

Herbal medicine in new era

Abstract

Herbal medicine is the precursor of modern medicine and drug development. It is still the useful knowledge and routines to foster new therapeutics in the clinic and useful drugs against new diseases. This article brings a glimpse of this special medical discipline. Comparisons between herbal medicine and modern pharmaceutical/medicines are provided.

Keywords: herbal medicine, drug development, cancer treatment, clinical therapy

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Introduction

Medical significance

Natural components and drugs play huge role in large population of infectious patients. To strengthen this argument, several well-known modern drugs are exemplified herein. For example, the most effective antibiotics (penicillin, streptomycin or cephalosporin) are all-natural resource chemical products and drugs worldwide. They are more useful than a series of synthetic antibiotics (sulphonamide) developed before penicillin. Many natural products and drugs are widely utilized as anti-diabetic agents and different types of anti-cancer drugs worldwide. In addition, digitoxin (a natural chemical drug) is used against fatal heart symptoms. These kinds of drugs play key roles in the treatment of many diseases and face new challenge for the generations to come.^{1,2}

Significance of herbal medicine

Medicinal chemistry and pharmacological efforts to develop drugs is a complicated process due to drug screening convention limitation. As a result, herbal medicine tradition must be introduced.

Methods

General scenario of herbal medicine

Herbal medicine has a long history of evolution in styles and practice worldwide. In its early stage, herbal or animal medicines were widely utilized over many different countries, including Greece, as allopathic medicine, Ayurvedic medicine in India and traditional Chinese medicine.³⁻⁷ Yet, most of such countries lost this tradition. China still maintains herbal medicine in modern day because it reserves many ancient medical books by leading publication systems in the ancient world.

China has a long reputation of treating a wide variety of diseases by herbal medicine. This type of medical practice dates back at least 2000 years. Several earliest medical books were published between 100BC to 1900AD. It has been successfully managed for large epidemics since the era of Zhong-Jin Zhang (AD150-219) in China. According to theory of traditional Chinese medicine (TCM), human diseases can be categorized with patient's imbalance between "Yin-Yang". TCM doctors try to combat these patterns of symptoms (like fever, cough and immune deficiency) by strengthening, modulating

and offsetting these damaged "Yin-Yang" in human bodies by formulated herbals.⁸⁻¹¹ The formulated herbal medicines contain large components of chemical admixtures and somewhat like modern drug combinations in western styles of therapeutic philosophy.

TCM for various diseases

TCM has its advantageous and disadvantageous to manage diseases. The advantages for TCM can be both acute disease (like microbial or viral infection) and chronic diseases (like cancer, diabetes, obesity, bone diseases and metabolic symptoms).¹²⁻²⁴

Apart from different disease types, some disease symptoms are also within the range of TCM. For example, Ma-Xing-Shi-Gan-Tang is prescribed to remove toxic heat obstruction in the lungs of infected patients. These items of herbal formulas are historically used as the preventive measures to attack widespread epidemics like avian flu or Ebola epidemics in modern days.²⁵⁻³¹

In viral epidemics, a series of disease risk-factor is somewhat like "Helium-liqi" in ancient Chinese nomination in medical literatures. "Helium" is a high contagious disease that belong to outside invaders. The character of Helium is a process somewhat like bacteria or viral infection in symptoms of high infectivity, sudden climate related. Hygiene and isolation are workable options for disease managements in the same time.

Diabetes (Xiaoke Diabetes, a Chinese definition of diabetes) characterized with symptoms of thirsty, hungry and urination has been noticed over two thousand years in China.³²⁻³⁴ In the second half of last century, type 2 diabetes mellitus (T2DM) was gradually recognized as a major public healthcare problem worldwide.³²⁻³⁴ The incidence of T2DM in China and other developing and developed countries has been growing due to incomplete knowledge about causality, pathogenesis, antidiabetic therapeutics.³⁵⁻⁴¹ Despite some therapeutic advances, T2DM treatments are not widely successful in clinical trials. Currently, a lot of herbs and natural products, even natural chemical drugs are first-line anti-diabetic drugs for patients with T2DM.

