

# Prevalence of Thrombocytopenia among Chinese Adult Antiretroviral-naïve HIV-positive Patients

Hong-Wei Fan, Fu-Ping Guo, Yi-Jia Li, Ning Li, Tai-Sheng Li

Department of Infectious Diseases, Peking Union Medical College Hospital, Chinese Academy of Medical Sciences, Beijing 100730, China

## Abstract

**Background:** The prevalence of thrombocytopenia among Chinese antiretroviral therapy (ART)-naïve HIV-infected adults has not been well-described. The aim of this study was to investigate the prevalence and associated risk factors of thrombocytopenia among Chinese ART-naïve HIV-infected adults.

**Methods:** We performed a cross-sectional study of Chinese adult ART-naïve HIV-infected patients from September 2005 through August 2014. Socio-demographic variables and laboratory results including platelets, CD4<sup>+</sup> cell count, and viral load were obtained from medical records. Factors and outcomes associated with thrombocytopenia were assessed using logistic regression.

**Results:** A total of 1730 adult ART-naïve HIV-infected patients was included. The mean age was 38 years. The prevalence of thrombocytopenia was 4.5%. There were significant differences in the prevalence of thrombocytopenia between patients <30 years of age (2.8%) and 30–39 years (4.0%) compared with patients greater than 50 years (7.0%) ( $P = 0.006$  and  $P = 0.044$ , respectively). The prevalence of thrombocytopenia was also significantly different between patients with CD4<sup>+</sup> counts of 200–349 cells/mm<sup>3</sup> (3.3%) and >350 cells/mm<sup>3</sup> (2.8%) compared with patients with CD4<sup>+</sup> counts of 50–199 cells/mm<sup>3</sup> (7.1%) ( $P = 0.002$  and  $P = 0.005$ , respectively). The prevalence of thrombocytopenia was significantly different by hepatitis C virus antibody (HCV-Ab) seropositivity (10.2% for HCV-Ab positive vs. 3.9% for HCV-Ab negative,  $P = 0.001$ ). We observed differences in prevalence of thrombocytopenia by mode of transmission of HIV infection: Blood transmission (10.7%) versus men who have sex with men (3.9%) ( $P = 0.002$ ) and versus heterosexual transmission (3.9%) ( $P = 0.001$ ). In binary logistic regression analyses, age  $\geq 50$  years, HCV-Ab positivity and having a CD4<sup>+</sup> cell count of 50–199 cells/mm<sup>3</sup> were significantly associated with thrombocytopenia with adjusted odds ratio of 2.482 (95% confidence interval [CI]: 1.167, 5.281,  $P = 0.018$ ), 2.091 (95% CI: 1.078, 4.055,  $P = 0.029$ ) and 2.259 (95% CI: 1.028, 4.962,  $P = 0.042$ ), respectively.

**Conclusions:** Thrombocytopenia is not common among adult ART-naïve HIV-infected patients in China. Older age (age over 50 years), HCV-Ab positivity and lower CD4<sup>+</sup> cell count are associated with an increased risk of thrombocytopenia. Therefore, early diagnosis and treatment of thrombocytopenia in these patients are necessary.

**Key words:** HIV; Prevalence; Thrombocytopenia

## INTRODUCTION

Hematologic abnormalities are common manifestations of advanced HIV infection and AIDS.<sup>[1,2]</sup> The prevalence of thrombocytopenia in adult antiretroviral therapy (ART)-naïve HIV-infected patients ranges from 5.9% to 40%.<sup>[3-6]</sup> Furthermore, race and ethnicity may affect the prevalence of thrombocytopenia.<sup>[4]</sup> Thrombocytopenia may be the first clinical manifestation in asymptomatic HIV-infected patients and may progress over time resulting in severe bleeding.<sup>[7]</sup> Thrombocytopenia is characterized by a platelet (PLT) count  $<100 \times 10^9/\text{mm}^3$ ,<sup>[8]</sup> and also frequently occurs in HIV-infected patients.<sup>[5,9]</sup> To our knowledge, the prevalence of thrombocytopenia among ART-naïve

HIV-infected patients in China has not been extensively studied. We combined data from three large HIV cohorts in China to evaluate the prevalence of and associated risk factors for thrombocytopenia among Chinese ART-naïve HIV-infected adults.

