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COMMENT

Prophylaxis and treatment of HIV infection in pregnancy, Swedish guidelines 2024

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ABSTRACT

In May 2024, the Swedish Reference Group on Antiviral Therapy updated the guidelines on management of HIV infection in pregnancy. The most important recommendations and revisions were: (i) ART during pregnancy should be started as early as possible and continue after delivery; (ii) Suppressive ART should normally not be modified; (iii) The treatment target of HIV RNA <20 copies/ml remains; (iv) Dolutegravir/emtricitabine/tenofovir DF is the first-line drug combination also in pregnant women and women planning pregnancy; (v) There is no evidence of an increased risk of neural tube defects associated with dolutegravir; (vi) Mode of delivery for women with effective ART and HIV RNA <200 copies/ml should follow standard obstetric procedures; (vii) Caesarean section is recommended if HIV RNA ≥200 copies/ml; (viii) Scalp electrode, foetal blood sampling and/or vacuum delivery should be used on strict indications, but does not necessitate intensified infant prophylaxis; (ix) Management and mode of delivery in case of premature or full-term rupture of membranes should follow standard obstetric procedures; (x) Recommended infant antiretroviral prophylaxis has been updated; (xi) The duration of infant antiretroviral prophylaxis (gestational age ≥35 weeks and mother on effective ART and HIV RNA <200 copies/ml) has been changed from 4 to 2 weeks; (xii) Infants born to women with HIV RNA ≥200 copies/ml should receive 4 weeks of combination prophylaxis; (xiii) Fertility evaluation and assisted reproduction should be offered to women on suppressive ART according to the same principles as for other women; (xiv) Women living with HIV should still be advised against breastfeeding; (xv) Women who nevertheless opt to breastfeed should be offered intensified support and follow-up.

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The Swedish Reference Group on Antiretroviral Therapy (RAV) has in May 17, 2024 on their website published new updated guidelines on management of HIV in pregnancy, in Swedish (Profylax och behandling av hivinfektion vid graviditet 2024 – Behandlingsrekommendation) [1]. We here present an English translation of the recommendations.

Background

Mother-to-child transmission of HIV

General

More than 90% of all children living with HIV worldwide were infected by their mothers during foetal life, at birth or through breastfeeding. WHO estimates that 1.5 million children were living with HIV in 2022 [2]. The majority of HIV-infected children are born in sub-Saharan Africa. Without prevention against mother-to-child transmission (MTCT), HIV-1 transmission rate is 15–25% if the mother is not breastfeeding. The risk of transmission increases towards the end of pregnancy and most transmissions occur close to or at delivery. If the mother is untreated and breastfeeding, the transmission risk is 25–40%. The transmission risk during breastfeeding decreases significantly with ongoing antiretroviral therapy (ART) and has in studies been reduced to less than 1% [3–6].

Swedish experience

In the last ten years, two children born in Sweden to women known to be living with HIV have been infected. In these cases, it was not possible to provide timely and optimal ART during pregnancy. Annually, 50–70 children are born to women living with HIV in Sweden, indicating a transmission rate of $< 0.5\%$. The majority of women living with HIV in Sweden deliver vaginally.

Risk factors for HIV transmission

The maternal plasma viral load is the strongest factor influencing the risk for HIV MTCT [7] and the risk is as low as 0.09–0.6% in women on effective ART, with low viral load (VL). Maternal primary infection during pregnancy results in very high VL and thus an increased risk of transmission [8–10]. Low VL without ART is not as protective against HIV transmission [11]. Early ART and early virus control, as well as maintaining undetectable or low VL during pregnancy and delivery, are associated with a substantially reduced risk of MTCT [10, 12].

ART prophylaxis against MTCT

Zidovudine was administered to pregnant women in the first study (ACTG 076, 1994) that demonstrated the effect of drug prophylaxis on MTCT of HIV [13], and has traditionally been included in combination ART for prophylaxis against MTCT of HIV ever since. In ACTG 076, intravenous zidovudine was also given to the mother during delivery and zidovudine monotherapy to the child. There is no evidence that zidovudine is superior to other NRTIs in terms of prophylaxis against MTCT, nor that intravenous zidovudine given to women on effective ART, with low VL around the time of delivery further reduces the risk of transmission [14].

Post-exposure prophylaxis after birth has been shown to be safe [15, 16] and effective. Combination ART prophylaxis in children at high risk of transmission is more effective than monotherapy. No difference has been demonstrated between the use of two or three drugs [17].

Rupture of the membranes

Time for rupture of the membranes and mode of delivery have not been shown to be associated with increased risk of MTCT in women on suppressive ART [18–20]. Prematurity has been associated with increased MTCT, but there is no evidence for this in women on suppressive ART. Amniocentesis, scalp electrodes and other invasive procedures do not lead to increased MTCT in women on suppressive ART [21–23].

Mode of delivery

Pre-labour caesarean section reduces the risk of MTCT in women with no or non-suppressive ART [24, 25]. In women on suppressive ART, vaginal delivery does not increase the MTCT risk compared to pre-labour caesarean section [10, 18, 26]. Caesarean section carries an increased risk of maternal complications, such as thrombosis, infection and bleeding. Against this background, there is no reason to recommend elective caesarean section in women on effective ART with virus levels < 200 copies/ml [25].

Breastfeeding

There is limited data on the risk of MTCT of HIV through breast milk in high-income countries. Between 2019 and 2021, 25 out of 41 (61%) Swiss women living with HIV breastfed their infants and no MTCT occurred [27]. In the UK, 111 breastfed infants of women living with HIV have been followed since 2012, (1.3% of all infants born to women living with HIV in the country), without any

case of HIV transmission. In 10 cases, breastfeeding was stopped after the mother's VL increased [28]. In low- to middle-income settings, the postnatal risk of HIV transmission *via* breast milk in women on ART has been reported to be low but not eliminated. In the PROMISE study, women were treated with ART throughout the breastfeeding period and the transmission rate was 0.3% (95% CI 0.1–0.6) at 6 months and 0.6% (95% CI 0.4–1.1) at 12 months. In total, HIV was postnatally transmitted to seven infants of breastfeeding women on ART. In two of these infants, transmission occurred despite the mother's HIV RNA being $<$ 40 copies/ml (at 13 and 38 weeks postnatal age) [5, 6]. In the DolPHIN-2 study, one HIV transmission was found at week 76 postpartum in a cohort of 230 breastfeeding mothers with repeated HIV RNA $<$ 50 copies/ml, at 12, 24, 48 and 72 weeks postpartum [29]. Risk factors for HIV transmission *via* breast milk in untreated and suboptimally treated women are detectable HIV RNA, advanced HIV infection, prolonged breastfeeding, breast and nipple infection/inflammation, infection of the infant's gut or mouth, and mixed-feeding, especially solid food given to infants younger than 2 months [5].

