Clinical and Electrophysiologic Evaluation of Peripheral Neuropathy in a Group of HIV-Infected Patients in Thailand

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Objective: *To study characteristics of peripheral neuropathy in a group of Thai HIV-infected patients by clinical and electrophysiologic evaluation.*
Material and Method: *Patients with HIV infection from HIV and neurology clinic were recruited during June and October 2005. Neurological examination and nerve conduction study were done in all patients to establish the presence and pattern of peripheral neuropathy. Clinical data were compared between the groups with and without HIV-related neuropathy.*
Results: *Forty-eight HIV-infected patients were recruited but complete data were obtained in 34 patients. There were 11 males and 23 females with average age of 36.3 $\pm$ 7.3 years. Among these, 17 (50.0%) patients received a diagnosis of HIV-related neuropathy. Distal symmetrical polyneuropathy (DSP) accounted for 64.7%, mononeuropathy multiplex (MM) for 17.6%, acute inflammatory demyelinating polyneuropathy (AIDP) for 11.8%, and progressive polyradiculopathy (PP) for 5.9% of cases with HIV-related neuropathy. The presence of neuropathy was not correlated with age, sex, body mass index, and duration of HIV infection. However, patients with HIV-related neuropathy had significantly lower nadir CD4 cell counts than patients without HIV-related neuropathy ($p < 0.05$). When taking antiretroviral therapy in to account, we did not find correlation of any drugs with the presence of DSP except for stavudine, which had shown a statistical trend.*
Conclusion: *The incidence of HIV-associated neuropathy in this group of Thai patients was higher than previous report. The most common pattern was distal symmetrical polyneuropathy, which was associated with low nadir CD4 cell counts.*

Keywords: *Peripheral neuropathy, HIV infection, Electrodiagnosis, Antiretroviral drug, Nadir CD4 cell counts, Distal symmetrical polyneuropathy, Thai*

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Peripheral neuropathy is a well-established complication in patients with human immunodeficiency virus (HIV) infection[1]. The painful conditions caused by peripheral neuropathy may lead to increased disability even in relatively healthy HIV-infected men[2]. Early diagnosis and rehabilitative intervention play an important role in such conditions[3].

HIV infection has become a major public health problem in Thailand. In 2005, there were 540,822 living cases of HIV infected Thais[4]. Highly active antiretroviral therapy (HAART) regimens, provided by the government and self-paid, were introduced in Thailand around the year 2000[5]. Up to January 2005, there were 50,986 patients receiving this therapy[4]. As more HAART regimens are being prescribed, side-effects from various antiretroviral drugs must be monitored. Distal symmetrical polyneuropathy (DSP), the most common form of HIV-related neuropathy, has been commonly observed in patients taking some antiretroviral drugs, particularly stavudine (d4T)[6,7] and didanosine (ddI)[6,8].

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There are only a few studies of any neurological complications of HIV infection in Thailand, and the relationship of peripheral neuropathy to severity of the disease and certain antiretroviral drug in Thai population has not been studied. In addition, as far as the authors know, there is no report in the literature on the pattern of involvement of HIV-associated peripheral neuropathy that has been clinically and electrophysiologically studied in a Thai population. Therefore, the authors conducted this research to study the incidences of peripheral neuropathy by clinical and electrophysiological evaluation in a group of Thai HIV-infected patients and to find the correlation between a certain pattern of peripheral neuropathy and characteristics of the patients.

Material and Method

The present study was conducted at Queen Savang Vudhana Memorial Hospital, The Thai Red Cross Society from June to October 2005. The research proposal was approved by the Ethics Committee of the hospital. The subjects were recruited from two sources: (i) known cases of HIV-infected patients who had been treated on an outpatient basis at the HIV clinic and (ii) referred HIV-infected patients from the neurological clinic with clinical signs and symptoms of neuropathy. Subjects with the following conditions were excluded: diabetes, history of alcohol intake, toxic substances/drugs known to cause neuropathy except antiretroviral and antituberculosis, macrocytic anemia, and any known cause of neuropathy. The subjects were informed about mild discomfort from electrophysiologic study or from venupuncture and informed consents were obtained from all participants.

Clinical history and neurological examination were done by a neurologist focusing on symptoms and signs of neuropathy. Sensory testing included vibration, pinpricks, and joint position. Manual muscle testing and deep tendon reflexes were tested. Other data concerning the subjects were obtained from OPD cards, including medical treatments related to HIV-infection, complete blood count, and nadir CD4 cell count.

