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A novel model for exploring the correlation between patterns and prescriptions in clinical practice of traditional Chinese medicine for systemic lupus erythematosus

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B-code;
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Summary
Objectives: Traditional Chinese medicines in treating systemic lupus erythematosus are not uncommon. However, logic of pattern diagnosis and consensus on treating this disease is lacking. This study aimed to explore the correlation between the pattern diagnosis of and its corresponding prescription in systemic lupus erythematosus.
Design: Clinical data including patterns and prescriptions from the electronic medical records of lupus patients in a medical center were collected. Using a specific coding system (B-code) to encode the patterns and prescriptions provided a platform for data processing and statistics, and nonlinear canonical correlation analysis was employed to examine the correlation between them.
Results: In the 261 valid visits collected, a total of 46 patterns and 193 prescriptions were encoded into 57 B-codes. In our database, ''Yin, Vacuity, Heat, and Dampness'' were the most common B-codes (more than 90%) in both patterns and prescriptions. ''Anemarrhena, Phellodendron, and Rehmannia Pill (Zhi-Bai-Di-Huang-Wan)'' and ''Miltiorrhizae Radix (Dan-Shen)''

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were the most frequently used formula (52%) and herb (48%), respectively. Water-rheum, kidney, and stasis were among the three most effective variable sets for correlating the patterns and prescriptions.
Conclusion: By using B-code with nonlinear canonical correlation analysis, the clinical dataset can be examined to shed light on the logic of pattern differentiation and principle of treatment for a specific disease.

Introduction

Traditional Chinese medicine (TCM) has played a unique role in health care in East Asia for over thousands of years and a theoretical and practical medical system has been developed. The utilization of TCM is common in Taiwan and Asian countries as well as among Asian immigrants in western countries. As a complementary medical system, TCM may play an important role in some chronic diseases which cannot be cured by western medicine, such as irritable bowel syndrome,[1] rheumatoid arthritis,[2] and systemic lupus erythematosus (SLE).[3] In Taiwan, women used more TCM services than men, especially in diseases of the musculoskeletal system and connective tissue, such as SLE.[4]

SLE is a chronic autoimmune disorder that can be severe and life-threatening.[5] With variable presentations of SLE, it is considered as one of the differential diagnoses in virtually any patient presenting with many clinical problems.[6] Despite the improved survival and multiple medications in patients with SLE, there is currently neither curative nor satisfactory treatment available.[7] Therefore, many patients with SLE resort to TCM. In Taiwan, around 60% patients with SLE have received TCM treatment.[8]

TCM physicians collect a large number of symptoms using a systems diagnosis approach, which is not usually used in western medicine, to examine patients with rheumatic diseases.[9] Then TCM physicians perform diagnosis and draw conclusions about patient pathological conditions in terms of ''patterns''.[10] Pattern identification is a unique TCM concept that summarizes the nature, location, and mechanism of diseases corresponding to the definitions of the World Health Organization.[11] According to the patterns determined, TCM physicians decide on the therapeutic principle and prescribe the formula and herbs. Owing to the variable manifestations of SLE, there are as many as 35 patterns summarized, depending on the experience of different TCM physicians.[12] Similarly, the prescriptions for patients with SLE are also diverse and discordant. Thus, how to assess the effective indication of each TCM prescription and to establish a prescription database is an essential issue.

With the therapeutic experience of TCM experts being subjective and unique, coming up with a logical summary that can be agreed by all is a difficult, if not impossible, task. In our previous study,[10] an expert system using B-code was designed to propose the corresponding formula or herbs to match different patterns. This system helps young physicians and medical students to learn more on SLE treatment. However, it is not precise enough for clinical physicians to prescribe individualized medication for each patient with SLE according to the few patterns only. The formulas statistically gathered from current huge health database cannot completely match all the patterns of different patients with SLE. A model for exploring the correlation between patterns and prescriptions to find more precise herbs or formulas for patient with SLE is necessary in clinical practice. Thus, this study aims to establish a model for examining the correlation between disease patterns and prescriptions for patients with SLE.

Methods

This study uses B-code to construct a database of disease patterns and prescriptions for patients with SLE, and to analyze the correlation between them. The process for constructing this model is shown in Fig. 1, and the four steps involved are described as follows.

Step 1: Collect clinical data from patients with SLE

This study collected clinical data such as patterns and prescriptions from the electronic medical records of patients with SLE in the TCM department of Chang Gung Memorial Hospital. The disease patterns for each patient were diagnosed and revised by a senior TCM expert well versed in rheumatology and at least another TCM physician. The prescription database comprised the formulas and herbs prescribed by the attending TCM physician.

Step 2: Construct the B-code database for TCM prescriptions

Formulas and herbs from TCM textbooks, such as ''Chinese Herbal Medicine[13]'', ''Formula of Traditional Chinese Medicine[14]'' and ''Treatments and Prescriptions of Traditional Chinese Medicine[15]'', were included in this database. Each formula or herb is matched to the corresponding disease patterns by the TCM expert and then encoded by the B-code. The first element of the B-code represents the causes of disease (病因 bingyin); the second element represents the diseased organ in various viscera and bowels (藏府 zangfu); the third element represents the diseased aspect (層次 cengci, namely 氣 qi, 血 xue, 陰 yin, 陽 yang) and body parts (部位 buwei); and the fourth element represents the mechanisms (病機 bingji). Using B-code to encode disease patterns is a practical way for statistical analysis.[10] It is used in our prescription database to encode the function of formulas or herbs. If any formula or herb was encoded to the same code with a specific disease pattern, that formula or herb would be categorized as the most suitable prescription for that disease pattern.

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