U = U (undetectable = untransmittable) is scientifically proven only in sexual exposure involving vaginal, anal and/or oral intercourse. Thus, the recommendation remains that women living with HIV should not breastfeed in order to eliminate the risk of postnatal transmission.

Most high-income countries advise against breastfeeding, but in recent years several countries have developed guidelines for the management of women on suppressive ART who choose to breastfeed despite being advised against. Guidelines from the United Kingdom [30], the United States [31] and EACS/PENTA [32] consider breastfeeding to be possible if the mother has undetectable virus (no HIV RNA cut-off given), while guidelines from Switzerland [33] define a cut-off at 50 copies/ml. The first three guidelines recommend stopping or pausing breastfeeding if the virus is detectable. Switzerland recommends stopping/pausing breastfeeding at $>$ 50 copies/ml.

Women on suppressive ART, living with HIV in Sweden who choose to breastfeed despite information and advice against, are offered support and follow-up so that breastfeeding is carried out as safely as possible. The mother should be informed that available studies indicate a low but existing risk of MTCT through breastfeeding and that a decision to breastfed requires careful monitoring of the woman and the infant (Table 3). When there are two guardians, both should receive the information.

HIV-2

The risk of MTCT is lower in untreated HIV-2 than in HIV-1, probably due to lower VL (5). Women with HIV-2 should also be treated during pregnancy regardless of VL.

The treatment of HIV-2 is complex because HIV-2 naturally has reduced sensitivity to several antiretroviral drugs [34]. Prophylaxis and treatment during pregnancy in women with HIV-2 should therefore be planned in close collaboration with infectious disease specialists who are experienced in treatment of HIV-2.

Antiretroviral therapy in pregnancy

General

ART during pregnancy is provided for two reasons: as treatment for the woman's HIV infection and as prophylaxis against MTCT. HIV treatment can sometimes be associated with side effects, and it can be difficult to determine whether e.g. fatigue and gastrointestinal problems are linked to the medication, the pregnancy or both.

ART effects on the foetus and infant

There are no documented teratogenic effects of current antiretroviral drugs. However, caution should generally be exercised with newly introduced drugs during pregnancy, due to uncertainty about possible side effects on the foetus/infant. However, no increase in the total number of malformations during ART in pregnancy has been demonstrated to date. In the Antiretroviral Pregnancy Registry (APR), an ongoing registry of a predominantly US HIV population, malformations have been noted in 3.0% of 11,767 live births exposed to ART in the first trimester, which was comparable both to those exposed later in pregnancy and to an HIV-negative control group (2.8 and 2.7%, respectively) [35]. On the other hand, there is some evidence that there is an increased risk of birth defects in untreated HIV during pregnancy, providing further motivation for ART in pregnant women [36].

Pharmacokinetics in pregnancy

Accelerated elimination (clearance) has been reported for several drugs during pregnancy, most pronounced during the third trimester. After delivery, pharmacokinetics normalises within days to weeks. Other pharmacokinetic changes described during pregnancy include

altered absorption, volume of distribution and protein binding [37]. Because of altered pharmacokinetics, changes in drug dosage during pregnancy may sometimes be considered in cases where significant drug resistance exists. The extent to which the pharmacokinetics in pregnancy of the different antiretroviral drugs have been studied varies.

Passage across the placenta and into the genital mucosa

Most nucleoside analogs such as zidovudine, lamivudine, abacavir, emtricitabine, and tenofovir disoproxil fumarate pass extensively across the placenta to the foetus. In the case of tenofovir alafenamide, there are insufficient data. Nevirapine crosses the placenta rapidly and completely and produces a high foetal serum concentration if the mother takes the drug at least one hour before delivery [38] and the same is relevant for doravirine [39], raltegravir [40, 41], elvitegravir and dolutegravir [42]. Protease inhibitors cross the placental barrier to a small extent [43].

There are no studies that directly correlate drug concentrations in vaginal secretions with a protective effect against MTCT of HIV, but it can be theoretically assumed that the presence of anti-retroviral drugs in the birth canal contributes to protection against transmission [44–46].

Passage to breast milk

In the absence of large-scale breastfeeding studies for most antiretroviral drugs, the pharmacokinetic properties of HIV drugs in breast milk are insufficiently investigated, as are the potential effects of breast milk exposure on infants who do not acquire HIV infection. A small Swiss study of 21 mother-infant pairs reported the relationship between drug concentration in maternal plasma and breast milk. Passage to breast milk was good for rilpivirine, efavirenz, nevirapine, abacavir, lamivudine, emtricitabine, tenofovir alafenamide and raltegravir but very low for tenofovir disoproxil fumarate, dolutegravir, bictegravir and darunavir/ritonavir [47]. Plasma concentrations of drugs were below the 10% exposure index (safety threshold for infant exposure to maternal drugs *via* breast milk). Plasma concentrations in infants did not necessarily correlate with concentrations in breast milk [47].

Resistance to antiretroviral drugs

Treatment failure and ongoing viral replication is associated with a high risk of drug resistance development. Resistance is usually due to therapy failure, but can also be due to infection with resistant virus. Resistance in a pregnant woman poses several problems such as: 1) increased risk of MTCT as it may be more difficult to achieve viral suppression 2) limited treatment options for the infant if infected.

