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Acupoint selection rules for acupoint application in lung diseases in the post-epidemic era

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Abstract

Objective: To summarize the rules of acupoint selection of acupoint application to prevent and treat lung diseases under the background the post-epidemic era using data-mining technology. **Method:** The CNKI, Wanfang database, and VIP database were searched for clinical study articles on lung diseases treated by acupoint application published in the past 5 years. Data-eligible papers were extracted to establish a database of acupoint application for lung disease using Microsoft Excel 2019, with the goal of analyzing the frequency of acupoints, acupoint-meridian association, acupoint-location association, specific acupoint frequency, and cluster analysis. Association rules, consisting of acupoints with an application frequency of ≥ 10, were devised by the Apriori algorithm to explore the correlation between acupoint groups and to analyze the rules of the compatibility of acupoint prescriptions. **Results:** A total of 229 eligible papers met our inclusion criteria. Forty-seven acupoints were applied, for a total frequency of acupoints of 1,035 times. Among these, acupoints for lung diseases were primarily distributed in the back-and-waist and chest-and-abdomen areas. From the analysis of the association rules, we obtained four groups of acupoint association rules based on acupoint clusters with a frequency ≥ 10 and found that Feishu (BL 13), Tiantu (CV 22), Dazhui (GV 14), Dingchuan (EX-B1), and Danzhong (CV 17) constitute the core acupoints of prescriptions for clinical acupoint application to prevent and treat lung diseases. **Conclusion**: It is clearly shown that the core acupoints are relatively concentrated and that the selected acupoints were mainly locally selected, which could be a matching reference for the long-term prevention and treatment of lung diseases, including COVID-19.

Key words: Acupoint application, Lung diseases, Acupoint selection rules, Post-epidemic era, Data-mining, Association rules, Cluster analysis

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***Abbreviations*:** LDs, lung diseases; AA, acupoint application.

***Competing interests*:** The authors declare that they have no conflict of interest.

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Background

Lung diseases (LDs) are particularly common and occur frequently in the clinic setting; they are characterized by cough, sputum production, and shortness of breath, among other symptoms [1]. The relapse rate and difficulty eradicating LDs have a major impact on the mental and physical health of patients [2] and for this reason, LDs have become an important area of research in traditional Chinese medicine [3]. The prediction and treatment of LDs are an important and largely unmet need, and controlling their recurrence remains a major clinical problem. Acupoint application (AA) therapy has been proven as a complementary method for the treatment of the diseases. A large number of studies have demonstrated the therapeutic application of conventional intervention combined with AA in the treatment of LDs, such as chronic obstructive pulmonary disease [4–6]. Since the outbreak of coronavirus disease 2019 (COVID-19), great success has been achieved in its prevention and control with effort in China, and the country has entered the post-epidemic era [7]. But in this era, there may be epidemic, social, financial and environmental risks etc. both domestically and internationally, and may appear "backflow," "concurrent," and "backward" about it. With the addition of the global situation remains very serious, it probably shows that this disease will become a new and long-standing epidemic.

AA, as an external treatment method combining medicine, acupoints, and meridians to achieve a comprehensive effect, can reach the site of the disease through the skin–collaterals–meridians–zang-fu levels, and coordinate the yin and yang and resisting pathogenic factors from the direct action of drugs and stimulation of local nerves under the acupoints based on the media characteristics of the meridians, namely "internally, meridians connect with the zang-fu organs, and externally with the joints,"in the Miraculous Pivot. A is a treatment in traditional medicine that has been regarded as a recommended therapy for the prevention and treatment of COVID-19 [8–10] ,which demonstrates a special advantage in treating diseases and may effectively prevent and treat the occurrence and development of LDs, including COVID-19.

The contemporary medical model has changed its focus from treatment to prevention. However, there is currently no summary of the rules of selecting acupoints for AA to prevent and treat LDs. Thus, rules for selecting acupoints for the prevention and treatment of LDs over the past 5 years has been discussed via data-mining, which could be used as a corresponding reference for the prevention and treatment of LDs, including COVID-19.

Data and methods

Data sources

The authors searched the electronic databases CNKI, Wanfang Database, VIP Database for articles published from January 2016 to May 2021. The search was not limited by the language used.

