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Care for HIV-Exposed Children In the First Year of Life

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The care of infants born to human immunodeficiency virus (HIV)-infected mothers is unique and often challenging to healthcare providers. The progress in HIV treatment, care, and support in past years, particularly in prevention programs aimed at eliminating mother-to-child transmission, resulted in a significant number of children who were exposed to HIV in utero being born HIV-free. However, children born to HIV-infected mothers are considered vulnerable whether they are born with HIV or not. They require diligent healthcare follow up because exposure to HIV can have a negative impact on their growth and development. One of the most important goals for healthcare providers is to help these children attain a good quality of life by providing appropriate postnatal care in a timely manner. Primary care should include antiretroviral (ARV) therapy, identification of risks for HIV infection, optimization of growth and development, administration of immunizations, and screening for infectious diseases. Anticipatory guidance for the HIV-exposed child is also important. Primary care pediatric nurses and nurse practitioners require a good understanding of the needs of uninfected-HIV infants who were exposed to HIV in utero and education for their families.

Little has been done to provide guidelines for the optimal care of human immunodeficiency virus (HIV)-exposed, but uninfected, infants to help them to reach their full potential. Data from the Centers for Disease Control and Prevention (CDC) (2018) show that approximately 8,500 women living with HIV give birth annually in the United States, and only a small proportion of their babies are born with perinatal diagnoses of HIV. In 2016, only 99 infants were born with perinatal diagnoses of HIV (CDC, 2018). However, those HIV-free children who are born to women with HIV require special care to address their risk for postnatal HIV infection. They need nutritional support, timely vaccinations, and screenings for infectious diseases, such as group B streptococcus, pertussis, tuberculosis, and *Pneumocystis carinii* pneumonia. Families of HIV-exposed but uninfected infants also need special support, accurate medical information, and anticipatory guidance to help them prevent the transmission of HIV to their infants while ensuring proper bonding and care (Robinson & Fernandez, 2010).

Currently, most healthcare providers who interact with HIV-exposed infants and their families have limited knowledge about how those families are caring for their infants because they do not interact with them on a routine basis (Robinson & Fernandex, 2010). As a result, there is often a significant gap in care (Robinson & Fernandez, 2010). This article aims to help by providing comprehensive information to pediatric nurses and nurse practitioners who care for HIV-exposed uninfected children.

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General Guidelines for Care During Office Visits

The World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) recommend that an HIV-exposed infant should be followed up within 14 days after birth, and then monthly with their primary care provider (Siberry, 2014). A full reassessment should be done at each primary care follow-up visit to check for growth issues, such as retardation and neuro-developmental issues, as well as other physical findings that may indicate the infant has HIV (Siberry, 2014). During the visit, the practitioner should share important information about minimizing HIV infection risk to the child, conduct virological tests to detect HIV infection, and counsel the mother about her own status (WHO, 2008). The visit also gives clinicians an opportunity to assess the family's need for social support, review plans for testing and results, and reiterate safe feeding practices, such as formula feeding instead of breastfeeding (Siberry, 2014).

Testing

Children younger than 18 months require a virological assay to test for HIV (Robinson & Fernandez, 2010). Antibody testing cannot be used to verify the infection status of an infant. The reason is because the mother's HIV antibodies are transferred across the placenta in the third trimester and do not decay completely from the bloodstream of some infants until they reach 18 months of age (Robinson & Fernandez, 2010). The two most commonly used virological tests in the United States are nucleic acid amplification tests are 1) HIV-1 DNA polymerase chain reaction (PCR), which detects cell-associate proviral DNA, and 2) HIV-1 RNA PCR, which detects plasma viral RNA (Robinson & Fernandez, 2010). Both assays have high sensitivity and specificity by the first 4 to 6 weeks of life (Robinson & Fernandez, 2010). Babies born to HIV-infected women are tested when they are 14 to 21 days old, then at 1 to 2 months, and again at 4 to 6 months (Robinson & Fernandez, 2010). Results on both virologic tests must be negative to confirm the infant does not have HIV (U.S.