There is a particularly high risk of resistance when nevirapine has been used as monotherapy prophylaxis against MTCT [18] because nevirapine has a long half-life and a low barrier to resistance. Single-dose nevirapine for mother and child was previously recommended by WHO for prophylaxis against MTCT in resource-limited settings. The benefit in terms of reduced MTCT was considered to outweigh the risk of resistance, but the WHO now recommends that all pregnant women living with HIV should start combination ART and continue life-long. In Sweden, it is recommended that nevirapine be added to other combination therapy 4–12 h before the estimated time of delivery when VL $<$ 200 copies/ml have not been achieved at the time of delivery, due to its good penetration across the placenta. In case of known nevirapine resistance, alternative treatment, should be considered (Table 1).

Treatment target

Viral load

The target for ART, for both pregnant and non-pregnant women, is HIV RNA $<$ 20 copies/ml. A limited proportion of people living with HIV (PLHIV) with good adherence and effective ART have detectable virus ($<$ 200 copies/ml) by current virus quantification methods. If treatment and adherence are considered fully adequate, detectable low-grade viremia ($<$ 200 copies/ml) need not be considered as treatment failure.

Recommendations

General

InfCareHIV pregnancy module

The National Quality HIV Register (InfCareHIV) includes pregnancy data for monitoring and quality assurance of women's antiviral treatment during pregnancy and childbirth (https://infcarehiv.se/for-dig-som-vardgivare-och-anvandare-av-infcarehiv). In February 2024, 868 pregnancies and 743 deliveries were included in the register.

HIV screening of pregnant women

A prerequisite for prevention of MTCT is that the woman's HIV status is known during pregnancy. Therefore, according to the Swedish National Board of Health and Welfare's regulations, all pregnant women in Sweden should be offered HIV testing and counselling regarding

Table 1. Antiretroviral drug dosing recommendations for women during delivery and for newborns.

To the woman

For women with HIV RNA levels ≥ 200 copies/ml, intravenous infusion of zidovudine should be administered at a dose of 2 mg/kg over 1 h, followed by 1 mg/kg/hour until delivery to ensure adequate drug exposure for the child as early as possible.

If a caesarean section is planned, the infusion should be started 4 h before the procedure. If delivery is expected within an hour or an emergency caesarean section is required within the same time, the infusion should be started as soon as possible, and the loading dose of 2 mg/kg can be given over 30 min instead of 1 h.

Administer a single dose of 200 mg nevirapine tablet (alternatively, 20 ml oral solution of 10 mg/ml) orally 4–12 h before the estimated time of birth. In case of NNRTI resistance, add 50 mg dolutegravir.

To the infant

The mother is on effective ART with HIV RNA < 200 copies/ml

- Infants born ≥ gestational week 35, where the mother is on effective ART with HIV RNA less than 200 copies/ml
  - Zidovudine (oral solution 10 mg/ml), 4 mg/kg × 2 orally for 2 weeks
  - Start treatment within 4 h after birth.
  - Continue for a total of 2 weeks.
- Infants born gestational week 30–34
  - Zidovudine (oral solution 10 mg/ml), 2 mg/kg × 2 orally or zidovudine (infusion solution 10 mg/ml), 1.5 mg/kg × 2 intravenously for the first 14 days.
  - After 14 days of age, the dosage should be adjusted to 3 mg/kg × 2 orally or 2.3 mg/kg × 2 intravenously.
  - Start treatment within 4 h after birth.
  - Continue for a total of 4 weeks.
- Infants born < gestational week 30
  - Zidovudine (oral solution 10 mg/ml), 2 mg/kg × 2 orally or zidovudine (infusion solution 10 mg/ml) 1.5 mg/kg × 2 intravenously.
  - Start treatment within 4 h after birth.
  - Continue for a total of 4 weeks.

Mothers with HIV RNA ≥ 200 copies/ml

- **Combination ART**
  - Zidovudine (oral solution 10 mg/ml) or zidovudine (infusion solution 10 mg/ml) as per the treatment plan above based on gestational age.
  - Lamivudine (oral solution 10 mg/ml) 2 mg/kg × 2.
  - If the mother has received a single dose of nevirapine as described above, administer nevirapine (oral solution 10 mg/ml, 2 mg/kg orally) to the infant as a single dose at 48–72 h of age.
  - If the mother has not received nevirapine more than 2 h before delivery (sufficient amount has not passed through the placenta), administer a dose of 2 mg/kg to the infant immediately after birth in addition to the dose at 48–72 h of age.
  - Start zidovudine and lamivudine treatment within 4 h after birth.
  - Continue for a total of 4 weeks.

Alternative drugs

- Raltegravir (25 mg tablet) (no oral solution available, making administration difficult), 1.5 mg/kg once daily from birth to day 7, then 3 mg/kg × 2
  - Use with caution due to its effect on bilirubin metabolism.
- Abacavir (oral solution 20 mg/ml), 2 mg/kg of abacavir orally × 2
- Tenofovir disoproxil fumarate (33 mg/g powder), 5 mg/kg of tenofovir DF once daily.
- Start treatment within 4 h after birth.
- Continue for a total of 4 weeks.

protection against infection and transmission of HIV during pregnancy. Co-infection with hepatitis B and C viruses is important for the woman herself and for the risk of transmission of these three viral infections to the infant, which is why serology testing for these viruses should be performed if HIV infection is found. There is no increased risk of MTCT of hepatitis B or C virus in women living with HIV on suppressive ART.

It is important that staff at maternity clinics are trained and updated on HIV so that the testing and associated counselling can be offered in a professional and confidence-building manner. Individuals residing in Sweden without a permit should also be provided testing, prophylaxis and care during pregnancy, childbirth and after delivery to the same extent as those with a residence permit or citizenship.

Pre-pregnancy considerations

Advances in treatment have led to an increasing number of PLHIV planning for family and children. Contraception, childbearing and the risk of HIV transmission should be discussed and considered from different perspectives.

Planning for pregnancy in discordant couples

There is no risk of infection during vaginal intercourse if the partner living with HIV is on suppressive ART [48], which means that discordant couples who want to have children can opt for natural conception.

Fertility assessment/treatment in women living with HIV

In vitro fertilisation (IVF) for women living with HIV has not generally been offered in Sweden, as the risk of MTCT has not been considered sufficiently low. In parts of the country, fertility evaluation has not been offered to women living with HIV, despite suppressive ART. The recommendation group has been highly critical of this and hopefully the National Board of Health and Welfare during autumn 2024 will change the recommendation in accordance with the opinion of the Reference Group on Antiviral Therapy, which consider fertility evaluation and assisted reproduction should be offered to women living with HIV on suppressive ART according to the same principles as for other women. Until this is decided, it is possible to refer women for assisted conception to the Centre of Reproductive Medicine at Karolinska University Hospital.