All of the patients were then scheduled for nerve conduction study that was done by a physiatrist using Chulalongkorn electrodiagnostic study techniques and references values[9-13]. Motor conduction study was bilaterally performed in the following nerves: median, ulnar, common peroneal, and tibial nerves. Antidromic sensory conduction study was done in median, ulnar, and sural nerves. Routine needle electromyography was not performed, unless there was clinical evidence of radicular diseases. The presence and patterns of neuropathy were then determined by the neurologist based on history, clinical presentation, and electrophysiological abnormalities.

Statistical analyses were done using computerized statistical program (SPSS version 11.5). Independent t-test was used to compare mean between two groups of continuous variables. The Chi-square test and Fisher's exact test were used to evaluate the proportion between groups. A p-value of less than 0.05 was considered statistically significant.

Results

Forty-eight patients were recruited in the present study and were scheduled for thorough neurological examination and electrophysiological evaluation. Fourteen patients were lost to follow-up for neurological examination and were excluded from the present study. In the remaining 34 patients, there were 11 males and 23 females with an average age of 36.3 ± 7.3 years. The average time since diagnosis of HIV-infection was 42.3 ± 36.6 months. The average body mass index was 21.5 ± 3.6 kg/m^2 for male and 21.8 ± 5.6 kg/m^2 for female. Seventeen patients (50.0%) had received diagnosis of HIV-related neuropathy. Distal symmetrical polyneuropathy (DSP) accounted for 64.7%, mononeuropathy multiplex (MM) for 17.6%, acute inflammatory demyelinating polyneuropathy (AIDP) for 11.8%, and progressive polyradiculopathy (PP) for 5.9% of cases with HIV-related neuropathy. The remaining 17 patients were all classified as patients without HIV-related neuropathy in the authors' data analysis. They had either no neuropathy or neuropathy that was not related to HIV-infection. Four patients were documented for neuropathy that was not related to HIV-infection. One of these had peroneal neuropathy on the side of her recent tibial fracture. Three remaining female patients had isolate median neuropathy at wrists that was most likely from carpal tunnel syndrome. The clinical features of all patients are summarized in Table 1. Numbness is a dominant symptom in all patterns of HIV-related neuropathy. Some of the patients with numbness reported pain and burning sensation in the lower extremities. Impaired vibratory perception in toes was mostly observed in this group. Numbness was also observed in 7 (42%) of 17 patients without HIV-related neuropathy. Some of them also reported pain in the lower extremities. Ten (59%) patients without HIV-related neuropathy had not reported any symptoms of neuropathy.

Table 1. Symptoms and clinical signs of patients without and with HIV-related neuropathy

	No. (%) of patients without HIV-related neuropathy (n = 17)	No. (%) of patients withHIV-related neuropathy			
		DSP (n = 11)	MM (n = 3)	IDP (n = 2)	PP (n = 1)
Symptoms					
Numbness	7 (42)	9 (82)	3 (100)	2 (100)	1 (100)
Aching pain	2 (12)	0 (0)	0 (0)	1 (50)	0 (0)
Shooting pain	1 (6)	3 (28)	0 (0)	0 (0)	1 (100)
Burning sensation	0 (0)	2 (19)	0 (0)	0 (0)	0 (0)
Weakness of lower extremities	0 (0)	3 (28)	1 (34)	2 (100)	1 (100)
No symptoms	10 (59)	0 (0)	0 (0)	0 (0)	0 (0)
Clinical Signs					
Decreased/absent ankle reflexes	0 (0)	8 (73)	0 (0)	2 (100)	1 (100)
Impaired PPS of feet/toes	0 (0)	8 (73)	1 (34)	2 (100)	1 (100)
Impaired vibration of toes	0 (0)	9 (82)	1 (34)	2 (100)	1 (100)
Weakness of EHL	0 (0)	7 (64)	1 (34)	2 (100)	1 (100)

PPS = pinprick sensation, EHL = extensor hallucis longus

Table 2. Associated clinical features in patients with and without HIV-related neuropathy

	Patients without HIV-related neuropathy (n = 17)	Patients with HIV-related neuropathy (n = 17)	p-value
Age (years, mean $\pm$ SD)	33.9$\pm$4.4	38.7$\pm$8.8	0.058*
Sex (female:male)	13:4	10:7	0.463
Body mass index (kg/m^2, mean $\pm$ SD)	22.9$\pm$6.0	20.5$\pm$3.5	0.155*
Nadir CD4 cell count (cell/mm^3, mean $\pm$ SD)	256.0$\pm$210.0	96.0$\pm$107.0	0.010*
Duration of HIV infection (months, mean $\pm$ SD)	38.6$\pm$15.3	44.5$\pm$39.1	0.739*
Use of Antiretroviral drug (yes:no)	12:5	12:5	1.000
Use of Antituberculosis drug (yes:no)	1:16	6:11	0.085

* t-test
Chi-square test
Fisher's Exact test

The characteristics of the patients are shown in Table 2. The presence of HIV- related neuropathy does not correlate with age, sex, body mass index, and duration of HIV infection. Patients with HIV-related neuropathy had significantly lower nadir CD4 cell count (96 ± 107 cell/mm^3) than those without (256 ± 210 cell/mm^3) at $p < 0.05$. DSP, the commonest type of neuropathy in the present study was also related with low CD4 cell count with statistical significance at $p < 0.05$ (data not shown).

