Infection with human immunodeficiency virus (HIV), the causative agent of acquired immunodeficiency syndrome (AIDS) has become a significant medical problem during the 1980s. Hundreds of infants and thousands of women have been reported to have AIDS. In addition, there are thousands more women infected with HIV, at risk for AIDS, and capable of transmitting HIV to their fetuses/infants if they become pregnant.

DEFINITIONS

Perinatal, the time period including pregnancy through 28 postnatal days; congenital (intrauterine) infection, infection acquired transplacentally; intrapartum infection, infection acquired during the time of delivery; postnatal infection, infection acquired after pregnancy and delivery; HIV infection, asymptomatic or symptomatic infection with HIV; AIDS, meeting the Centers for Disease Control definition for AIDS.

EPIDEMIOLOGIC FEATURES OF AIDS AND HIV

The primary risk factor for AIDS in infants is congenital (and possibly intrapartum) exposure to a mother infected with HIV. Other risks have included transfusion of blood or clotting factor concentrates. However, since the institution of routine testing of blood donors, these risks have become extremely small. Because the majority of women with AIDS (78%) are of childbearing age, it is important that the physician inquire about risk factors in women of childbearing age to provide optimal care and prevention of HIV transmission. The primary risk factors for AIDS in the reported cases in women are IV drug abuse (49%), heterosexual transmission from a person known to be at risk of HIV infection (28%), and transfusion or clotting factor therapy before blood was screened in middle 1985 (11%). Although the sex distribution of pediatric AIDS cases is relatively even (54% boys, 46% girls), the racial distribution of pediatric AIDS is uneven: blacks 54%, Hispanics 24%, whites 21%, and others 1%.

RISKS AND MEANS OF CONGENITAL/INTRAPARTUM HIV INFECTION

The seroprevalence rate in an unselected population of childbearing women has been reported to range from 0.7/1,000 in New Mexico to 20/1,000 in an inner New York City hospital. In childbearing women who are IV drug abusers, the seropositive rate is 30%. Hoff et al reported seroprevalence rates in childbearing women in Massachusetts by type of hospital. They found 8/1,000 in the inner city hospitals, 2.6/1,000 in metropolitan hospitals, 2.2/1,000 in urban-suburban hospitals, 0.3/1,000 in suburban hospitals, and 1.2/1,000 in suburban-rural hospitals. The rate for similar populations in New York City is 15.8/1,000 and for upstate New York it is 1.8/1,000.

The risk of congenital or intrapartum transmission of HIV from an infected woman to her fetus or newborn depends on multiple factors that are not yet clearly defined. The best estimates of the risk for congenital or intrapartum transmission from an infected woman range from 30% to 50%, although reports of transmission have ranged from 0% to 65%. The relevance of the timing of maternal infection, presence or absence of symptoms of AIDS in the mother, or other variables that influence transmission and infection in the fetus is unknown. Cesarean section has not been proven to be protective. Additional studies are necessary to define more precisely the risk and variables associated with perinatal transmission of HIV.

A few case reports suggest that women who were infected with HIV immediately postpartum (through blood transfusion) transmitted HIV to...
their infants through breast-feeding. Others have found that infants breast-fed as many as 7 months after birth did not become infected with HIV if they were born to women infected prepartum with HIV, suggesting that the relative risk of breast-feeding compared with intrauterine transmission is low. Other types of postpartum transmission from a mother to her newborn (eg, physical affection such as touching and kissing) have not been documented.

**DIAGNOSIS OF HIV INFECTION IN INFANTS**

Because there is transplacental passage of maternal antibody to HIV in all infants born to seropositive mothers, the diagnosis of HIV infection in newborns is extremely difficult with currently available laboratory methods. Both the enzyme immunoassay (or enzyme-linked immunosorbent assay) and a confirmatory Western blot test are expected to be positive in the serum of both infected and uninfected infants born to a seropositive mother. Passive acquired HIV antibody decreases to undetectable levels in 50% of infants by 10 months, 75% of infants by 12 months, and most infants by 15 months. Unfortunately, some HIV-infected infants fail to elaborate HIV antibody and will, therefore, be HIV antibody negative but can be identified as HIV infected by viral culture and/or antigen detection. Thus, HIV seronegativity does not completely exclude congenital HIV infection.