The key words used to search the literature were "asthma" OR "bronchitis" OR "acute respiratory infection" OR "pneumonia" OR "chronic obstructive pulmonary disease," "lung cancer" OR "cough" OR "lung distension" OR "cold" AND "acupoint application" OR "tian moxibustion" OR "blistering moxibustion."

Taking CNKI as an example, the search formula was the subject search (subject search, SU) = ("acupoint application" + "tian moxibustion" + "blistering moxibustion") and SU = ("asthma" + "bronchitis" + "acute respiratory tract infection" + "pneumonia" + "chronic obstructive pulmonary disease" + "lung cancer" + "cough" + "lung distension" + "cold").

Literature selection

They only considered in selecting articles was that the study was a randomized controlled trial. Patients were diagnosed with the above diseases. The treatment group used any AA methods with or without other Chinese medicine therapies, whereas the control group was limited to non-AA therapies or no treatment. The sample size was at least 30, and the number of acupoints used was at least 2.

Data extraction and standardization

Two investigators examined all titles and abstracts identified from the electronic databases were examined. The full text of the articles was retrieved for each record that had the possibility of meeting the inclusion criteria and was managed by EndNote X8 software. Two reviewers independently assessed the eligibility of the retrieved articles according to the criteria. Data from all eligible articles were extracted by one reviewer to establish the database of AA for LD using Microsoft Excel 2019, and the other reviewer checked for accuracy and completeness. All disagreements were resolved by discussion between the two reviewers and by seeking the opinion of a third reviewer when necessary. The descriptions of points and meridians were normalized by referring to "The Name and Positioning of Acupoints" [11].

Data analysis

SPSS 25.0 was used to analyze the rules of acupoint selection. The association rules, which were analyzed by SPSS Modeler 18.0, could reveal the relevance of all the acupoints in LD treatment via the indexes of rule support and confidence. Rule support shows the probability that a transaction contains A and B,

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indicating the statistical significance of the association rules. Confidence shows the probability that a transaction having A also contains B, indicating the confidence of the association rule [12].

Results

Literature description

An initial search identified 821, 915, and 1,260 potentially relevant articles from the CNKI, VIP, and Wanfang databases, respectively; 229 eligible articles met our inclusion criteria and were thus subjected to analysis (Figure 1). Among these studies, the combination of standard treatment was the most commonest, such as medicinal drugs, asthma, spasmolytic, and anti-infection.

Frequency of acupoint analysis

The acupoints were analyzed to determine which ones were applied the most frequently and how often they were used. In total, 47 acupoints were applied, for a total frequency of 1,035 times. Among all, Feishu (BL 13), Tiantu (CV 22), Danzhong (CV 17), Dingchuan (EX-B1), and Dazhui (GV 14) were the top five acupoints used (Table 1).

Analysis of the acupoint–meridian association

The acupoint–meridian association was analyzed to determine the distribution of the acupoint meridians for LDs. As shown in Table 2, Pangguang (Bladder) Meridian, Conception Vessel, Governor Vessel, and Wei (Stomach) Meridian were the most popular meridians.

