

Traditional Chinese Medicine as Prevention and Treatment Strategies of HIV Infection

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Abstract

Traditional Chinese medicine (TCM) has produced impressive responses in treatment of acquired immunodeficiency syndrome (AIDS) patients. However, various terms, such as principle, standard, assumption, convention, and concept, for TCM treatment are not accepted by conventional AIDS experts. The increasing popularity of TCM has also inspired horror about their toxicity and uncertainty of complex components. In this paper, the evidence of Chinese herbal treatment of AIDS patients and prevention of the spread of HIV was provided; an overview of the TCM practitioners' concepts of how TCM work was discussed. We reported fourteen relevant studies, including ten Chinese herbal compounds, and four TCM extracts. In the TCM's study, these aspects, including critically assessing the authenticity, strict quality assurance measures, feasible evaluation system of the acute and chronic toxicity and clinical efficacy, are very important. We believe that potential drugs derived from TCM will be found, and TCM will play a crucial role in the prevention and treatment of AIDS.

Keywords: Traditional Chinese medicine, Chinese herbal compounds, TCM extracts, HIV.

Introduction

Traditional Chinese medicine (TCM) and Western medicine are two different forms of treating and eradicating diseases. The key concepts and therapies of TCM, that play a role in the evaluation and treatment of acquired immunodeficiency syndrome (AIDS) patients [1]. AIDS is one of the most prevalent chronic diseases in the world, and the morbidity and mortality associated with the disease is significant in the whole world. AIDS patients is identified in terms of either their CD4⁺ T cell counts below 200 cells/ μ L of blood or the occurrence of specific diseases in association with Human immunodeficiency virus infection (HIV) infections. Without specific treatment, about half of people infected with HIV develop AIDS within ten years [2].

The evidence has demonstrated that, during treating patients with AIDS, regimens included multidrug has resulted in substantial reductions in progression to AIDS, opportunistic infections, hospitalizations, and deaths [3]. The regimens contained two different classes drugs can usually intensify the therapeutic efficacious of each agent, and reduce the adverse effects. However,

the regimen's composing of three classes of drugs are no more effective than regimens comprised of two distinct classes [4]. Interestingly, TCM has recommended combinatory therapeutic strategies for more than 2500 years [5]. A large number of compounds, separated from TCM and other natural sources, are demonstrated to have profound and synergistic anti-HIV activity. In order to improve clinical efficacy, based on the symptoms and characteristics of patients, regimens contained a mixture of different kinds of plants or minerals were utilizing [6].

Treatments of TCM start with whole system analysis and then adjust the body imbalance of Yin and Yang and the pathologic changes through readjusting the functions of Zang-Fu organs. The objective in this paper is to review the beneficial and harmful effects of TCM on patients with HIV infection and AIDS. The outcomes of interest would cover therapeutic effect, virological responses, adverse events, and quality of life.

Rational Drug Design in the HIV

Not all viruses enter the nucleus to integrate their genomes into the host-cell chromosome. However, for retroviruses this stage in the replication cycle makes them different from other viruses. HIV-1 integrase has NLS (nuclear localization signals) which plays an important role in intranuclear transport of viral PIC (preintegration complex). NLSs bind to the cell transport machinery. Transportin-SR2 is the nuclear import protein for HIV-1 integrase. Interaction of HIV-1 with the transportin-SR2 and probably with other cellular factors makes nuclear import very flexible and deals with a bulky process at the same time. Probably particular cellular transporters such as transportin-SR2 also specify uniqueness of retroviral nuclear import. These transporters will interact exclusively with retroviral PICs [7].

HIV protease has an important role in viral replication and is considered very attractive target for new antiretroviral drugs. However, it becomes less effective due to highly resistant new viral strains of HIV, which have multiple mutations in their proteases. By used a lead expansion method to create a new set of compounds with a new mode of action to protease binding site. There are many compounds chemically diverse from the initial hit were generated and screened to determine their ability to interact with protease and establish their QSAR properties. Further computational analyses revealed one unique compound

with different protease binding ability from the initial hit and its role for possible new class of protease inhibitors[8].

