Distribution of elements extracted from symptom patterns and characteristics of polysomnograph of common symptom patterns of insomnia with Traditional Chinese Medicine

Cui Yinglin, Zheng Weifeng, Xu Li, Meng Yi, Wang Yuqin, Chang Xuehui

Abstract

OBJECTIVE: To analyze the distribution and combined regulation of elements of symptom patterns in the diagnosis of insomnia with Traditional Chinese Medicine (TCM).

METHODS: The samples were collected from the patients, diagnosed with insomnia, of Henan Province Hospital of Traditional Chinese Medicine between June 2011 and September 2013. The symptom patterns in insomnia were extracted. Next, symptom differentiation, characteristics of polysomnography (PSG), distribution and combined regulation of these symptom patterns were conducted by tests.

RESULTS: In total, 286 eligible patients were recruited. The main locations of the disease symptom elements were the brain and heart, and the main characteristics of the disease symptom elements were phlegm-heat, Yin-deficiency and Qi-stagnation. The elements from two or three symptom patterns were commonly manifested in patients with insomnia, especially from three symptom patterns. We also found that all TCM symptom patterns had an effect on polysomnographic indicators in PSG tests.

CONCLUSION: The elements of symptom patterns in insomnia were identified as mainly fire-heat and phlegm-heat. The most common patterns of excess were pathogenic fire derived from stagnation of liver-Qi, and mental disturbance due to phlegm-heat, while the most common patterns of deficiency in both the heart and the spleen. There are many differences in PSG indicators of different syndrome patterns of insomnia.

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Key words: Sleep initiation and maintenance disorders; Symptom elements; Polysomnogram; Polysomnography

INTRODUCTION

Insomnia is a common sleep disorder. Chronic insomnia can lead to a deficit in the attention, judgment, memory and daily work capacity of individuals, can reduce quality of life, and can seriously affect the social functioning and mental activities of daily living. Traditional Chinese Medicine (TCM) offers some advantages to the treatment of insomnia. But the clinical judgment of TCM symptom patterns in insomnia is currently based on four diagnostic criteria: insight, auscul-
tation and olfaction, inquiry, and pulse-taking and palpation. The treatment lacks objective and uniform diagnostic criteria; instead, it is based on a rather subjective approach. The symptom pattern differentiation method that has been proposed in recent years makes the diagnosis of TCM symptoms more standardized and meticulous. In particular, the clinical application of polysomnography (PSG) provides an objective basis for diagnosing insomnia. To our knowledge, no studies on TCM treatment for insomnia have yet focused on specific elements differentiation from TCM symptom patterns combined with PSG data. This study aimed to analyze the distribution of elements of symptom patterns in patients with insomnia.

MATERIALS AND METHODS

Participants
The subjects were the outpatients and inpatients of Henan Province Hospital of TCM, recruited between June 2011 and September 2013. The study followed the ethics standards set by the hospital ethics committee in Henan province, and informed consent was obtained.

Diagnostic criteria
We applied western-type diagnostic criteria in accordance with the diagnostic criteria for insomnia described in the Chinese Classification of Mental Disorders Version 3 (CCMD-3). We applied the following TCM diagnostic criteria in accordance with the criteria established by Zhou and by the State Administration of Traditional Chinese Medicine: (a) subjects who found it difficult to go to sleep or to remain asleep (a condition that lasted for more than 3 weeks) or who stayed awake almost all night; and (b) subjects in whom the condition was often accompanied by headache, dizziness, heart palpitations, forgetfulness and fatigue.

Inclusion criteria
The inclusion criteria were as follows: (a) the disease matched the Chinese- and western-style diagnostic criteria; and (b) the subjects were aged 18-75 years.

Exclusion criteria
The exclusion criteria were patients with severe heart disease, lung disease or gastrointestinal disease, or with abnormal thyroid function.

Research methods
(a) Survey tools: based on the results of earlier research, the study used the "Information Collection Table of Insomnia in TCM Clinic" unified and formulated by the research group. The main contents were demographics and information collected from four TCM diagnostic techniques. The identification of symptom patterns was conducted by a TCM associate chief physician or a chief physician. PSG testing was conducted using Alice 5 Polysomnography of Weikang Company of Philips (Allegheny County, Pittsburgh, PA, USA). The polysomnographic indicators included EEG, EOG, jaw EMG, oxygen saturation, leg EMG, ECG, chest and abdominal movement, nose and mouth flow; all tests were performed in a quiet, comfortable sleep monitoring room, and lasted 7 h.
(b) Extraction of TCM symptom patterns: based on Zheng and Zhou, we conducted TCM differentiation of insomnia. According with pre-study and extraction principle, unified syndrome were divided into symptom elements of diseases location and symptom elements of diseases character.
(c) Statistical analysis: data analysis was conducted using SPSS17.0 analysis of variance; Chi-square, and rank sum tests were performed to reveal the differences between groups. Statistical significance was set at $P \leq 0.05$.