Twenty-four patients (70.6%) had received antiretroviral treatment with mean duration of the therapy at 17.3 ± 8.7 months. The HAART regimens mostly used among the patients were d4T + 3TC + NVP, as shown in Fig. 1. In the group of patients who had HIV-related neuropathy; 10 of 11 patients with DSP, 2 of 3 patients with MM, and 1 of 2 patients with IDP had used antiretriviral therapy. One patient with PP did not use any of the regimens. The high percentage of antiretroviral use in patients with DSP urged the authors to find associations between various antiretroviral agents and this pattern of neuropathy. The authors did not find a significant correlation between the presence of DSP and the following antiretroviral agents: stavudine, nevirapine, zidovudine, lamivudine, and efavirenz (Table 3). However, there was a statistical trend toward a higher incidence of DSP ($p = 0.063$) in patients who had received stavudine. In this group

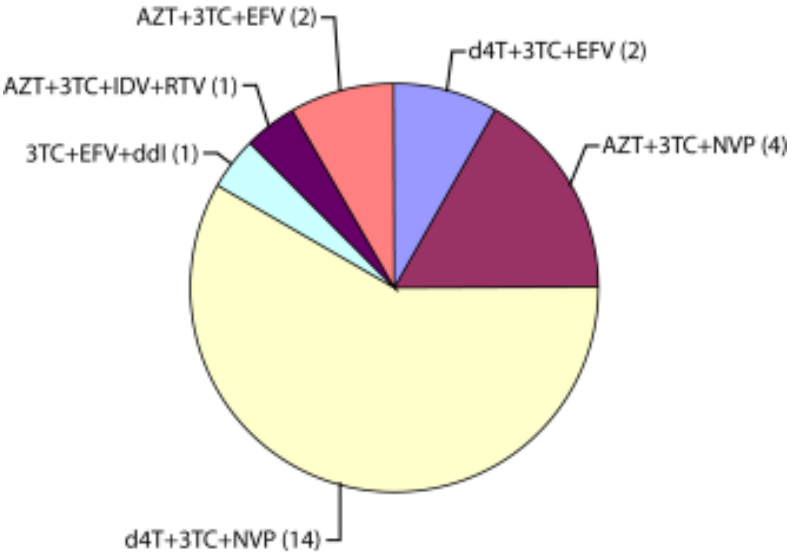

Fig. 1 Antiretroviral drugs used among HIV-infected patients. AZT, zidovudine; ddI, didanosine; d4T, stavudine; EFV, efavirenz; IDV, indinavir; NVP, nevirapine; RTV, ritonavir; 3TC, lamivudine

of patients, the duration of this drug usage did not differ statistically among the patients with DSP (17.6 $\pm$ 5.4 months) and the patients without HIV-related neuropathy (16.8 $\pm$ 8.9 months).

Seven patients had received antituberculosis treatment with a mean duration at 6.7 $\pm$ 4.5 months; six of them had HIV-related neuropathy (5 cases with DSP, 1 case with mononeuropathy multiplex). The presence of HIV-related neuropathy and usage of antituberculosis drugs showed statistical trend by Fisher's Exact test ($p = 0.085$), as shown in Table 3. Isoniazid, included throughout the course of treatment in the presented patients, is well known cause of peripheral neuropathy in adults. However, there was no correlation between this drug and the presence of DSP ($p = 0.269$).

Discussion

There are at least six patterns of HIV-associated peripheral neuropathy. These includes distal symmetrical polyneuropathy (DSP), inflammatory demyelinating polyneuropathy (IDP), progressive polyradiculopathy (PP), mononeuropathy multiplex (MM), autonomic neuropathy, and diffuse infiltrative lymphocytosis syndrome (DILS)[14].