Table 1.
Antiretroviral Drug Dose and Duration

ARV Drug and Dose	Duration
Zidovudine should be given to **all** HIV-exposed newborns and should be started as soon after birth as possible, preferably within 6 to 12 hours of delivery.	Within 6 to 12 hours of delivery.
≥35 weeks gestation at birth: 4 mg/kg orally twice daily (if unable to tolerate oral agents, 3 mg/kg/dose intravenously, beginning within 6 to 12 hours of delivery, then every 12 hours).	Birth through 6 weeks.
≥30 to <35 weeks gestation at birth: 2 mg/kg orally (or 1.5 mg/kg intravenously) every 12 hours, advanced to 3 mg/kg orally (or 2.3 mg/kg intravenously) every 12 hours at age 15 days.	Birth through 6 weeks.
<30 weeks gestation at birth: 2 mg/kg orally (or 1.5 mg/kg intravenously) every 12 hours, advanced to 3 mg/kg orally (or 2.3 mg/kg intravenously) every 12 hours after age 4 weeks.	Birth through 6 weeks.
Nevirapine administered in addition to zidovudine to newborns of HIV-infected women who received no antepartum ART prophylaxis.	Given to newborns if no antepartum ART prophylaxis is given.
Weight band dosing.	Three doses in the first week of life.
Birth weight 1.5 to 2 kg: 8 mg for each dose.	First dose within 48 hours of birth (as soon after birth as possible).
Birth weight >2 kg: 12 mg for each dose.	Second dose 48 hours after first.
	Third dose 96 hours after second.

Notes. ART = antiretroviral therapy; HIV = human immunodeficiency virus. Nevirapine dosing given as actual doses not as milligram per kilogram dosing.

Source: Siberry (2014). Adapted from DHHS, 2017.

Department of Health and Human Services [DHHS], 2017). The first negative result must be obtained when the baby is 1 month or older, and the second must be done at 4 months or older. Two positive tests indicate the infant has HIV (DHHS, 2017).

Prophylaxis

Multiple routes exist by which a child can get an HIV infection. The most common is mother-to-child transmission, which can happen during pregnancy, childbirth, and via breastfeeding (Siberry, 2014). Antiretroviral (ARV) drugs can effectively eliminate the risk of mother-to-child transmission during the course of pregnancy, and they can also help improve maternal survival (Barker & Mate, 2012).

According to the WHO, ARV treatment should be initiated as soon as possible in HIV-exposed infants (Horwood et al., 2009). If an infant is suspected to have been exposed to the virus postnatally, even when the virologic tests are negative, they should be started on co-trimoxazole prophylactically at 2.5 to 5 mg/kg twice daily. Antiretroviral theory (ART) prophylaxis and co-trimoxazole should be discontinued if virologic results prove absence of the infection based on two negative results performed no earlier than 2 months, and at least one performed no earlier than 4 months (Siberry, 2014). Table 1 describes the ARV drug, dose, and duration of treatment.

Immunizations. Infants in the United States who have been exposed to HIV but are uninfected must be on a routine vaccination schedule (Jones et al., 2011). Infants born to HIV-infected mothers can have low levels of passively transferred protective maternal antibodies, and that puts them at a higher risk for pneumococcal infection and other preventable diseases (Jones et al., 2011). These infants should be given vaccines for hepatitis B, diphtheria, tetanus toxoids, acellular pertussis, inactivated poliovirus, pneumococcal conjugate 13, *Haemophilus influenzae* type B, and rotavirus (Robinson & Fernandez, 2010). Hepatitis B is a common co-infection in HIV-positive mothers, and it can be transmitted from mother to child during delivery. It is impossible to reduce this transmission to zero, so in the United States, a birth dose of the vaccine is provided, which has reduced vertical transmission by 75% (Chotun, Nel, Cotton, Preiser, & Anderson, 2015).

Feeding. The WHO recommends that HIV-positive women breastfeed exclusively for the first six months of the infant's life, unless replacement with formula feeding is acceptable, feasible, affordable, sustainable, and safe (Ngwende et al., 2013). Exclusive breastfeeding does not irritate the stomach lining like mixed feeds or commercial milk products (Ngwende et al., 2013). Breastfeeding carries some risk for vertical transmission, but breast milk is sufficient to meet the nutritional needs of the infant under the age of 6 months (Nabwera et al., 2017). Unfortunately, HIV-infected mothers in the United States are not advised to breastfeed because maternal or infant ARV cannot totally eliminate HIV transmission via breast milk (Siberry, 2014). Therefore, mothers should be repeatedly counseled against breastfeeding before delivery and during the initial outpatient visits (Siberry, 2014).