## METHODS

### Study population

This was a cross-sectional study with data retrieved from three multicenter prospective studies<sup>[10-13]</sup> in China, established in 2005, 2009, and 2012, respectively. The research centers are from several different regions of China, including Beijing, Shanghai, Guangdong, Fujian, Yunnan, Henan, Zhejiang, Jiangxi, Guangxi, and Shanxi province. The patients represent a broad cross section of Chinese HIV-infected patients. HIV infection was determined by

Access this article online

Quick Response Code:



Website:  
www.cmj.org

DOI:  
10.4103/0366-6999.151078

**Address for correspondence:** Prof. Tai-Sheng Li,

Department of Infectious Diseases, Peking Union Medical College Hospital, Beijing 100730, China  
E-Mail: litsh@263.net

standard serum enzyme-linked immunosorbent assays and also confirmed by Western blotting analyses. Patients were only considered for enrollment in this study if they were ART-naïve and at least 18 years of age at the time of enrollment. The protocols were approved by independent ethics committees and institutional review boards, and the clinical trials were carried out in accordance with the principles of *Good Clinical Practice* and *Declaration of Helsinki*.

### Study-outcome definitions

Thrombocytopenia was defined as PLT count  $<100 \times 10^9/L$ . Mild thrombocytopenia was defined as a PLT count between  $99 \times 10^9/L$  and  $50 \times 10^9/L$ , and severe thrombocytopenia as  $<50 \times 10^9/L$ . Besides, anemia was defined as hemoglobin  $<100$  g/L, and neutropenia was defined as neutrophil count  $<1500$  cells/mm<sup>3</sup>.

### Data collection

Medical records were reviewed to ascertain demographic, clinical, and laboratory characteristics. Variables included age, sex, HIV transmission route, cytomegalovirus (CMV) antibody (Ab), hepatitis B surface antigen (HBsAg) and hepatitis C virus Ab (HCV-Ab), CD4<sup>+</sup> T-cell count, and HIV viral load (VL). Age was categorized as  $<30$ , 30–39, 40–49, and over 50 years. HIV transmission routes were defined as homosexual transmission (men who have sex with men [MSM]), heterosexual transmission, blood transmission, or unknown transmission risk. CD4 cell count was categorized as  $<50$ , 50–199, 200–349, and over 350 cells/mm<sup>3</sup>. VL was categorized as  $<5\log_{10}$  copies/ml and  $>5\log_{10}$  copies/ml.

### Statistical analysis

All statistical analyses were performed using the SPSS 19.0 statistical package (IBM Corporation, Armonk, New York, USA). We assessed the frequency of thrombocytopenia by baseline demographic and clinical factors, including age at enrollment, sex, HIV transmission route, opportunistic infections (OIs), HBsAg positivity, HCV-Ab positivity, CMV-Ab positivity, baseline CD4 cell count, and baseline VL. Noncategorical variables were assessed by Student's *t*-test, and categorical variables were assessed by Chi-square test. Bonferroni correction was used in multiple comparisons. Odds ratios and 95% confidence intervals (CI) were calculated to assess the relationship between each risk factor and the thrombocytopenia. To adjust for potential confounders, we used both univariate and multivariate binary logistic regression models. Variables included in the models were age, sex, transmission route, history of OIs, HBsAg positivity, HCV-Ab positivity, CMV-Ab positivity, CD4 cell count, and VL. The statistical test was two-tailed, and a  $P < 0.05$  was considered to be statistically significant.

## RESULTS

### Patient characteristics

We included 1730 Chinese adult ART-naïve HIV-infected patients. Baseline characteristics are summarized in

Table 1. Most patients were men (69.8%), mean age was 38 years, mean CD4 count was 229 cells/mm<sup>3</sup>, and mean VL load was  $4.7\log_{10}$  copies/ml. The prevalence of thrombocytopenia was 4.5%, while the prevalence of mild thrombocytopenia was 4.1%, and severe thrombocytopenia was 0.4%. Twenty-nine patients (1.7%) had both neutropenia and thrombocytopenia, 3 (0.2%) had both anemia and thrombocytopenia, and 6 (0.3%) had pancytopenia.

