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# Clinical Characteristics and Treatment Outcomes in Human Immunodeficiency Virus (HIV)-Infected Patients with Liver Abscess: A Retrospective Study of 53 Patients

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**Background:** Although episodes of liver abscess (LA) have been reported in patients infected with the human immunodeficiency virus (HIV), specific symptoms in these patients remain unclear.





**Material/Methods:** The clinical characteristics, laboratory findings, treatments, and final clinical outcomes of LA in 53 HIV-infected patients were analyzed.

**Results:** The most common clinical manifestations were fever (92.5%), chills (41.5%), and abdominal pain (37.7%). The mean CD4<sup>+</sup> T cell count in these HIV-infected patients at admission was 328.09±236.192 cells/μL. LA and blood cultures were positive in six (17.6%) and two (5.4%) patients, respectively. Thirteen strains of pathogens, including *Staphylococcus*, *Corynebacterium*, and *Candida*, were detected in LA cultures. Forty-four (95.7%) of 46 patients were successfully treated with antibiotics plus image-guided percutaneous aspiration, drainage, or surgery, whereas four (57.1%) of the remaining seven patients were successfully treated with antibiotics alone. Septic shock [odds ratio (OR)=8.970; 95% confidence interval (CI)=0.840–92.110; *p*=0.014] and ascites (OR=7.057; 95% CI=0.683–72.957; *p*=0.016) were found to be independent risk factors for poor prognosis. The clinical characteristics of LA in HIV-infected patients were nonspecific, with bacteria being the primary pathogens.

**Conclusions:** Antibiotics plus image-guided percutaneous drainage can effectively improve treatment outcomes in HIV-infected patients with LA.

**MeSH Keywords:** **HIV • Liver Abscess • Prognosis**

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## Background

Liver abscess (LA) is classified as a pus-filled suppurated mass in the liver parenchyma, probably caused by infection and multiplication of microorganisms [1]. The incidence of this rare condition varies across regions. For example, the incidence of LA was found to be 1.1–1.3 per 100,000 individuals in western countries [2–4] and 17.6 per 100,000 individuals in Asian countries [5]. Moreover, the incidence of LA in the United States has increased from 3.59 to 4.0 per 100,000 individuals [6]. The mortality rate of LA is relatively high, between 10% and 40% [7]. In recent years, a generally immunocompromised state has been regarded as the key risk factor for LA, although other factors, including diabetes mellitus (DM), cirrhosis, sex, and age have been associated with the onset of LA [8].

Acquired immunodeficiency syndrome (AIDS), characterized by an immunodeficient and immunocompromised state, is an infectious disease caused by human immunodeficiency virus (HIV). HIV-infected patients are susceptible to a number of infections [9, 10], with LA being one of the most common and severe infections reported. In Taiwan, the incidence of amoebic LA in HIV-infected patients has increased markedly [11]. However, the specific characteristics of LA in Chinese patients with underlying HIV infection remain largely unknown.

We have had 8 years of experience in the diagnosis and management of LA in HIV-infected patients. This retrospective study was therefore performed to identify the clinical manifestations; evaluate the imaging, pathological, and microbiological characteristics; and determine the preferred treatment plan for these patients. This study also sought to identify factors that could predict the persistence of LA in HIV-infected patients.

## Material and Methods

### Patients

This retrospective study included HIV-infected patients with LA who were admitted to Beijing Youan Hospital, Capital Medical University, China, between January 2010 and December 2018, inclusive. The study procedure complied with the principles of the Declaration of Helsinki and was approved by Beijing Youan Hospital, which waived the requirement for written informed consent owing to the retrospective nature of the study. Only the first episode of LA experienced by each patient during the study period was included in the statistical analyses.

### Population

The hospital records of Beijing Youan Hospital were subjected to a computerized search using ICD-9 codes to identify

HIV-infected patients diagnosed with LA during the study period. Patient characteristics were recorded at admission, with readmissions considered single admissions.

### Data collection and definitions

Data collected from patients' electronic medical records included general information, medical history, clinical symptoms, findings at physical examination, laboratory data, imaging results, treatments, complications, and outcomes. LA was diagnosed based on clinical characteristics, imaging results, microbiological findings, and/or pathological findings. Patients aged <18 years, those with hydatid disease of the liver or secondary pyogenic LA, and those with incomplete data were excluded.

