Clinical Risk Factors on Survival among HIV-Infected Children Born to HIV-Infected Mothers

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Objective: *The present study was to investigate clinical risk factors of survival among HIV-infected children born from HIV-infected mothers in the Southern region of Thailand.*
Material and Method: *Data from routine prospective cohort studies between 1990 and 2010 were analyzed. In these studies, 1,549 HIV-infected children born to HIV-infected mothers were enrolled at birth and followed longitudinally. Information on demographic, clinical manifestations, and HIV-infection status factors was collected. Survival analysis was used to determine risk factors associated with mortality.*
Results: *Results found that one-fourth of HIV-infected children died (434, 28.02%) during the follow-up period. The follow-up available equals to 135,295 person-months. The incidence rate was 1.03 times per 100 person-months (95% CI: 0.97 to 1.08). The median survival time among HIV-infected children from diagnosis to death was 87.34 months (95% CI: 87.32 to 87.36). HIV-infected children were diagnosed to confirm as AIDS (88.44%) and symptomatic HIV positive (11.56%). Clinical risk factors on survival among HIV-infected children were found. HIV-infected children were more likely to die if they were infected with candidiasis (HR: 1.47, 95% CI: 1.07 to 2.00), Mycobacterium tuberculosis (HR: 1.51, 95% CI: 1.26 to 1.81), and Pneumocystis jiroveci (HR: 1.50, 95% CI: 1.27 to 1.76) as compared to HIV-infected children without clinical manifestation.*
Conclusion: *Mortality among infected children born to HIV-positive mothers is high in the Southern region of Thailand. Consequently, health service system related to prevent mother-to-child HIV-transmission is needed to improve child survival.*

Keywords: *Clinical risk factor, Survival, Infected children, HIV-positive mother*

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HIV/AIDS have emerged globally as a major public health problem. Mother to children transmission (MTCT) remains critical concerns worldwide and is the dominant mode of acquisition of HIV-infection in children[1]. Human immunodeficiency virus type 1 (HIV-1) may transmit from mother-to-child during antepartum, intrapartum, and postpartum period[2,3], but relatively frequent in during delivery[4].

The global MTCT rates show geographical difference. The overall MTCT rate of HIV-1 infection tends to be higher in developing countries and ranged 13 to 48%[5-9]. The rate is slightly lower in developed countries where the range is 13 to 32%[5]. The lowest rates are reported in European and American countries and the highest is in African countries[6,7]. In Africa and Asia, heterosexual transmission of HIV is the most common transmission[3]. In 1998, new pediatric HIV infection mainly occurred in Africa (90%). One fifth was in children less than 15 years (20%)[3]. In addition, it was estimated that 330,000 children less than five years died in sub-Saharan Africa. The mortality rates of HIV-specific in children less than five years were between 10 and 25 per 1,000 children[10].

In Thailand, HIV prevalence among pregnant women has increased slightly from 0.64 to 1.18% between 2003 and 2009[11]. Approximately, the prevalence of mother-to-child transmission has risen from 0.6 to 2.3% between 1990 and 2000[12]. In addition, mother-to-child transmission has increased to 3.2% in 2012[13]. However, a number HIV-infected child has declined between 1984 and 2010[14]. Of these, 3.62% were HIV-infected children born to

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HIV-infected pregnant women between 1984 and 2011[15]. An estimated 10,000 children are born to HIV-infected mothers annually[16], and 2,000 children daily become infected[12]. The overall mortality rates are increasing among children less than 5 years of age. Of these, 30,000 children are already infected and 7,500 cases have developed to AIDS[12].

During the past year, further information has become available on many aspects of mother-to-child transmission. Most reports on impact of maternal HIV-infection on children survival dealing with HIV-infection. Relatively few studies have investigated the role of clinical manifestations on survival among HIV-infected children born to HIV-infected mothers. Hence, the purpose of the present study was to investigate an association between clinical manifestations and survival among HIV-infected children born to HIV-infected mothers in the Southern region of Thailand.

Material and Method

Initially, the subjects were HIV-infected children born to HIV-infected mothers who routinely registered and followed-up in a hospital-based between 1990 and 2010. As well, a hospital-based study was established in both tertiary care and community hospitals covering 14 provinces in the Southern region of Thailand. Fifty two thousand four hundred twenty eight HIV-infected and AIDS patients were registered. The followed-up treatment was included in the cohort study. The study design is shown elsewhere[17]. Of the registered patients, 1,549 HIV-infected children born to HIV-infected mothers were followed-up. Approximately, a quarter of HIV-infected children died during the follow-up period (434, 28.02%).

