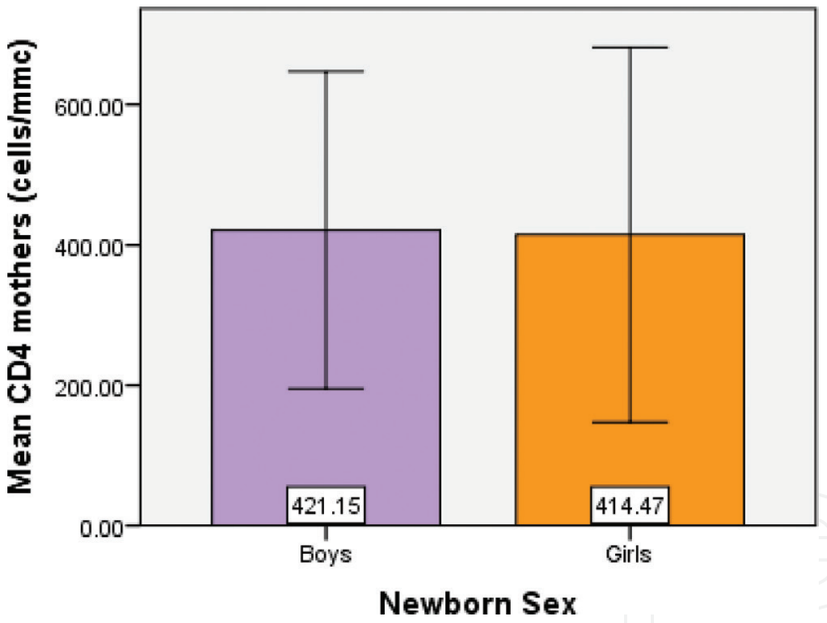

Figure 2. Mean CD4 count in mothers according with newborn sex.

of 35.1 (**Figure 2**). There are no significant differences between the mean CD4 values of the two groups [t = 0.151; df = 122; p = 0.880; the IC 95% for the average is (−81,046; 94,418)].

The mean cART duration in male children was 28.33 weeks with a standard deviation of 14.095, and in female children, the mean cART duration was 26.74 weeks with a standard deviation of 14.81 (**Figure 3**). There are no significant differences of the mean cART duration between the two groups [t = 0.613; df = 122; p = 0.541; the IC 95% for the average is (−3551; 6735)].

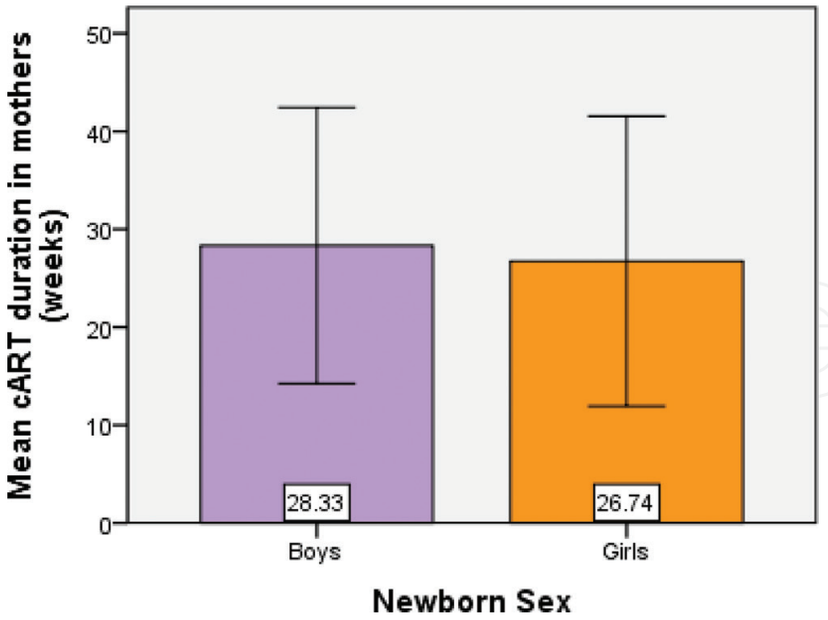

Figure 3. Mean cART duration in pregnancy according with newborn sex.

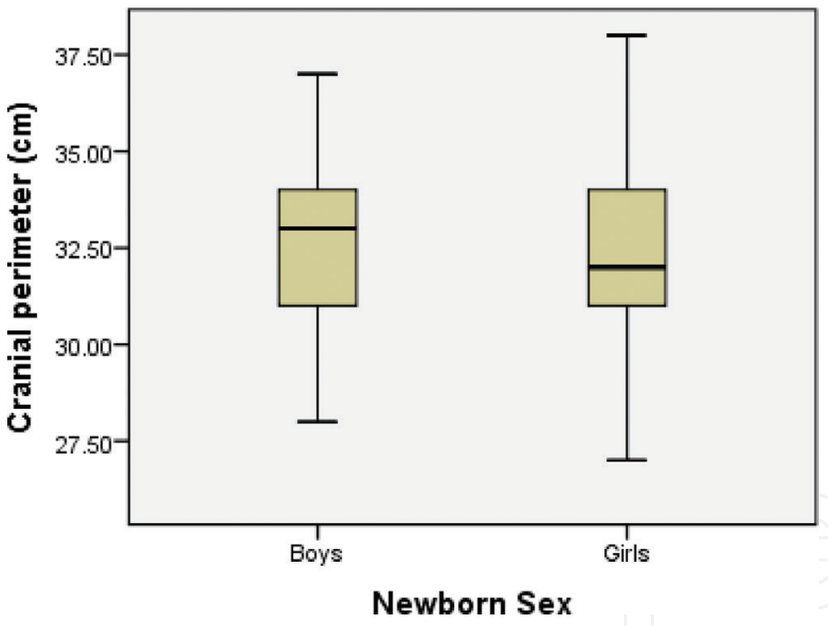

Figure 4. Cranial perimeter according with newborn sex.

