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Infants with HIV-AIDS Mothers (BIHA): A Case Report

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ABSTRACT

HIV (Human Immunodeficiency Virus) is an RNA class retrovirus that specifically attacks the human immune system. A decrease in the immune system in HIV-infected people facilitates various infections, which can lead to the onset of AIDS. AIDS (Acquired Immunodeficiency Syndrome) is a set of clinical symptoms and signs in people with HIV due to opportunistic infections due to a decrease in the immune system. Opportunistic infections can be caused by various viruses, fungi, bacteria, and parasites, and can attack various organs, including the skin, gastrointestinal tract / intestines, lungs, and brain. Infection of infants or children by HIV (Human Immunodeficiency Virus) is mostly transmitted vertically from mother to baby during pregnancy, childbirth, and through breast milk. Horizontal transmission through transfusion of blood products or other transmission such as child sexual abuse occurs less frequently than vertical transmission. A newborn baby from a mother with HIV-AIDS, accompanied by signs of infection in the baby, the patient's mother was found to be reactive on the HIV test and a decrease in CD4. Physical examination results on system examination were good. The results of laboratory support examinations obtained an increase in CRP and hypoglycemia. The diagnosis of infant with mother HIV-AIDS (BIHA) and neonatal infection was established based on the history, physical examination results and supporting examinations of the mother and baby that had been carried out. The patient received main therapy by giving antiretroviral prophylaxis in the form of zidovudine 4mg/kg/time, 2 times a day until the baby is 6 weeks old and antibiotics according to the diagnosis.

Introduction

HIV (Human Immunodeficiency Virus) is an RNA class retrovirus that specifically attacks the human immune system (Grandi & Tramontano, 2018). A decrease in the immune system in HIV-infected people facilitates various infections, which can lead to the onset of AIDS (Bekker et al., 2023). HIV is a retrovirus that primarily targets CD4 T-helper lymphocytes, leading to immune suppression and increased susceptibility to opportunistic infections. Without treatment, most HIV-infected individuals progress to AIDS (Vijayan et al., 2017). The rate of progression varies based on viral load, immune status, and transmission mode. In infants, vertical transmission is the predominant route of infection. Risk factors for mother-to-child transmission (MTCT) include high maternal viral load, low CD4 count, nutritional deficiencies, and presence of co-infections during pregnancy (Amin et al., 2021). Transmission risk is also influenced by delivery method, duration of membrane rupture, and breastfeeding practices. Effective prevention strategies include antiretroviral therapy (ART) for pregnant women, safe delivery practices, and appropriate infant feeding guidelines (Powell et al., 2023). This case report explores the clinical presentation, diagnosis, and management of an infant born to an HIV-positive mother.

Recent advancements in HIV research and treatment have significantly improved outcomes for both infected individuals and those at risk of transmission. The introduction of integrase

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strand transfer inhibitors (INSTIs), such as dolutegravir, has revolutionized ART, offering better viral suppression with fewer side effects. Studies have shown that early initiation of ART in infants dramatically reduces mortality and morbidity rates (Osman 2020). Additionally, advancements in point-of-care diagnostic testing, including nucleic acid-based tests, allow for earlier detection of HIV in neonates, enabling timely intervention (Ofori et al., 2024). The use of long-acting injectable ARTs is currently being explored as a potential alternative to daily oral regimens, which could improve adherence and treatment success (Scarsi & Swindells, 2021). Prevention strategies, such as pre-exposure prophylaxis (PrEP) for high-risk pregnant women and enhanced maternal ART regimens, have shown promising results in reducing perinatal HIV transmission rates (Henderson et al., 2024). Recent WHO guidelines emphasize a universal test-and-treat approach, ensuring that all HIV-positive pregnant women receive immediate ART regardless of CD4 count (World Health Organization, 2021). Despite these advances, challenges remain, particularly in low-resource settings where access to timely diagnosis, ART, and specialized care is limited (Mahlangu et al., 2024). Efforts are ongoing to improve healthcare infrastructure, expand access to treatment, and integrate HIV management into broader maternal and child health programs.