DSP, observed in 10-55% of the patients, has been commonly observed in the later stages of HIV infection[15-17] and in patients taking some antiretroviral drugs: stavudine (d4T)[6,7], and didanosine (ddI)[6,8]. Acute and chronic forms of IDP can occur in HIV-infected patients. The incidence of IDP in this group of patients is difficult to determine, but is generally

Table 3. Antiretroviral drugs received in patients with DSP and patients without HIV-related neuropathy

	Patients without HIV-related neuropathy (n = 17)	Patients with DSP (n = 11)	p-value
Zidovudine (yes:no)	7:10	2:9	0.249
Stavudine (yes:no)	5:12	8:3	0.063*
Efavirenz (yes:no)	4:13	3:8	1.000
Nevirapine (yes:no)	7:10	8:3	0.212*
Lamivudine (yes:no)	12:5	9:2	0.668

* Chi-square test
Fisher's Exact test

a less frequent form of neuropathy. IDP can occur following seroconversion and at the early stage of HIV infection[18], or can occur at a later stage, which has been found to be related with cytomegalovirus (CMV)[19]. Clinical manifestations of PP include a rapidly progressive paraparesis, radiating pain and paresthesia in the cauda equina distribution, lower extremity areflexia, mild sensory loss, and sphincter dysfunction[14]. While CMV, being the most common infectious agent related to PP, M. tuberculosis has also been found in a previous study[20]. Vasculitis of the peripheral nerve may cause MM, which may occur as the first symptoms of HIV infection or in a later stage[21]. CMV has been cultured from peripheral nerves of patients who had developed MM[22,23]. DILS associated with multivisceral CD8 T-cell infiltration, has a variety of neurological presentations including painful symmetric or asymmetric sensorimotor neuropathy, distal sensory neuropathy, mononeuritis multiplex and demylinating polyneuropathy[14].

There were a few reports about the incidence of peripheral neuropathy in HIV-infected patients among Asian countries. In Japan, a nationwide survey of neurological complications in 1854 HIV-infected patients had found that the incidence of peripheral neuropathy was 2.6%[24]. A retrospective study in northern Thailand has shown peripheral nerve involvement at 3.8% in 155 AIDS patients[25]. The incidence of peripheral neuropathy in the present study was higher than a previous report in Thailand. This may be due to different methodology, defining criteria of peripheral neuropathy, and patient populations. The previous studies[24,25] had sought out all neurological complications from HIV-infection whereas the present study had focused on complications in peripheral nerves and had sought out abnormalities from both clinical findings and electrophysiological study.

Some symptoms observed in HIV-infected patients may not be specific to neuropathy, as can be seen in that 42% of patients who did not have HIV-related neuropathy had complained of numbness. Complaint of numbness may lead to suspicion of neuropathy in a clinical setting, so nerve conduction study should be performed to detect the presence of neuropathy. Many authors used electrodiagnostic study to establish the presence of subclinical neuropathy in HIV-infected patients[26-29]. Surprisingly, the authors did not find subclinical neuropathy in this group of patients. Some of the presented patients had presented with pain in the lower extremities, which may result from small fiber neuropathy. Routine nerve conduction study cannot detect the presence of this type of neuropathy, which has to be confirmed by quantitative sensory testing. However, the tool is not available in the hospital. Therefore, this may lead to some undiagnosted cases of small fiber neuropathy in the present study.

The most common pattern of HIV-related neuropathy in the present study was DSP, which is similar to those reported from countries in other continents. An African study of peripheral neuropathy in individuals with HIV infection showed the prevalence of peripheral neuropathy at 44%: subclinical neuropathy accounted for 56%, DSP for 22%, and IDP for 15%[26]. The author noted the abnormality in subclinical neuropathy had a similar characteristic of DSP. Another African study found DSP as the commonest type of peripheral neuropathy in HIV-infected patients (37.5%)[30]. A study in Brazil had found sensitive-motor axonal neuropathy as the commonest abnormalities from electroneuromyography[31]. The feature is fairly consistent with DSP. In North America, earlier studies of peripheral neuropathy in HIV-infected patients had revealed high incidences of DSP among later stages of HIV-infection from 35% to 43%[15,32]. However, a later study displayed a lower incidence of DSP at 13.1% and was related with antiretroviral drugs[6]. In the present study, DSP accounted for 32.4% in all of the patients and was related to lower nadir CD4 cell counts. There was no correlation of DSP with any antiretroviral drugs except stavudine, which had shown a statistical trend. The authors believe that the presented data was simply underpowered to detect a significant correlation between this drug and DSP.

Patients who had antituberculosis treatment seem to have an increased incidence of HIV-related neuropathy. However, when taking isoniazid into account, no significant correlation was shown between the patients who have had this drug and the incidence of DSP. This suggests increased disease severity as being the cause of neuropathy rather than isoniazid itself, because nadir CD4 cell counts was lower in this group of patients (n = 6) who had HIV-related neuropathy with tuberculosis (mean + SD, 45 + 26 cell/mm^3 [range, 11 - 86]).