The mean cranial perimeter in all studied newborn was 32.5 cm with a standard deviation of 2.13939. In male children the mean cranial perimeter was 32.5 cm with a standard deviation of 1.95503, and in female children, the mean cranial perimeter was 32.5 cm with a standard deviation of 2.34895 (**Figure 4**). The obtained cranial perimeters correspond to 3–5th percentiles on growth charts.

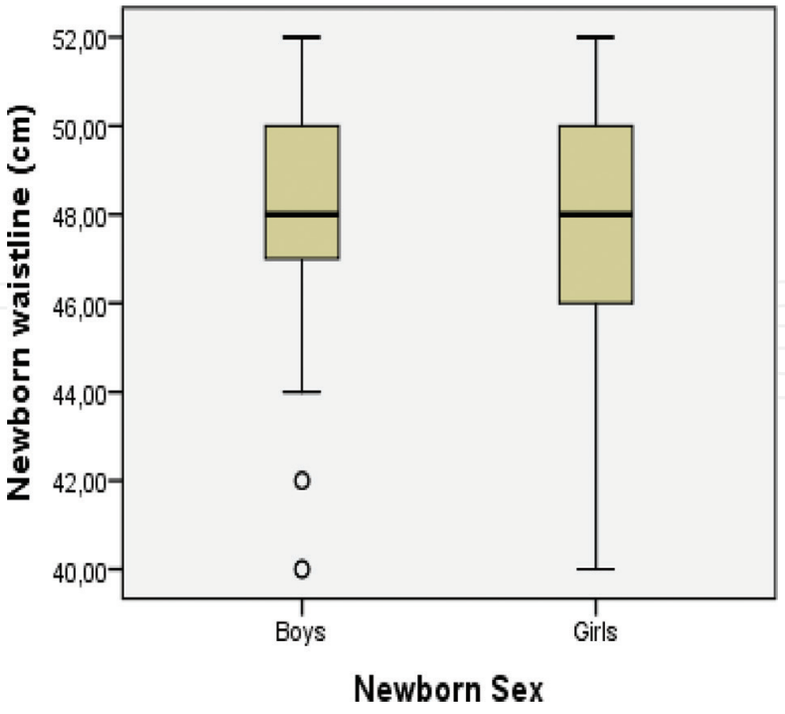

Figure 5. Length according with newborn sex.

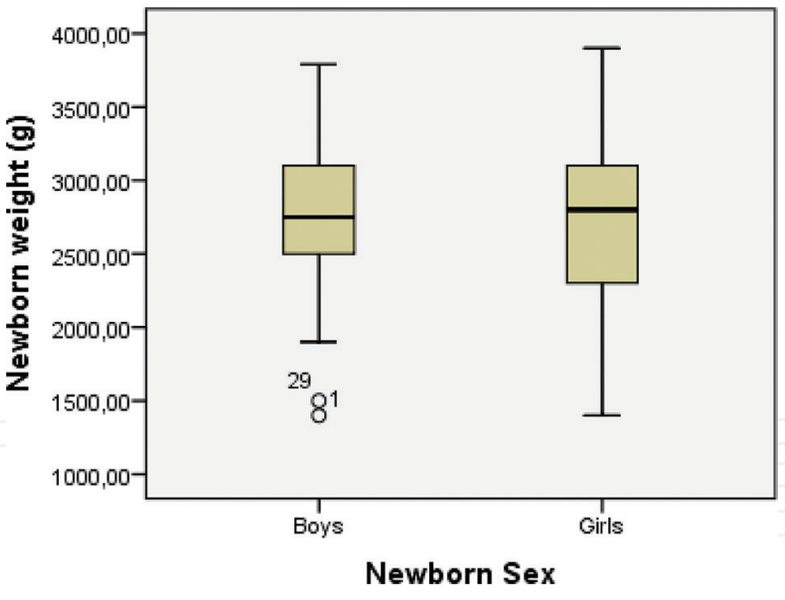

Figure 6. Weight according with newborn sex.

The mean length in newborn from HIV-positive mothers was 47.7258, with a standard deviation of 2.67885. In male children it was 47.9 cm with a standard deviation of 2,66,445, and in female children it was 47.51 cm with a standard deviation of 2.70309 (**Figure 5**). These length values correspond to 10–25th percentiles on growth charts.

The mean weight in male children was 2734.69 g with a standard deviation of 436,65,942, and in female children, the mean weight perimeter was 2677,4138 g with a standard deviation of 542,33,918 (**Figure 6**). These weight values correspond to 5–10th percentiles on growth charts.

9. Conclusions

HIV infection continues to be an important public health problem worldwide due to its cost, morbidity, and mortality. Antenatal screening for HIV should be implemented for every woman as the easier method available to reduce transmission, especially mother-to-child transmission.

Although in our study C-section did not make a clear delimitation between HIV-positive and HIV-negative children, it seems that in children born from HIV-positive mothers with high HIV viral load, delivery by C-section is mandatory.

Although the indication of C-section in HIV-positive women is controversial, in situations in which HIV viral load is high or is not affordable near the time of delivery, and in mothers with poor adherence to antiretroviral treatment, C-section remains one of the most important measures of prevention for HIV mother-to-child transmission.

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