Antenatal care and psychosocial support during pregnancy

For both medical and psycho-social reasons, the pregnant woman living with HIV, and her partner should be cared for by a multidisciplinary team consisting of infectious disease physician, infectious disease nurse, gynecologist/obstetrician, midwife, paediatrician and a counsellor with HIV expertise. In units with few pregnant women living with HIV, it is important to develop linkages to larger HIV clinics. InfCareHIV can be used for remote consultations.

Testing during pregnancy and childbirth

Determination of CD4-cell count

- According to standard procedures [34].

Determination of plasma HIV RNA at initiation and modification of treatment

- Four weeks after starting or changing treatment and then every 4 weeks until viral suppression is reached. If treatment is initiated late in pregnancy, HIV RNA should be checked 1–2 weeks after ART start.

Determination of plasma HIV RNA in women on suppressive ART

- At least once every trimester, about 3 weeks before a planned caesarean section, and close to delivery.
- In case of planned vaginal delivery, HIV RNA should also be checked 1–2 times a month from week 32 onwards and at the time of delivery.

Resistance testing before treatment and in case of suspected or manifested failure

- Resistance testing should be performed before starting treatment and in case of failure. If VL is low, resistance testing can be performed on previously stored plasma or serum samples.
- Treatment of resistant virus should be done in close consultation with an infectious disease specialist with good knowledge of HIV resistance. Previous treatment history should be considered.
- Treatment failure is managed according to the general HIV treatment recommendations [34].

Prenatal diagnosis

- If prenatal diagnosis is indicated, a combination of ultrasound and biochemical tests is recommended in the first instance. Non-invasive prenatal testing (NIPT) should be offered to minimise the need for invasive procedures.
- If non-invasive testing indicates a high risk of chromosomal abnormality and amniocentesis is considered, HIV treatment should be optimised, if necessary, to achieve the treatment target of $<$ 20 copies/ml before the procedure. The same principle applies to chorionic villi biopsy.

Pap smear

- Pap smear is recommended during pregnancy, unless recently done.

External turning

- External reversal of breech/transversal position in gestational week 36–37 should be offered to women on effective ART with HIV RNA $<$ 200 copies/ml.

ART during pregnancy

Previously untreated and women with ongoing treatment who wish to become pregnant

- Newer medicines with insufficient safety data during pregnancy should be avoided and replaced if necessary.

Women with ongoing ART when pregnancy is detected

- The basic principle is that well-controlled ART should be continued as changes in treatment can lead to risk of treatment failure.
- Cobicistat should be switched for pharmacokinetic reasons.
- Cabotegravir should be replaced due to insufficient safety data in pregnancy.
- Dual therapy should be extended to triple therapy due to insufficient data in pregnancy.
- Successful treatment with rilpivirine can be continued. At least monthly monitoring of HIV RNA is recommended [49].

Previously untreated women starting ART during pregnancy

- ART should be initiated as soon as possible.
- The treatment target of suppression of HIV RNA to $<$ 20 copies/ml should be achieved as soon as possible.
- The possibility of resistance should be considered.
- Dolutegravir + emtricitabine/tenofovir disoproxil fumarate is recommended as first line combination.
- If abacavir is planned as part of treatment, the woman should first be tested for HLA B*5701.

- Newer drugs with insufficient safety data in pregnancy should be avoided.

Previously drug-exposed, but currently untreated woman to start ART during pregnancy

- Consideration should be given to previous treatment and resistance test results.

In case of HIV/hepatitis B virus co-infection

- In case of concurrent chronic HBV infection, emtricitabine/tenofovir disoproxil fumarate is the recommended first-line NRTI combination.

Woman with HIV-2

- Same principles as for HIV-1 regarding treatment of the woman, mode of delivery and prophylaxis for the child.
- HIV-2 specific ART is given according to the general recommendation for HIV treatment [34].
- Do not use NNRTIs.

Management close to delivery

HIV RNA > 200 copies/ml before delivery (last two weeks before expected/planned delivery)

- If HIV RNA > 200 copies/ml at the last scheduled sampling occasion, a repeat rapid HIV RNA test is recommended.
- If HIV RNA > 200 copies/ml persists or if a repeat test cannot be performed, a pre-labour caesarean section should be performed despite a vaginal delivery being previously planned.
- If treatment failure is suspected, intensified treatment based on treatment history and resistance patterns should be considered.
- The addition of dolutegravir to non-integrase inhibitor combinations is a way to achieve rapid reduction of HIV RNA [50].

ART during delivery

If the woman is effectively treated and has HIV RNA < 200 copies/ml at delivery

- The infant can be delivered vaginally unless there are obstetric contraindications.
- In the case of caesarean section, it is recommended that the woman take her antiretroviral drugs before the procedure even when fasting before surgery.
- In case of vaginal delivery, the woman should continue ART as usual during the delivery.

If the woman has or is suspected to have HIV RNA ≥ 200 copies/ml close to delivery

- Delivery by pre-labour caesarean section.
- Intravenous zidovudine during delivery as pre-exposure prophylaxis for the infant.
- Nevirapine orally to the woman in a single dose 4–12 hours before the expected delivery, as pre-exposure prophylaxis to the child.
- In case of known NNRTI resistance, 50 mg dolutegravir is added if the woman is not on integrase-inhibitor.
- For preparation and dosage, see Table 1.

Woman not tested for HIV earlier in pregnancy

- When a woman presents for delivery without previous HIV testing, rapid HIV testing should be offered.

Woman with HIV infection detected during delivery

- Start immediate ART with good placenta passage as pre-exposure prophylaxis to the infant: zidovudine intravenously, and nevirapine 200 mg × 1 orally (see Table 2), tenofovir disoproxil fumarate 245 mg 2 × 1 orally and dolutegravir 50 mg orally. If possible, an acute caesarean section is performed before established labour and rupture of the membranes.
- Blood samples should be taken for analysis of HIV RNA, CD4-cell count and antiretroviral resistance.
- After delivery, the infectious disease clinic should be contacted to plan continued ART.

