Ancient Traditional Chinese Medicine Diagnostic Technology with Material

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Abstract. Objective: Traditional Chinese medicine (TCM) not only focuses on the advancement of physical diagnosis technology—observing, listening, smelling, inquiring, taking the pulse and palpating lesions—but has also continually created uses of materials for diagnosis contrary to popular understanding. METHODS: Based on literature research, giving evidence which can be found in ancient TCM books is as the method. RESULTS: Whether in the past or present time, human activities are embedded in technology with materials. Ancient Chinese doctors diagnosed disease with materials also. The materials which the ancient Chinese utilized for diagnosis mainly came from the daily life. This is very similar to TCM theory of putting daily life experiences and objects into practice. CONCLUSION: It is not as most people think that ancient TCM doctors did not pay attention to the utilization of materials for diagnosis. They knew that the physical technology is based on accumulation of abundant practical experience, which is difficult to be taught by only oral transmission. Some of the diseases are complicated and easily can mislead the doctors, therefore, the uses of materials complement and help the unskilled doctors from making misdiagnosis.

Introduction

Technology is utilized as an effective vehicle for achieving a specific purpose[1]. Whether now or in the past, even as far as in prehistoric times, humans have been creating and using technology[2]. Just as the great philosopher Mencius (372-289 BC) said, "The good eyesight of Lou Li and the manual dexterity of Ban Gongshu, without compasses and carpenter's square, could not compose circles and squares." That is, human activities are embedded in technology. However, the creation of technology is certainly not a human being's innate ability. It is generated along with the progress of human society, and human society advances with the development of technology[3]. For example, TCM creates new diagnostic technology and treatment through practice in daily life in combination with past clinical experience in order to offer superior health services. With regard to the technology of TCM, other than physical technology—observing, listening, smelling, inquiring, taking the pulse and palpating lesions, material objects—are also employed. Chinese medicine and acupuncture in TCM are well-known examples of utilization of materials for treatment. Besides treatment, ancient Chinese doctors had also utilized materials for diagnostic purposes like the saying, "To do a good job, one must first sharpen one's tools."

Living Supplies Utilized for Diagnosis

Technology may be defined to include tools and their employment[1]. However, such tools are not always newly created but are sometimes new uses of existing goods. The original value and role of this object may change according to its primary instrumentation[2]. For instance, items used in daily life such as water, food, paper, cloth, an umbrella etc., can be found to be used in diagnoses or autopsies in ancient books on TCM, similar to the guiding principle of TCM is to observe, to find, to solve than to prove[4].
Paper or cloth used in testing urine

Jaundice is caused by an increased concentration of total bilirubin in the serum, leading to yellowish pigmentation of the body. The disease had already appeared early in Huangdi’s Internal Classic (Huang Di Nei Jing, completed in about the 1st-2nd Century BC). In addition, Hong Ge had found that yellowish pigmentation of jaundice was first seen in the eyes, and afterwards in the skin and urine in A Handbook of Prescriptions for Emergencies (Zhou Hou Bei Ji Fang, completed in about 341 AD), Chapter 13th: Prescriptions of cold damage, seasonal epidemic and warm pathogen diseases (Zhi shang-han shi-qi wen-bing fang). Ge had also found the yellow urine of patients with jaundice would produce pigmentation on white paper, yet generally yellow urine would not. Therefore a sheet of white paper was applied to confirm the diagnosis of jaundice. Furthermore, Chapter 31st: Prescriptions of a sharp attack of jaundice (Zhi cu fa huang-dan zhu huang-bing) of the same book described that the remedy of yin huang (yin jaundice), with yellow sweat stains on worn clothes and having yellow snot and spit, was to take a spoon of powder pounded from Man jing zi (Fructus Viticis) for the first dose and 2 spoons for the next, both times mixed with well water of the first pump in the daytime every day. During the course of the treatment, the patient dipped a piece of white cloth into the urine, judged the degree of yellow pigmentation and recorded it every night until recovery. In this case, it could be seen that the diagnostic tool was altered from white paper to white cloth. The main reason might have been to save money for the patient because paper could not be reused and the patient needed to keep record of the urine test every day for a period of time. Moreover, cloth was used in urine test simply because cloth also possesses the property of determining urine colorimetry like white paper.