AIDS (Acquired Immunodeficiency Syndrome) is a set of clinical symptoms and signs in people with HIV due to opportunistic infections due to a decrease in the immune system. Opportunistic infections can be caused by various viruses, fungi, bacteria, and parasites, and can attack various organs, including the skin, gastrointestinal tract / intestines, lungs, and brain. Most people infected with HIV will progress to AIDS if not treated with antiretroviruses (ARVs). The speed of change from HIV infection to AIDS is highly dependent on the type and virulence of the virus, nutritional status, and mode of transmission. Thus, HIV infection can be divided into 3 types, namely: a) *rapid progressor*, lasting 2 - 5 years; b) *average progressor,* lasting 7 - 15 years, and c) *slow progressor,* more than 15 years (Kemenkes RI, 2019).

Infection of infants or children with HIV (*Human Immunodeficiency Virus*) is mostly transmitted vertically from mother to baby during pregnancy, childbirth, and through breast milk. Horizontal transmission through transfusion of blood products or other transmission such as child sexual abuse occurs less frequently than vertical transmission (Indonesian Pediatric Association, 2011). HIV prevalence varies significantly by region, with certain areas experiencing higher rates due to socio-economic and healthcare accessibility factors. According to data from the Ministry of Health Indonesia (Kemenkes RI, 2023), the estimated number of people living with HIV in Indonesia is approximately 526,841, with 30% of new infections occurring in women of reproductive age. In West Java, where RSUD Ciawi is located, HIV prevalence remains a significant concern, particularly among pregnant women. The national program for Prevention of Mother-to-Child Transmission (PMTCT) reports that in 2022, around 3,873 pregnant women were diagnosed as HIV-positive, and only 1,972 received antiretroviral (ARV) treatment. The low coverage of maternal HIV treatment poses a risk for increased perinatal HIV transmission. At RSUD Ciawi, recent hospital records indicate that X% of all pregnant women tested for HIV were reactive, highlighting the importance of routine antenatal screening and early intervention. This case study contributes to the growing body of evidence emphasizing the need for improved maternal health monitoring and neonatal HIV prophylaxis in Indonesia.

HIV attaches to CD4 and CCR5 (chemokine coreceptor) molecules; the surface of the virus fuses with the cell membrane, allowing it to enter T-helper lymphocytes. After integration in the host genome, the HIV provirus forms and then follows transcription and production of viral mRNA. HIV structural proteins are made and assembled inside the host cell. Viral buds from host cells can release millions of HIV particles that can infect other cells (Rahmiwati, 2015).

There are 3 risk factors for HIV transmission from mother to child, namely:

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a. Maternal Factors
   i. The number of HIV viruses in the mother's blood (viral load): is the most important factor in the transmission of HIV from mother to child: the higher the number, the greater the possibility of transmission, especially during / near childbirth and breastfeeding period of the baby.
   ii. CD4 count: mothers with a low CD4 count (especially < 350/µL) have a low immune system as many lymphocytes are destroyed.
   iii. Nutritional status during pregnancy: low body weight and nutritional deficiencies especially protein, vitamins and minerals during pregnancy increase the mother's risk of infectious diseases that can increase the mother's blood levels of HIV, thus increasing the risk of transmission to the baby.
   iv. Infectious diseases during pregnancy: STIs (syphilis, etc.), reproductive organ infections, malaria, and tuberculosis are at risk of increasing HIV levels in the mother's blood, thus increasing the risk of HIV transmission to the baby.
   v. Breast problems: such as nipple blisters, mastitis, and breast abscesses will increase the risk of HIV transmission through breastfeeding.