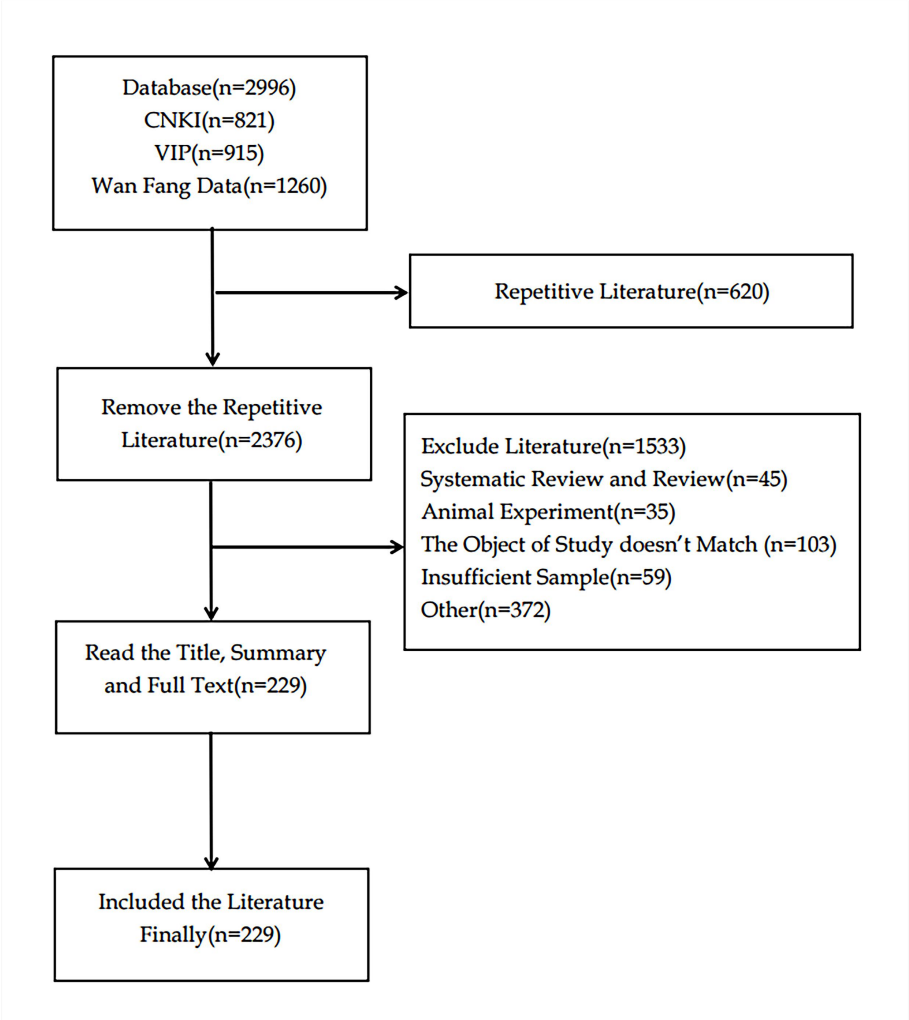

Figure 1 The Flow chart of literature screening

Table 1 The frequency of acupoints analysis for treatment of lung diseases

Ranking	Acupoint	Frequency	Support (%)
1	Feishu (BL 13)	209	20.19
2	Tiantu (CV 22)	128	12.37
3	Danzhong (CV17)	111	10.72
4	Dingchuan (EX-B1)	107	10.34
5	Dazhui (GV 14)	82	7.92
6	Shenshu (BL 23)	68	6.57
7	Pishu (BL 20)	59	5.70
8	Geshu (BL 17)	43	4.15
9	Gaohuang (BL 43)	42	4.06
10	Zusanli (ST 36)	34	3.29
11	Xinshu (BL 15)	24	2.32
12	Fengmen (BL 12)	20	1.93
13	Shenque (CV 8)	16	1.55
14	Fenglong (ST 40)	13	1.26

Table 2 Acupoint-meridian association for lung diseases

Meridian	Total Frequency of Acupoints		Number of Acupoints	
	Frequency	Percentage (%)	Number	Percentage (%)
Pangguang (Bladder) Meridian	469	45.31	10	21.28
Conception Vessel	274	26.47	7	14.89
Extraordinary Point	107	10.34	1	2.13
Governor Vessel	93	8.99	4	8.51
Wei (Stomach) Meridian	50	4.83	5	10.64
Fei (Lung) Meridian	18	1.74	6	12.77
Pi (Spleen) Meridian	7	0.68	3	6.38
Shen (Kidney) Meridian	6	0.58	2	4.26
Dan (Gallbladder) Meridian	3	0.29	2	4.26
Xinbao (Pericardium) Meridian	3	0.29	1	2.13
Gan (Liver) Meridian	2	0.19	2	4.26
Other	2	0.19	2	4.26
Xin (Heart) Meridian	1	0.10	1	2.13

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Specific acupoint frequency analysis

Table 3 shows the specific points in the AA prescription for LDs. The back-shu points, with a frequency of 406 times, were most frequently used, accounting for 39.23% of the total frequency of the specific points. In ranking order, the top points were BL 13, Shenshu (BL 23), and Pishu (BL 20).

Analysis of the acupoint–location association

Because the function of acupoints is closely related to their location, the analysis of the acupoint–location association could discover the distribution of the used acupoints in the body. Acupoints for LDs were mainly distributed in the back-and-waist and chest-and-abdomen areas. Among areas, back-and-waist had the highest number of acupoints and total application frequency (Table 4).