The primary outcome was the time from HIV-infected diagnosis until death, during the follow-up treatment period. The other outcomes and variables such as clinical manifestations were routinely collected and observed by health staff responsible for epidemiological surveillance and disease control at each hospital. Staff was trained to access the outcome and clinical manifestations during the study period. Data was recorded monthly using a rigorous standard database developed by the Bureau of Epidemiology, Department of Disease Control, Ministry of Public Health. Case report forms were sent to the provincial health offices, where they were reviewed and pooled from all hospitals and entered into a database. Data was checked for internal validity completeness prior to being recorded. It was then sent to the center for diseases control and prevention region 11th Nakhon Si Thammarat and 12th Songkhla. Instrument and data collection procedures are shown elsewhere[18].

Initially, baseline demographic characteristics and clinical manifestations were presented as descriptive analysis. The Kaplan-Meier method was used to estimate the primary outcome of time from HIV/AIDS diagnosis to death. The statistical significance of difference between survival times was performed using Cox's proportional hazard model. Demographic and clinical manifestation factors were constructed using bivariate analysis to demonstrate the clinical manifestation factors associated to death among infected children born to HIV-positive mothers. Results of this study are presented as hazard ratios (HR) which are comparable to relative risks (RR) with 95 percent confidence intervals (95% CI). The interpretation is presented as no association if the HR included 1, risk association if the HR is greater than 1, and protective effects if the HR is less than 1.

Furthermore, the HIV/AIDS database was approved by both the 11th and 12th regional offices for disease prevention and control, Nakhon Si Thammarat and Songkhla provinces, Thailand. This study was also approved by the Ethics Committees on Human Rights Related to Human Experimentation, Thaksin University, Thailand.

Results

A prospective cohort of HIV-infected children born to HIV-infected mothers in the Southern region of Thailand was observed. Results found that one-fourth of HIV-infected children died (434, 28.02%) during the follow-up period. The follow-up period available was 135,295 person-months. The incidence rate was 1.03 times per 100 person-months (95% CI: 0.97 to 1.08). The median survival time among HIV-infected children from diagnosis to death was 87.34 months (95% CI 87.32 to 87.36). Survival time from HIV diagnosis to death, as estimated by Kaplan-Meier, where half of HIV-infected children experienced death is shown in Fig. 1.

Half (50.16%) of the HIV-infected children were female. The HIV-infected children had an average age at diagnosis of 3.74 years (SD = 3.37). Most of them had Thai nationality (95.48%). According to the parental occupation, one-fifth of them were employee (19.95 vs. 14.14%) and two-thirds of them had unknown occupations (63.52 vs. 64.04%). Two-thirds of them resided in a rural area (68.50%). Geographically, one-third of them resided in the east coast of Thailand (34.54%). Regarding the diagnosis

and admission, most of them were diagnosed as AIDS (88.44%). Two-thirds of them were inpatients (67.38%) and only one-tenths had complementary care (13.39%), as shown in Table 1.

The clinical manifestations among HIV-infected children born from HIV-infected mothers were respiratory tract infection (20.72%), wasting syndrome (emaciation or slim disease) (20.46%), weight loss (or failure to thrive) (19.56%), chronic or recurrentdiarrhea (15.62%), and *Pneumocystis jiroveci* (11.81%). In addition, HIV-infected children infected with other clinical manifestations are presented in Fig. 2.

To identify an association between demographic factors and survival among HIV-infected children born to HIV-infected mothers, Cox's proportional hazard model was used. The association between demographic factors and survival was not shown in the present study. Initially, corresponding risk of demographic factors on survival among HIV-infected children were examined and found. It was found that HIV-infected children with an increasing age at diagnosis were more likely to die by about 10% (HR: 1.10, 95% CI: 1.08 to 1.12). In cases of HIV-infected children who had other nationalities, they were more likely to die by about 27% (HR: 1.27, 95% CI: 1.12 to 1.44) compared to those who were Thai.