Maternal ART after childbirth

General

- Antiretroviral treatment should be continued after delivery and a prompt visit to the infectious disease specialist should be planned if ART was started during pregnancy or if there have been problems with any aspect of treatment during pregnancy.

Mode of delivery

Pre-labour caesarean section

- Pre-labour caesarean section should be planned according to the same principles as for other indications. Women who undergo caesarean due to non-suppressed viral load > 200 copies/ml despite ART may be scheduled about 10–14 days before the expected delivery to avoid spontaneous onset of labour.

Table 2. Follow-up of children of women living with HIV.

Clinical check-up and blood sampling	
• 0–3 days:	HIV RNA Cord blood should not be used due to the risk of contamination from the mother's blood. The sampling can be coordinated with PKU sampling at > 48 hours of age to minimise the number of sampling occasions.
• 4–6 weeks:	HIV RNA
• > 4 months:	HIV RNA
• 20–24 months:	HIV antibodies

The follow-up schedule applies to children with indeterminate or negative infection status. The number of sampling occasions is low, and it is important that all sampling is performed in a timely manner and that results are obtained for all samples taken, otherwise the diagnosis of an HIV-infected child may be significantly delayed. For children with confirmed or suspected HIV infection, treatment decisions and more frequent follow-up and testing are needed.

- If a woman scheduled for pre-labour caesarean section because of high HIV RNA presents to the obstetric unit in active labour, an acute caesarean section should be performed unless labour has progressed too far.
- Antibiotic prophylaxis is given on the same indications as for women without HIV.

Vaginal delivery

- Vaginal delivery is recommended for women on effective ART with HIV RNA < 200 copies/ml when sampled within 2–4 weeks before delivery and without obstetric indication for caesarean section.
- Scalp electrode, scalp sampling and/or suction cup are used on strict indications but are not contraindicated and do not require modified prophylaxis for the infant.

Antiretroviral prophylaxis of newborns

Infants born to women on effective ART with HIV RNA < 200 copies/ml before delivery and born ≥ gestational week 35

- Zidovudine monotherapy.
- Start as soon as possible, no later than 4 hours after birth, and continue for 2 weeks.
- See Table 1 for dosage.

Infants born to women on effective ART with HIV RNA < 200 copies/ml at time of delivery and born < gestational week 35

- Zidovudine monotherapy.
- Start as soon as possible, no later than 4 hours after birth, and continue for 4 weeks.
- See Table 1 for dosage.

Infants born to a woman with HIV RNA ≥ 200 copies/ml before delivery

- Nevirapine orally as a single dose to the infant at 48–72 hours of age.
- If the woman has received nevirapine < 2 hours prior to delivery (sufficient quantity has not crossed the placenta), an additional dose is given to the infant as soon as possible, but no later than 4 hours of age.
- Two-drug combination therapy (in addition to nevirapine) as post-exposure prophylaxis to the infant. Start with zidovudine and lamivudine.
- Start as soon as possible, no later than 4 hours after birth, and continue for 4 weeks.
- If antiretroviral drug resistance of the mother's virus is known or suspected, prophylactic treatment is given to the child on an individual basis. Consultation with an HIV specialist infectious diseases physician/paediatrician is recommended.
- See Table 1 for drugs and dosages.

Infants of women whose HIV infection is diagnosed after delivery

- In cases where the woman's HIV diagnosis is discovered after childbirth, the above procedure regarding infant prophylaxis can be followed. Prophylaxis can be initiated up to 48 hours of age.

Action that has led to an increased risk of exposure to the mother's blood in a woman on effective ART with HIV RNA < 200 copies/ml

- If there has been an action with increased exposure to maternal blood (such as the use of a foetal scalp electrode, scalp blood sampling, vacuum extraction resulting in skin abrasion, or accidental incision during a caesarean section) and the RNA level is less than 200 copies/ml, specific post-exposure prophylaxis is not necessary.

Infant feeding

General information

- ART significantly reduces the risk of HIV transmission to the child during breastfeeding, but does not eliminate it. Therefore, women living with HIV are advised against breastfeeding.

Table 3. Monitoring of women and children during breastfeeding and management of treatment failure.

Clinical check-up and blood sampling
• HIV RNA testing of mother and infant every month during breastfeeding and two months after cessation of breastfeeding to rapidly identify treatment failure. • If the mother's HIV RNA is 50–200 copies/ml during breastfeeding despite good adherence to ART and blip is suspected, a temporary pause (or cessation) of breastfeeding should be considered and formula introduced while waiting for the results of a follow-up HIV RNA test (taken within 1–2 weeks). If HIV RNA is then $<$ 50 copies/ml, resumption of breastfeeding can be considered. If the HIV RNA in the follow-up sample remains between 50–200 copies/ml, it is recommended that breastfeeding be stopped. • If maternal HIV RNA is $>$ 200 copies/ml, it is recommended that breastfeeding be discontinued, formula introduced, and post-exposure prophylaxis considered for the infant. The decision on post-exposure prophylaxis should consider the time elapsed since the last potential exposure. • If breast-feeding needs to be interrupted, a stable sports bra should be used, possibly in combination with pharmacological lactation inhibition. • After cessation of breast-feeding, the regular follow-up program should be followed according to Table 2.
Post-exposure prophylaxis to the child in case of maternal treatment failure
• Zidovudine + lamivudine + dolutegravir (from 4 weeks of age) for 6 weeks (dosage according to RAV's 'Antiretroviral treatment of HIV infection 2021 - Treatment recommendation') [34]. • Known maternal virus drug resistance may need to be considered. • Contact with an HIV specialist infectious disease physician/paediatrician is recommended.

- The woman should be offered help to stop milk production (Table 3).
- Free-of-charge infant formula and support for bottle feeding should be offered to women throughout Sweden.
- Women who choose to breastfeed despite being advised against it will be offered support and close follow-up during the period of breastfeeding.