To accomplish a gene transfer task successfully, retroviral vectors must effectively transduce diverse cell cultures at different phases of a cell cycle. However, very promising retroviral vectors based on the foamy viral (FV) backbone lack the capacity to efficiently transduce quiescent cells. FV are not able to infect non-dividing cells efficiently most likely because of lower integration efficiency compared to lentiviruses unless cells are undergoing mitosis [9]. Hence, the current study leads to the fact that FV vectors could be further improved to be effective in gene therapy to target non-dividing cells.

Central nervous system dysfunction is an important cause of morbidity and mortality in patients with HIV-1 infection and acquired immunodeficiency virus syndrome (AIDS). Patients with AIDS are usually affected by HIV-associated encephalitis (HIVE) with viral replication limited to cells of monocyte origin. In conclusion, the HSP90A and fibronectin 1 play important roles in HIVE pathogenesis [10].

The Efficacy of Traditional Chinese Medicine

People choose to take TCM as alternatives to orthodox medicines owing to their natural origins [11]. Thousands of years of TCM's clinical application have accumulated a number of cases that exhibit reliable *in vivo* efficacy and safety. However, owing to the shortage of clinical evidence collected under strict international standards, the international community even including some Chinese persons is doubtful about the efficacy of TCM. Standardization of clinical research data confines the conversion of clinical trial's data and the generalization of TCM. The Chinese government has a plan aiming at international regulatory

approval of TCM. Tasy Pharmaceuticals keep the advantage in the highest flight with the same industry; and the drug candidate, the compound T89 (also known as Dantonic®), may become the first TCM to receive Food and Drug Administration (FDA) approval in the United States. It is currently under a global phase III trials [12].

Artemisinin is a kind of TCM extract derived from *Artemisia annua*[13]. For thousands of years, Malaria was a life-threatening disease. In 1950s, because of the emergence of parasites resistant to existing antimalarial drugs, there was an urgent need for new antimalarial drug candidates [14]. Tu Y et al. found that artemisinin had activity against malaria. Its overpowering antimalarial activity was demonstrated in numerous clinical cases in the whole world. In the meantime, the World Health Organization officially proposed artemisinin and its derivatives, such as artesunate and artemether, to be chosen as a kind of clinical drug for the treatment of malaria, particularly as a part of combination therapies with other antimalarial drugs [14].

Chinese Herbal Compounds

Chinese herbal formulae consist of different herbs and therefore, are liable to produce a number of metabolites that may pursue multi-targets of a body. Crude extracts stemming from one kind of plants often is consisted of various ingredients. Chinese herbal compounds not only inhibit and prevent the growth of virus, but also regulate organism immunity and prevent from the complications due to HIV-1 infection. The four primary roles of TCM for treatment of AIDS patients are enhancing immunity, reducing the toxicity and side effects of HARRT, inhibiting viral infection, and improving the quality of life in patients. Table 1 gives a summary of effective Chinese herbal formulae from TCM.

Table 1: Inhibition of HIV function by Chinese herbal compounds

Name	Herbs	Curative effect	Reference
Yiaikang capsule	Ginseng, astragalus mongholicus, atractylodes macrocephala, tuckahoe, radix angelicae sinensis, rhizoma ligusticichuanxiong, root of herbaceous peony, radix scutellariae	Reducing morbidity and increasing CD4 ⁺ count and delaying disease progression	[15-17]
Mianyi No. 2	American ginseng, Cordyceps mycelium, Schisandrachinensis	The immune reconstitution efficiency, CD4 ⁺ T cell counts, CD45RA counts and CD45RO counts	[18-20]
Dangguishaoyaosan		Treatment of chronic pelvic infection; protecting the renal function	[21-23]
Aizhi 1		Improving distribution of abnormal fatty; refining hyperlipemia; and increasing CD4 ⁺ T cell counts.	[24]
Shenlingfuzheng Capsule	Codonopsis, Astragalus, Atractylodes, Jiaogulan, black ants, Ganoderma lucidum	Improve the quality of life; reduce the incidence of nausea (or vomiting) and fatigue; improved or stabilized immunization function	[25-26]
Extracts from Liangcha	Liangcha	Inhibiting different HIV-1 strains	[27]
ZL-1		Inhibiting the replication of HIV-1; against HIV-1 drug-resistant mutant.	[28]
Aikeqing capsule	Herba Epimedii, Rhizoma Polygoni Cuspidati, Fructus Ligustri Lucidi, Radix Scutellariae, Radix Glycyrrhizae, etc.	Increasing or stabilizing CD4 ⁺ T cell counts; relieving clinical symptoms; alleviating gastrointestinal adverse reactions	[29]
Ailing Granule		Controlling patients' viral load, prolonging life of HIV infection	[30]
Qishile	Chinese buckeye seed, turmeric, erigeron breviscapus, liquorice, astragalus root, ginseng	Inhibiting HIV-1 replication by multitargets, including reverse transcriptase, protease and virus entry	[31]