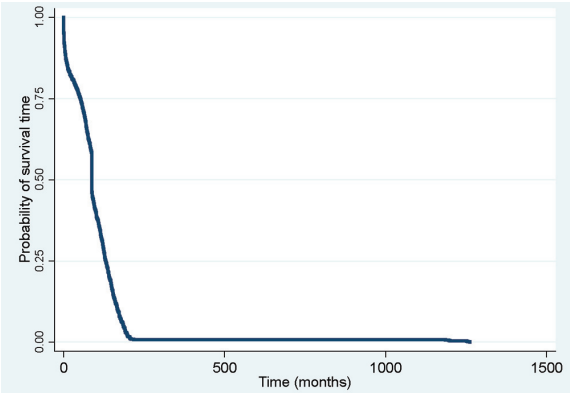

Fig. 1 Kaplan-Meier survival estimate of time from diagnosis to death among infected children born to HIV-positive mothers.

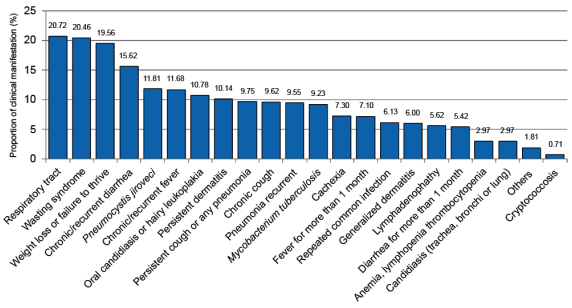

Fig. 2 Proportion of clinical manifestation among HIV-infected children born to HIV-infected mothers in the Southern region of Thailand.

Table 1. Characteristics of HIV-infected children born to HIV-infected mothers in the Southern region of Thailand (n = 1,549)

Factors	Number	Percent
Diagnosis		
AIDS	1,370	88.44
Symptomatic HIV+	179	11.56
Sex		
Male	772	49.84
Female	777	50.16
Age at diagnosis (year)		
Mean ± SD (min:max)	3.74±3.37 (0.1:25)	
Race		
Thai	1,479	95.48
Others	70	4.52
Father's occupation		
Agriculture	99	6.39
Government official and enterprise	21	1.36
Sale	15	0.97
Employee	309	19.95
Fishery	35	2.26
Others	86	5.55
Unknown	984	63.52
Mother's occupation		
Agriculture	93	6.00
Sale	18	1.16
Employee	219	14.14
Sex worker	14	0.90
Others	213	13.75
Unknown	992	64.04
Resident area		
Urban	361	23.31
Rural	1,061	68.50
Unknown	127	8.20
Region area		
West coach	492	31.76
East coach	535	34.54
Southern bordered	522	33.70
Type of patients		
Outpatient	505	32.62
Inpatient	1,043	67.38
Complementary care		
Yes	189	13.39
No	389	27.57
Unknown	833	59.04

HIV-infected children who resided in rural areas were more likely to die by about 17% (HR: 1.17, 95% CI: 1.02 to 1.33), compared to those who resided in an urban area. In addition, HIV-infected children who resided in the east coast were more likely to die by about 48% (HR: 1.48, 95% CI: 1.29 to 1.70), compared to children who resided in the west coast of the Southern region of Thailand. Finally, HIV-infected children who had unknown origin of complementary care were more likely to die by about 39% (HR: 1.39, 95% CI: 1.17 to 1.64), compared to those who had complementary care. To the contrary, demographic factors such as sex, parental occupation, type of patient, and type of diagnosis were not significantly associated with survival among HIV-infected children (no data presented).

To identify an association between clinical manifestation factors and survival among HIV-infected children born, further analysis was conducted. All possible clinical factors were considered. Results were that there was a statistically significant association between clinical manifestations and survival among HIV-infected children. HIV-infected children infected with candidiasis were more likely to die by about 47% (HR: 1.47, 95% CI: 1.07 to 2.00) compared with children who did not have candidiasis. Additionally, HIV-infected children who were infected with *Mycobacterium tuberculosis* were more likely to die by about 51% (HR: 1.51, 95% CI: 1.26 to 1.81), compared as compared with children who did not have *M. tuberculosis*. Finally, HIV-infected children who had *P. jiroveci* infection were more likely to die by about 50% (HR: 1.50, 95% CI: 1.27 to 1.76), compared to children who did not have *P. jiroveci* infection (Table 2). Furthermore, Kaplan-Meier survival time, from diagnosis to death, where half of HIV-infected children experience death, was categorized by presenting with and without clinical risk factors such as candidiasis, *M. tuberculosis*, and *P. jiroveci*, as shown in Fig. 3-5.