### Prevalence of thrombocytopenia by age groups

Figure 1 describes the prevalence of thrombocytopenia among patients according to age. The prevalence of thrombocytopenia was 2.8%, 4.0%, 5.2%, and 7.0% among patients younger than 30, 30–39, 40–39 and over 50 years of age, respectively. There was significant difference in the prevalence of thrombocytopenia between patients younger than 30 years of age and those aged over 50 years ( $P = 0.006$ ); while the difference between patients aged 30–39 years and those aged over 50 years was marginally significant ( $P = 0.044$ , according to Bonferroni correction).

**Table 1: Demographic characteristics of 1730 HIV/AIDS patients in China (n (%))**

Characteristics	Values
Age (years)	
<30	432 (25.0)
30–39	594 (34.3)
40–49	402 (23.2)
>50	302 (17.5)
Sex	
Male	1207 (69.8)
Female	523 (30.2)
Route of transmission	
MSM	689 (39.8)
Heterosexual	765 (44.2)
Blood	150 (8.7)
Other/unknown	126 (7.3)
HBs-Ag <sup>+</sup>	180 (10.6)
HCV-Ab <sup>+</sup>	167 (9.9)
CMV-IgM <sup>‡</sup>	50 (3.7)
OI history <sup>§</sup>	287 (16.7)
CD4 <sup>+</sup> count (cells/mm <sup>3</sup> )	
<200	745 (43.1)
200–349	695 (40.2)
Over 350	290 (16.8)
Viral load ( $\log_{10}$ copies/ml)	
<5	1154 (66.7)
Over 5	576 (33.3)
Thrombocytopenia	
Overall	78 (4.5)
Mild (PLT $50\text{--}99 \times 10^9/L$ )	71 (4.1)
Severe (PLT $<50 \times 10^9/L$ )	7 (0.4)

<sup>\*</sup>32 patients missing data; <sup>†</sup>50 patients missing data; <sup>‡</sup>369 patients missing data; <sup>§</sup>13 patients missing data. MSM: Men who have sex with men; HBs-Ag: Hepatitis B surface antigen; HCV-Ab: Hepatitis C virus antibody; CMV-IgM: Cytomegalovirus immunoglobulin M; OI: Opportunistic infection; PLT: Platelet.

### Prevalence of thrombocytopenia by CD4 cell counts

The prevalence of thrombocytopenia was 3.8%, 7.1%, 3.3%, and 2.8% among patients with CD4 cell counts of <50, 50–199, 200–349, and >350 cells/mm<sup>3</sup>, respectively [Figure 2]. The prevalence of thrombocytopenia was significantly different between patients with CD4 cell counts of 50–199 cells/mm<sup>3</sup> compared with 200–349 cells/mm<sup>3</sup> ( $P = 0.002$ ), and between patients with CD4 cell counts of 50–199 cells/mm<sup>3</sup> versus >350 cells/mm<sup>3</sup> ( $P = 0.005$ ).

### Prevalence of thrombocytopenia by hepatitis C virus seropositivity

The prevalence of thrombocytopenia was significantly different between patients who were HCV-Ab positive (10.2%) and those who were HCV-Ab negative (3.9%) ( $P = 0.001$ ) [Figure 3].

### Prevalence of thrombocytopenia by transmission route

The prevalence of thrombocytopenia was 3.9%, 3.9%, and 10.7% among the patients with homosexual (MSM), heterosexual, and the blood transmission ( $P = 0.001$ ) [Figure 4]. The prevalence of thrombocytopenia differed between patients with blood transmission and MSM patients ( $P = 0.002$ ), and between patients with blood transmission and those with heterosexual transmission ( $P = 0.001$ ).

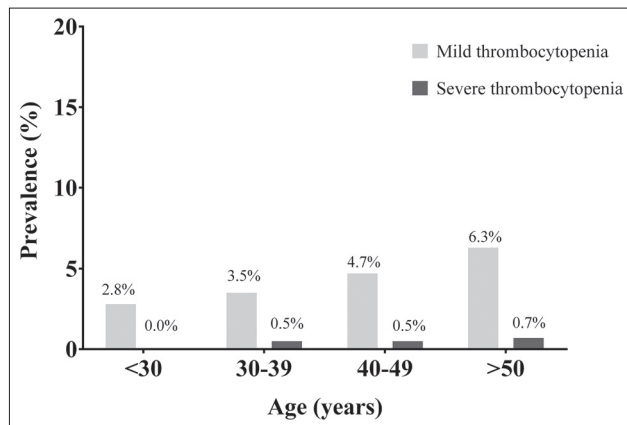
### Prevalence of thrombocytopenia by other risk factors