Information session on infant feeding

- An information session on infant feeding is recommended to include:
  - Informing both guardians (when two are present).
  - Reviewing the current state of knowledge on the risk of HIV transmission to the child through breastfeeding.
  - Acknowledging that the current recommendation is to refrain from breastfeeding.
  - Discussion about women's desire to breastfeed.
    - Pros and cons for the child's health.
    - Information that formula feeding in Sweden is safe, unlike in many other parts of the world.
    - Grief/feeling of loss when not breastfeeding your child.
    - Aspects of stigma as a cause of wanting to breastfeed and, if requested, suggestions for strategies for how this can be handled.

Follow-up of infants born to women living with HIV

General information

- To determine infection status, the infant should be followed up with clinical examination and testing at a facility with expertise in HIV, as well as in testing and examination of the child (Table 2). Early diagnosis of possible HIV infection is important as the risk of rapid progression of symptoms and deteriorated immune status is relatively high during the first months of life.

Follow-up during breastfeeding

- Women on suppressive ART (see criteria) and who choose to breastfeed despite thorough information and advice against should be offered support and follow- up according to the following guidelines to ensure safe breastfeeding. They should be informed that existing studies suggest a low but existing risk of MTCT through breastfeeding and that this requires careful monitoring of the woman and child (Table 3).
- Criteria:
  - HIV RNA should have been maintained at $<$ 50 copies/ml for as long as possible, but at least during the last trimester of pregnancy.
  - The infant was born full term ($\geq$ 37 weeks of gestation).
  - A history of good adherence to ART.
  - Regular contact with the follow-up clinic and the multidisciplinary team.
  - The woman must be willing and able to attend monthly follow-up visits with HIV RNA testing for themselves and their child during breastfeeding and for 2 months after weaning.
- The risk of HIV transmission increases with longer duration of breastfeeding and therefore the breastfeeding period is recommended to be as short as possible with the aim of weaning by 6 months of age at the latest.
- Exclusive breastfeeding is considered to carry the lowest risk, but in special cases, such as mastitis, infant formula can be used temporarily. Mixed feeding, i.e. breastfeeding and solid food, potentially

increases the risk of HIV transmission and should be avoided.

- Women who choose to breastfeed (and who meet the criteria above) are advised to breastfeed for as short a time as possible, to breastfeed exclusively and to stop breastfeeding if they have a breast infection/mastitis or if they or their infants have symptoms of gastroenteritis. They should be provided with clear information, including how to deal with common complications associated with breastfeeding, and have access to advice and support.
- If the mother's HIV RNA is 50–199 copies/ml during breastfeeding despite good adherence to ART and a blip is suspected, a temporary pause (or termination) of breastfeeding should be considered. When breastfeeding is interrupted, infant formula is introduced while waiting for the results of a follow-up HIV RNA test (taken within 1–2 weeks). If HIV RNA is $<$ 50 copies/ml, resumption of breastfeeding can be considered. If HIV RNA in the follow-up sample remains between 50–199 copies/ml, it is recommended that breastfeeding be stopped (Table 3).
- If maternal HIV RNA is $\geq$ 200 copies/ml, it is recommended that breastfeeding be stopped, formula introduced, and post-exposure prophylaxis considered for the infant (Table 3). In case of weaning to solid food, this should be introduced at 6 months of age if breastfeeding is still ongoing. The aim is to avoid a sudden weaning by a planned switch to formula and/or solid food.

Determination of infection status

- HIV infection in non-breastfed infants can usually be detected by HIV RNA PCR at 1–4 months of age, as most infants infected during pregnancy and/or delivery have high levels of virus. Infection during breastfeeding may lead to diagnosis at older age.
- The onset of viremia may be delayed in infants infected despite post-exposure prophylaxis, why testing 2 weeks after completed prophylaxis is recommended.
- Definitive diagnosis of HIV infection requires virus detection by PCR (RNA and/or DNA) on at least two separate occasions. HIV antibody tests cannot be used during the first 20 months as antibodies are transferred from the mother regardless of whether the child is infected or not. Maternal antibodies may persist up to 20 months.
- If the infant has negative HIV RNA tests on two occasions after 4 weeks of age, there is minimal likelihood of infection, provided the infant has not been breastfed.
- It is very important that all the samples in the schedule (Table 2) are collected and answered, otherwise there is a risk that it will take too long for a potentially HIV-infected child to be diagnosed.
- After 20 months of age, an HIV antibody test should be performed to verify clearance from maternal HIV antibodies. This confirms that the child is not infected.
- There are no proven harmful effects of exposure to ART during foetal life. However, the number of children followed over time is limited, and long-term follow-up of uninfected children is therefore of value.

Vaccination

- Children born to women living with HIV can follow the entire Swedish vaccination program, including vaccination against rotavirus.
- BCG vaccination for children at risk of tuberculosis exposure, is recommended according to standard principles at 6 weeks of age if HIV testing (Table 2) at 0–3 days of age is negative. It is important for the physician responsible for the HIV testing to immediately contact the child health clinic and inform about BCG vaccination should not be administrated if HIV RNA tests positive at birth. Regional routines for the contact ways between maternity clinics and child health clinics need to be established
- Children living with HIV in Sweden should not receive BCG vaccine.

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References

[1] Referensgruppen för antiviral terapi (RAV). Profylax och behandling av hivinfektion vid graviditet 2024 – behandlingsrekommendation. 2024 [May 17, 2024]. https://www.sls.se/rav/rekommendationer/hiv/Profylax-och-behandling-av-hivinfektion-vid-graviditet-2024/. In Swedish.

[2] UNAIDS. UNAIDS data 2023.Available from URL: https://www.unaids.org/en/resources/documents/2023/_unaids_data.

[3] Daniels B, Spooner E, Coutsoudis A. Getting to under 1% vertical HIV transmission: lessons from a breastfeeding cohort in South Africa. BMJ Glob Health. 2022;7(9):e009927.

[4] Nagot N, Kankasa C, Tumwine JK, et al. Extended pre-exposure prophylaxis with lopinavir-ritonavir versus lamivudine to prevent HIV-1 transmission through breastfeeding up to 50 weeks in infants in africa (ANRS 12174): a

randomised controlled trial. Lancet. 2016;387(10018):566–573. Epub 20151119 doi: 10.1016/S0140-6736(15)00984-8. PubMed PMID: 26603917.