b. Infant Factors
   i. Gestational age and birth weight: premature babies or LBW babies are susceptible to HIV infection because their organs and immune systems are not well developed.
   ii. Breastfeeding period: the risk of transmission through breastfeeding without treatment ranges from 5 - 20%.
   iii. The presence of wounds in the baby's mouth: the risk of transmission is greater when the baby is breastfed. iii.

c. Obstetric factors
   i. Type of delivery: the risk of transmission in vaginal delivery is greater than SC delivery, because the baby will be exposed to blood and vaginal fluids when passing through the birth canal as a way for the HIV virus from the mother to enter her body.
   ii. Length of labor: the longer the labor process, the higher the risk of mother-to-child transmission of HIV, as the baby has longer contact with the mother's blood/saliva.
   iii. Rupture of membranes > 4 hours before delivery increases the risk of transmission by 2 times compared to rupture of membranes < 4 hours.
   iv. Episiotomy, vacuum extraction and forceps also increase the risk of HIV transmission.

The lowest risk of mother-to-child HIV transmission occurs during pregnancy at 5 - 10%, during breastfeeding at 5 - 20% (average 15%), and the highest risk of mother-to-child HIV transmission is during childbirth at 10 - 20%, and the overall risk of transmission is at 20 - 50% (Ministry of Health, 2019).

There are 3 phases of the natural course of HIV infection, namely:

a. Phase 1 (*window period*): the body has been infected with HIV, but blood tests have not found anti-HIV antibodies, usually lasting about 2 weeks - 3 months from the initial infection and the patient is very easy to transmit HIV to others. Symptoms of acute infection that can occur in the form of fever, sore throat, enlarged lymph nodes, skin rash, joint pain, headache, can be accompanied by coughing like flu symptoms. The '*flu-like syndrome*' phase occurs due to seroconversion in the blood when viral replication is very intense in HIV primary infection.
b. Phase 2 (latent phase): May be asymptomatic to mildly symptomatic. The blood test for HIV shows a positive result, although the symptoms of the disease have not yet appeared. In this phase, the patient can still transmit HIV to others. The asymptomatic

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period lasts on average for 2 - 3 years, while the period with mild symptoms can last for 5 - 8 years.

c. Phase 3 (terminal phase): Immunity has decreased dramatically, resulting in various opportunistic infections in the form of inflammation of various mucosa, for example fungal infections in the mouth. (Indonesian Ministry of Health, 2019)

Diagnosis of HIV in infants can be seen from :

1. Physical Examination

   At the end of pregnancy or during labor, vertical transmission occurs in 50-70% of cases, ensuring that the baby is born without defects. Therefore, the absence of physical anomalies during delivery does not rule out infection. Regular monitoring is required; it should be done once a month for the first six months, once every two months for the next six months, and then once every six months. Failure to thrive, anorexia, recurrent or prolonged fever, swollen glands, liver, and spleen can all be signs of abnormalities, such as progressive encephalopathy. Recurrent respiratory infections, prolonged diarrhea, recurrent pyoderma, and opportunistic infections, including fungal infections such as candidiasis and protozoan infections such as Pneumocystis carinii, are potential symptoms in other organs (Rahmiwati, 2015; Hartanto, & Marianto, 2019).

2. Supportive Testing

   CDC has recommended HIV testing for all pregnant women since 2006, repeat testing in the third trimester for high-risk women and those living in high prevalence areas. Specifically in pregnancy screening from the first visit and before delivery, HIV testing is recommended for all pregnant women in epidemic areas. Pregnant women with STIs and TB are prioritized for HIV testing in low prevalence areas. In addition to HIV testing, all pregnant women should also be screened for hepatitis and other sexually transmitted diseases. Rapid tests, EIA (Enzyme Immunoassay) or ELISA tests, and Western blots tests are the recommended tests in Indonesia. Laboratory tests should be rechecked if the result is at risk and negative at least three, six, and twelve months after the negative laboratory test in pregnant women who are not at risk, then there is no need for rechecking. At least two weeks after the initial screening, the test should be repeated with new material if the result is uncertain; if the result is the same, proceed to PCR screening. The rapid test can be repeated three, six, twelve months after the initial screening if PCR screening is not possible. Patients can be considered negative if the result is still unclear after one year and the risk is low. Test results are called “indeterminate” if there are two “reactive” results or if only one “reactive” test is “risky” or “risky” for the partner. The ANC examination of pregnant women with HIV still includes a complete and directed history and the 10 T test (weight and height measurement, blood pressure check, nutritional status determination, fundus uteri height, fetal presentation and heart rate determination, Tetanus Toxoid, iron tablets, laboratory tests, case management and interview) (MOH, 2020; MOH, 2014).