The included patients were categorized into two groups, those exhibiting improved clinical signs and symptoms as well as reduced or absorbed LA (improvement group) and those without significant improvements in clinical signs and symptoms and those who were discharged or died during hospitalization (non-improvement group).

### Statistical analysis

All data were analyzed using SPSS 20.0. Parametric variables were analyzed using Student's *t*-tests, and nonparametric variables were analyzed using Mann-Whitney *U*-tests. Categorical variables were analyzed using the  $\chi^2$  or Fisher's exact test. Results were considered statistically significant if the *p*-value was <0.05. Clinically relevant variables and variables with *p*-values <0.10 in univariate analyses were included in binary logistic regression analysis.

## Results

### Demographic and clinical characteristics

The demographic characteristics of the 53 HIV-infected patients diagnosed with LA between January 2010 and December 2018 are presented in Table 1. These 53 patients included 52 (98.1%) men and one (1.9%) woman, of mean±SD age 36.96±10.86 years (range, 20–71 years). Forty-eight (90.6%) patients were successfully treated, whereas five (9.4%) showed no improvements in clinical signs and symptoms and were discharged or died during hospitalization.

The most common HIV transmission route was homosexual contact (*n*=20, 37.7%), followed by extramarital heterosexual contact (*n*=6, 11.3%), blood transfusion (*n*=3, 5.7%), and drug addiction (*n*=3, 5.7%).

**Table 1.** Demographic characteristics of 53 HIV-infected patients with liver abscess.

Characteristics	Total (n=53)	Improvement group (n=48)	Non-improvement group (n=5)	t or $\chi^2$	p
Gender (Male/Female)	53 (52/1)	48 (47/1)	5 (5/0)	0	1
Age, mean $\pm$ SD (years)	36.96 $\pm$ 10.86	37.33 $\pm$ 11.10	33.40 $\pm$ 8.26	0.767	0.446
Underlying diseases (n, %)					
Diabetes mellitus	1 (1.89%)	1 (2.08%)	0 (0)	0	1
HBV hepatitis	2 (3.77%)	2 (4.17%)	0 (0)	0	1
HCV hepatitis	1 (1.89%)	1 (2.08%)	0 (0)	0	1
Alcoholism	3 (5.66%)	2 (4.17%)	1 (20.00%)	0.195	0.659
Gallbladder diseases	24 (45.28%)	19 (39.58%)	5 (100.00%)	4.455	0.035*
Syphilis	23 (43.40%)	22 (45.83%)	1 (20.00%)	0.403	0.525
Transmission (n, %)					
Homosexuality	20 (37.74%)	18 (37.50%)	2 (40.00%)		
Heterosexuality	6 (11.32%)	5 (10.42%)	1 (20.00%)		
Drug addiction	3 (5.66%)	3 (6.25%)	0 (0)		
Transfusion	3 (5.66%)	3 (6.25%)	0 (0)		
Unknown	21 (39.62%)	19 (39.58%)	2 (40.00%)		
Previous ART therapy (n, %)	15 (28.30%)	15 (31.25%)	0 (0)	0.911	0.34
Length of hospitalization, mean $\pm$ SD (days)	27.94 $\pm$ 17.81	28.71 $\pm$ 17.48	20.60 $\pm$ 21.51	0.968	0.338

**Table 2.** Clinical manifestations in 53 HIV-infected patients with LA.

Clinical manifestation	Total (n=53)	Improvement group (n=48)	Non-improvement group (n=5)	t or $\chi^2$	p
Fever	49 (92.45%)	44 (91.67%)	5 (100.00%)	0	1
Chills	22 (41.51%)	22 (45.83%)	0 (0)	2.258	0.133
Abdominal pain	20 (37.74%)	17 (35.42%)	3 (60.00%)	0.353	0.552
Cough	11 (20.76%)	10 (20.83%)	1 (20.00%)	0	1
Vomiting and nausea	7 (13.21%)	6 (12.50%)	1 (20.00%)	0	1
abdominal discomfort	7 (13.21%)	7 (14.58%)	0 (0)	0.05	0.824
Fatigue	6 (11.32%)	4 (8.33%)	2 (40.00%)	1.919	0.166
Diarrhea	5 (9.43%)	5 (10.42%)	0 (0)	0	1
Body weight loss	2 (3.77%)	0 (0)	2 (40.00%)	10.458	0.001
Hepatomegaly	7 (13.21%)	7 (14.58%)	0 (0)	0.05	0.824
Splenomegaly	23 (43.40%)	21 (43.75%)	2 (40.00%)	0	1
Right upper quadrant tenderness	18 (33.96%)	15 (31.25%)	3 (60.00%)	0.633	0.426
Murphy's sign	4 (7.55%)	4 (8.33%)	0 (0)	0	1