[5] Flynn PM, Taha TE, Cababasay M, et al. Association of maternal viral load and CD4 count With perinatal HIV-1 transmission risk During breastfeeding in the PROMISE postpartum component. J Acquir Immune Defic Syndr. 2021;88(2):206–213.

[6] Flynn PM, Taha TE, Cababasay M, et al. Prevention of HIV-1 transmission Through breastfeeding: efficacy and safety of maternal antiretroviral therapy Versus infant nevirapine prophylaxis for duration of breastfeeding in HIV-1-infected women With high CD4 cell count (IMPAACT PROMISE): A randomized, Open-Label, clinical trial. J Acquir Immune Defic Syndr. 2018;77(4):383–392.

[7] Mofenson LM, Lambert JS, Stiehm ER, et al. Risk factors for perinatal transmission of human immunodeficiency virus type 1 in women treated with zidovudine. Pediatric AIDS clinical trials group study 185 team. N Engl J Med. 1999; 341(6):385–393. Epub 1999/08/05.

[8] Drake AL, Wagner A, Richardson B, et al. Incident HIV during pregnancy and postpartum and risk of mother-to-child HIV transmission: a systematic review and meta-analysis. PLoS Med. 2014;11(2):e1001608. Epub 20140225.

[9] Lockman S, Creek T. Acute maternal HIV infection during pregnancy and breast-feeding: substantial risk to infants. J Infect Dis. 2009;200(5):667–669.

[10] Townsend CL, Byrne L, Cortina-Borja M, et al. Earlier initiation of ART and further decline in mother-to-child HIV transmission rates, 2000-2011. AIDS. 2014;28(7):1049–1057.

[11] Ioannidis JPA, Tatsioni A, Abrams EJ, et al. Maternal viral load and rate of disease progression among vertically HIV-1-infected children: an international meta-analysis. AIDS. 2004; 18(1):99–108. Epub 2004/04/20. doi: 10.1097/00002030-200401020-00012.[pii].

[12] Tubiana R, Le Chenadec J, Rouzioux C, et al. Factors associated with mother-to-child transmission of HIV-1 despite a maternal viral load <500 copies/ml at delivery: a case-control study nested in the french perinatal cohort (EPF-ANRS CO1). Clin Infect Dis. 2010;50(4):585–596. Epub 2010/01/15.

[13] Connor EM, Sperling RS, Gelber R, et al. Reduction of maternal-infant transmission of human immunodeficiency virus type 1 with zidovudine treatment. Pediatric AIDS clinical trials group protocol 076 study group. N Engl J Med. 1994;331(18):1173–1180. Epub 1994/11/03

[14] Tariq S, Townsend CL, Cortina-Borja M, et al. Use of zidovudine-sparing HAART in pregnant HIV-infected women in Europe: 2000-2009. J Acquir Immune Defic Syndr. 2011; 57(4):326–333. Epub 2011/04/19.

[15] Kakkar FW, Samson L, Vaudry W, et al. Safety of combination antiretroviral prophylaxis in high-risk HIV-exposed newborns: a retrospective review of the Canadian experience. J Int AIDS Soc. 2016;19(1):20520. Epub 20160212.

[16] Smith GD, Taylor J, Almqvist KF, et al. Arthroscopic assessment of cartilage repair: a validation study of 2 scoring systems. Arthroscopy. 2005;21(12):1462–1467.

[17] Nielsen-Saines K, Watts DH, Veloso VG, et al. Three postpartum antiretroviral regimens to prevent intrapartum HIV infection. N Engl J Med. 2012;366(25):2368–2379. Epub 2012/06/22.

[18] Boer K, England K, Godfried MH, et al. Mode of delivery in HIV-infected pregnant women and prevention of mother-to-child transmission: changing practices in Western Europe. HIV Med. 2010;11(6):368–378. PubMed PMID: ISI: 000278522100003. doi: 10.1111/J.1468-1293.2009.00800.X.

[19] Mark S, Murphy KE, Read S, et al. HIV mother-to-child transmission, mode of delivery, and duration of rupture of membranes: experience in the current era. Infect Dis Obstet Gynecol. 2012;2012:267969–267965. Epub 2012/06/13.

[20] Peters H, Francis K, Harding K, et al. Operative vaginal delivery and invasive procedures in pregnancy among women living with HIV. Eur J Obstet Gynecol Reprod Biol. 2017;210:295–299. Epub 20161224

[21] Mandelbrot L, Jasseron C, Ekoukou D, et al. Amniocentesis and mother-to-child human immunodeficiency virus transmission in the agence nationale de recherches sur le SIDA et les hepatites virales french perinatal cohort. Am J Obstet Gynecol. 2009;200(2):160 e1–9. Epub 2008/11/07. [pii] doi: 10.1016/j.ajog.2008.08.049.

[22] Mandelbrot L, Mayaux MJ, Bongain A, et al. Obstetric factors and mother-to-child transmission of human immunodeficiency virus type 1: the french perinatal cohorts. SEROGEST french pediatric HIV infection study group. Am J Obstet Gynecol. 1996;175(3 Pt 1):661–667. Epub 1996/09/01.

[23] Coll O, Suy A, Hernandez S, et al. Prenatal diagnosis in human immunodeficiency virus-infected women: a new screening program for chromosomal anomalies. Am J Obstet Gynecol. 2006;194(1):192–198. Epub 2006/01/04.

[24] Andiman W, Bryson Y, de Martino M, International Perinatal HIV Group., et al. The mode of delivery and the risk of vertical transmission of human immunodeficiency virus type 1–a meta-analysis of 15 prospective cohort studies. N Engl J Med. 1999;340(13):977–987. Epub 1999/04/01.

[25] Giaquinto C, Ruga E, De Rossi A, et al. Mother-to-child transmission of HIV infection in the era of highly active antiretroviral therapy. Clinical Infectious Diseases. 2005; 40(3):458–465. PubMed PMID: ISI:000227492500018. doi: 10.1086/427287.

[26] Briand N, Jasseron C, Sibiude J, et al. Cesarean section for HIV-infected women in the combination antiretroviral therapies era, 2000-2010. Am J Obstet Gynecol. 2013; 209(4):335.e1–e1- e12. Epub 2013/06/25.