Food used in prognosis of disease

The progress of diseases can be uncertain, and it sometimes may be insufficient to control the state of the disease by physical technology alone. Ancient Chinese doctors also realized this problem, and devoted themselves to a solution in the treatment process, particularly in the diagnostic stage. An example was mentioned in Clause 332nd of Treatise on Cold Damage Diseases (Shang Han Lun, written in 200-205 AD by Zhong-jing Zhang). The critically ill patient, with both cold limbs and diarrhea, was short of appetite due to insufficient yang-qi in the stomach, so there were two prospects when he or she asked for food. One was that the patient was getting better because the stomach qi began to recover. The other was that the patient was getting worse because the decay of stomach qi caused a muscular spasm of the stomach leading to a false impression of a hunger. Food retention, caused by insufficient stomach qi, would obstruct stomach qi and transform into internal heat after eating. Therefore, Zhang anticipated the prognosis of a critically ill patient, having both cold limbs and diarrhea, to be curable if there was no fever with food.

In addition, A Handbook of Prescriptions for Emergencies, Chapter 1st: Prescriptions of a sudden coma (Jiu cu-zhong e-si fang) prescribed piercing the patient’s ear or nose with scallion to treat sudden coma and to diagnose its prognosis. It says, "Thrust a scallion into a patient's ear, and do not feel scared when seeing blood in an ear or the nose. Conversely it will be refractory without bleeding observed." The passage may be regarded as an instance of conclusions from clinical observations in ancient times. They discovered that there are passages connecting the eyes, ears and the nose, and that all yang meridians merge together in the head, so the head is the last part of the body to cool down during a coma. Hence, scallion, a common material in daily life, which possesses the quality of tenacity but is not too hard and has the effects of restoring yang and promoting blood circulation, can be used as a tool for diagnosing the condition of the patient's qi and blood circulation by pricking the nose or ear, which are also relatively thin areas of the head with lower risk of traumatization of the head. If bleeding was observed, it revealed that the qi and blood still flowed; if bleeding was not present, the patient might be incurable because his or her qi and blood had stagnated and did not flow freely. Another therapy for sudden coma in this chapter was also based on the similar principle, "Stab the ear, male left ear or female right (left for yang and right for yin), into 7 or 8 inches with scallion. It is fine to have bleeding in the eyes." Besides scallion, garlic also has the effect of unblocking all orifices and dispelling dampness and epidemics. Garlic was also used as a tool to test a patient
whether suffering from hydropoisoning or not in Complete Records of Sacred Benevolence (Sheng Ji Zong Lu, written in 1117 AD), Volume 149th: Section of miscellaneous treatment (Za liao men). It said, "Boil a few buckets of water, put four liters of mashed garlic into the boiling water for a while and then remove the garlic. A person who has erythema after bathing in garlic water suffers from hydropoisoning."

Moreover, another example of using food in an inspection was found in Record of Redressing Mishandled Cases (Xi Yuan Ji Lu, published in 1247 AD), Chapter 8th: A post-mortem (Yan shi). It stated that if no bruise was found while performing an autopsy on bone injuries, the forensic expert might immerse the corpse or bone in medicated leaven or vinegar for a few minutes. However, if the injuries were still hidden, the forensic expert could submerge the body or the bone in smashed white plum. This description showed that the ancient had realized that the acidic property of medicated leaven, vinegar, and white plum could make the bruise more obvious, because the acidity leads to denaturation of hemoglobin from the bruise and deepens its color[5]. Likewise, when treating an unconscious patient with invisible bruising, a practitioner of traditional Zhuang medicine would smear the patient’s body with the mashed leaves of lime trees and then the injury would appear[6].