Infections

Group B Streptococcus

Group B streptococcus causes neonatal sepsis and is a cause of mortality worldwide. Studies from both developing and developed countries indicate that infants who are HIV-exposed are at increased risk for group B streptococcus (Dauby, Chamekh, Melin, Slogrove, & Goetghebuer, 2016). Transmission of group B streptococcus from a colonized mother to her newborn can occur vertically before or during labor, or horizontally during the neonatal period (Dauby et al., 2016). These infants have higher infection rates, particularly severe cases, and require more hospitalizations (Dauby et al., 2016). Studies indicate there is a correlation between advanced maternal HIV infection when maternal CD4 count is lower than 350 cells/mm3 and higher morbidity in HIV-exposed infants (Dauby et al., 2016). In the HIV-exposed infants, group B streptococcus typically presents with meningitis (Dauby et al., 2016). The reasons for the increased group B streptococcus risk in these infants include a compromised immune system, a neonatal gut microbiome dysbiosis, and the mother's inability to breastfeed. When an HIV-positive mother does not breastfeed her infant, it hampers passive protection of the neonate that occurs through ingestion of group B streptococcus-specific IgA in breastmilk. These altered infant feeding practices are likely to have more effect on the incidence of group B streptococcus (Cools et al., 2017). New interventions, such as promoting breastfeeding or using probiotics and prebiotics, can be used effectively to prevent group B streptococcus (Cools et al., 2017).

Pertussis

Pertussis has re-emerged in developed countries, and is prevalent in low and middle-income countries mainly due to the failure to recognize the disease in HIV-exposed infants who present with only the classic paroxysmal coughing spells. Pertussis is more common in HIV-exposed infants, and rate of hospitalization is higher in this population (Soofie et al., 2016). These cases of pertussis typically occur by 3 months of age in an HIV-exposed infant due to low transplacental maternal antibodies (Soofie et al., 2016). The number of hospitalizations in 2014 in the United States was similar to the number of hospitalizations worldwide in the HIV-exposed infant younger than age 6 months (Soofie et al., 2016). Vaccination of both the infant and the mother can reduce the risk of pertussis (Soofie et al., 2016). Vaccination with acellular pertussis during pregnancy is safe and effective at protecting infants from pertussis and reduces mortality in infants too young to be vaccinated. Use of a polymerase chain reaction (PCR) test can help diagnose pertussis in these infants (Soofie et al., 2016).

Tuberculosis. As per the American Academy of Pediatrics (AAP) (1997), infants of HIV-infected women may be at increased risk of tuberculosis (TB) due to household exposure of immune-compromised individuals who are at risk for TB and HIV infection. An HIV-positive mother should be checked for TB during pregnancy, and the infant should be checked before being discharged from the nursery. Information about the TB status of other household contacts should be requested (AAP, 1997). If the mother has hematogenous dissemination of TB, then the infant should be checked for congenital TB (AAP, 1997). If the mother or a household contact has active TB pulmonary disease, then the infant should be separated from that person until the person is considered non-contagious (AAP, 1997). Any infant or young child exposed to a person with contagious TB should undergo tuberculin skin testing and a chest X-ray (AAP, 1997). Even if the skin test is nonreactive and the chest radiograph shows no abnormalities, the infant should receive prophylaxis with isoniazid for three months until a skin test is repeated. If the skin test is positive (5 or more millimeters of the induration), antituberculous therapy is continued (AAP, 1997). All HIV-uninfected children who reside with HIV-infected individuals should have annual TB skin testing beginning at 1 year of age (AAP, 1997).

***Pneumocystis carinii* pneumonia.** *Pneumocystis carinii* pneumonia (PCP) is a common and often fatal opportunistic infection in HIV-exposed infants (Simonds, Oxtoby, Caldwell, Gwinn, & Rogers, 1993). PCP peaks at 3 to 6 months of age and is rare in the first month of the infant's life (Simonds et al., 1993). Clinicians should consider PCP if an HIV-exposed infant presents with fever, dyspnea, progressive cough, and poor feeding. Untreated infants can become hypoxic, can develop respiratory failure, and can even die (Simonds et al., 1993). Failure to recognize HIV exposure to start treatment in these infants has been a prominent gap. These infants need to be identified earlier to start chemoprophylaxis as per the recommended guidelines (Simmonds et al., 1993).