Results

Herbal medicine practice

TCM treats patients according to their abnormal symptoms and disease categorizations (majorly outside invaders and body-organ

dysfunction) (Figure 1) many pathogenic symptoms of serious diseases such as pulmonary obstruction, high fever and unconscious can be relieved by different formulae of herbal medicines.

Modern medical practice calls for new drug developments and clinical applications. Although few herbal medicines have been published for specific viruses such as Ebola, avian flu, Zika therapeutics in ancient Chinese books, a great number of new chemical ingredients from microbial or plants in western countries have been available for modern diseases. Previously, ingredients from microbial or plants in western society were very expensive. Now, these ingredients are much cheaper due to technical advancements, especially extraction methods. Next generations of cutting-edge technology will enable us quick development of natural chemical drugs. Figure 1 depicts general routine of TCM in the clinic that may help western doctors understand Chinese medicine with a closer look.

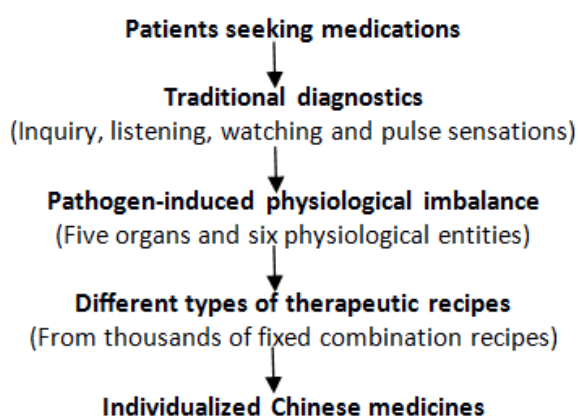


Figure 1 Diagrams of traditional Chinese medicines therapeutic routes.

In TCM, formulae of herbal medicine is presented in different forms and dosage-different formulae (Fangji, prescription). Different herbal formulae can be used to treat one disease or symptom. However, one herbal formula can be used for different diseases or symptoms in a similar clinical situation. It may be regarded as tricky in western philosophy. But it is a usual strategy in TCM practice. Next generation of cutting-edge technology (genomic/epigenetic and molecular basis) will enable us quick development of modern pharmaceuticals. All these medical explorations and drug development must go through robust experimental and clinical verification.

Current drug developments

Currently, many different types of modern drug developments need huge funds to support. Drug producer is a pillar industry for a small number of world-leading countries worldwide.⁴²⁻⁴⁷ Nevertheless, drug discovery, development and manufacture have been a bottleneck stage over the past two decades. The constantly declining of drug successful rates in clinical evaluation have multiple causes, such as higher therapeutic demanding for new drugs as well as rising cost for cutting-edge equipment utility. Therefore, a great amount of money needs to be paid for drug screening, experimental mechanistic studies and systematic clinical evaluations. Despite greater expenses in drug developing countries, cancer therapies only improve slightly,

especially for cancer metastasis treatments. Thus, it is necessary to learn from TCM in drug developments.

Herbal medicine in world markets

Overall, herbal medicine must be translated into modern drug developments and clinical evaluations. In the past, a great amount of work for natural chemical drugs has been undergone. However, most of these efforts and processes are based on western medical philosophy. Almost half chemical drugs in western markets are coming from natural microbial, plant and animals. Despite a lot of successes, many obstacles still need to overcome. Yet, currently no specific drug developmental system has been widely used and wholly dependent upon. Updating drug development routine is an inevitable avenue.

Drug development transformation

Facing the situations of high risks, cost surge and low productivity in modern drug developments, creative studies for science and technology can provide such opportunity and unprecedented insights into powerful therapeutics against many new diseases, high mortality and new pathogens in TCM.

The advantages of natural chemical drugs comparing with synthetic chemotherapeutic agents are low toxicities and drug cocktail (mixture ingredients). The drug combinational rules widely used in China may play pivotal roles for a variety of new lethal virus infections and late-staged cancer management, which needs good paradigm propagation worldwide.⁴⁸⁻⁵⁸ To ensure a smooth progress of natural chemical drug developments, new ideas and perspective must be explored. Some medical articles and books can also attract the attention and get quick feedback in the clinic.