Strengthen the immune system

During HIV illness, patients may experience acute infection period, asymptomatic period, continuous period and the fourth, symptoms of swollen lymph nodes. Chinese herbal compounds may play an important role in an asymptomatic incubation period.

Yiaikang capsule consists of several kinds of herbs, such as ginseng, astragalusmongholicus, atractylodesmacrocephala, tuckahoe, radix angelicaesinensis, rhizome ligusticichuanxiong, root of herbaceous peony, and radix scutellariae. Two clinical observations of 133 and 284 cases respectively, of treating HIV and AIDS patients with Yiaikang capsule, showed that it was superior to model Chinese's drugs in reducing morbidity and increasing CD4⁺ T cell counts and delaying disease progression, but there was no statistical significance in reducing viral load[15-17].

Mianyi 2 is made of several kinds of herbs, including American ginseng, Cordyceps mycelium, Schisandrachinensis. Liu Z. et al. reported that using a combination of HAART and Mianyi 2 treated 264 patients, who failed to immune reconstitution after HAART, for six months. They discovered that the effective rate of the treatment group (34.48%) was significantly superior to the control group (21.37%). Compared with control group, treatment group could significantly increase the CD4⁺, CD45RA, CD45RO T cell counts, and CD8CD28 relative counts. Mianyi 2 could effectively improve the immune reconstitution efficiency [18-20].

Aikeqing Capsule, a compound preparation of TCM developed by Guangzhou University of Traditional Chinese Medicine, is composed of nine kinds of Chinese herbal medicines, including Herba Epimedii, Rhizoma Polygoni Cuspidati, Fructus Ligustri Lucidi, Radix Scutellariae, Radix Glycyrrhizae, etc. Clinical trials showed that Alco capsule could inhibit the AIDS virus *in vitro*, and increase or stabilize CD4⁺ T cell counts [29].

Song CX et al. investigated the effect of Ailing granule on the function of immunological cells in people living with HIV/AIDS. They conducted a clinical trial of 45 cases of AIDS patients with Ailing granule for four months. Patients could maintain stable CD4⁺ T cell counts, increased IFN- γ secretion ability of CD4⁺ T cell, and decreased IL-4 secretion ability of CD4⁺ T cell to some extent. Ailing granule exerted the effect on quantity of immunological cells, tranquilization immune function, controlling viral load, and prolonging life of HIV infection [30,32].

Reduction of side effects

Pan JL found by clinical trial of 10 cases that Dangguishaoyaosan could treat HAART-induced chronic pelvic infection [21]. Huang L, et al. reported that Dangguishaoyaosan alleviated HAART-induced liver dysfunction, by reducing elevated liver enzyme levels, and improving symptoms such as abdominal distension, diarrhea, poor appetite and hypochondriac pain [22]. Zhang PJ et al. also found that it degraded the vascular endothelial growth factor (VEGF) and the urinary albumin excretion rate (UAER) levels of early diabetic nephropathy patients. That was one of the possible mechanisms of Dangguishaoyaosan to protect the renal function [23].

A clinical trial of five cases using Aizhi 1 prescription to remedy AIDS patients for two years was carried out. Li XH et al. found that distribution of abnormal fatty was improved after 60-150 days, and the area of improvement included infaces, limbs, chests and abdomens, in proper sequence. In addition, it refined hyperlipemia and increased CD4⁺ T cell counts [24].

Shenlingfuzheng Capsule consists of Codonopsis, Astragalus, Atractylodes, Jiaogulan, black ants, Ganodermalucidum. Li X, et al. studied the therapeutic effect of Shenlingfuzheng Capsule by about 60 AIDS patients. After 6 months, there were significant differences between the treatment group and control groups in nausea (or vomiting) and fatigue. Shenlingfuzheng Capsule combined with HAART reduced the incidence of nausea (or vomiting) and fatigue [25]. Liu ZW, et al. found that it could improve or stabilize immunization function of a portion of patients [33].