Among 1207 male patients, 60 (5.0%) patients had thrombocytopenia compared with 18 (3.5%) out of

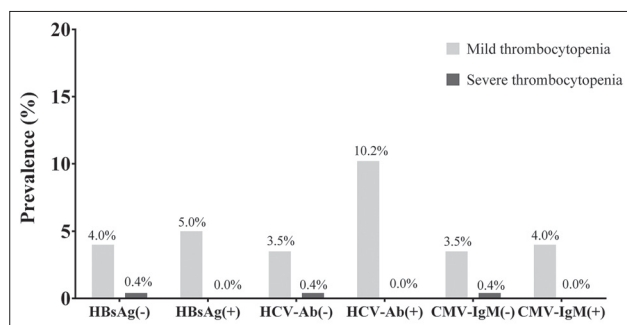
523 female patients. The prevalence of thrombocytopenia did not differ significantly by sex ( $P = 0.098$ ). The prevalence of thrombocytopenia was 4.6% among patients with VL < 5log<sub>10</sub> copies/ml and 4.3% among those with VL ≥ 5log<sub>10</sub> copies/ml ( $P = 0.459$ ). The prevalence of thrombocytopenia also did not differ significantly by HBsAg positivity (4.4% among HBsAg– patients vs. 5.0% among HBsAg+ patients,  $P = 0.415$ ), by CMV-Ab positivity (3.9% among CMV-immunoglobulin M [IgM]– patients vs. 4.0% among CMV-IgM+ patients,  $P = 0.590$ ), nor by history of OIs (4.3% for those without OIs vs. 5.6% for those with a history of OIs,  $P = 0.218$ ) [Figure 3].

### Risk factors for thrombocytopenia among antiretroviral therapy-naïve patients

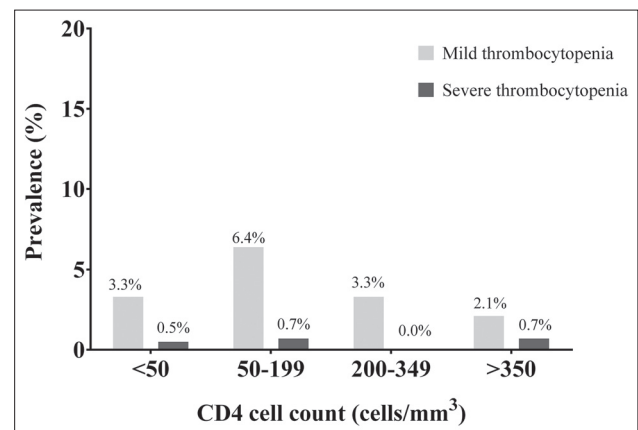
In a multivariate logistic regression model, we analyzed factors associated with the thrombocytopenia among Chinese adult ART-naïve HIV-infected patients. Table 2 demonstrates the results of the logistic regression analysis. Age ≥50 years, HCV-Ab positivity and lower CD4+ cell count (50–199 cells/mm<sup>3</sup>) were significantly associated with thrombocytopenia. We did not find a statistically significant association between VL and the presence of thrombocytopenia.



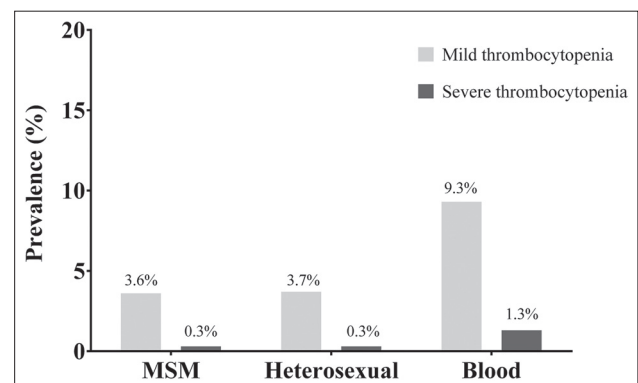
**Figure 1:** Prevalence of thrombocytopenia among patients with different age.