However, some clinical manifestations do not reduce the survival rate. The reduction association between clinical manifestation and survival among HIV-infected children was found. Among HIV-infected children who had clinical factors were less likely to die such as, weight loss or failure to thrive (HR: 0.59, 95% CI: 0.51 to 0.66), chronic or recurrent diarrhea (HR: 0.67, 95% CI: 0.58 to 0.77), chronic or recurrent fever (HR: 0.84, 95% CI: 0.71 to 0.98), persistent or severe lower respiratory tract infection (HR: 0.70, 95% CI: 0.60 to 0.80), repeated common infection

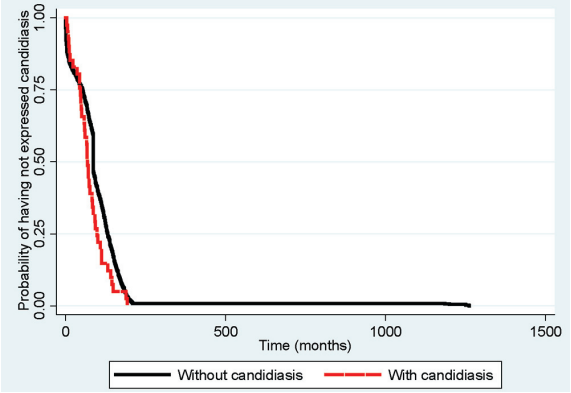

Fig. 3 Kaplan-Meier survival estimate of time from diagnosis to death among infected children born to HIV-positive mothers by candidiasis.

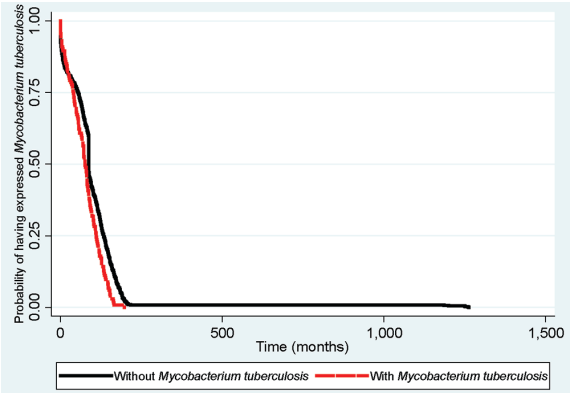

Fig. 4 Kaplan-Meier survival estimate of time from diagnosis to death among infected children born to HIV-positive mothers by *Mycobacterium tuberculosis*.

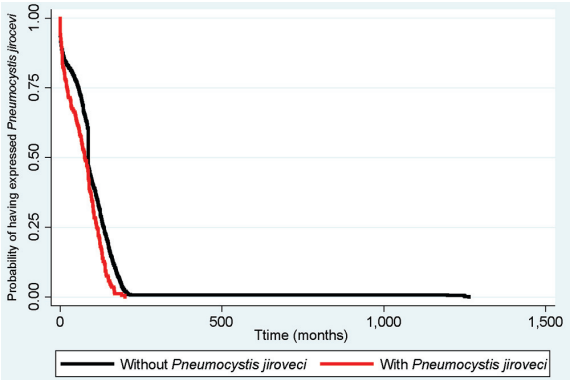

Fig. 5 Kaplan-Meier survival estimate of time from diagnosis to death among infected children born to HIV-positive mothers by *Pneumocystis jiroveci*.

Table 2. Clinical manifestation associated to survival among HIV-infected children born to HIV-infected mothers in the Southern region of Thailand