**Oily paper umbrella used in examination of wound**

Other than examining a wound with the acidic property of food, filtering with an oily umbrella was employed in the story of Dream Stream Essays (Meng Xi Bi Tan, written in about 1086-1093 AD), Volume 11th: National affairs (Guan zheng). Chu-hou Li, a chamberlain for ceremonials, was the magistrate of Shen county in Lu-zhou city. One day he heard that a person was beaten to death and went to check the injuries of the dead, but he could not find out any traces of injury with many measures such as smearing pickle meat or ash soup on the body. An elder visited and said, "The bruises would appear by both covering the dead with a new red-oily umbrella in the sun and by pouring some water on the body." Li followed his words and then he saw the scars clearly. This demonstrates that the ancient Chinese had already known to apply the optical principle of "filtering" to examine a wound of a corpse, like modern forensic techniques, enhancing the visibility of the secretion of an injured bone by using ultraviolet light[7]. However, in Record of Redressing Mishandled Cases, Chapter 8th and 18th both pointed out the limitation of a post-mortem examination with "red light" from sunlight through a red umbrella. "This method does work but only on fine days." The author proposed solutions to be used on a cloudy or raining day—using the lighting of a charcoal flame or having the body or bones boiled to highlight the bruises. However, a better method, the utilization of yellow light, was discovered in the book, Read Law with Right Ways (Du Lv Pei Xi, published in 1674 AD). It said, "If the bruises of a corpse cannot be found on a rainy day, one does not need to make use of the ancient methods. Just cover the body with a new yellow-oily umbrella of Hang-zhou (in Zhejiang Province), and then any damage to the bones will be revealed even more clearly than on a bright sunny day." This statement indicated that the ancient Chinese doctors learned from previous experience and improved their diagnostic technology.

**Water used in judgment of illness**

A Handbook of Prescriptions for Emergencies, Chapter 63th: Prescriptions for treatment of venomous insect poisoning (Zhi zhong gu-du fang) recorded that those who were poisoned by a venomous insect would have a sharp pain around stomach and then died after their viscera were digested by the insect. Additionally, should a person spit in water, that his or her saliva sank in water would mean that he or she had been poisoned by insects. This description revealed that the ancient Chinese doctors had discovered that the density of the spit of a patient poisoned by a venomous insect was different from someone who had not been poisoned. This is an example of using water to diagnose whether or not someone had been poisoned.

Another similar illustration can be found in Treatise on the Pathogenesis and Manifestations of All Diseases (Zhu Bing Yuan Hou Lun, completed in 610 AD), Volume 25th: Manifestations of venomous insect poisoning (Gu-du-bing zhu hou). Ask a patient to spit into the water from the first pump of the day from a well before breakfast on an empty stomach. If he or she was poisoned by a venomous insect, the saliva will sink straight down into the bottom of the water. If the person was
poisoned by a plant toxin, the saliva would diffuse loosely in the water. Also described in this chapter, apart from water, some foods or common materials were also applied as instruments for diagnosing diseases resulting from poisoning by a venomous insect. For instance, if a patient put a soybean in his or her mouth and the hull shed off, that meant the patient might have been poisoned by a venomous insect. Another chapter in this book described that a patient was asked to sleep in a bed with a swan skin under the sheet without telling the patient about the skin. If the symptom got worse, then the person was poisoned.

Moreover, a person could boil a freshly-laid egg, strip off the egg white and ask the patient to keep the whole yolk in his or her mouth around the clock. After two meals had passed, the patient spat the yolk into two roof tiles with some frost and dew at night, and then saw the color of the yolk next early morning. The patient was poisoned if the yolk became green. Another example can be found in Compendium of Medicine (Yi Xue Gang Mu, completed in 1565 AD). Those who don't sense a fishy taste when chewing a raw soybean or taste sweet when chewing alum have definitely been poisoned by a venomous insect. Similarly, Collection of Life Saving with Emergency Treatment (Ji Jiu Guang Sheng Ji, published in 1805 AD) provided another testing method. A person put a cooked duck egg with a silver hairpin in his or her mouth at meal-time. If both duck egg and hairpin turned black, that meant the person was poisoned.

Furthermore, this book also offered a preventive measure of mixing the meal with rhinoceros horn before eating whenever visiting a place with venomous insects. The poisoned meal would burst with foam. From all the testing or precautionary methods described above, it could be concluded that these methods are a collection of wisdom from the daily life and experience of ancient Chinese. They discovered that soybean, swan skin, boiled yolk, alum, duck egg, silver or rhinoceros horn could bring about a chemical reaction with the toxin of a venomous insect.