**Figure 3:** Prevalence of thrombocytopenia among patients with different serum biomarkers.



**Figure 2:** Prevalence of thrombocytopenia among patients with different CD4+ count.



**Figure 4:** Prevalence of thrombocytopenia among patients with different transmission routes.

**Table 2: Association of thrombocytopenia with related factors among Chinese adult ART-naïve HIV-infected patients**

Variables	Thrombocytopenia (n (%))		Crude OR (95% CI)	P	Adjusted OR* (95% CI)	P
	Yes	No				
Age, years						
<30	12 (2.8)	420 (97.2)	Reference	Reference	Reference	Reference
30–39	24 (4.0)	570 (96.0)	1.474 (0.729, 2.980)	0.281	1.370 (0.671, 2.796)	0.387
40–49	21 (5.2)	381 (94.8)	1.929 (0.936, 3.974)	0.075	1.688 (0.805, 3.539)	0.166
>50	21 (7.0)	281 (93.0)	2.616 (1.267, 5.402)	0.009	2.482 (1.167, 5.281)	0.018
Sex						
Male	60 (5.0)	1147 (95.0)	1.468 (0.858, 2.511)	0.161		
Female	18 (3.4)	505 (96.6)	Reference	Reference		
Route of transmission						
MSM	27 (3.9)	662 (96.1)	Reference	Reference	Reference	Reference
Heterosexual sex	30 (3.9)	735 (96.1)	1.001 (0.589, 1.701)	0.998	0.872 (0.501, 1.517)	0.627
Blood	16 (10.7)	134 (89.3)	2.928 (1.535, 5.583)	0.001	1.790 (0.850, 3.770)	0.125
Other/unknown	5 (4.0)	121 (96.0)	1.013 (0.383, 2.683)	0.979	0.821 (0.304, 2.218)	0.697
HBs-Ag						
Negative	67 (4.4)	1451 (95.6)	Reference	Reference		
Positive	9 (5.0)	171 (95.0)	1.140 (0.558, 2.327)	0.719		
Unknown	2 (6.3)	30 (93.7)	1.444 (0.338, 6.168)	0.620		
HCV-Ab						
Negative	1454 (96.1)	59 (3.9)	Reference	Reference	Reference	Reference
Positive	17 (10.2)	150 (89.8)	2.793 (1.587, 4.915)	<0.001	2.091 (1.078, 4.055)	0.029
Unknown	2 (4.0)	48 (96.0)	1.027 (0.244, 4.326)	0.971	0.859 (0.199, 3.713)	0.839
CMV-IgM						
Negative	51 (3.9)	1260 (96.1)	Reference	Reference		
Positive	2 (4.0)	48 (96.0)	1.029 (0.243, 4.353)	0.969		
Unknown	25 (6.8)	344 (93.2)	1.795 (1.097, 2.940)	0.020		
OIs						
Negative	62 (4.3)	1368 (95.7)	Reference	Reference		
Positive	16 (5.6)	271 (94.4)	1.303 (0.741, 2.292)	0.358		
Unknown	0 (0)	13 (100)	NA	0.978		
CD4+ count, cells/mm <sup>3</sup>						
<50	7 (3.8)	175 (96.2)	1.410 (0.502, 3.956)	0.514	1.255 (0.440, 3.581)	0.671
50–199	40 (7.1)	523 (92.9)	2.696 (1.245, 5.839)	0.012	2.259 (1.028, 4.962)	0.042
200–349	23 (3.3)	672 (96.7)	1.206 (0.533, 2.730)	0.652	1.069 (0.466, 2.450)	0.875
Over 350	8 (2.8)	282 (97.2)	Reference	Reference	Reference	Reference
Viral load, log <sub>10</sub> copies/ml						
<5	53 (4.6)	1101 (95.4)	1.061 (0.652, 1.726)	0.812		
Over 5	25 (4.3)	551 (95.7)	Reference	Reference		

OR: Odds ratio; MSM: Men who have sex with men; HBs-Ag: Hepatitis B surface antigen; HCV-Ab: Hepatitis C virus antibody; CMV-IgM: Cytomegalovirus immunoglobulin M; OI: Opportunistic infections; CI: Confidence interval; ART: Antiretroviral therapy; NA: not applicable. \*Factors with statistical significance in univariate analyses were included in multivariate regression.