The present study still has some limitations due to its cross-sectional design and lack of tools to document the presence of small fiber neuropathy. Both small and large peripheral nerve fibers are involved in DSP[33]. A higher frequency of DSP and subclinical neuropathy may be detected if quantitative sensory testing is used along with clinical and electrodiagnostic

evaluations. Further studies are needed to clarify this suspicion.

In conclusion, the authors found that the pattern of HIV-related neuropathy in this group of Thai patients was similar to the previous reports from countries in other continents. The incidence of HIV-related neuropathy was higher than a previous report in Thailand. There is correlation of HIV-related neuropathy with immunosupressed status.

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ลักษณะทางคลินิกและไฟฟ้าวินิจฉัยของความผิดปกติทางระบบประสาทส่วนปลายในผู้ป่วยติดเชื้อเอชไอวี

คมวุฒิ คนฉลาด, ขวัญรัตน์ หวังผลพัฒนศิริ

วัตถุประสงค์: *เพื่อศึกษาหาลักษณะของความผิดปกติทางระบบประสาทส่วนปลายในกลุ่มผู้ป่วยไทยที่ติดเชื้อเอชไอวี โดยอาศัยลักษณะทางคลินิกและไฟฟ้าวินิจฉัย*

วัสดุและวิธีการ: *ผู้ป่วยติดเชื้อเอชไอวีที่ได้รับการรักษาที่คลินิกสำหรับผู้ติดเชื้อเอชไอวี และ คลินิกอายุรกรรมประสาท ในช่วง เดือนมิถุนายน ถึง ตุลาคม พ.ศ. 2548 ได้ถูกคัดเข้าการศึกษาครั้งนี้ โดยมีการประเมินทางประสาทวิทยา และตรวจการชักนำกระแสประสาท เพื่อค้นหาความผิดปกติของระบบประสาทส่วนปลาย และรูปแบบของความผิดปกติ ข้อมูลทางคลินิกได้ถูกนำมาเปรียบเทียบและวิเคราะห์ระหว่างกลุ่มที่มีความผิดปกติของระบบประสาทส่วนปลายและกลุ่มที่ไม่มีความผิดปกตินี้*

ผลการศึกษา: *ผู้ป่วยติดเชื้อเอชไอวีจำนวน 48 รายได้ถูกคัดเพื่อเข้ารับการศึกษาครั้งนี้ แต่สามารถรวบรวมข้อมูลได้สมบูรณ์ 34 ราย เป็นเพศชาย 11 ราย เพศหญิง 23 ราย โดยมีอายุเฉลี่ย 36.3 $\pm$ 7.3 ปี ในจำนวนนี้พบผู้ป่วยที่มีความผิดปกติของระบบประสาทส่วนปลาย 17 ราย (50%) ในจำนวนนี้พบรูปแบบความผิดปกติของระบบประสาทส่วนปลายได้แก่ distal symmetrical polyneuropathy ร้อยละ 64.7 mononeuropathy multiplex ร้อยละ 17.6 acute inflammatory demyelinating polyneuropathy ร้อยละ 11.8 และ progressive polyradiculopathy ร้อยละ 5.9 ไม่พบความสัมพันธ์ระหว่างความผิดปกติของระบบประสาทส่วนปลายกับ อายุ เพศ และดัชนีมวลกาย อย่างไรก็ตาม พบว่าผู้ป่วยที่มีความผิดปกติของระบบประสาทส่วนปลายที่เกี่ยวข้องกับการติดเชื้อเอชไอวีมีค่า nadir CD4 cell count ต่ำกว่า ผู้ป่วยที่ไม่พบความผิดปกติของระบบประสาทส่วนปลายอย่างมีนัยสำคัญทางสถิติ ($p < 0.05$) และไม่พบความสัมพันธ์ของการเกิด distal symmetrical polyneuropathy กับการใช้ยาต้านไวรัสตัวใด นอกจาก stavudine ซึ่งพบแนวโน้มทางสถิติ*

สรุป: *อุบัติการณ์ของความผิดปกติทางระบบประสาทส่วนปลายในกลุ่มผู้ป่วยไทยที่ติดเชื้อเอชไอวีสูงกว่าที่เคยรายงานไว้ในประเทศไทย รูปแบบความผิดปกติที่พบได้บ่อยที่สุดได้แก่ distal symmetrical polyneuropathy ซึ่งมีความสัมพันธ์กับค่า nadir CD4 cell count ที่ต่ำ*