HIV infection is probable in an infant who, on serial specimens assayed by the same technique, has persistent or increasing titers of antibody to HIV or who demonstrates the appearance of new HIV-specific antibody bands on diagnostic tests such as Western blot or radioimmunoprecipitation assay. Additional tests currently under study include assays for HIV-specific IgM, HIV antigen, and viral nucleic acids and viral culture. Positive viral culture of infant's blood or tissue is the definitive means of diagnosis but sensitivity is not established in infants. The sensitivity and specificity of the detection of HIV antigen and viral nucleic acids in infants is unknown.

**CLINICAL FEATURES OF AIDS IN INFANTS**

The incubation period of HIV infection in children may vary depending on the route of transmission. The majority of infants with perinatally acquired disease will appear normal at birth but within the first 24 months of life will have clinical illness. A small number of infected infants have remained asymptomatic for as many as 8 years.

Clinical features associated with HIV infection in infants include failure to thrive, generalized lymphadenopathy, hepatosplenomegaly, parotitis, persistent oral candidiasis, and chronic or recurrent diarrhea. Developmental disabilities and neurologic dysfunction are frequently seen. Bacterial infections with common organisms (*Streptococcus pneumoniae* and *Haemophilus influenzae* type b) causing pneumonia, sepsis, meningitis, bone and joint infection, and otitis media are common and frequently recurrent. Lymphoid interstitial pneumonia has been reported in about 40% of infants and children with AIDS. Cardiomyopathy, hepatitis, and renal disease have also been described.

Craniofacial dysmorphic features have been reported in a small number of infants with HIV infection. It is uncertain whether this is specifically due to HIV or whether other factors are involved.

Hyper-γ-globulinemia, particularly IgG, is usually present, although a few infected children may have hypo-γ-globulinemia.

Reported overall mortality in children with AIDS is 65% with the majority of deaths occurring during the first 24 months of life.

**RISKS TO PERINATAL HEALTH CARE WORKERS (Appendix)**

In health care workers, there are no known instances of HIV infection acquired through exposure to infants at delivery. The quantitative risk of acquisition of HIV infection by nonparenteral exposure has not been established, but it is clearly of a low magnitude. Nevertheless, medical history and examination do not reliably identify all mothers infected with HIV, and during delivery and initial care of the infant, health care workers are exposed to large amounts of maternal blood. In view of the utility of gloves in the prevention of other blood-borne diseases, and the low added costs involved, it is prudent for health care workers to use gloves for handling the placenta or the baby before he or she has been washed.

**RECOMMENDATIONS**

1. Because the placenta and infant may be heavily contaminated with maternal blood, gloves should be used for handling the placenta or infant until the blood has been removed from the infant's skin. Hands should be washed immediately after gloves are removed and/or when skin surfaces are contaminated with blood.

2. Personnel assisting in the resuscitation of the newborn should use mechanical (adapted wall) suction equipment. Traps should be used in the line if mouth suction of the airway is performed in an emergency if mechanical suction is not available.
3. Infants of known seropositive mothers may be cared for in the normal nursery and do not require isolation in a private room or cubicle. Gloves should be worn for contact with blood or blood-containing fluids and for procedures that involve exposure to blood. Gloves are not required for prevention of HIV transmission while changing diapers in usual circumstances. Of course, hand washing after changing diapers is always required to reduce the transmission of other pathogens.22

4. Currently, a definitive determination that an infant <15 months of age is infected with HIV should be based on either (a) a diagnosis of AIDS based on Centers for Disease Control criteria or (b) a combination of antibody to HIV and a compatible immunologic profile and clinical course or (c) laboratory evidence of HIV in blood or tissues (culture or antigen detection).