## DISCUSSION

We found an overall low prevalence of thrombocytopenia, and in particular severe thrombocytopenia, among Chinese adult ART-naïve HIV-infected patients. To our knowledge, this is the first study in China to determine the prevalence of thrombocytopenia in adult ART-naïve HIV-infected patients.

A previous study of the Taiwanese population receiving periodic health examinations found the prevalence of thrombocytopenia to be 0.5%.<sup>[8]</sup> There are no data regarding the prevalence of thrombocytopenia in the mainland of China. In our study, the prevalence of thrombocytopenia among Chinese adult ART-naïve HIV-infected patients was 4.5%, which was higher than the general population. This

suggests that thrombocytopenia occurs more frequently in ART-naïve HIV-infected patients in China compared with the general population. In addition, 22% of adults diagnosed with immune thrombocytopenia are HIV-positive.<sup>[14]</sup> As such, HIV infection should be considered as a differential diagnosis for individuals presenting with thrombocytopenia. Thrombocytopenia in HIV-infected patients is likely to be multifactorial, with contributions from splenic PLT sequestration, immune-mediated PLT destruction, and decreased PLT production related to direct infection of megakaryocytes by HIV.<sup>[15-17]</sup>

The prevalence of thrombocytopenia observed in this study is consistent with several previous published studies.<sup>[3,4,18-21]</sup> However, other studies have demonstrated a higher



prevalence of thrombocytopenia.<sup>[5,22]</sup> Prior to the advent of highly active ART, the prevalence of HIV-associated thrombocytopenia was estimated to be 10–30%.<sup>[23,24]</sup> Ambler *et al.*<sup>[5]</sup> investigated the prevalence of thrombocytopenia ( $<100 \times 10^9/L$ ) in HIV positive ART-naïve patients in Australia. In that study, the overall prevalence of thrombocytopenia was 26%. The discrepancy between the prevalence observed in their study and ours may be explained by varying definitions of thrombocytopenia and differences in characteristics between the two study population.

We found that thrombocytopenia was significantly associated with CD4+ counts between 50 and 200 cells/mm<sup>3</sup>. Other studies have also found a lower CD4+ count (CD4 < 200 cells/mm<sup>3</sup>) to be a risk factor for thrombocytopenia.<sup>[19,20,25]</sup> Muñoz *et al.*<sup>[26]</sup> found a decrease in PLT number predicted a steep decline of CD4 + T cell counts in homosexual men. Patients with more severe immunodeficiency (CD4+ < 200 cells/mm<sup>3</sup>) presented with a lower PLT count. However, these studies did not further divide CD4+ cells into <50 and 50–200 cells/mm<sup>3</sup>. We found a CD4+ count between 50 and 200 cells/mm<sup>3</sup> but not <50 cells/mm<sup>3</sup>, was significantly associated with an increased risk of thrombocytopenia. The mechanism for this is unclear and needs to be studied further.

We found an association between HCV-Ab positivity and thrombocytopenia among Chinese adult ART-naïve HIV-infected patients, which is in line with previous studies.<sup>[8,27-29]</sup> An association between chronic immune thrombocytopenic purpura and HCV has been described previously,<sup>[27]</sup> cryoglobulins,<sup>[28]</sup> and anti-PLT autoantibodies<sup>[29]</sup> have been detected in thrombocytopenic patients with HCV. Lai *et al.* found that anti-HCV antibodies in the setting of thrombocytopenia may be associated with hepatocellular damage, hepatic fibrosis, liver cirrhosis, and inadequate production of thrombopoietin.<sup>[8,30]</sup>

We found older age (age >50 years) was a risk factor for thrombocytopenia, similar to previous studies.<sup>[8]</sup> The increase in the prevalence of thrombocytopenia with age may be due to a higher incidence of myelodysplasia in older patients, but this requires further evaluation.

Our study has some limitations. First, it was a retrospective observational study which has inherent limitations. Second, selection bias may have affected the findings. However, the results of this large cohort study likely still reflect the true prevalence of thrombocytopenia in this population of Chinese HIV-infected adults. This study provides the basis for recommendations to improve the clinical care of HIV-infected persons and lays the groundwork for further studies on the pathophysiology of HIV-associated thrombocytopenia.