Antiviral activitys

Liu WQ, et al. evaluated the anti-HIV activities of extracts from Liangcha by cytotoxicity assay, syncytium reduction assay, protection for HIV-1 lytic induction assays, and ELISA assay for HIV-1 p24 antigen expression. They found that extracts could potently and broadly exhibit different HIV-1 strains (EC₅₀ range 12.74~116.87 $\mu\text{g}\cdot\text{mL}^{-1}$, according to different HIV-1 strains). Meantime, its toxicity was low (CC₅₀ range 564.79~1699.22 $\mu\text{g}\cdot\text{mL}^{-1}$); and it could inhibit the recombinant HIV-1 reverse transcriptase (IC₅₀ = 5.3 $\mu\text{g}\cdot\text{mL}^{-1}$) [27]. ZL-1 is an anti-HIV formulation from Chinese's herbs. The pharmacodynamics of the formulation *in vitro* shown that it could efficiently inhibit the replication of HIV-1 (IC₅₀ = 70.7 $\mu\text{g}\cdot\text{mL}^{-1}$). It also shown potent activity against HIV-1 drug-resistant mutant [28].

Qishile is the effective parts of a Chinese herbal formula which is composed of Chinese buckeye seed, turmeric, erigeron breviscapus, liquorice, astragalus root, ginseng. The IC₅₀ values of Qishile for inhibiting cytopathic effects of HIV-1_{IIIB} was 3.55 $\mu\text{g}/\text{mL}$ and the therapeutic index (TI) of this formulae was 44.65. Moreover, its activity, which protected MT-4 cells from lysis induced by HIV-1_{IIIB} was potent (IC₅₀ = 18.77 $\mu\text{g}\cdot\text{mL}^{-1}$); and the TI value was 5.49. Researchers found that it played its inhibitory activity on HIV-1 entry by blocking cell-to-cell fusion. It also showed an obvious inhibitory effect on clinical strain HIV-1_{KM018} and drug resistant strain HIV-1_{74V}. Qishile could inhibit HIV-1 replication through multitargets, such as reverse transcriptase, protease and virus entry [31].

Improvement in quality of life

Xu LR et al. carried out a clinical research based on 1200 cases of treating HIV and AIDS patients with Yiaikang capsules, Aining granules and Tangcao tablets. Their objective is whether using TCM improves the quality of life of symptomless HIV infected persons or not. Applying patient report outcome (PRO) scale and the world health organization AIDS determination of quality of life short scale forms (WHOQOL-HIV-BREF) investigated asymptomatic HIV infected persons. They found that according to the PRO scale, the treatment with TCM showed a trend of stability after six months; according to the WHOQOL-HIV scale, the quality of life was increased. Dialectical therapy of Chinese's medicine can significantly improve quality of life in patients [34].

Li X, et al. explored the clinical effects of Shenlingfuzheng Capsule on asymptomatic HIV infected patients. After treatment, Karnovsky score was from 86.62 to 96.61. They found that using Shenlingfuzheng Capsule improved the quality of life in patients [26]. Li JR et al. applied Ping'ai Granules 1 to treat 107 cases of AIDS patients. After 6 months, TCM symptoms of 54.69% patients were improved [35].

Traditional Chinese Medicine Extracts

TCM extracts are extracted from animals, plants and other herbs, without changing its structure and formation. In the process of extraction, theory, strengthening body resistance to eliminate pathogenic factors, is used as the guide of an original prescription of TCM; and methods of general physical and chemical extraction separations are used. So far, scholars found that different kinds of TCM can alleviate the symptoms of AIDS through unusual pathways [36]. This part has been confirmed in extracts derived from TCM; during the past years, the activities TCM extracts have been frequently observed (Table 2).