Factors	Person (months)	IR/100	HR	95% CI	p-value
Candidiasis in trachea, bronchi or lung					0.023
No	132,240	1.01	1		
Yes	3,054	1.34	1.47	1.07 to 2.00	
Cryptococcosis					0.897
No	134,350	1.02	1		
Yes	945	1.16	1.04	0.57 to 1.88	
Mycobacterium tuberculosis (pulmonary or extrapulmonary)					<0.001
No	125,061	1.00	1		
Yes	10,234	1.32	1.51	1.26 to 1.81	
Pneumonia recurrent (bacteria)					0.188
No	123,387	1.01	1		
Yes	11,908	1.15	1.13	0.95 to 1.34	
Pneumocystis jiroveci					<0.001
No	122,750	0.99	1		
Yes	12,545	1.37	1.50	1.27 to 1.76	
Wasting syndrome (emaciation, slim disease)					0.536
No	109,487	1.01	1		
Yes	25,807	1.09	1.04	0.91 to 1.19	
Weight loss or failure to thrive					<0.001
No	107,497	1.06	1		
Yes	27,797	0.89	0.59	0.51 to 0.66	
Chronic/recurrent diarrhea more than 1 month					<0.001
No	110,860	1.05	1		
Yes	24,435	0.91	0.67	0.58 to 0.77	
Chronic/recurrent fever more than 1 month					0.027
No	117,769	1.03	1		
Yes	17,525	0.96	0.84	0.71 to 0.98	
Persistent or severe lower respiratory tract					<0.001
No	110,543	1.03	1		
Yes	24,751	0.99	0.70	0.60 to 0.80	
Repeated common infection (ostitis, pharyngitis)					<0.001
No	124,306	1.05	1		
Yes	10,988	0.78	0.61	0.49 to 0.76	
Chronic cough					0.002
No	121,169	1.03	1		
Yes	14,125	0.98	0.77	0.64 to 0.92	
Generalized dermatitis					0.002
No	125,366	1.04	1		
Yes	9,929	0.82	0.72	0.57 to 0.89	
Oral candidiasis or hairy leukoplakia					0.525
No	120,431	1.03	1		
Yes	14,864	0.97	0.95	0.79 to 1.12	
Diarrhea for more than 1 month					0.050
No	125,446	1.05	1		
Yes	9,848	0.77	0.80	0.63 to 1.01	
Fever for more than 1 month					0.633
No	125,759	1.02	1		
Yes	9,535	1.08	1.05	0.86 to 1.29	

IR = incident rate; HR = hazard ratio; TB = tuberculosis

Table 2. (cont.)

Factors	Person (months)	IR/100	HR	95% CI	p-value
Cachexia or more than 10% weight loss					0.019
No	121,801	1.05	1		
Yes	13,493	0.76	0.79	0.65 to 0.97	
Persistent dermatitis more than 1 month					0.396
No	118,753	1.04	1		
Yes	16,541	0.87	0.93	0.78 to 1.10	
Anemia, lymphopenia thrombocytopenia					0.766
No	130,598	1.03	1		
Yes	4,696	0.89	1.04	0.77 to 1.43	
Persistent cough or any pneumonia more than 2 month (except TB)					0.843
No	121,702	1.03	1		
Yes	13,593	0.95	1.01	0.85 to 1.22	
Lymphadenophathy more than 1 cm at least 2 noninguinul sites for more than 1 month					0.034
No	126,066	1.04	1		
Yes	9,228	0.80	0.78	0.62 to 0.99	
Others					0.012
No	133,722	1.02	1		
Yes	1,572	1.53	1.76	1.17 to 2.64	

IR = incident rate; HR = hazard ratio; TB = tuberculosis

(HR: 0.61, 95% CI: 0.49 to 0.76), chronic cough (HR: 0.77, 95% CI: 0.64 to 0.92), generalized dermatitis (HR: 0.72, 95% CI: 0.57 to 0.89), cachexia (HR: 0.79, 95% CI: 0.65 to 0.97), and lymphadennophathy (HR: 0.78, 95% CI: 0.62 to 0.99), compared to those without clinical risk factors, as shown in Table 2.

Discussion

The present study yielded information on clinical risk factors and survival among HIV-infected children born to HIV-infected mothers. Cox's model demonstrated that clinical risk factors associated to survival among HIV-infected children born to HIV-infected mothers were candidiasis, *M. tuberculosis*, and *P. jiroveci*.

The strengths of the present study were the information about the HIV-infected children as it was prospectively gathered, and the clinical information were routinely observed and recorded to database. All HIV-infected children's data from all hospitals was monthly recorded through the database under supervision and monitoring by the Center for Disease Control and Prevention Region 11th and 12th in the Southern part of Thailand. That was an appropriate strategy for gathering prospective information regarding clinical information and survival of HIV-infected children. Furthermore, the study was carried out in the Southern region of the country with its varied traditional and cultural contexts. Therefore, it is comprehensive of the whole population of children in the Southern region of Thailand.

Regarding the sample size, a large number of the HIV-infected children had been routinely observed and followed up over the duration of the study. The findings show a very high precision. The study presents a very narrow 95% confident intervals. In addition, Cox's model was constructed, which is an appropriate statistical method used in the present study to analyze the outcome time to events as presented in most longitudinal study.