**Table 3.** Laboratory results of 53 HIV-infected patients with liver abscess.

Variable	Total (n=53)	Improvement group (n=48)	Non-improvement group (n=5)	t or $\chi^2$	p
WBC count >9.5×10 <sup>9</sup> /L	26/53 (49.06%)	24/48 (50.00%)	2/5 (40.00%)	0	1
Neutrophil% >75.0%	28/53 (52.83%)	25/48 (52.08%)	3/5 (60.00%)	0	1
Hb <130 g/L	46/53 (86.79%)	41/48 (85.42%)	5/5 (100.00%)	0.05	0.824
PLT >350×10 <sup>9</sup> /L	17/53 (32.08%)	17/48 (35.42%)	0/5 (0)	1.235	0.266
PLT <125×10 <sup>9</sup> /L	3/53 (5.66%)	2/48 (4.17%)	1/5 (20.00%)	0.195	0.659
ALT >50 U/L	17/52 (32.69%)	14/47 (29.79%)	3/5 (60.00%)	0.753	0.386
AST >40 U/L	28/52 (53.85%)	24/47 (51.06%)	4/5 (80.00%)	0.581	0.446
TBIL >21.8 umol/L	12/52 (23.08%)	12/47 (25.53%)	0/5 (0)	0.533	0.465
DBIL >7.1 umol/L	17/52 (32.69%)	15/47 (31.92%)	2/5 (40.00%)	0	1
ALB <40 g/L	45/51 (88.24%)	41/47 (87.23%)	4/4 (100.00%)	0	1
ALP >125 U/L	24/45 (53.33%)	22/42 (52.38%)	2/3 (66.67%)	0	1
BUN >8 mmol/L	2/52 (3.85%)	1/47 (2.13%)	1/5 (20.00%)	0.566	0.452
Crea >97 umol/L	4/52 (7.69%)	4/47 (8.51%)	0/5 (0)	0	1
PT >12.8 s	32/48 (66.67%)	28/44 (63.64%)	4/4 (100.00%)	0.852	0.356
PTA <80%	31/48 (64.58%)	28/44 (63.64%)	3/4 (75.00%)	0	1
ESR >20 mm/H	37/41 (90.24%)	34/38 (89.47%)	3/3 (100.00%)	0	1
CD4 <sup>+</sup> T cells cells/ul	328.09±236.19	335.40±236.44	258.00±248.14	0.694	0.491
CD4 <sup>+</sup> T cells distribution (%)					
CD4 <sup>+</sup> T ≤200 cells/ul	17 (32.08%)	15 (31.25%)	2 (40.00%)	0	1
CD4 <sup>+</sup> T >200 cells/ul	36 (67.92%)	33 (68.75%)	3 (60.00%)		
Imaging findings(n, % or mean±SD)					
Single lesion	40 (75.47%)	37 (77.08%)	3 (60.00%)	0.089	0.756
Multiple lesions	13 (24.53%)	11 (22.92%)	2 (40.00%)		
Gas formation	7 (13.21%)	7 (14.58%)	0 (0)	0.05	0.824
Abscess location					
Left lobe	9 (16.98%)	6 (12.50%)	3 (60.00%)	4.27	0.039
Right lobe	33 (62.26%)	33 (68.75%)	0 (0)	6.418	0.011
Both lobes	9 (16.98%)	7 (14.58%)	2 (40.00%)	0.664	0.415
Caudate lobe	2 (3.77%)	2 (4.17%)	0 (0)	0	1
Maximal diameter of abscess					
≤5 cm	6 (11.32%)	6 (12.50%)	0 (0)	1.798	0.407
5<≤10 cm	31 (58.49%)	27 (56.25%)	4 (80.00%)		
>10 cm	16 (30.19%)	15 (31.25%)	1 (20.00%)		

WBC – white blood cell count; Hb – hemoglobin; PLT – platelet; ALT – alanine aminotransferase; AST – aspartate aminotransferase; TBIL – total bilirubin; DBIL – direct bilirubin; ALB – albumin; ALP – alkaline phosphatase; BUN – blood urea nitrogen; Crea – serum creatinine; PT – prothrombin time; PTA – prothrombin activity; ESR – erythrocyte sedimentation rate.