Discussion

Paradigm introductions for viral-infection, diabetes and cancer

Since virus-induced human mortality acts differently (Ebola or avian flu with quick human mortality and HIV or Zika with slow pathogenesis processes), drug evaluative routines, disease pathologic discovery and drug mechanisms must be carried out by alternative ways. For Ebola or avian flu treatment, quick disease management or viral proliferative inhibition is the key. Yet for HIV or Zika infections, managing damaged human organs or physiological entities (immune rebuilding or cerebral damage protection) is more important to understand.⁵⁹⁻⁷²

Similarly, tumours are categorized with different subtypes and pathologic stages. This pathologic variation is very suitable for individualized therapeutics such as TCM, drug sensitivity testing and pharmacogenetic approaches (Table 1).⁷³⁻⁸¹

The key quality of different chemotherapeutic agents is the balance between therapeutic responses and toxicities and risks, displaying as a therapeutic index gain. Many currently incurable diseases, such as HIV-infections in humans may come from shortage of effective natural chemotherapeutic drugs and fundamental knowledge of patho-therapeutic relationship. The only limitation of natural chemotherapeutic agents was the cost of drug purification and natural product cultivation and collection. However, with the modern

purification and cultivation technology, natural chemical agents will be much cheaper in the future. Owing to this advancement, a growing number of natural chemical drugs may get into the markets. There will be plenty of herbal products in future pharmaceutical markets.

Table 1 Patho-therapeutic relations in TCM

Disease causality	Main symptoms	Therapeutics
Wind evil	Sudden & movable	Prevent wind/expel wind
	Different types of colds	Fang-fen
	Movable headache	Jin-jie
	Urticaria/nettle-rash	Leaf of bamboo
Cold evil	Pain & stasis	Warm & circulation promotion
	Whole-body pains and ache	Si-ni-tang
	Immovable	Huang-qi
	Solid cancers	Fu-zi
Wet evil / damp evil	Circulation stasis	
	Phlegm & Damp	Clearance & anti-inflammation
	Gastro-intestinal symptoms	Yi-yi-ren
	Xiaoke (diabetes)	Di-huang
Heat evil	Phlegm-damp syndrome (cough)	
	Heat-related symptoms	Expel heat & stay cold
	Fever	Yin-qiao
	Sweat	Jing-yin-hua
	Coma	Water melon
Li-qi	Unconsciousness	Shi-gao
	Fever, infection & Deaths	Isolation and treatments
	Fever	Qing-Hao
	Diarrhoea	Ma-hua-san
	Bleeding	

Education and publications

Though a great number of first line and second-line pure therapeutic chemical drugs such as camptothecine, harringtonine were discovered from herbal resources by western scientists, some of them were long reported in TCM literature. Medicinal chemists

and pharmacologists worldwide are paying growing attention to from surveying TCM past and new literature. Although this literature is valuable for modern medicine, these TCM books are unpopular in normal medical universities worldwide, even in China. Limited courses of herbal medicine decrease the quality of clinical practice and drug developments until now.

Comparisons in cancer treatments

Cancer treatment by TCM is one hot spot in modern China. Many TCM hospitals in China have a special department of cancer therapeutics. TCM for cancer treatments has been positively reported in China. According to the principles of TCM, human bodies are balanced by fighting between inner upright strength and outside damaging air. Current principles of TCM therapies seeks therapy by strengthening upright air rather than expelling outside evils. Additionally, expelling exogenous wind-heat recipes are also used for cancer therapies by TCM.

There are two pathways of therapeutics-malignant targets and symptom relieving in TCM. Solid cancer is regarded as syndrome of blood stasis and phlegm-damp syndrome. To achieve phlegm-damp syndrome control, cancer patient symptoms and syndromes may be clinically treated. It is also manifested as survival benefits in cancer patients. Besides symptom ameliorating, TCM can sometimes play decisive roles in cancer treatments.

Apart from first-line anticancer drug, herbal or natural compounds can be used as assistant therapeutic agents to treat cancer growth, invasive and remote metastasis. These compounds are less cytotoxic in western medical encyclopaedia, such as curcumin or anthocyanins. In western countries, cancer assistant therapies include nutritional support, pain relieving, cardiovascular detoxication, antioxidants and many others. Though promising, cancer assistant therapies are not mainstreaming clinical cancer treatments in most western countries. At this stage of medical knowledge, the core of cancer assistant therapeutics is to combine cytotoxic anticancer drugs and assistant therapeutic agents (mostly natural chemical or biological compounds). Generally, drug combination for cancer is as good as therapeutic combination paradigm for HIV (Table 2).