Management of newborns of PLHIV mothers:

1. Nutritional Management

   Breastfeeding women who have HIV is basically prohibited. However, breast milk should only be given in combination with formula if formula feeding is not possible due to financial reasons. Given the importance of antenatal care, this should be shared as soon as possible. Exclusive breastfeeding is allowed in some places, including South Africa, as long as the mother or child is taking antiretroviral drugs. Comparing infants who are breastfed and fed formula or other foods with infants who are exclusively

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breastfed for the first six months, there is evidence that the risk of transmission is reduced by three to four times (MOH RI, 2014).

Indonesia adopted the 2003 Global Strategy for Infant and Young Child Feeding by establishing the National Strategy for Infant and Young Child Feeding (IYCF). IYCF is also recommended for HIV. WHO established AFASS for BMS for infants born to HIV-positive mothers, namely: (Rahmiwati, 2015: Indonesian Pediatric Association, 2013)

a. Acceptable: The mother is not constrained by socio-cultural norms in making dietary substitutions or worried about discrimination or stigma.
b. Feasible: To prepare and feed a newborn, the mother or family has plenty of time, information and other resources. When there is pressure from family, community and society, mothers receive support.
c. Affordable : Mothers and families can buy, produce, and prepare limited amounts of food, as well as food, fuel, and clean water. Do not spend money on food and family health.
d. Sustainable : Infants should receive fresh replacement food every day and/or night (every 3 hours). As long as infants need it, food should continue to be distributed.
e. Safe, Clean, Quality : The replacement food needs to be kept clean and with the right amount of nutrients.

2. ARV prophylaxis

ARV prophylaxis is given to infants born to HIV-infected mothers. If the baby gets formula milk, Zidovudine can be given for 6 weeks, if the baby gets breast milk, Zidovudine and Nevirapine can be given for 6 weeks, provided that the mother is receiving ART therapy (Kemenkes RI, 2014).

Table 1. Dosage of Antiretroviral administration in infants

	Dosage	Duration of Administration
Zidovudine	• Gestational age > 35 weeks : 4mg/kg/day, twice daily, may be started at 6-12 hours of age • Gestational age > 30 to < 35 weeks : 2mg/kg/time, every 12 hours, then 3mg/kg/12 hours at 15 days of age • Gestational age < 30 weeks : 2mg/kg/meal, every 12 hours, then 3mg/kg/meal every 12 hours after 4 weeks of age	Birth to 6 weeks of age
Nevirapin	• Birth weight 1500-2000 grams : 8mg/dose • - Birth weight 2000-2499 grams : 10mg/dose • - Birth weight >2500 grams : 15mg/dose	Birth to 6 weeks of age

Source : (Ministry of Health, 2014)

1. Prophylaxis of Opportunistic Infections

Infants born to HIV-infected mothers are susceptible to opportunistic infections. Co-trimoxazole prophylaxis can be given to infants born to HIV-infected mothers from 6 weeks of age until HIV infection in the child can be ruled out. The dose that can be given is 4-6 mg TMP/kgBB every 24 hours (Kemenkes RI, 2014).