RESULTS

Extraction of elements from symptom patterns
Combined with the characteristics of the clinical pathogenesis of insomnia, the elements of symptom patterns were extracted in terms of the location of seven diseases and the characteristics of six diseases (Table 1).

Combined regulation of the elements extracted from symptom patterns
According to our clinical research, we found that a variety of symptom-pattern elements in insomnia occur at the same time. Most common of these was a combina-

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Frequency (times)</th>
<th>Frequency (%)</th>
<th>Location</th>
<th>Frequency (times)</th>
<th>Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire-heat</td>
<td>123</td>
<td>43.0</td>
<td>Brain</td>
<td>248</td>
<td>86.7</td>
</tr>
<tr>
<td>Phlegm-heat</td>
<td>93</td>
<td>32.5</td>
<td>Heart</td>
<td>230</td>
<td>80.4</td>
</tr>
<tr>
<td>Yin-deficiency</td>
<td>56</td>
<td>30.1</td>
<td>Liver</td>
<td>67</td>
<td>23.4</td>
</tr>
<tr>
<td>Qi-stagnation</td>
<td>67</td>
<td>23.4</td>
<td>Kidney</td>
<td>56</td>
<td>30.1</td>
</tr>
<tr>
<td>Qi-deficiency</td>
<td>66</td>
<td>23.1</td>
<td>Spleen</td>
<td>52</td>
<td>18.2</td>
</tr>
<tr>
<td>Blood-deficiency</td>
<td>52</td>
<td>18.2</td>
<td>Gallbladder</td>
<td>14</td>
<td>4.9</td>
</tr>
<tr>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Stomach</td>
<td>9</td>
<td>3.2</td>
</tr>
</tbody>
</table>
tion of elements from two or three symptom patterns, especially from three patterns. In the study of the characteristics of single-disease symptom-pattern elements combined with the location of single-disease symptom-pattern elements, there was a high frequency of phlegm-heat + heart, Qi-stagnation + liver, Qi-stagnation + stomach, blood-deficiency + heart, and blood-deficiency + liver, showing the symptom patterns of: phlegm-heat disturbing heart, liver depression and Qi stagnation; irritated stomach; heart blood-deficiency; and liver blood-deficiency. In the study of the characteristics of single-disease symptom-pattern elements combined with the location of two-disease symptom-pattern elements, there was a high frequency of fire + Qi-deficiency + heart + spleen, Yin-deficiency + heart + kidney, blood-deficiency + heart + spleen, Qi-deficiency + heart + gallbladder, showing the symptom patterns of heart-spleen Qi-deficiency, heart-kidney Qi-deficiency, heart-spleen blood-deficiency and heart-gallbladder Qi deficiency. Finally, in the study of the characteristics of two-disease symptom-pattern elements combined with the location of single-disease symptom-pattern elements, there was a high frequency of fire + Qi-stagnation + liver, showing the symptom patterns of pathogenic fire derived from the stagnation of liver-Qi. The results are shown in Table 2.

Index analysis of symptom patterns on polysomnograph

The results showed that the TCM symptom patterns of five groups all had an effect on polysomnographic indicators. By applying an SNK (Student-Newman-Keuls) test to each group, the results were as follows: (a) sleep latency, total sleep time (TST), S1%, S3%, REM%, arousal index and time awake of group 1 can be used in clinical detection and epidemiological studies; (b) sleep latency of group 2 can be used in clinical detection and epidemiological studies; (c) S1%, REM% and WASO (wake time after sleep onset) of group 4 can be used in clinical detection and epidemiological studies; and (d) REM% and time awake of group 5 can be used in clinical detection and epidemiological studies. Statistical analyses were performed by applying the Wilcoxon test to the WASO of groups 1 and 2 ($P < 0.0001$). The differences in S1% among groups 1 and 4 were significant ($P < 0.0001$). The differences in REM% among groups 1, 4 and 5 were significant ($P < 0.0001$), while the difference in WASO between groups 4 and 5 was not significant ($P < 0.0001$, Table 3).