In conclusion, thrombocytopenia is not common among adult ART-naïve HIV-infected patients in China. Older age, HCV-Ab positivity and lower CD4+ cell count are associated with an increased risk of thrombocytopenia. Routine assessment for thrombocytopenia among this HIV-infected population should be performed to optimize clinical management.

## ACKNOWLEDGMENTS

We are grateful to all the patients for their participation. We thanked Doctor Felicia Chow from the University of California, San Francisco for her aid in language editing. We thanked Doctor Hai-Yu Pang from the Central Clinical Laboratory of Peking Union Medical College Hospital for her help in statistical analyses.

## REFERENCES

1. Bello JL, Burgaleta C, Magallon M, Herruzo R, Villar JM. Hematological abnormalities in hemophilic patients with human immunodeficiency virus infection. *Am J Hematol* 1990;33:230-3.
2. Zon LI, Arkin C, Gropman JE. Haematologic manifestations of the human immune deficiency virus (HIV). *Br J Haematol* 1987;66:251-6.
3. Wondimeneh Y, Muluje D, Ferede G. Prevalence and associated factors of thrombocytopenia among HAART-naïve HIV-positive patients at Gondar University Hospital, northwest Ethiopia. *BMC Res Notes* 2014;7:5.
4. Firnhaber C, Smeaton L, Saukila N, Flanigan T, Gangakhedkar R, Kumwenda J, *et al.* Comparisons of anemia, thrombocytopenia, and neutropenia at initiation of HIV antiretroviral therapy in Africa, Asia, and the Americas. *Int J Infect Dis* 2010;14:e1088-92.
5. Ambler KL, Vickars LM, Leger CS, Foltz LM, Montaner JS, Harris M, *et al.* Clinical features, treatment, and outcome of HIV-associated immune thrombocytopenia in the HAART era. *Adv Hematol* 2012;2012:910954.
6. Morris L, Distenfeld A, Amorosi E, Karpatkin S. Autoimmune thrombocytopenic purpura in homosexual men. *Ann Intern Med* 1982;96:714-7.
7. Scaradavou A. HIV-related thrombocytopenia. *Blood Rev* 2002;16:73-6.
8. Lai SW, Huang CY, Lai HC, Liao KF, Lai YM, Liu CS, *et al.* Thrombocytopenia and its related factors: A hospital-based, cross-sectional study. *Ann Acad Med Singapore* 2010;39:9-12.
9. Marks KM, Clarke RM, Busse JB, Talal AH, Glesby MJ. Risk factors for thrombocytopenia in HIV-infected persons in the era of potent antiretroviral therapy. *J Acquir Immune Defic Syndr* 2009;52:595-9.
10. Li T, Guo F, Li Y, Zhang C, Han Y, Lye W, *et al.* An antiretroviral regimen containing 6 months of stavudine followed by long-term zidovudine for first-line HIV therapy is optimal in resource-limited settings: A prospective, multicenter study in China. *Chin Med J* 2014;127:59-65.
11. Li T, Dai Y, Kuang J, Jiang J, Han Y, Qiu Z, *et al.* Three generic nevirapine-based antiretroviral treatments in Chinese HIV/AIDS patients: Multicentric observation cohort. *PLoS One* 2008;3:e3918.
12. Li Y, Han Y, Xie J, Gu L, Li W, Wang H, *et al.* CRF01\_AE subtype is associated with X4 tropism and fast HIV progression in Chinese patients infected through sexual transmission. *AIDS* 2014;28:521-30.
13. Wang H, Li Y, Zhang C, Han Y, Zhang X, Zhu T, *et al.* Immunological and virological responses to cART in HIV/HBV co-infected patients from a multicenter cohort. *AIDS* 2012;26:1755-63.
14. McDonald EJ, Butler A. Immune thrombocytopenia in adults: A single-centre retrospective review of patients presenting over 7 years. *N Z Med J* 2010;123:18-25.
15. Coyle TE. Hematologic complications of human immunodeficiency virus infection and the acquired immunodeficiency syndrome. *Med Clin North Am* 1997;81:449-70.
16. Torre D, Pugliese A. Platelets and HIV-1 infection: Old and new aspects. *Curr HIV Res* 2008;6:411-8.
17. Cole JL, Marzec UM, Gunthel CJ, Karpatkin S, Worford L, Sundell IB, *et al.* Ineffective platelet production in thrombocytopenic human immunodeficiency virus-infected patients. *Blood* 1998;91:3239-46.
18. Denué BA, Gashau W, Bello HS, Kida IM, Bakki B, Ajayi B. Relation between some haematological abnormalities, degree of immunosuppression and viral load in treatment-naïve HIV-infected patients. *East Mediterr Health J* 2013;19:362-8.
19. Sullivan PS, Hanson DL, Chu SY, Jones JL, Ciesielski CA. Surveillance for thrombocytopenia in persons infected with HIV: Results from the multistate adult and adolescent spectrum of disease project. *J Acquir Immune Defic Syndr Hum Retrovirol* 1997;14:374-9.