The limitation of the study was the fact that all HIV-infected children were routinely observed and followed-up, which was purposively selected in areas allocated in the Southern region of Thailand, especially majored in community hospital based. The process of selecting samples could influence information about the child's survival and clinical outcomes. Thus, the results of this study must be carefully interpreted owing to lack of random selection. In addition, a possible cause of information bias could have occurred. The cause of death was unidentified by physicians and the process of recoding. Therefore, the outcome may have subsequently occurred more than in normal HIV-infected children. Finally, the important independent

clinical factors such as CD4 count or viral load, which are associated with the mortality of HIV/AIDS patients were not accounted for as confounding factors due to missing data[17].

From this study, the result indicated that median survival time among HIV-infected children was 87.34 months (95% CI: 87.32 to 87.36), which was slightly lower than the Tovo's study[19]. Whereas, Tovo's study followed-up HIV-1-infected children in Italy and revealed that median survival time was 96.2 months. Regarding progression to AIDS in HIV-infected children, the study showed that four-fifths of HIV-infected children had mostly developed to AIDS (88.44%) and only one-tenth of HIV-infected children were classified into symptomatic HIV-positive (11.56%). It implied that HIV-infected children were more likely to progress to AIDS than HIV-infected children in the Mahdavi's study[20], which conducted and followed-up HIV-infected children from birth in Ukraine. In contrary, the Mahdavi's study revealed that only one-fifth of HIV-infected children had developed AIDS (22%) at a median age of 10 months.

Furthermore, HIV-infected children more rapidly progressed to AIDS than HIV-infected adults[7]. Approximately, a quarter of HIV-infected children rapidly progressed to AIDS or death in the early years of life. This may have been caused by the level of maturity of the immune system at the time of HIV acquisition, volume of virus-infected, and/or route of infection[7]. These important biological factors may have affected to survival among HIV-infected children. Accordingly, the clinical manifestations are associated with survival among HIV-infected children born to HIV-infected mothers. The study revealed that HIV-infected children who had primary opportunistic infections[7] such as candidiasis (trachea, bonchi or lung), *M. tuberculosis* (pulmonary or extrapulmonary), and *P. jiroveci* were more likely to die than HIV-infected children who did not have these opportunistic infections.

To the contrary, HIV-infected children who had clinical manifestation HIV-related to signs and symptoms were less likely to die such as, weight loss or failure to thrive, chronic or recurrent diarrhea, chronic or recurrent fever, persistent or severe lower respiratory tract infection, repeated common infection, chronic cough, generalized dermatitis, cachexia, and lymphadennophathy. This implies that these are minor HIV-related signs and symptoms that are rarely present at birth but progressive over subsequent months or years[7]. Additionally, HIV-infected children might be early detected from these HIV-related signs and symptoms prior to having advanced stage of disease. HIV-infected children may benefit from being given intensive care in order to achieve a longer life span.

This present study is relevant to the Mahadavi's study[20], Lallemant's study[21], and Nikolopoulos's study[22]. In particular, Lallemant conducted a survey in Pointe-Noire, Republic of Congo and demonstrated that the most common causes of death in HIV-infected children were pneumonia (30%), pyrexia (22%), diarrhea (16%), and wasting syndrome (16%)[21]. The ongoing cohort study made by Mahadavi in Ukraine revealed that the most prevalent AIDS indicator disease was *P. jiroveci*[20]. A surveillance study of HIV/AIDS by Nikolopoulos[22] in Greece reported that *P. jiroveci* was the most frequent opportunistic infection among pediatric AIDS cases that have been reported since the onset of the epidemic.

Generally, it has been reported that opportunistic infections are a major cause of infection and death among HIV/AIDS patients. In particular, HIV-infected children are also exposed to primary infection with opportunistic organism, which have more susceptibility to infection than adults[7]. In addition, HIV-infected mothers who had opportunistic pathogens might be more likely to horizontally transmit infections to their children, resulting in the increased likelihood of primary acquisition pathogens and infection in children[23]. Therefore, opportunistic infections might affect HIV-infected children and uninfected children from HIV-infected mothers[23].

