RESEARCH ARTICLE

Application of Traditional Chinese Medicine Four-diagnostic auxiliary apparatus in evaluation of health status and clinical treatment

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jing University of Traditional Chinese Medicine, respectively. Then, the included subjects were diagnosed by the Four-diagnostic auxiliary apparatus.

RESULTS: Thirty liver cancer patients and 30 paired healthy controls were enrolled in this study. Based on the apparatus, the pulse wave velocity was significantly higher in patients compared with controls ($P < 0.05$). The number of patients with purple tongue and ecchymosis were more than controls ($P < 0.05$). The number of patients (10%) with yellow tongue coating were higher than the controls (0%). Patients were inclined to be with water type and fire type constitution.

CONCLUSION: TCM Four-diagnostic auxiliary apparatus can be applied in clinical diagnosis of body constitution and health status of subjects. It promotes the accuracy and speed for disease diagnosis and TCM standardization.

INTRODUCTION

The four diagnostic methods used in Traditional Chinese Medicine (TCM) are the major methods for disease diagnosis.[1] The four diagnosis methods and symptom pattern identification were performed mainly based on *Yin*, *Yang*, *Qi* and blood condition. Individuals varied the causes of diseases, which is related with the constitution of subjects. The constitution identification of subjects is benefit to understand the body

Abstract

OBJECTIVE: To evaluate the application of Traditional Chinese Medicine (TCM) Four-diagnostic Auxiliary Apparatus in disease diagnosis.

METHODS: The liver cancer patients and healthy controls were recruited from Shanghai Integrated Chinese and Western Medicine Hospital and Bei-

characteristic, disease treatment and prevention. In recent times, the diagnosis of diseases mainly depends on the application of medical equipments that improved the diagnostic accuracy and speed.[2,3] It is necessary to develop the high-tech equipment to diagnose the diseases by TCM.

Digitalization and quantization of four diagnostic methods provide simple, convenient, cheap, efficacious, appropriate health data monitoring, evaluation, and intervention method, which inherits TCM diagnostic methods and improves the progress of science and technology in TCM.[4] TCM four-diagnostic auxiliary apparatus is the only apparatus that can automatically extracted the diagnostic information for TCM.[5] It combined multi-information fusion technology, the data supported four diagnostic parameters, the equipment integration of the computer statistical analysis, with clinical experience of Chinese medicine experts, which makes the diagnostic information more stable and standard. Meanwhile, the apparatus shows advantages in disease diagnoses, symptom pattern identification and individualized therapy recommendations.[6-8] In this study, we aimed to investigate the potential for the application of this apparatus in practice.

METHODS

Subjects

In this study, patients with liver cancer were recruited from Shanghai Integrated Chinese and Western Medicine Hospital. All the patients were diagnosed with primary liver cancer based on pathological examination, type B ultrasound, CT, MRI, Alpha-fetoprotein, and enzymatic examination. The patients who were accompanied by diseases that could affect tongue and pulse, such as hemangioma, varicose veins of the lower extremities, tongue lesions, etc. were excluded. Cases were also excluded if they were accompanied with heart, lung, brain, kidney related diseases and other serious diseases or metabolic disorders, such as hypertension, diabetes, hyperlipidemia, hyperuricemia. Other exclusion criteria included pregnant or lactation women and cases with mental disorder.

In addition, the healthy controls without chronic diseases and acute diseases occurred within three months were recruited from the Beijing University of Traditional Chinese Medicine.

Experimental method

The Traditional Chinese Medicine (TCM) Four-diagnostic auxiliary apparatus (BD-SZ, Registration number YZB/Jin 0019-2014), was developed by the team of Beijing University of Chinese Medicine. The apparatus can automatically extract the diagnostic information of traditional Chinese indexes such as looking, listening, asking and feeling the pulse, accompanied with dynamic electrocardiogram (ECG), oxygen, pulse wave velocity (PWV), vascular compliance and other available diagnostic information.[9,10]

Before the test, the TCM Four-diagnostic auxiliary apparatus instrument was checked and debugged to make it reach the most stable state. All the subjects were allowed to calm for 5-10 min to exclude external disturbances and informed about the detailed test procedures and matters needing attention. First, the basic information of the subjects were collected, and the ECG limb leads were connected with the corresponding limbs. Pulse pressure probe was put to test the subject's radial artery pulse pulsation. Then the pulse chart, ECG and photoelectric volume chat were collected by computer *via* putting the photoelectric finger volume clip on the subject's right middle finger. In the tongue diagnosis mode, subjects were informed to put the tongue out of the mouth, and images of tongue were acquired by adjusting the camera. The clear and complete picture of tongue were collected for further analysis. Subsequently, in the listening module, subjects listened and repeated following hints and the digital audio data were stored. After collecting the the basic information, and the results of pulse diagnosis, tongue diagnosis, the asking mode was performed. The symptoms self stated by subjected were input into the asking mode by computer. Then the diagnostic report was automatically generated combined with all the information of diagnostic modes.

Statistical analysis

All the data were analyzed by SPSS 20.0 (IBM Corp., Released 2011. IBM SPSS Statistics for Windows, Version 20.0., Armonk, NY, USA). Data were expressed as mean ± standard deviation ($\bar{x} \pm s$) or number (percentage). The difference between patient group and controls were analyzed by paired t test or χ^2 testing. $P < 0.05$ was defined as statistically significance.

RESULTS

Totally 30 cases (28 males and 2 females, age range: 36-80 years) with liver cancer were enrolled in this study and 30 age and gender paired healthy controls were included. Compared with the patient group, PWV was significantly higher than that of the control group and the pulse pressure and pulse rate were significantly lower ($P < 0.05$). No difference was observed in the pulse parameters, pulse power and pulse rate between two groups ($P > 0.05$) (Table 1).

As shown in Table 2, the number of patients who were present with purple tongue and ecchymosis were significantly higher than healthy controls ($P < 0.05$). The healthy controls trended to show pale white (3.3% *vs* 0.0%) and light red tongue (73.3% *vs* 36.7%). More patients (10.0%) were present with yellow tongue coating compared with controls (0.0%). Compared with control group, the proportion of patients with water