20. Enawgaw B, Alem M, Addis Z, Melku M. Determination of hematological and immunological parameters among HIV positive patients taking highly active antiretroviral treatment and treatment naïve in the antiretroviral therapy clinic of Gondar University Hospital, Gondar, Northwest Ethiopia: A comparative cross-sectional study. *BMC Hematol* 2014;14:8.
21. Dikshit B, Wanchu A, Sachdeva RK, Sharma A, Das R. Profile of hematological abnormalities of Indian HIV infected individuals. *BMC Blood Disord* 2009;9:5.
22. Vannappagari V, Nkhoma ET, Atashili J, Laurent SS, Zhao H. Prevalence, severity, and duration of thrombocytopenia among HIV patients in the era of highly active antiretroviral therapy. *Platelets* 2011;22:611-8.
23. Mientjies GH, van Ameijden EJ, Mulder JW, van den Hoek JA, Coutinho RA, von dem Borne AE. Prevalence of thrombocytopenia in HIV-infected and non-HIV infected drug users and homosexual men. *Br J Haematol* 1992;82:615-9.
24. Stasi R, Willis F, Shannon MS, Gordon-Smith EC. Infectious causes of chronic immune thrombocytopenia. *Hematol Oncol Clin North Am* 2009;23:1275-97.
25. Parinitha S, Kulkarni M. Haematological changes in HIV infection with correlation to CD4 cell count. *Australas Med J* 2012;5:157-62.
26. Muñoz A, Carey V, Saah AJ, Phair JP, Kingsley LA, Fahey JL, *et al.* Predictors of decline in CD4 lymphocytes in a cohort of homosexual men infected with human immunodeficiency virus. *J Acquir Immune Defic Syndr* 1988;1:396-404.
27. Bauduer F, Marty F, Larrouy M, Ducout L. Immunologic thrombocytopenic purpura as presenting symptom of hepatitis C infection. *Am J Hematol* 1998;57:338-40.
28. Rajan SK, Espina BM, Liebman HA. Hepatitis C virus-related thrombocytopenia: Clinical and laboratory characteristics compared with chronic immune thrombocytopenic purpura. *Br J Haematol* 2005;129:818-24.
29. Kajiwaru E, Akagi K, Azuma K, Onoyama K, Fujishima M. Evidence for an immunological pathogenesis of thrombocytopenia in chronic liver disease. *Am J Gastroenterol* 1995;90:962-6.
30. Wang CS, Yao WJ, Wang ST, Chang TT, Chou P. Strong association of hepatitis C virus (HCV) infection and thrombocytopenia: Implications from a survey of a community with hyperendemic HCV infection. *Clin Infect Dis* 2004;39:790-6.

**Received:** 24-10-2014 **Edited by:** Yuan-Yuan Ji  
**How to cite this article:** Fan HW, Guo FP, Li YJ, Li N, Li TS. Prevalence of Thrombocytopenia among Chinese Adult Antiretroviral-naïve HIV-positive Patients. *Chin Med J* 2015;128:459-64.

**Source of Support:** This study was supported by grants from National Natural Science Foundation of China (No. 81071372) and National Key Technologies R and D Program for the 12<sup>th</sup> Five-year Plan (No. 2012ZX10001003-001). The funders had no role in study design, data collection, data analyses, preparation of the article, or decision to publish.  
**Conflict of Interest:** None declared.