Baicalin

Baicalin (BA) is a kind of flavonoids compound, coming from the root of *scutellariabaicalensis*. The chemical structure of BA is shown in Figure1(A). Wang et al. found that BA was a kind of anti-HIV-1 active compound [37]. The complexity of baicalin and Zinc (BA-Zn) have lower cytotoxicity and higher anti-HIV-1 activity compared with those of BA *in vitro*. The cytotoxicity of BA-Zn ($CC_{50} = 221.52\mu\text{M}$) was about 1.2-fold lower than that of BA ($CC_{50} = 101.73\mu\text{M}$). BA inhibited HIV-1 induced syncytium formation ($EC_{50} = 43.27\mu\text{M}$), HIV-1 p24 antigen ($EC_{50} = 41.97\mu\text{M}$) and HIV-1 RT production ($EC_{50} = 47.34\mu\text{M}$). The BA-Zn inhibited HIV-1 induced syncytium formation ($EC_{50} = 29.08\mu\text{M}$), HIV-1 p24 antigen ($EC_{50} = 70.35\mu\text{M}$) and HIV-1 RT production ($EC_{50} = 31.17\mu\text{M}$) [47].

The common andrographis herb

Andrographis paniculata plant extract possesses a variety of pharmacological activities. Andrographolide is the major constituent of the extracts; its chemical structure is shown in

Table 2: The anti-HIV effect of Chinese medicine extracts

Chinese medicine extract	Origin	Effects	References
Baicalin	<i>Scutellariabaicalensis</i>	Anti-HIV-1	[37]
Andrographolide	Common andrographis herb	Reduce human peripheral expression of blood CD4 ⁺ T cell lymphocyte counts in CXCR4 and CCR5	[38-40]
Coumarins	Roots of <i>Citrus hystrix</i>	5-hydroxynoracronycine showed anti-HIV-1 protease activity with an IC50. Value of 93.1 IM.	[41-43]
Trichosanin	Root tuber of the <i>Trichosanthes kirilowii</i>	RT activity, P24 antigen and reverse transcriptase	[44-46]