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2. Immunization

   According to some researchers, infants who contract HIV through vertical transmission can still respond immunologically to vaccinations up to one to two years of age. Due to prophylaxis of opotunistic infections, immunization and nutrition. Breastfeeding is not recommended. However, breast milk can be given exclusively in situations where the patient is unable to provide formula that meets AFASS standards (Indonesian Pediatric Association, 2013).

Therefore, the prognosis will be good if with antiretroviral administration, morbidity and mortality rates will decrease (Indonesian Pediatric Association, 2011). Counseling parents about HIV infection, evaluation and management of opportunistic infections, adequate nutrition, monitoring growth and development, and immunization for preventable infections. If possible (after 6 months of ARV treatment), immunization measures are carried out to complete the unmet schedule, not with live vaccines except measles (Kemenkes RI, 2014). This study aims to: 1) Describe the clinical presentation, diagnosis, and management of an infant born to a mother with HIV-AIDS (BIHA) at RSUD Ciawi. 2) Analyze the prevalence and risk factors associated with mother-to-child transmission (MTCT) of HIV in the study location. 3) Evaluate the effectiveness of prophylactic antiretroviral therapy (ART) and antibiotic treatment in reducing neonatal HIV transmission and infection rates. 4) Provide insights into best practices for the management of HIV-exposed infants to improve healthcare outcomes in similar settings.

Methods

This study follows a descriptive case report design based on a clinical observation method. The research focuses on documenting the clinical presentation, diagnostic process, and management of an infant born to an HIV-positive mother at RSUD Ciawi. A qualitative case report that presents a single case of BIHA (Infant with HIV-AIDS Mother) to illustrate clinical findings and management strategies. The writing of this case report uses the clinical observation method which includes collecting patient data through history taking, physical examination, and laboratory support examination. The following stages were carried out in this study:

1. Patient Data Collection

   Data were obtained from infant patients born to mothers with HIV-AIDS at RSUD Ciawi on December 10, 2023. The data collected included:

   a. Results of physical examination of the baby.
   b. Maternal health history during pregnancy.
   c. History of labor and postpartum care.

2. Laboratory examination

   Laboratory tests are performed to support the diagnosis, which include:

   a. Quantitative CRP test in infants.
   b. Blood glucose level test of the infant.
   c. HIV reactive test and CD4 count of the patient's mother.

3. Diagnosis

   The diagnosis is based on the results of history taking, physical examination of the baby, and the results of laboratory support tests that show an increase in CRP, hypoglycemia, and a positive HIV reactive result in the mother.

4. Therapeutic Intervention and Management

   Patient management includes:

   a. Zidovudine prophylactic antiretroviral administration at a dose of 4 mg / kg / time, twice a day for 6 weeks.

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b. Antibiotics such as Ampicillin 125 mg and Gentamicin 12.5 mg every 36 hours.
c. Adequate nutrition to support infant development and growth.

5. Evaluation and Monitoring

The patient is monitored throughout the treatment and nutrition period. Follow-up examinations are conducted to ensure a positive response to the therapy given.

6. Research Instruments

The instruments used in this study were clinical and documentative in nature, including:

a. Clinical Observation Sheet - used to record the results of history taking, physical examination, and medical interventions given to the patient.
b. Medical Record Form - as a secondary data source containing information on the mother's pregnancy history, delivery process, and postpartum care.
c. Laboratory Test Results - includes quantitative data from the CRP test, the infant's blood glucose level, and the mother's HIV status and CD4 count.
d. Clinical Diagnosis Guidelines - refer to perinatal HIV and neonatal infection diagnosis guidelines to ensure conformity to diagnostic criteria.
e. Therapeutic Evaluation Record - to document the patient's response to antiretrovirals, antibiotics, and nutritional support during treatment.

The findings were analyzed descriptively, focusing on clinical presentation, diagnostic criteria, treatment effectiveness, and outcome monitoring. All patient data were anonymized to protect confidentiality. Ethical approval was obtained following hospital regulations and research ethics guidelines. This research aims to provide insights into the management of HIV-exposed infants, highlighting challenges and best practices for reducing perinatal HIV transmission.