Table 2 A comparison between western therapy and TCM practice

Categories	Western therapy	Chinese therapy
Diagnostics	Instruments	Inquiry, listening, watching and pulsing
Drug numbers	1-3 drugs commonly	3-8 herbs
Suitability	Acute disease	Chronic disease
Toxicity	Various	Only some toxic drugs
ADME (such as P450)	Commonly available	Difficult to undergo until now
Costs	High (especially new drugs)	Generally low and easy accessed

Future direction

Ideology promotion

The quality of natural drug developments can be improved by a deeper understanding of herbal medicine practice and theories.

Research on herbal medicine will translate eastern therapeutic measures into western medical paradigms. Currently, most people in China believe that natural herbs have no toxicity. This view has no scientific basis. But many natural chemotherapeutic agents generally show less toxicities comparing with synthetic chemical agents at the same therapeutic ranges. It appears that nature is the greatest medicinal chemist in this very planet.

Therapeutic study for new diseases

Zika virus epidemic in America is an emerging medical crisis that is receiving growing body of global attention. Good Zika knowledge must be established as early as possible. Innovation of Zika therapy by TCM or natural chemotherapeutic agents may be useful in the future. We suggest that TCM study may create workable solution on Zika pathogenesis and therapeutics in the future.

Genomic study

Apart from general pathway for pathogenesis and therapeutics, new generations of techniques may be borrowed for TCM and natural chemical drug developments, such as cancer genomic study and HIV-integration into human genomes. But these issues face ethical debates and regulatory challenges.

Treatment of metastasis by TCM

Neoplasm metastasis is a multi-step and multi-level phenotype that is responsible for 90% cancer mortality in the clinic.⁸²⁻⁸⁷ Many different states of metastatic cells (ever-changing character) in wide-ranges of human organs and tissues are now known as neoplasm plasticity.⁸⁵⁻⁸⁷ A lot of currently licensed drugs only target a narrow range of these various metastatic states. Nevertheless, TCM is famous for solving whole-body disease and body and organ imbalance. The question of whether TCM can be an alternative solution for neoplasm metastasis is open.

In TCM practice, doctors commonly change their therapeutic strategy according to past medication and cure patients in a short period of time. This phenomenon is not common in western treatments. Many therapeutic drugs are required to treat patients lifelong. Balanced therapeutics of these two systems may be promoted in disease treatments. (Figure 2).

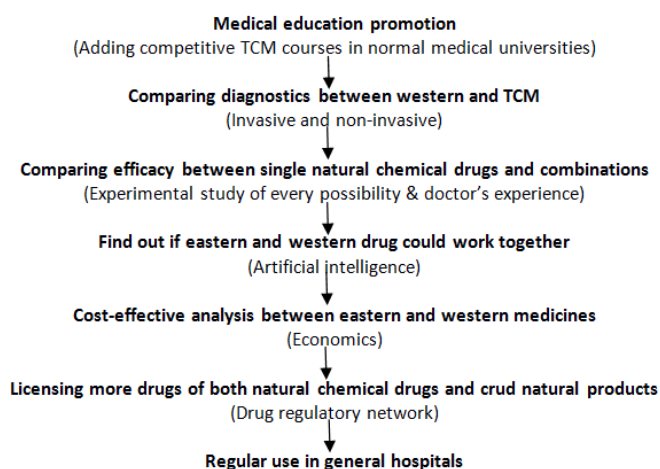


Figure 2 Roadmap for the promotion of natural chemical drugs and TCM.

Conclusion

Herbal medicine and natural chemical drugs are interrelated for both basic and practical values. Creative ideas and scientific approaches can promote medical tools against dangerous diseases. Herbal medicine knowledge must be established for high-quality and wider-range drug development and clinical applications.⁸⁸⁻⁹¹ To achieve this goal, integration of western and eastern medical practices is a top priority.

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Conflicts of interest

The authors declare there is no conflict of interest.

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