Children who are HIV-positive may present with mucosal candidiasis, oral thrush, sinusitis otitis media, parotid gland swelling, lymphadenopathy, chronic interstitial lung disease, and herpes zoster (Siberry, 2014). An HIV-exposed child should be tested immediately for HIV if any of these conditions surface (Siberry, 2014).

Costs, Barriers, and Missed Opportunities

Cost is a major constraint in many low-resource countries that try to test for early infant diagnosis (Dunning et al., 2017), but not in the United States because there are more resources available. The AAP recommends that physicians document three negative PCRs by DNA followed by serologic reversion by enzyme-linked immunosorbent assay (ELISA) of children who are exposed to HIV in utero (Benjamin et al., 2001). The cost of diagnosing HIV with the use of serologic follow up given the high quality of PCR is also unknown. The cost per child of conducting both an ELISA and a Western blot test is approximately $351 (Benjamin et al., 2001). Diagnosis of HIV during early infancy, followed by prompt initiation of ARV therapy, dramatically reduces mortality.

There are also certain barriers to care. For instance, a family may live in a rural area, and find it difficult to travel to a clinic and wait for care, even in the United States (Bonawitz et al., 2016). It is very important that caregivers understand the child's ARV treatment and adherence (Coulibalyet al., 2016). Poor healthcare facilities, insufficient knowledge among heathcare workers and caregivers, and bad attitudes among healthcare workers prevent families from getting timely care for these infants (Coulibaly et al., 2016). The inability to prevent HIV transmission in the United States has been linked with missed opportunities to provide ARV to infected mothers and late maternal diagnosis of HIV

(Taylor et al., 2017). Other factors include health disparities, missed testing opportunities, and inconsistencies in the care of HIV-infected women in early interventions that could optimize the care of women and infants (Taylor et al., 2017). Other barriers in the United States include insurance concerns, low incomes, and inaccessibility of care for many minorities. Some pregnant women go undiagnosed and do not realize they are HIV positive. Other women know their status and are taking medications, but their baby can still be exposed to HIV, resulting from missed follow ups, improper feeding, and inaccessible services.

Nursing Implications

Nurses and nurse practitioners are front-line providers who can educate families and provide anticipatory guidance that can help families seek out the best care for the HIV-exposed infants. Nurses should know the extreme importance of recognizing the early signs of HIV infection in an infant and provide prompt treatment. Nurses also need to know that prevention of HIV transmission in an HIV-exposed infant should include appropriate ARV treatment, immunizations, feeding, and regular check ups. Prevention of HIV begins before the baby is born, so providing appropriate care for the HIV-infected mother and infant is very important (Robinson & Fernandez, 2010).

Nurses must educate families about HIV testing. The HIV status of the baby may remain unknown for several months, so nurses should be prepared to provide supportive care for families who may have a great deal of anxiety while they are waiting for this information. Each visit must include a discussion about the importance of giving the infant ARV drugs as prescribed. HIV-positive mothers should be advised to formula feed only and not breastfeed (Robinson & Fernandez, 2010). HIV-exposed infants must receive the same immunizations as other infants (Robinson & Fernandez, 2010).

Mothers and caregivers should also receive education on the modes of HIV transmission. They should know that HIV is not transmitted by touching, hugging, or kissing their infants (Robinson & Fernandez, 2010). Learning that your child is infected with HIV can be emotionally devastating (Siberry, 2014). Clinicians can help by listening and offering emotional support, in addition to providing reassurance that there are effective treatments that can help with quality of life and survival in these infants (Siberry, 2014).

Providers should know that some HIV-infected women might be seriously ill, and have partners or other children who are ill, or have died because of complications of AIDS (AAP, 1997). They might be very poor, not have healthcare coverage, or might fear losing their existing insurance coverage (AAP, 1997). Other factors, such as substance abuse, alcohol use, housing insecurity, domestic violence, and depression, should be screened, and social services should be used to enhance proper care of the infant as well as the mother (AAP, 1997).

Often, a mother does not learn she has HIV until her child comes to the hospital and is diagnosed. This is particularly true when the child was exposed or infected in utero. If the child is tested and diagnosed as early as possible in infancy, and if appropriate treatment is provided, they can avoid seroconverting from HIV-exposed to HIV-positive status. Applying these recommendations can guide nurses and nurse practitioners who diagnose and treat patients with HIV, and help improve outcomes and quality of life in HIV-exposed infants.

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