The PSG tests were conducted on the patients with different syndrome patterns of insomnia, to discuss the difference of PSG indicators, for accurately study on clinical characteristics of syndrome patterns of insomnia. PSG indicators used in this test includes sleep latency, TST, S1%, S3%, REM%, arousal index, WASO, time awake and so on. The results show that there are different among PSG indicators of the patients with different syndrome patterns. There are significant differences between syndrome patterns of

### Table 2 Combination of elements of symptom patterns in insomnia

<table>
<thead>
<tr>
<th>Combination</th>
<th>Laws of symptom pattern element combination</th>
<th>Frequency (times)</th>
<th>Ratio (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elements from two symptom patterns</td>
<td>The characteristics of single-disease symptom-pattern elements combined with the location of single-disease symptom-pattern elements</td>
<td>96</td>
<td>33.6</td>
</tr>
<tr>
<td></td>
<td>The characteristics of single-disease symptom-pattern elements combined with the location of two-disease symptom-pattern elements</td>
<td>67</td>
<td>23.4</td>
</tr>
<tr>
<td>Elements from three symptom patterns</td>
<td>The characteristics of two-disease symptom-pattern elements combined with the location of single-disease symptom-pattern elements</td>
<td>123</td>
<td>43.0</td>
</tr>
</tbody>
</table>

### Table 3 PSG indicators for elements of symptom patterns in insomnia ($ \bar{s} \pm s $)

<table>
<thead>
<tr>
<th>PSG indicators</th>
<th>Group 1 $\bar{s}$</th>
<th>Group 2 $\bar{s}$</th>
<th>Group 3 $\bar{s}$</th>
<th>Group 4 $\bar{s}$</th>
<th>Group 5 $\bar{s}$</th>
<th>F value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sleep latency</td>
<td>57.4±11.4 $\bar{s}$</td>
<td>49.5±9.1 $\bar{s}$</td>
<td>36.5±4.1 $\bar{s}$</td>
<td>37.4±4.0 $\bar{s}$</td>
<td>37.4±5.0 $\bar{s}$</td>
<td>79.7</td>
</tr>
<tr>
<td>Total sleep time</td>
<td>318.0±32.3 $\bar{s}$</td>
<td>315.9±34.4 $\bar{s}$</td>
<td>347.9±16.9 $\bar{s}$</td>
<td>296.3±22.6 $\bar{s}$</td>
<td>296.8±13.7 $\bar{s}$</td>
<td>61.4</td>
</tr>
<tr>
<td>S1 (%)</td>
<td>27.3±5.8 $\bar{s}$</td>
<td>21.8±5.7 $\bar{s}$</td>
<td>22.6±6.8 $\bar{s}$</td>
<td>15.1±2.2a $\bar{s}$</td>
<td>21.8±3.3 $\bar{s}$</td>
<td>83.6</td>
</tr>
<tr>
<td>S2 (%)</td>
<td>56.8±7.8 $\bar{s}$</td>
<td>57.8±7.0 $\bar{s}$</td>
<td>56.2±7.5 $\bar{s}$</td>
<td>52.2±4.0 $\bar{s}$</td>
<td>51.1±3.1 $\bar{s}$</td>
<td>15.6</td>
</tr>
<tr>
<td>S3 (%)</td>
<td>3.9±3.7 $\bar{s}$</td>
<td>6.6±4.5 $\bar{s}$</td>
<td>6.2±4.9 $\bar{s}$</td>
<td>7.7±3.2 $\bar{s}$</td>
<td>6.7±2.0 $\bar{s}$</td>
<td>9.5</td>
</tr>
<tr>
<td>REM (%)</td>
<td>11.9±4.7 $\bar{s}$</td>
<td>13.7±3.6 $\bar{s}$</td>
<td>14.5±3.9 $\bar{s}$</td>
<td>25.0±2.5 $\bar{s}$</td>
<td>20.5±2.6 $\bar{s}$</td>
<td>173.7</td>
</tr>
<tr>
<td>Arousal index</td>
<td>30.0±6.5 $\bar{s}$</td>
<td>26.1±6.1 $\bar{s}$</td>
<td>24.5±6.0 $\bar{s}$</td>
<td>38.1±3.7 $\bar{s}$</td>
<td>38.6±2.6 $\bar{s}$</td>
<td>98.8</td>
</tr>
<tr>
<td>WASO</td>
<td>12.5±3.2 $\bar{s}$</td>
<td>12.7±7.8 $\bar{s}$</td>
<td>11.8±2.4 $\bar{s}$</td>
<td>16.1±4.4 $\bar{s}$</td>
<td>16.5±1.7a $\bar{s}$</td>
<td>24.4</td>
</tr>
<tr>
<td>Time awake</td>
<td>111.4±27.0 $\bar{s}$</td>
<td>117.1±28.8 $\bar{s}$</td>
<td>102.1±18.4 $\bar{s}$</td>
<td>149.4±21.2 $\bar{s}$</td>
<td>153.5±11.5 $\bar{s}$</td>
<td>65.0</td>
</tr>
</tbody>
</table>

Notes: group 1: pathogenic fire derived from stagnation of liver-Qi, 67 cases; group 2: mental disturbance due to Phlegm-heat, 94 cases; group 3: Yin-deficiency and fire-flourishing, 56 cases; group 4: deficiency of both heart and spleen, 52 cases; group 5: Qi-deficiency of both heart and gallbladder, 14 cases. WASO: wake time after sleep onset; PSG: polysomnography; REM: rapid eye movement; the rank sum test was used when variance is irregular; $\alpha=0.05$. $P < 0.001$ of each PSG indicator.