Systematic clustering analysis

To further understand the rules of acupoint selection for preventing and treating LDs with AA, a systematic cluster analysis of high-frequency acupoints (i.e., those with a frequency of ≥ 10) was carried out. The results indicated that there are four groups: (1) BL 13, CV 22, CV 17, EX-B1, GV 14; (2) Geshu (BL 17), Xinshu (BL 15); (3) BL 23, BL 20, Gaohuang (BL 43), Zusanli (ST 36), Shenque (CV 8); and Fengmen (BL 12), Fenglong (ST 40) (Figure 2).

Table 3 Analysis of the specific points for lung diseases

Types of Specific Acupoint	Total Frequency of Acupoints		Acupoints Selected (Top 3)
	Frequency	Percentage (%)	
Back-Shu Points	406	39.23	Feishu (BL 13), Shenshu (BL 23), Pishu (BL 20)
Crossing Points	263	25.41	Tiantu (CV 22), Dazhui (GV14), Fengmen (BL 12)
Front-Mu Points	137	13.24	Danzhong (CV 17), Zhongfu (LU 1), Guanyuan (CV 4)
Eight Influential Points	120	11.59	Danzhong (CV 17), Zhongwan (CV 12), Taiyuan (LU 9)
Extra Points	107	10.34	Dingchuan (EX-B1)
He-Sea Points	38	3.67	Zusanli (ST 36), Chize (LU 5), Yanglingquan (GB 34)
Luo-Connecting Points	20	1.93	Fenglong (ST 40), Neiguan (PC 6), Lieque (LU 7)
Eight Confluent Points	5	0.48	Neiguan (PC 6), Lieque (LU 7)
Jing-Well Points	5	0.48	Yongquan (KI 1)
Shu-Stream Points, Yuan-Source Points	3	0.29	Taiyuan (LU 9), Shenmen (HT 7), Taichong (LR 3)
Lower He-Sea Points	1	0.10	Yanglingquan (GB 34)
Xi-Cleft Points	1	0.10	Kongzui (LU 6)

Table 4 Acupoint-location association for lung diseases

Location	Total Frequency of Acupoints		Acupoints Selected (Top 3)
	Frequency	Percentage (%)	
Back and Waist	668	64.54	Feishu (BL 13), Dingchuan (EX-B1), Dazhui (GV 14)
Chest and Abdomen	291	28.12	Tiantu (CV 22), Danzhong (CV 17), Shenque (CV 8)
Lower Extremities	59	5.7	Zusanli (ST 36), Fenglong (ST 40), Sanyinjiao (SP 6)
Upper Extremities	11	1.06	Chize (LU 5), Neiguan (PC 6), Lieque (LU 7)
Head and Neck	6	0.58	Fengchi (GB 20), Baihui(GV 20), Renying (ST 9)