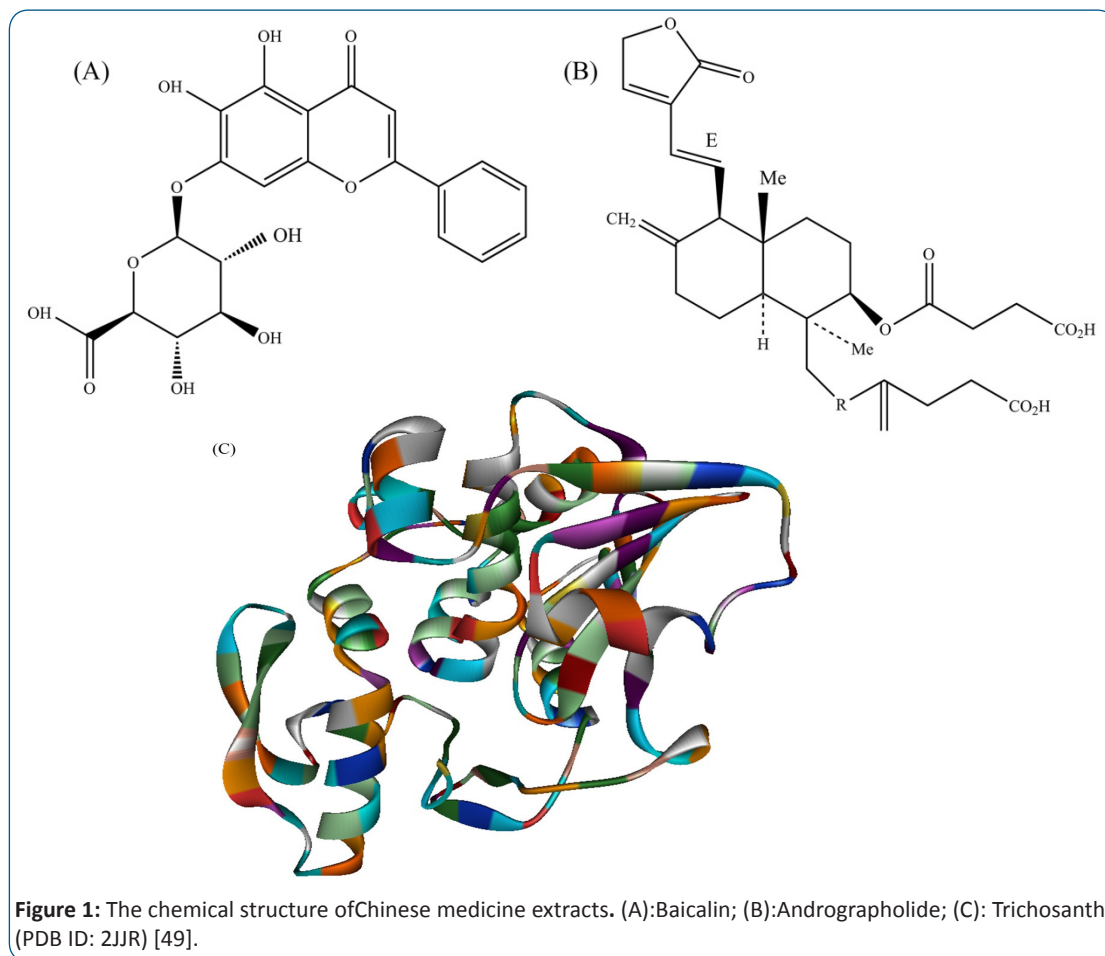


Figure 1(B). The common andrographis herb is often used as the main ingredients of TCM, such as the cheese anti-inflammatory capsule. Researchers found that protein and mRNA of coreceptor (CXCR4 and CCR5) were expressed at low levels on human CD4⁺ T cells after taking AndrographitisHerba. AndrographitisHerba might have the effect of down-regulating CXCR4 and CCR5 [48].

A phase I clinical trial of andrographolide was conducted; and the experiment object included 13 HIV-positive patients and five healthy volunteers. A study protocol was as following: a dose was five mg/kg body weight in the first three weeks. Then increased to 10 mg/kg body weight in the next three weeks, and then increased to 20 mg/kg body weight in the final three weeks. Unfortunately, owing to adverse events, at six weeks, the trial was stopped. After taking 10 mg/kg andrographolide, the CD4⁺ T cell lymphocyte counts in HIV-positive patients were significantly improved from a baseline mean of 405 cells/mm³ to 501 cells/mm³. There were no statistically significant changes in mean plasma HIV-1 RNA levels [38,40].

Uttekar MM, et al. synthesized a series of andrographolide derivatives and evaluated their anti-HIV activity in a cell-free virus infectivity assay using TZM-bl cells. They found that compared to andrographolide, 3-nitrobenzylidene derivative showed higher *in vitro* anti-HIV activity, whereas 2',6'-dichloro-nicotinoyl ester derivative showed higher TI value. These derivatives had an effect of inhibiting HIV-1 infection by blocking gp120-CD4/CXCR4/CCR5 interaction. Furthermore, molecular docking studies disclosed that these compounds may be binding to the V3 loop of HIV-1 envelope protein, gp120 [39].

Coumarins

Vogel A found Coumarin at first in 1820. Coumarin exists naturally in many plants, such as tonka bean (*Dipteryx odorata*), vanilla grass (*Anthoxanthum odoratum*), sweet woodruff (*Galium odoratum*), mullein (*Verbascum spp.*), sweet grass (*Hierochloa odorata*), etc. Coumarin and its derivatives have a wide diversity in structure; and its relative molecular mass is small. Coumarins inhibited the replication of HIV; its major targets included the HIV reverse transcriptase, protease and integrase [42]. The anti-HIV-1 protease and integrase activities of many coumarin derivatives from roots of *Citrus hystrix* were evaluated. Only 5-hydroxynoracronycine showed anti-HIV-1 protease activity ($IC_{50} = 93.1 \mu M$). They concluded that, there possibly was a synergistic effect of the crude extracts, so these compounds showed weaker activity than the crude extracts [41].

Lin PH et al found that one of the coumarin derivatives, BPRHIV001, inhibited Tat transactivity ($EC_{50} = 1.3 nM$). BPRHIV001 might exert its effects through repressing the PI3K/Akt pathway. BPRHIV001 not only overcame AZT- and EFV-resistant virus replication, but also exhibited a synergistic interaction with AZT and EFV [43].

Trichosanin

Trichosanin (TCS) (Figure 1(C)) is an active component extracted from the root tuber of *Trichosanthes kirilowii*. It is a type I ribosome-inactivating protein with potent inhibitory activity against HIV-1. When adding TCS to the cells, which infected by HIV-1, Zhao QY et al. observed that RT activity, P24 antigen and reverse transcriptase assay were negative [44,50].

TCS was found to obviously inhibit syncytia formation induced by HIV-1 (syncytium-inducing (SI) = 193.3). TCS did not reduce chronically HIV-1 infected culture [50].