5. In the United States and other countries where safe nutrition other than breast-feeding is available, HIV-infected mothers should be advised against breast-feeding their infants to avoid that possible route of HIV infection.

6. Presently, in most areas, prevalence of HIV infection in pregnant women does not warrant the cost of universal screening. However, serologic testing should be offered to pregnant women at increased risk for HIV infection. This may include routine screening of mothers (or newborns) in high seroprevalent areas. Counseling, guidance, and information should be offered to the woman who is seropositive or at high risk regarding the implications of a current or future pregnancy to both herself and the baby.

7. To prevent or better treat HIV infections there is a need to provide: (a) serologic surveys of anonymous specimens from infants to help define geographic prevalence of maternal HIV infection in areas where prevalence is unknown; (b) development and evaluation of new laboratory tests for the early identification of HIV infection in the newborn and young infant; (c) educational initiatives regarding AIDS, its transmission, and methods to prevent infection, including information concerning sexual and contraceptive behaviors; (d) counseling and easy access to drug treatment programs for individuals who are at increased risk for HIV infection secondary to such IV drug abuse; and (e) development and timely execution of carefully designed experimental protocols for the treatment of infants with HIV infection and its complications.

APPENDIX

The risk to health care workers of acquiring HIV infection in the perinatal setting will vary widely. The following analysis should help hospitals assess the risk, as well as the costs and benefits of implementing universal precautions on a routine basis.

Example 1: Low Prevalence Area

If the incidence of HIV infection in the maternal population is 1:1,000, then 1,000 deliveries would be required for a health care worker to be exposed to the HIV virus. Mere contact with such patients does not result in transmission; there must also be either a needlestick, blood coming in contact with mucous membranes, or abraded or cut skin. Not all needlesticks or blood on skin results in transmission: the risk of transmission to persons with needlesticks from infected patients is approximately 1:250.23 Conclusive data for the risk of cutaneous exposure to perinatal fluids are not available. The risk of transmission for three estimates is as follows.

<table>
<thead>
<tr>
<th>If transmission rate from blood fluids is:</th>
<th>No. of deliveries needed for transmission to occur</th>
<th>No. of years for transmission if 5,000 deliveries per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:100</td>
<td>100,000</td>
<td>20</td>
</tr>
<tr>
<td>1:250</td>
<td>250,000</td>
<td>50</td>
</tr>
<tr>
<td>1:1,000</td>
<td>1,000,000</td>
<td>200</td>
</tr>
</tbody>
</table>

Example 2: High Prevalence Area

If the incidence of HIV in the maternal population were 1:50, the following analysis would apply.

<table>
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<th>If transmission rate from blood fluids is:</th>
<th>No. of deliveries needed for transmission to occur</th>
<th>No. of years for transmission if 5,000 deliveries per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:100</td>
<td>5,000</td>
<td>1</td>
</tr>
<tr>
<td>1:250</td>
<td>12,500</td>
<td>2.5</td>
</tr>
<tr>
<td>1:1,000</td>
<td>50,000</td>
<td>10</td>
</tr>
</tbody>
</table>

The benefits of routine universal precautions, assuming they are 100% effective, will be prevention of one case of
HIV infection in a health care worker in the interval listed in the last column, as well as possible reduction of anxiety among the workers. There will be other benefits in preventing transmission of diseases that are more common than HIV infection, such as hepatitis B. The costs will include the direct costs of supplies and the added costs of disposal of such materials, which can be substantial.

REFERENCES

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15. Centers for Disease Control: Classification system for HIV infection in children under 13 years of age. MMWR 1987;36:225
**Perinatal Human Immunodeficiency Virus Infection**

*Pediatrics* 1988;82:941

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