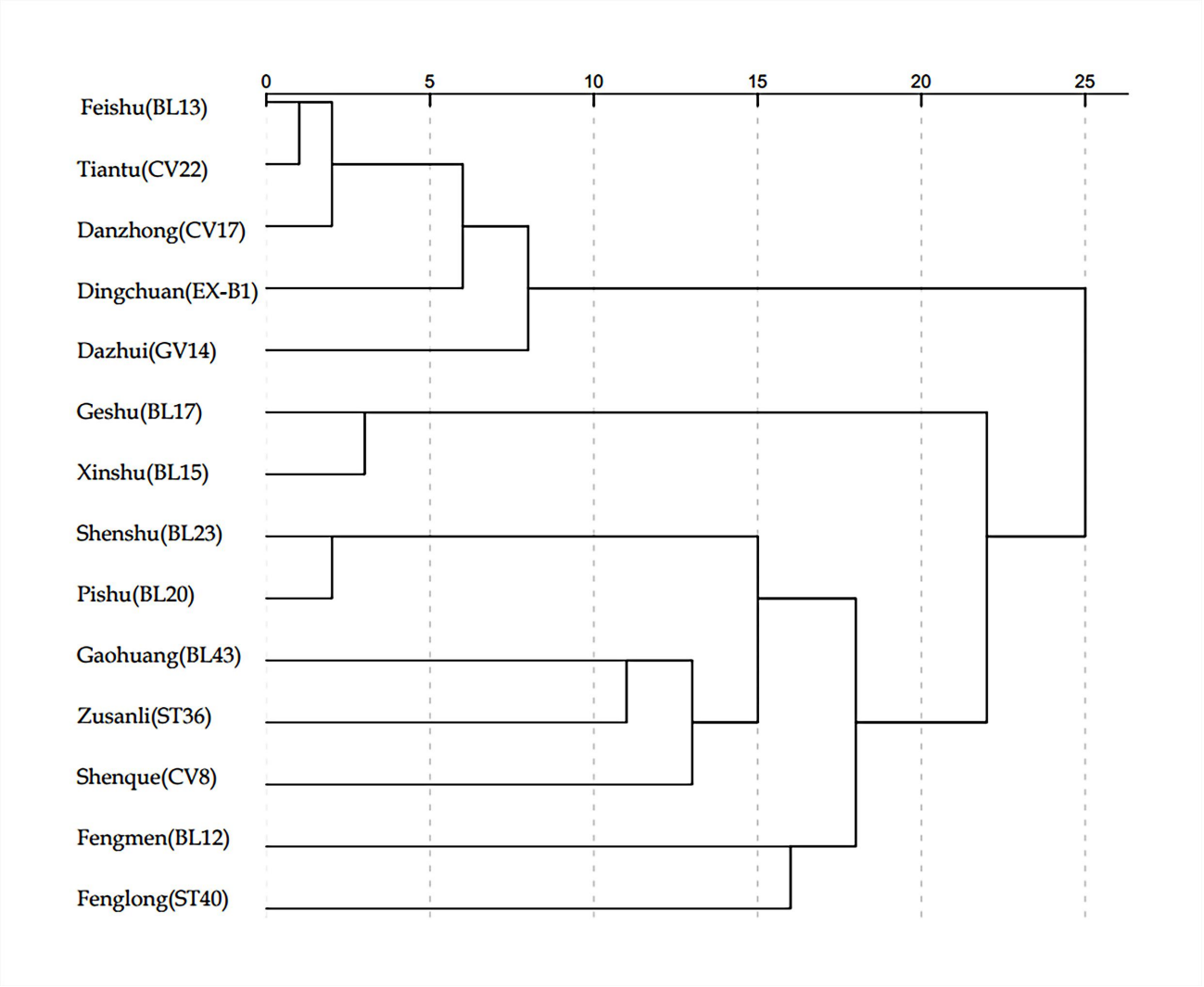

Figure 2 The cluster analysis dendrogram for lung diseases

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Analysis of association rules

The SPSS Modeler 18.0 data-mining software was used to correlate the 14 points with a frequency of at least 10. Figure 3 shows the results of the correlation analysis. The thicker the connection line, the stronger the association strength. BL 13, CV 17, and CV 22 were most strongly associated with each other, and as compared with other points, these three points also had a greater association strength with other points.

The association analysis is to reveal the rules for acupoints matching for AA in LDs. Fifteen association rules were devised using the Apriori algorithm, among which BL 13–GV 14–EX-B1 had the highest confidence, and BL 13 and CV 22 were the most popular match (Table 5). According to the theory of meridians and acupoints, front–back acupoint matching was used the most.

Discussion

Etiology and pathogenesis of LDs

LDs are mostly attacked by exogenous pathogenic factors, improper diet, emotional damage, and weakness due to chronic disease, mainly reflecting decreased lung and respiratory function, abnormal water and fluid transportation and distribution, and dysfunctional defense of external pathogenic factors, among others. They may also include a series of diseases involving the heart, spleen, liver, kidneys, bladder, large intestine, and zang-fu viscera [13]. Yi Guan states that "the lung is an organ for Qingxu. Anything (such as water, dampness, phlegm or foreign bodies) in the lungs will cause the cough" [14]. Plain Questions Tai Yin and Yang Ming theory says that "if a patient catches a cold, his/her upper body may be affected" [15]. This theory has shown that the physiological and pathological characteristics of the lung click with LDs occurrence and development. The treatment is always to release the lung and dispel the pathogenic factors while considering other symptoms and replenishing and restoring pulmonary qi.