**Table 4.** Treatments and complications in 53 HIV-infected patients with LA.

Variable	Total (n=53)	Improvement group (n=48)	Non-improvement group (n=5)	t or $\chi^2$	p
Treatments (n, %)					
Medical treatment	7 (13.21%)	4 (8.33%)	3 (60.00%)	6.52	0.011
Percutaneous drainage	44 (83.02%)	42 (87.5%)	2 (40.00%)	4.27	0.039
Surgical drainage	2 (3.77%)	2 (4.17%)	0 (0)	0	1
Complications (n, %)					
Sepsis	11 (20.75%)	9 (18.75%)	2 (40.00%)	0.287	0.592
Septic shock	5 (9.43%)	3 (6.25%)	2 (40.00%)	2.733	0.098
Pleural effusion	24 (45.28%)	20 (41.67%)	4 (80.00%)	1.361	0.243
Ascites	17 (32.08%)	13 (27.08%)	4 (80.00%)	3.645	0.056
Portal venous thrombosis	6 (11.32%)	6 (12.50%)	0 (0)	0.01	0.922
Length of hospitalization, mean $\pm$ SD (days)	27.94 $\pm$ 17.81	28.71 $\pm$ 17.48	20.60 $\pm$ 21.51	0.968	0.338

Of the 53 HIV-infected patients, 23 (43.4%) developed LA 2 months to 7 years after being diagnosed with AIDS. Of these 23 patients, 15 (65.2%) received antiretroviral therapy (ART). The other 30 (56.6%) patients were unaware of HIV infection until developing LA (ART-naïve patients), with 23 (76.7%) of these 30 patients receiving ART during the subsequent course of their disease.

Among the 53 study patients, 23 (43.4%) had syphilis and one (1.9%) had diabetes mellitus. Two (3.8%) patients were coinfecting with hepatitis B virus (HBV) and one (1.9%) with hepatitis C virus (HCV). No patient was infected with both HBV and HCV. Three (5.7%) patients reported a history of alcohol abuse, and 24 (45.3%) patients had gallbladder diseases.

### Symptoms and signs

The most frequent symptom experienced by these patients was fever ( $n=49$ , 92.5%), followed by chills ( $n=22$ , 41.5%) and abdominal pain ( $n=20$ , 37.7%). Other symptoms included cough ( $n=11$ , 20.8%), vomiting and nausea ( $n=7$ , 13.2%), abdominal discomfort ( $n=7$ , 13.2%), and fatigue ( $n=6$ , 11.3%). Uncommon symptoms included diarrhea ( $n=5$ , 9.4%) and weight loss ( $n=2$ , 3.8%).

Clinically, 23 (43.4%) patients had splenomegaly, 18 (34.0%) had right upper quadrant pain, seven (13.2%) had hepatomegaly, and four (7.6%) were positive for Murphy's sign at admission (Table 2).

### Laboratory and imaging findings

As shown in Table 3, white blood cell counts were elevated ( $>9.5 \times 10^9/L$ ) in 26 (49.1%) patients and anemia in 46 (86.8%). Abnormal results included elevated alanine aminotransferase (32.7%), aspartate aminotransferase (53.9%), total bilirubin (23.1%), direct bilirubin (32.79%), and alkaline phosphatase (53.3%) activities. The mean CD4<sup>+</sup> T cell count at admission in all 53 HIV-infected patients was  $328.09 \pm 236.19$  cells/ $\mu$ L, with 17 (32.1%) patients having CD4<sup>+</sup> T cell counts  $<200$  cells/ $\mu$ L.