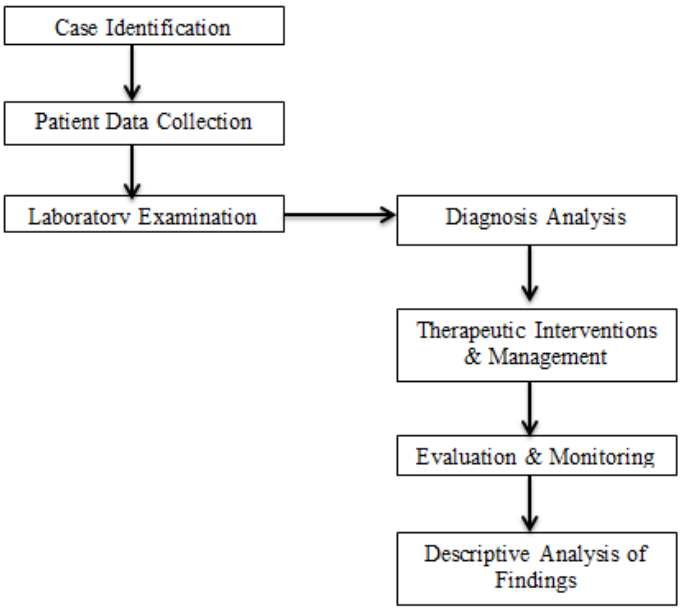

Figure 1: Research flow chart

Results

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The patient was born per vaginam at Ciawi Hospital on December 10, 2023, born healthy and spontaneous with a birth weight of 2550 grams and born to a mother who was HIV aids reactive. The patient's mother was only detected reactive during laboratory tests at Ciawi Hospital. As of December 10, 2023, the patient was admitted to the Cempaka Ward of RSUD Ciawi. During the patient's treatment, all were in good health, active movement, strong crying. The patient had no vomiting, no runny nose, and no diarrhea. The patient's mother was HIV reactive during blood laboratory examination when she was about to give birth. History of hypertension, diabetes, asthma, allergies, and heart disease were denied. The patient was the 3rd child, born spontaneously vaginally at Ciawi Hospital, at term gestation (39 weeks), with a BWL of 2550 grams and PBL of 47 cm. At birth, the patient cried immediately and no abnormalities or congenital diseases were found. The patient's mother rarely checked pregnancy, the total check-up during pregnancy was 2 times at the midwife. Complaints during pregnancy were denied.

The results of the physical examination of the patient obtained compos mentis consciousness, looked healthy and the patient's general condition was good. Vital signs examination, the patient's temperature was 36.8 C, pulse 139x/min, respiration 43x/min, O2 saturation 98% with *room water*. The patient's weight was 2250 g and body length was 47 cm with an impression of good nutritional status and normal stature according to WHO Z-scores. System examination was within normal limits.

The results of laboratory support examinations obtained quantitative CRP increased and hypoglycemia and obtained from the mother's laboratory results reactive on HIV and CD4 tests. The diagnosis of BIHA and *neonatal infection* was confirmed by the clinical symptoms of the infant and mother and supported by the findings of the supporting examination of the infant and mother. The patient was treated during the treatment period and provided adequate nutritional intake. Medical treatment included antibiotics such as ampicillin 125mg, gentamicin 12.5 mg per 36 hours, and antiretrovirals such as zidovudine 10 mg until the baby was 6 weeks old.

Discussion

HIV (*Human Immunodeficiency Virus*) is an RNA class retrovirus that specifically attacks the human immune system. A decrease in the immune system in HIV-infected people facilitates various infections, which can lead to the onset of AIDS. AIDS (*Acquired Immunodeficiency Syndrome*) is a set of clinical symptoms and signs in people with HIV due to opportunistic infections due to a decrease in the immune system. Opportunistic infections can be caused by various viruses, fungi, bacteria, and parasites, and can attack various organs, including the skin, gastrointestinal tract / intestines, lungs, and brain (Kemenkes RI, 2019).