Clinical acupoints selection of AA

Our study suggests that the most commonly used acupoints for the prevention and treatment of LDs by AA are BL 13, CV 22, CV 17, EX-B1, GV 14, BL 20, and BL 23, whereas the most involved acupoints are on the Pangguang (Bladder) meridian, involving Conception and Governor vessel. The branch of the Pangguang (Bladder) meridian runs downward along the medial border of the scapular region, parallel to the vertebral column, passing Dazhu (BL 11), BL 12, BL 13, and other acupoints. This is a barrier to the body and the first line of resistance to exogenous pathogenic-qi. It can also regulate the function of organs corresponding to the meridians, to resist the invasion of pathogenic factors, preventing them from reaching the lungs. Conception Vessel passes through Guanyuan (CV 4) and other points to the throat; Governor Vessel runs posteriorly along the interior side of the spinal column to Fengfu (GV 16). Their commonly used points, such as CV 17, CV 22, GV 14, and so forth, are on the surface reflection of the lung and trachea. Evidence from above reveals indication rules that the indications of points extend to where their pertinent meridians reach.

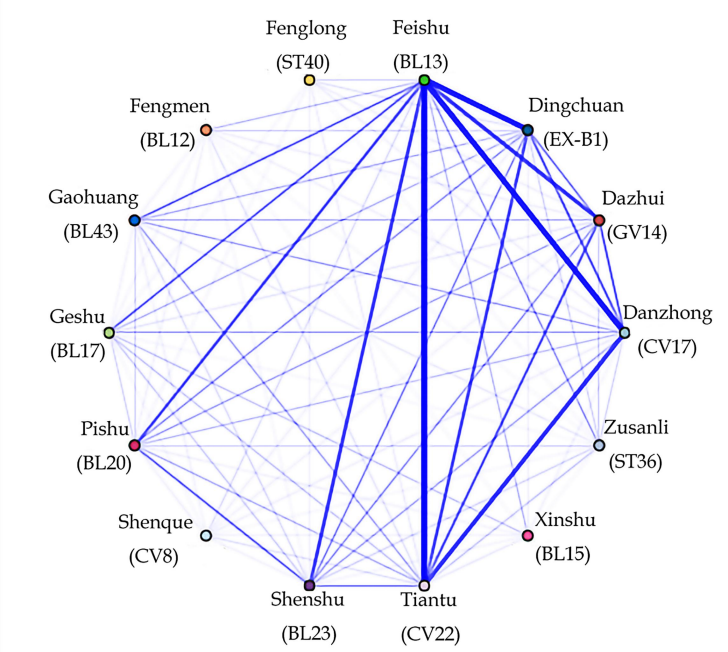

Figure 3 The frequently used points for lung diseases

Table 5 Acupoints matching for lung diseases

Ranking	Consequent Acupoint	Antecedent Acupoint	Instances	Support (%)	Confidence (%)
1	Feishu (BL 13)	Dazhui (GV 14) - Dingchuan (EX-B1)	37	16.16	100.00
2	Feishu (BL 13)	Dazhui (GV 14) - Danzhong (CV 17)	46	20.09	97.83
3	Feishu (BL 13)	Geshu (BL 17)	43	18.78	97.67
4	Feishu (BL 13)	Pishu (BL 20) - Shenshu (BL 23)	40	17.47	97.50
5	Feishu (BL 13)	Shenshu (BL 23)	68	29.69	97.06
6	Feishu (BL 13)	Dingchuan (EX-B1)	107	46.72	96.26
7	Feishu (BL 13)	Gaohuang (BL 43)	42	18.34	95.24
8	Feishu (BL 13)	Dingchuan (EX-B1) - Tiantu (CV 22)	60	26.20	95.00
9	Feishu (BL 13)	Pishu (BL 20)	59	25.76	94.92
10	Feishu (BL 13)	Dingchuan (EX-B1) - Danzhong (CV 17)	48	20.96	93.75
11	Feishu (BL 13)	Danzhong (CV 17)	111	48.47	93.69
12	Feishu (BL 13)	Danzhong (CV 17) - Tiantu (CV 22)	79	34.50	93.67
13	Feishu (BL 13)	Tiantu (CV 22)	128	55.90	91.41
14	Feishu (BL 13)	Dazhui (GV 14)	82	35.81	90.24
15	Feishu (BL 13)	Dazhui (GV 14) - Tiantu (CV 22)	49	21.40	89.80