Forty (75.5%) patients had a single LA, whereas 13 (24.5%) had multiple LAs. LA was present in the right lobe in 33 (62.2%) patients, the left lobe in nine (17.0%), the caudate lobe in two (3.8%), and both lobes in nine (17.0%). LA diameter ranged from 2.10 to 16.30 cm, being  $<5$  cm in six (11.3%) patients,  $5 \leq 10$  cm in 31 (58.5%), and  $>10$  cm in 16 (30.2%).

### Microbiological characteristics

LA culture results were available for 34 (64.2%) of the 53 study patients. Of these 34 patients, six (17.6%) had positive bacterial cultures, with the most commonly identified species being *Staphylococcus*. Other microorganisms included *Corynebacterium* and *Candida*. Blood culture results were available for 37 (69.8%) patients, with two (5.4%) of these 37 patients having positive bacterial cultures. The microorganisms identified were *Staphylococcus aureus* and hemolytic *Staphylococcus*. LA and blood cultures were found in the active state in one patient, whereas there were no consistent trends for the detected strains.

## Treatment and outcomes

Patients were started on empirical antibiotic treatment at the onset of infection, with antibiotics subsequently changed based on the results of susceptibility tests. Seven (13.2%) patients received medical treatment alone without interventional treatment or surgery (Table 4), with four (57.1%) successfully treated with antibiotics alone. Of the three patients who did not respond to antibiotic treatment, two were discharged from the hospital for financial reasons and the third died of lymphadenoma during hospitalization.

Of the 53 patients, 44 (83.0%) underwent ultrasound or computed tomography (CT)-guided percutaneous drainage, with eight (18.2%) of these 44 patients undergoing drainage 2–3 times. Three patients (6.8%) experienced major complications following interventional drainage. One developed biliary fistulae, which were resolved with medical treatment, whereas two presented with LA rupture, which were resolved using interventional hemostatic therapy. Of the two patients with ruptured abscesses, one died of respiratory failure during hospitalization and the other was discharged owing to worsening of the condition.

Two (3.8%) of these 53 patients underwent successful surgical treatment. One patient required surgery because of LA rupture. The other patient, who was coinfecting with HBV, underwent surgery to determine whether the condition was malignant. Five (9.4%) patients developed septic shock. The mean length of hospitalization was  $27.9 \pm 17.8$  days (range, 3–82 days).

The improvement and non-improvement groups were compared to analyze the risk factors associated with final treatment outcome. Multivariable analysis showed that ascites [odds ratio (OR)=8.970; 95% confidence interval (CI)=0.840–92.110;  $p=0.016$ ] and septic shock (OR=7.057; 95% CI=0.683–72.957;  $p=0.014$ ) differed significantly in these two groups.

## Discussion

In the 1990s, the etiology of LA mainly included biliary tract infection, portal vein seeding, direct extension, hepatic arterial seeding, penetrating trauma, and cryptogenic causes [12]. More recently, however, LA has been associated with malignancy or its treatments, including radiofrequency ablation and tumor embolization, and immunosuppression [13–15]. Blood transfusion through the hepatic artery [16] and skin abscesses [17] have also been associated with the development of LA in HIV-infected patients. Approximately 50% of the HIV-infected patients in the present study were found to have gallbladder diseases. These patients often exhibit a combination of infections, such as pneumonia, oral *Candida* infection, and spontaneous

bacterial peritonitis. Therefore, it is important to identify the etiology of LA in HIV-infected patients.

A study of 23 HIV-infected patients with LA in Thailand reported that *Klebsiella*, *Escherichia coli*, and *Pseudomonas aeruginosa* were the most common causative pathogens [18], whereas another study reported that both *Mycobacterium avium* complex and *M. tuberculosis* were responsible for the development of LA in HIV-infected patients [19]. The most common pathogen observed in the current study was *Staphylococcus*. Few LA and blood cultures were positive for pathogens, which was likely due, at least in part, to empirical antibiotic pretreatment. *Staphylococci* are a group of gram-positive bacteria common in the mucosa of the skin and gastrointestinal and respiratory tracts. Thus, LA in HIV-infected patients may be caused by skin or respiratory tract infections. The development of molecular biology techniques, such as second-generation sequencing, may reveal the etiology and pathogenesis of LA.