[27] Crisinel PA, Kusejko K, Kahlert CR, et al. Successful implementation of new swiss recommendations on breastfeeding of infants born to women living with HIV. Eur J Obstet Gynecol Reprod Biol. 2023;283:86–89. Epub 20230215

[28] Bamford A, Foster C, Lyall H. Infant feeding: emerging concepts to prevent HIV transmission. Curr Opin Infect Dis. 2023;37(1):8–16. Epub 20231030.

[29] Malaba TR, Nakatudde I, Kintu K, et al. 72 Weeks post-partum follow-up of dolutegravir versus efavirenz initiated in late pregnancy (DolPHIN-2): an open-label, randomised controlled study. Lancet HIV. 2022;9(8):e534–e43. doi: 10.1016/S2352-3018(22)00173-4.PubMed PMID: 35905752.

[30] British HIV Association guidelines for the management of HIV in pregnancy and postpartum 2018 (2020 third interim update). British HIV Association (BHIVA). 2020. https://wwwbhivaorg/pregnancy-guidelines. (Accessed December 18, 2023).

[31] Panel on Treatment of HIV During Pregnancy and Prevention of Perinatal Transmission. Recommendations for the use of antiretroviral drugs during pregnancy and interventions to reduce perinatal HIV transmission in the United States. https://clinicalinfohivgov/en/guidelines/perinatal. (Accessed December 18, 2023). 2023.

[32] PENTA/EACS Guidelines. Version 12.0. 2023. https://wwweacsocietyorg/guidelines/eacs-guidelines/. (Accessed December 18, 2023).

[33] Recommendations of the Swiss Federal Commission for Sexual Health (FCSH) for Medical Care of HIV-Infected Women and their Offspring. Federal Commission for Sexual Health (FCSH). 2019. https://wwwbagadminch/bag/en/home/krankheiten/krankheiten-im-ueberbli. (Accessed December 14, 2023).

[34] Eriksen J, Carlander C, Albert J, et al. Antiretroviral treatment for HIV infection: swedish recommendations 2019. Infect Dis (Lond). 2020;52(5):295–329. Epub 2020/01/14

[35] Antiretroviral Pregnancy Registry Steering committee. The Antiretroviral Pregnancy Registry Interim Report for 1 January 1989 through 31 January 2023. 2023 Available from URL: www.APRegistry.com. (Accessed December 18, 2023).

[36] Bérard A, Sheehy O, Zhao J-P, et al. Antiretroviral combination use during pregnancy and the risk of major congenital malformations. AIDS. 2017;31(16):2267–2277.

[37] Graham SM, Holte SE, Peshu NM, et al. Initiation of antiretroviral therapy leads to a rapid decline in cervical and vaginal HIV-1 shedding. AIDS. 2007;21(4):501–507. Epub 2007/02/16. doi: 10.1097/QAD.0b013e32801424bd.[Mismatch] 00002030-200702190-00013 [pii].

[38] Mirochnick M, Fenton T, Gagnier P, et al. Pharmacokinetics of nevirapine in human immunodeficiency virus type 1-infected pregnant women and their neonates. Pediatric AIDS clinical trials group protocol 250 team. J Infect Dis. 1998;178(2):368–374. Epub 1998/08/11.

[39] Lê MP, Pencolé L, Peytavin G, et al. Placental transfer of doravirine, a recent HIV-1 NNRTI in the ex vivo human cotyledon perfusion model. J Antimicrob Chemother. 2021;76(9):2364–2367.

[40] Croci L, Trezzi M, Allegri MP, et al. Pharmacokinetic and safety of raltegravir in pregnancy. Eur J Clin Pharmacol. 2012;68(8):1231–1232. Epub 2012/03/03.

[41] Pinnetti C, Baroncelli S, Villani P, et al. Rapid HIV-RNA decline following addition of raltegravir and tenofovir to ongoing highly active antiretroviral therapy in a woman presenting with high-level HIV viraemia at week 38 of pregnancy. J Antimicrob Chemother. 2010;65(9):2050–2052. Epub 2010/07/16. [pii] 10.1093/jac/dkq264.

[42] Rimawi BH, Johnson E, Rajakumar A, et al. Pharmacokinetics and placental transfer of elvitegravir, dolutegravir, and other antiretrovirals during pregnancy. Antimicrob Agents Chemother. 2017;61(6)e02213-16.

[43] Marzolini C, Rudin C, Decosterd LA, et al. Transplacental passage of protease inhibitors at delivery. AIDS. 2002;16(6):889–893. Epub 2002/03/29.

[44] Cottrell ML, Garrett KL, Prince HMA, et al. Single-dose pharmacokinetics of tenofovir alafenamide and its active metabolite in the mucosal tissues. J Antimicrob Chemother. 2017;72(6):1731–1740.

[45] Dumond JB, Yeh RF, Patterson KB, et al. Antiretroviral drug exposure in the female genital tract: implications for oral pre- and post-exposure prophylaxis. AIDS. 2007;21(14):1899–1907.

[46] Min SS, Corbett AH, Rezk N, et al. Protease inhibitor and nonnucleoside reverse transcriptase inhibitor concentrations in the genital tract of HIV-1-infected women. J Acquir Immune Defic Syndr. 2004;37(5):1577–1580.

[47] Aebi-Popp K, Kahlert CR, Crisinel P-A, et al. Transfer of antiretroviral drugs into breastmilk: a prospective study from the swiss mother and child HIV cohort study. J Antimicrob Chemother. 2022;77(12):3436–3442. Epub 20220930.

[48] Rodger AJ, Cambiano V, Bruun T, et al. Sexual activity Without condoms and risk of HIV transmission in serodifferent couples when the HIV-Positive partner Is using suppressive antiretroviral therapy. Jama. 2016;316(2):171–181.

[49] Frange P, Tubiana R, Sibiude J, et al. Rilpivirine in HIV-1-positive women initiating pregnancy: to switch or not to switch? J Antimicrob Chemother. 2020;75(5):1324–1331.

[50] Bornhede R, Soeria-Atmadja S, Westling K, et al. Dolutegravir in pregnancy-effects on HIV-positive women and their infants. Eur J Clin Microbiol Infect Dis. 2018;37(3):495–500. Epub 2018/02/06.