From the point of view of the distribution of points, most were on the back–waist and chest–abdomen. This shows that the main clinical selection of the Conception–Governor vessel and Pangguang (Bladder) meridian points on the chest, shoulder, and back, core points on the local, reflecting the local and adjacent therapeutic effects, for which the saying "treat the disorders of points local and adjacent locations" applies, based on dialectical theory. From the specific acupoints, the styles of back-shu, crossing points, front-mu, and eight influential points are commonly used. As Plain Questions says, "The back-shu points are indicated in diseases of the corresponding zang-fu organs." Thus, among the specific points, the back-shu points are the most frequently used, and they indicate that most nerve grafts are located in the range of relevant internal organs and coincide roughly with the characteristics of spinal nerve segmental distribution. Stimulation of the back-shu point can act directly on the autonomic nerve center of the corresponding segment of the spinal cord, to adjust visceral function and realize the benign regulatory effect on internal organs and the whole body [16, 17].

The high-frequency acupoints (i.e., whose frequency

was ≥10) were categorized into four groups. On one hand, selected BL 13, CV 22, CV 17, EX-B1, and GV 14 were shown to tonify the lung and replenish qi, strengthening the body's surface resistance and eliminating pathogenic-qi; BL 15, BL 17, BL 20, and BL 23 were chosen to enrich the blood and benefit vital energy or invigorate qi and blood, emphasizing the theory of lung as qi and blood organ from clinical practice [18] and providing additional ideas for treating LDs.

The association analysis finds that BL 13, CV 22, CV 17, EX-B1, and GV 14 constituted the core prescription for clinical AA to prevent and treat LDs and highlighted the core position of BL 13 in AA for LDs. The association rules displaying the compatibility of distant and near acupoints could be considered when necessary to realize the process of propagated sensation along the meridian and dredge meridians and regulate the flow of qi and blood, enhance the synergistic effect of points compatibility, and improve the clinical therapeutic effects [19]. Applying the above points in turn can alleviate the local skin irritation caused by applying drugs in clinical practice, avoiding points of "fatigue" causing the "refractory period" to influence curative effect [20]. Combining organically with a variety of points-matching methods that cooperate with the theory, method, prescription, acupoint, and technique, so that the meridians and collaterals can play a multiaspect, multilinked, and multichannel regulating role in the diseased organs and systems, yin and yang maintain a dynamic equilibrium [21]. This is the fundamental purpose of selecting acupoints based on syndrome differentiation.

In addition, this study uses data-mining technology to analyze the modern clinical acupoint selection rules of AA in the treatment of LDs. The results are consistent with the acupoint selection of acupuncture intervention for COVID-19 in the Guidelines for COVID-19 Acupuncture Interventions (second edition) [22] issued by the Chinese Acupuncture Society. AA can improve the effectiveness of individuals' resistance to 2019-nCov by enhancing their resistance and immunity. The "long-tail effect" of the epidemic in the post-epidemic era depends on vaccine research and development and vaccination. Meanwhile, multitherapy, multichannel, prevention, diagnosis, treatment, and rehabilitation should not be abandoned. Reasonable AA, and points is plused or minused according to the different syndromes, may improve an individual's body immunity and coordinate yin and yang, which is conducive to helping patients recover and improve personal health, to meeting the long-term prevention and control requirements of the epidemic, and to better demonstrating the diversity and effectiveness of methods of traditional Chinese medicine treatment for the prevention and treatment of epidemics.

Problems and prospects

This study used data-mining methods to analyze the clinical literature on the prevention and treatment of LDs by AA, summarizing the application rules of acupoints and meridians for LDs. It provides a certain reference for the clinical practice for LDs, including COVID-19. However, this study also has some shortcomings. The included literature did not include foreign literature, and the studies included comprehensive AA therapy combined with other treatments. Thus, further research is needed regarding the efficacy of AA for the prevention and treatment of LDs. We did not evaluate the quality of the included studies, which might have caused bias about the published results. We might have missed some studies in our database search, which could have affected the results. Moreover, in the correlation analysis, we included only those acupoints used at a frequency of at least 10 times and thus might have missed some of the information. We hope that in future data research, we will select a curative effect index that can objectively reflects the real world and conduct a comprehensive study of acupoints including high-frequency acupoints with deeper-mining data, to find more hidden regulations and provide better definitive evidence for the further promotion and application of AA.

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