In conclusion, it was found that there are statistically corresponding clinical risk factors on the survival rates among HIV-infected children born to HIV-infected mothers. HIV-infected children who had opportunistic infections such as candidiasis, *M. tuberculosis*, and *P. jiroveci* were more likely to die when compared to children without clinical risk factors. Accordingly, there is a need to screen children born to HIV-infected mothers early. Perinatally, HIV-infected children, whether with existing HIV-positive symptoms or when there had been a progression to AIDS, should be identified. Furthermore, HIV-infected children should be routinely followed-up to intensively care and treated with appropriate clinical practice guidelines prior to developing severe clinical manifestations or opportunistic infections and death.

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What is already known on this topic?

Opportunistic infections are a potential risk on mortality among HIV/AIDS adult patients. Impact of maternal HIV infection on children survival dealing with HIV-infection is reported.

What this study adds?

Not only HIV/AIDS adult patients are at risk of mortality, but HIV-infected children born to HIV-infected mothers are also at an increasing risk of mortality from opportunistic infections such as candidiasis, *M. tuberculosis*, and *P. jiroveci*.

Potential conflicts of interest

None.

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ปัจจัยเสี่ยงทางคลินิกต่อการรอดชีพของเด็กที่ติดเชื้อเอชไอวีที่คลอดจากมารดาที่ติดเชื้อเอชไอวี

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วัตถุประสงค์: เพื่อศึกษาปัจจัยที่มีความสัมพันธ์ต่อการรอดชีพของเด็กที่ติดเชื้อเอชไอวีที่คลอดจากมารดาที่ติดเชื้อเอชไอวี

วัสดุและวิธีการ: การศึกษาครั้งนี้เป็นการศึกษาไปข้างหน้า กลุ่มตัวอย่าง คือ เด็กที่ติดเชื้อเอชไอวีที่คลอดจากมารดาที่ติดเชื้อเอชไอวี จำนวน 1,549 ราย และได้รับการติดตามตั้งแต่แรกคลอดจนกระทั่งเสียชีวิต เก็บรวบรวมข้อมูล จากฐานข้อมูลตั้งแต่ ปี พ.ศ. 2533 ถึง พ.ศ. 2553 ประกอบด้วย ข้อมูลลักษณะทางประชากร ข้อมูลทางคลินิก และการติดเชื้อเอชไอวี วิเคราะห์ข้อมูลด้วยสถิติระยะปลอดเหตุการณ์

ผลการศึกษา: ผลการศึกษาพบว่า เด็กที่ติดเชื้อจำนวน 1 ใน 5 เสียชีวิตขณะการติดตาม (434, 28.02%) มีระยะการติดตามเท่ากับ 135,295 บุคคล-เดือน อัตราอุบัติการณ์เท่ากับ 1.03 ต่อ 100 บุคคล-เดือน (95% CI: 0.97 ถึง 1.08) และค่าเฉลี่ยของระยะเวลาการรอดชีพ (median survival time) เท่ากับ 87.34 เดือน (95% CI 87.32 ถึง 87.36) และพบว่า เด็กที่ติดเชื้อเอชไอวีได้รับการวินิจฉัยเป็นเอดส์ร้อยละ 88.4 และมีลักษณะอาการคล้ายคลึงกับติดเชื้อเอชไอวีร้อยละ 11.56 จากการศึกษาปัจจัยทางคลินิกต่อการรอดชีพพบว่า เด็กที่ติดเชื้อเอชไอวีมีโอกาสการเสียชีวิต โดยเฉพาะผู้ที่ป่วยด้วยโรค Candidiasis (HR: 1.47, 95% CI: 1.07 to 2.00) วัณโรค (HR: 1.51, 95% CI: 1.26 to 1.81) และปอดอักเสบ (Pneumocystis jiroveci, HR: 1.50, 95% CI: 1.27 to 1.76) เมื่อเปรียบเทียบกับเด็กที่ติดเชื้อเอชไอวีและไม่มีอาการแสดงทางคลินิก

สรุป: จากผลการศึกษาพบว่าเด็กที่ติดเชื้อเอชไอวีที่คลอดจากมารดาที่ติดเชื้อเอชไอวีในภาคใต้ของประเทศไทยยังคงเป็นปัญหาสาธารณสุขที่สำคัญและมีอัตราตายสูง ดังนั้นการจัดระบบบริการด้านสาธารณสุขที่เกี่ยวข้องกับการป้องกันการติดเชื้อจากแม่สู่ทารกเป็นสิ่งจำเป็น และควรมีการดูอย่างใกล้ชิดเพื่อลดอัตราตายในเด็กที่ติดเชื้อจากมารดา