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pathogenic fire derived from stagnation of liver-Qi and other syndrome patterns in sleep latency, TST, S1%, S3%, REM%, arousal index, time awake. The sleep latency and sleep proportion of the first phase of syndrome patterns of pathogenic fire derived from stagnation of liver-Qi are much more than other syndrome patterns, and sleep proportion of the third phase and REM phase, arousal index and WASO are fewer. This suggests that the patients with syndrome patterns of pathogenic fire derived from stagnation of liver-Qi usually have trouble to fall asleep, and the sleep structure are mainly light sleep. There are also significant differences between syndrome patterns of mental disturbance due to phlegm-heat and other syndrome patterns. This suggests that the patients with syndrome patterns of mental disturbance due to Phlegm-heat usually have longer sleep latency, and are difficult to fall asleep in clinic. There are no significant differences between syndrome patterns of Yin-deficiency and fire-flourishing and other syndrome patterns. The sleep proportion of the REM phase and WASO of syndrome patterns of deficiency of both heart and spleen are more than other syndrome patterns, sleep proportion of the first phase is fewer. That shows that the patients with syndrome patterns of deficiency of both heart and spleen are dreaminess, lacking consistency, easier to wake up, and the sleep structure are mainly light sleep. The patients with syndrome patterns of Qi-deficiency of both heart and gallbladder usually are dreaminess, easier to wake up.

**DISCUSSION**

Elements of symptom patterns, also called "pattern factors", were the basic factors used to symptom differentiation. The elements are divided into the location of symptom patterns of diseases and the characteristics of symptom patterns of diseases. They include 20 symptom-pattern elements relating to disease location, 33 symptom-pattern elements relating to disease characteristics, and nine disease locations relating to Otorhinolaryngology. The differentiation of TCM symptom patterns was used as a diagnostic model. The use of symptom differentiation in TCM has contributed to the objective study of the characteristics and locations of diseases.

Guided by TCM symptom-pattern differentiation, the pattern elements are extracted from the symptom patterns in patients with insomnia. The results showed that pattern elements of the disease characteristics for insomnia were heat, phlegm-heat, Yin-deficiency, Qi-stagnation, Qi-deficiency and blood-deficiency (six categories), of which heat and phlegm-heat were the most common, accounting for 43.0% and 32.5%, respectively. As a Yang-pathogen, phlegm-heat can prevent Yang to enter Yin, leading to yang-excess and impairment of Yin, then Yang-excess and Yin-deficiency caused insomnia. Clearly, phlegm-heat is the main pathogenic cause of insomnia. Heat-pathogenesis is usually caused by pathogenic fire, which derives from the stagnation of liver-Qi and excessive heart fire. The pattern elements of the disease characteristics for insomnia are known as brain, heart, liver, kidney, spleen, gallbladder and stomach elements, of which the most common are brain and heart, accounting for 86.71% and 80.4%, respectively. Research into insomnia has revealed that malnutrition of heart blood is the fundamental pathogenesis of insomnia. Previous studies have suggested that insomnia is usually caused by pathogenic fire derived from stagnation of liver-Qi, excessive heart fire, and mental disturbance due to phlegm-heat. The most common pattern elements of insomnia are pathogenic fire derived from stagnation of liver-Qi, and mental disturbance due to phlegm-heat.

Analyzing the elements extracted from symptom patterns in insomnia, we found that the combinations are usually of elements from two or three symptom patterns. Especially the combination of elements accounted for 46.5% of symptom patterns of insomnia. The pathogenesis of insomnia is complex. It has formed the complicated and changing clinical symptoms by combination with syndrome elements of diseases location (such as fire-heat, phlegm-heat, Yin-deficiency, Qi-stagnation, Qi-deficiency and blood-deficiency) and syndrome elements of diseases character (such as brain, heart, liver, kidney, spleen, spleen, gallbladder and stomach). The type of pathogenic fire derived from stagnation of liver-Qi and mental disturbance due to phlegm-heat is the most common pattern of excess in insomnia, and the type of deficiency in both heart and spleen is the most common deficiency pattern.

There are different clinical manifestations among different TCM syndrome patterns of insomnia. We has found that it have many characteristics of PSG indicators in different TCM syndrome patterns of insomnia and there are difference among PSG indicators of TCM syndrome patterns of insomnia, providing evidences for TCM syndrome differentiation of insomnia in the future.

Limitations of the study were that: it was a single-center study, the sample size was small, and all the patients were selected from Henan Province Hospital of TCM only, and thus lacked generalizability.

**REFERENCES**