Typical symptoms of LA include the triad of fever, right upper quadrant pain, and hepatomegaly [4]. Other symptoms include nausea, vomiting, weight loss, and diarrhea. Jaundice is less common in these patients [20]. In the current study, most patients had fever; but <50% each had right upper quadrant pain and hepatomegaly. Some patients reported chronic febrile illness symptoms, such as long-term diarrhea, loss of appetite, and weight loss. LA in our HIV-infected patients did not always present with typical clinical symptoms. Moreover, many of these patients present with a combination of several opportunistic infections and malignant tumors, the symptoms of which might overlap with those of LA, resulting in a considerable diagnostic delay. Therefore, additional imaging examinations are required for diagnosis of LA in HIV-infected patients.

Ultrasound and CT are highly sensitive for the diagnosis of LA, with contrast-enhanced CT having a sensitivity of approximately 100% [13,20]. However, this condition must be distinguished from amoebic LA, cysts, tumors, and tumor-associated LA. Apart from imaging, LA can be diagnosed using LA smear, special staining, indirect hemagglutination assays for anti-amoebic antibodies, and tumor markers. Similar to previous studies, we found that the most common LA location was the right liver lobe (62.2%, 33/53) [14,21], with most of our patients presenting with a single LA (75.5%, 40/53).

At the beginning of the 20<sup>th</sup> century, the mortality rate from LA was as high as 75%–80% owing to the lack of effective treatment methods [12]. Although antibiotics are presently the primary treatment for LA, no recommendations have been proposed regarding antibiotic treatment of HIV-infected patients with LA. Rather, the principles for treating non-HIV-infected patients are generally applied. Empirical antibiotic treatment is designed to treat gram-negative bacilli, gram-positive cocci,

and anaerobic bacteria. Treatment with a third-generation cephalosporin plus metronidazole or piperacillin/tazobactam has shown curative effects in patients with LA [22, 23]. In addition to treatment with a third-generation cephalosporin and piperacillin/tazobactam, patients in the current study were administered metronidazole to treat anaerobic and/or amoebic infections. If antibiotic treatment is ineffective in HIV-infected patients, the possibility of opportunistic or atypical pathogenic infections should be considered. Percutaneous drainage should be considered another first-line treatment, as it reduces the mortality rate from LA to 10–30% [24]. Cultures of drained LA specimens could aid in determining the most appropriate antibiotic treatment. However, percutaneous drainage was reported unsuccessful in 15–36% of treatment patients, a failure likely due to the presence of multilumen LAs and drainage fluid adhesion [23,25,26]. Generally, percutaneous drainage is performed in patients with hemorrhage and biliary fistulae [27]. In this study, three (6.8%) of the 44 patients who developed LAs and experienced major complications related to interventional drainage showed effective improvement after treatment. Treatment selection is dependent on LA size and consistency [8], with few reports recommending surgical drainage in patients with an LA diameter >5 cm. In the current study, 39 (88.6%) of the 44 patients with large LAs (>5 cm) were treated with percutaneous drainage plus antibiotics, with a success rate of 38–39%, indicating that percutaneous drainage was effective in treating large LAs.

Factors such as male sex, cirrhosis, LA rupture, sepsis, multi-drug resistant infection, anemia, and air cavity formation have been associated with increased mortality in patients with LA. Septic shock or ascites associated with severe infections has

been associated with a high mortality rate. High-efficiency ART can induce immune reconstitution and impede the clinical progress of HIV/AIDS in HIV-infected patients, effectively altering prognosis, even in patients with severe complications. The poor prognosis of patients in the current study was not associated with highly active ART. Studies are needed to evaluate the effect of highly active ART in HIV-infected patients with LA.

This study had several limitations. First, it was a retrospective single-center study, indicating limitations in sample number and generalization. Moreover, owing to the limitations of the methods of detection, relevant data regarding the involved pathogens were likely insufficient.

## Conclusions

The clinical characteristics and laboratory findings of HIV-infected patients with LA are nonspecific, suggesting that the possibility of LA be considered in HIV-infected patients with fever, abdominal pain, and other non-specific manifestations. LA specimens should be tested for pathogens, including fungi and amoebae in addition to bacteria. Recommended treatment methods for these patients include antibiotic treatment combined with image-guided percutaneous suction and drainage, which may be more effective than simple antibiotic treatment, thereby improving prognosis.

## Conflict of interest

None.

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