Zhao WL, et al. investigated the relationship between TCS and HIV-1 particles, and demonstrated that TCS penetrated into viral particles, where it was protected from various protease digestions. Penetration of TCS had no obvious effect on viral integrity. Moreover, TCS penetrated into HIV-1 virions, showing potent anti-viral activity. They thought that the penetration of TCS into HIV-1 particles might be important to eliminate the virus [51].

Phase II clinical trials evaluated its safety and potential efficacy. In the Phase two clinical trials, patients, including those persons with AIDS-related and AIDS, and failing treatment with antiretroviral agents, were evaluated according to a protocol. In the protocol, trichosanin was added to the antiretroviral agent regimen. Ninety-three patients were treated with trichosanin, using a schedule of weekly, then monthly, intravenous injections of 1.2 mg of the drug in combination with antiretroviral agents, usually zidovudine. 85 patients were evaluated for efficacy, and there was a significant increase in CD4⁺ T cell levels after initiation of trichosanin therapy. During therapy, there was a median increase of 1.2 cells/mm³/month. In patients in the top 25th percentile, this increase was greater than 8.4 cells/mm³/month. During the period before trichosanin treatment (311±11.7 days) the median loss of CD4⁺ T cell was 6.91 cell/mm³/month. Addition of trichosanin to the treatment regimen resulted to a median gain of 1.1 CD4⁺ T cell/mm³/month [45-46,52].

Future Strategies of the TCMs Approach

Now it has something to do with R&D about disadvantageous position of Chinese herbal medicine in the international market. There are some problems affecting and baring the R&D of Chinese herbal medicine together. Additionally, it is a common, result of some interacting factors about the exaltation in R&D of the Chinese herbal medicine, it is very important for us to distribute more funds on the R&D and to emphasize curative effect firstly etc. We should establish the creative mode of Chinese herbal medicine with the government's help. In addition, the pharmaceutical enterprise is the body of the creative mode. Establish and perfect the Chinese herbal medicine creative system finally.

First, it is essential to strengthen the quality management of TCM, as well as unify standard and inspection methods. Secondly, to develop new TCM to adapt international market demand is also significant. Finally yet importantly, it is high time to improve the production and management of TCM. Without obtaining the standard of GMP, it will be hardly appreciated by the market, the absence of relevant certification, minimize its influence in the market. Therefore, it is indispensable to carry out the GMP.

Integration of Traditional and Western Medicine

Traditional and western medicine have made remarkable advances in the treatment of AIDS; however, there are a lot of problems against HIV-1. In the treatment of AIDS, theory of TCM strengthens the body resistance to eliminate pathogenic factors. TCM, usually being consisted of one or more kinds of

herbs, alleviates the symptoms of AIDS. Nevertheless, the main theory of western medicines is that antiviral drugs inhibit the replication of the HIV genome. The HARRT therapy is commonly used in the world; its antiviral function is very powerful. In order to reduce related symptoms, the more and more people use integration of traditional and western medicine to fight HIV-1[53].

TCMs approach comparison with western medicine

The immune systems of patients with AIDS was challenged by HIV viral, result in immune function gradually decline and other organs infection. Therefore, it is important to improve the immune function of AIDS patients. TCM had fewer drug resistance, toxicity responses and side effects. In addition, TCM can inhibit viral replication in different periods that enhance human immunity, and improve the life quality of patients. The treatment effect is similar or even better than HARRT. Hence, the combination of TCM and western medicine treatment of AIDS has good development. In the use of antiviral therapy of western medicine, combination of TCM can obtain a complementary effect. Used TCM and western medicine to resist HIV damage to the body together can improve the patient's quality of life.

Three kinds of common approaches in China

In China, there are three main strategies to cure AIDS patients, TCM and HAART combined therapy, HAART and TCM. A large number of studies show that HAART can significantly inhibit HIV viral load in plasma of patients, its antiviral effect is the most advantage of HARRT, but there is the certain side effect. TCM has an obvious effect on improvement of symptoms and enhancement of immune function, but its efficiency of antiviral aspects is very weak. However, TCM and HAART combined therapy, can be complementary to alleviate the toxic and side effects; and its curative effect is better than the other two ways[54].