Other than the density of water, its colorless and tasteless properties can also be used as a means of inspection. In the Ming Dynasty (1368-1644 AD), ancient Chinese doctors dropped two samples of two people's blood together in water in order to identify their parent-child relationship or that of brotherhood[8]. Through the eye of modern medicine, the determination of consanguinity by blood immune reaction were rough, but they were the representation of the subtle observation and findings made without any laboratory equipment by ancient Chinese doctors.

**Silver Products Utilized for Diagnosis**

In addition to the test of venomous insects poisoning, ancient physicians found several different toxicity tests. These methods came from practices in daily life, however doctors probably did not realize the mechanism of action behind them. For example, ancient Chinese doctors used to test toxicity with silver products because they had observed that many toxins would react with them to cause different discolorations. In A Handbook of Prescriptions for Emergencies, Chapter 68th: Prescriptions of acute poison from medicine (Zhi cu-zhong zhu-yao-du jiu-jie fang) prescribed placement of a piece of silver in the mouth immediately for a night whenever one has suspicions of being poisoned. The patient was poisoned by toxic medicine if the silver turned dark. If the patient was poisoned by the toxin of a blue medicine (ancient medicine colored blue with a toxin), the silver would turn cyan; if the toxin was from bacterial medicine, then it would become orange. Record of Redressing Mishandled Cases, Chapter 28th: Taking poison (Fu du) wrote that if a corpse was emaciated with yellowish appearance, collapsed eyes, bared teeth, atrophied lips, and a sunken abdomen, gold silkworm poisoning might be the cause of death. A silver hairpin was used in the postmortem and then the hairpin became yellow and the color could not be washed away with a decoction of Zao jiao (Gleditsia sinensis Lam.). During poison testing of the autopsy, plug a silver hairpin washed with a decoction of Zao jiao in advance into the throat of the dead and seal the mouth with paper. After a period of time, retract the hairpin. The hairpin will turn black and the discoloration cannot be washed out with a decoction of Zao jiao if the dead was poisoned, otherwise the hairpin would remain a fresh silver color.
Chinese Medicine Utilized for Diagnosis

Chinese medicine to a TCM doctor is as good soldiers to a general, so it may be a good idea to use Chinese medicine as a diagnostic tool. As Wan's a Piece of Esoteric Treasure—Pox, a monograph of pox (Wan-Shi Mi-Chuan Pian-Yu Dou Zhen, published in the middle of the 16th Century AD), Volume 13rd: Measles tuned with the moon over the west river (Ma-zhen xi-jiang-yue) referred to a diagnosis and eruption promoting of measles with Zhu ma (Boehmeria nivea (L.) Gaud.). Whenever a person with measles has no other disease and his or her measles cannot break out, scrape his or her body with the decoction of Zhu ma after taking the decoction of Jing Fang Bai Du San, and then measles will appear. In Zhang's Comprehension of Medicine (Zhang Shi Yi Tong, published in 1695 AD), Volume 9th: Section of miscellany (Za men) used wet scraping with the decoction of Zhu ma to diagnose and cure sha disease, which is triggered by seasonal mephitis, summer heat or the stagnation of food such as sunstroke, cholera, or enteritis. Because this disease is caused by the patient’s qi and blood stasis due to qi deficiency, gua-sha (skin scraping), having the effect of activating blood circulation and removing blood stasis, is the most convenient and inexpensive treatment. Some similar methods collected in this section has both diagnostic and therapeutic effectiveness, for instance, scraping the shoulders, arms and back while wet with water, or scraping with an oiled porcelain bowel. Moreover, this book found that the patients suffering from sha disease would taste sweetness while chewing raw soybeans, others would taste a fishy taste. Consequently, chewing of raw soybeans could be used as a tool to diagnose both venomous insect poisoning and sha disease.