HIV infection in children progresses more rapidly than in adults and some untreated children die in the first two years of life. In 2004, approximately 640000 children aged less than 15 years had a new HIV infection. In addition, because most HIV-infected mothers die of AIDS, 13 million children are orphaned and about 19 million will be by 2010 (Indonesian Pediatric Association, 2011).

The number of pregnant women in Indonesia with HIV positive amounted to 3873, pregnant women who entered HIV care with ARV treatment amounted to 1972 and the number of pregnant women who started ARVs amounted to 1536. The epidemiology of HIV infection in children acquired in the perinatal period is closely related to the epidemiology of HIV infection in women. Infection of the infant or child by HIV (*Human Immunodeficiency Virus*) is mostly transmitted vertically from mother to infant during pregnancy, childbirth, and through breast milk. Horizontal transmission through transfusion of blood products or other transmission such as child sexual abuse occurs less frequently than vertical transmission (Indonesian Pediatric Association, 2011).

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The patient was diagnosed with BIHA and *neonatal infection*. The diagnosis was based on history taking and physical examination first. From the anamnesis and supporting examination, the patient's mother was known to be HIV reactive during laboratory tests when she was about to give birth. On physical examination the patient appeared healthy, system examination was found all within normal limits and nutritional status was good.

HIV transmission from mother to child there are 3 factors, namely; maternal factors (the number of HIV viruses in the mother's blood (*viral load*), CD4 count, nutritional status during pregnancy, infectious diseases during pregnancy, problems with the breasts), infant factors (gestational age and baby's weight at birth, breastfeeding period, the presence of wounds in the baby's mouth), obstetric factors (type of labor, length of labor, rupture of membranes > 4 hours, episiotomy, vacuum extraction, and forceps). The lowest risk of mother-to-child HIV transmission occurs during pregnancy at 5 - 10%, during breastfeeding 5 - 20% (average 15%), and the highest risk of mother-to-child HIV transmission is during childbirth at 10 - 20%, and the overall risk of transmission is at 20 - 50% (Kemenkes RI, 2019).

BIHA laboratory confirmation criteria are HIV testing in mothers with reactive results, an absolute CD4 test of 399 cells/uL and a CD4% of 22%. In the patient, a laboratory examination was carried out for an increase in CRP and hypoglycemia. After taking a history, physical examination, and supported by the results of supporting examinations, the diagnosis of infants with HIV-AIDS mothers with *neonatal infection* was established. Therapy in patients with BIHA is aimed at prophylaxis in infants. Antiretroviral prophylaxis in the form of zidovudine or nevirapine until the age of 6 weeks, the dose given is in accordance with the gestational age and birth weight of the baby, nutrition in the form of breast milk or formula milk with nutritional management using AFASS, The patient is also given opportunistic infection prophylaxis because babies born to PLHIV mothers are susceptible to opportunistic infections, prophylactic co-trimoxazole can be given to babies born to HIV-infected mothers from 6 weeks of age until HIV infection can be ruled out, with a dose that can be given is 4-6mg TMP / kgBB every 24 hours (Kemenkes RI, 2014).

In the case of patients accompanied by *neonatal infection* and gestational age >35 weeks, zidovudine 4mg / kg / time, 2 times a day until the baby is 6 weeks old, and added with antibiotics such as ampicillin 125mg, gentamicin 12.5 mg per 36 hours.

Conclusion

In this patient, the diagnosis of infant with mother HIV-AIDS (BIHA) was primarily established through history taking and physical examination. The patient received early therapy for antiretroviral prophylaxis and antibiotics according to the diagnosis. Thus, with the administration of antiretrovirals, morbidity and mortality rates will decrease.

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