Combined treatments of TCM and western medicine

Cai Y, et al. reported that 36 patients who have already received HAART combination treatment for at least 2 years, showed blood changes after a 12-month treatment and a 24-month treatment using HARRT combined TCM (including Fuzheng, Kang'ai and other). Except for significant addition in hemoglobin, the rest of the safety index showed no significant change before and after the 12-month treatment and the 24-month treatment [55].

Investigators found that treatments of varicella zoster virus in HIV/AIDS patients using HAART combined with TCM (such as, Baiye powder, Ruyijinghuang powder, Zhuma ash, fresh *Opuntia dillenii* with borneol, Wugong Qingdai powder, etc.) for external application had good curative effects[56].

After combination of Chinese (such as Aikang) and Western medicine (HAART) treatment to AIDS patients, researchers found CD4⁺ T cell lymphocyte counts were higher than those with only HAART treatment, CD8⁺ T cell lymphocyte counts were lower than those only HARRT therapy [57-58]. A clinical observation of 47 cases showed that combination of Yiankang capsule and HAART improved the quality of life in patients, enhanced patient CD4⁺ T cell counts, and slowed down the

progress of the disease [59].

Summary and Perspectives

More and more AIDS patients around the world get benefits from TCM. In 2005, a survey in Hong Kong showed that 59.2% of HIV/AIDS patients use TCM, most patients using TCM for treatment of a minor illness (60.0%) and general healthcare (57.8%), while they chose western medicine for therapy of important disease [60]. Although numerous studies have shown the efficacy of TCM for prevention of HIV infection and treatment of AIDS patients, few of these studies were strictly designed, and the evidence was inadequate. Also, some people doubted that whether there were any inhibitors for treatment of AIDS patients from Chinese's herbs. To resolve these problems, we must decipher the two main difficult problems, which are the bottleneck that limits the globalization and application of TCM. The first is valid methods to evaluate the quality of TCM, and the other is the standardization of clinical research data. Chinese medicines are made of several herbs, which may comprise tens, hundreds, or even thousands of ingredients. That is important how these constituents interact with each other, and what the special active ones are. It is urgent and significant to find the reliability approach to evaluate the quality of TCM. Strategies for selecting single or several ingredients as the evaluating indicator and using different kinds of chromatography fingerprint methods, are used to control the quality of TCM. The quality control of TCM will develop in a more effective and comprehensive manner that addresses the inherent holistic nature of TCM[61].

Standardization of clinical research data confines the conversion of clinical trial's data and the use of information technology in construction, which has become an important challenge related to clinical research. Similarly, it also plays an essential role in the effective communication and the scientific and reasonable analysis in Chinese's medicine clinical research data. Using data standards in clinical research of TCM is another important part in improving the standardization of TCM development. It has a far-reaching significance in many respects, such as the internationalization of TCM, the interchange between home and abroad pharmaceutical enterprises, the communication between the disciplines and industry, the promotion of scientific results of TCM and the development of production technology, etc.[62].

Holism, which refers to the integrity of the human body itself and the unity of the human body and nature as well, is a key concept of TCM [63]. The attitude of TCM emphasizes regulating the integrity of a human body as well as the interaction between human individuals and their environment [64]. The theory of systematic biology helps human being to conceive the limitations of reductionism. Using systematic biology as a new approach, the study of TCM has already made significant strides. With the development of systematic biology, new ideas, methods and techniques have yet to emerge, and they are emerging in an endless stream as a result of exploring the complicated living systems. Utilizing these can reveal the mystery of TCM and increase its application in treatment of AIDS patients.

More attention should be given to discover novel inhibitors derived from TCM. In the struggle against HIV-1, the problems,

we face are fundamentally conceptual, rather than knowledge. The components of TCM may have been adverse effects on a body; and the main reason for causing adverse effects is pollution and unreasonable use rather than natural risks with herbs themselves. Making sure quality control system and instructing reasonable application of TCM, most adverse reactions can thus be avoided [65]. In an incredulous general condition, when we decide effective therapies, we must attach great importance to benefit-harm ratios, not rather than adverse effects. Application of TCM in treatment AIDS patients have revealed many advantages, mainly lying in individually treating, lower prices, and weaker toxic and side effects. Due to expensive and unpleasant side effects of western medicine, there is an urgent need to develop novel anti-AIDS drugs derived from TCM. We have adequate grounds to believe that patients to choose TCM for the therapy are quite clever. We hope that TCM will play a crucial role in the future treatment of AIDS patients[66].

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