Furthermore, Chuan xiong (Ligusticum chuanxiong Hort), which has effect of activating blood circulation and qi, was utilized as a tool to diagnose pregnancy in Compendium of Effective Prescriptions for Women (Fu-Ren Da-Quan Liang-Fang, completed in 1237 AD), Volume 11th: Pregnancy test (Yan tai fa). It is said that for the pregnancy test of a woman with amenorrhea for 3 months, ask her to take a square-inch-spoon of fine powder ground from raw Chuan xiong (Ligusticum chuanxiong Hort) with thick decoction of Ai ye (Artemisia Argyi) on an empty stomach. If she senses small motions in the abdomen, that means that she is pregnant. Other than using a single herb, a formula of medication can also be used for the purpose of diagnosis. In Treatise on Cold Damage Diseases, Clause 100th talked about how to use different formulas to treat the same disease. For example, if a person has cold disease with yang hesitant and yin tight pulses, they can be treated with two different formulas of medicine. The doctor should prescribe Xiao jian zhong decoction first to boost spleen energy. If it does not work, then Xiao chai hu decoction should be prescribed to regulate qi and blood activity.

Vaccination Utilized for Prevention

The initial symptoms of smallpox are seasonally epidemic and sometimes even fatal. These symptoms are similar to the fever of a cold, and they can be misdiagnosed easily. Ancient physicians were committed to finding effective therapy, and they understood that prevention is better than cure, which often prevented misdiagnoses. In Compendium of Materia Medica (Ben Cao Gang Mu, written in 1578 AD), Part of bug (Chong bu) recorded two ways to escape from the infection of smallpox. Ask children to eat flapjacks made of rice flour with white buffalo lice on their empty stomachs and to excrete smelly stool afterward. Do this every year, and they will be free of smallpox for life. Another way of preventing smallpox is to take bean sized honeyed pills made of 49 fried white buffalo lice, 40 ground green beans and 4.9 fengs (1feng=0.3 grams) Zhu sha (cinnabar). All to be swallowed with green beans decoction. Apparently, the ancient Chinese doctors had found that white buffalo lice possessed the effect of preventing smallpox. However, they did not necessarily realize that the lice had the preventative effect until after they stung the buffalo suffering from smallpox. At any rate, the preventative measure above was the prologue to "artificial immunity".

The reports of vaccination in Zhang's Comprehension of Medicine, Volume 12th: Section of infancy (Ying er men) showed that artificial immunity had been implemented in the past. Moreover, this procedure can be used for diagnostics and treatment. According to the author, Lu Zhang, the vaccination was used to allow a health child to develop immunity to smallpox when he or she has vital
qi to cope with limited toxins from the vaccination. The toxin was not strong enough to agitate the blood and qi, nor lead to the development of dangerous itch, collapsing of smallpox. Consequently, vaccination could be used as a shortcut to the prevention of full-blown infection.

Furthermore, Zhang introduced 3 kinds of vaccines. First was pox fluid. A few drops of pox fluid from an infected child was placed into another healthy child's nostril with cotton ball (left nostril for male child and right for female). The second was to use pox scabs. Pox scabs could also work if pox fluid could not be obtained. The last was a sick child's clothes if pox scabs were unavailable. One could also contract smallpox by wearing the clothes of a child who had once suffered from smallpox.

However, Zhang prompted that pox fluid and scabs should be taken from the children in the last stage of smallpox, because the toxin on the onset was blazing and should be avoided. From the example above, it is evident that TCM is based on real life practices. In addition, ancient Chinese doctors developed artificial vaccination which allowed doctors to control the occurrence and development of the disease, and to bring safety to patients.

**Conclusion**

Ancient Chinese doctors expanded and enhanced their diagnostic ability through the usage of daily life experience and materials/tools. In order to make the phenomenon of disease “tells the truth” and provide patients with the most appropriate treatments as soon as possible, TCM doctors committed to develop new technology and were not limited by the traditional methods of physical technology—observing, listening, smelling, inquiring, taking the pulse and palpate lesions. That is, ancient Chinese doctors, contrary to their popular portrayal and perception, actually paid close attention to the utilization of materials. Because ancient doctors realized that subtle physical technology should be based on accumulation of abundant practical experience, such information is difficult to teach by oral transmission alone. Hence the use of materials can complement and help unskilled doctors in making misdiagnosis.

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**References**


