

Analysis on Medication Rules of Traditional Chinese Medicine for Postpartum Abdominal Pain

Xiao Liu¹, Yue-Lei Qing¹, Shuang Huang¹, Chun-Jie Li¹, Wen-Li Luo¹, De-Mei Jiang¹, Tao Yu^{2*}

¹the first clinical medical college of Yunnan University of Chinese Medicine, Yunnan Kunming, 650000;

²Department of Gynecology, the First People's Hospital of Yunnan Province, Yunnan Kunming, 650000

*Corresponding to: Tao Yu, Department of Gynecology, the First People's Hospital of Yunnan Province, No. 157, Jinbi Road, Xishan District, Yunnan Province, China, 650000. E-mail: 1041685376@qq.com.

Author contributions

Xiao Liu performed the data reductions and wrote the manuscript; Yue-Lei Qing and Shuang Huang performed the data analyses; Chun-Jie Li and Wen-Li Luo helped perform the analysis with constructive discussions; De-Mei Jiang and Tao Yu contributed to the conception of the study.

Competing interests

The authors declare no conflicts of interest.

Abbreviations

CNKI, China National Knowledge Infrastructure.

CBM, China Biology Medicine disc.

TCM, Traditional Chinese Medicine.

Citation

Liu X; Qing YL; Huang S; Li CJ; Luo WL; Jiang DM; Yu T. Analysis on Medication Rules of Traditional Chinese Medicine for Postpartum Abdominal Pain. Med Data Min. 2022;5(1):1. doi: 10.53388/MDM20220206001.

Executive editor: Xiao-Lan Zhang.

Received: 22 September 2021; Accepted: 10 October 2021;

Available online: 10 February 2022.

© 2022 By Author(s). Published by TMR Publishing Group Limited. This is an open access article under the CC-BY license. (<http://creativecommons.org/licenses/by/4.0/>)

Abstract

Background: To explore the medication rules in traditional Chinese medicine for treating postpartum abdominal pain by using data mining technology. **Methods:** First, according to inclusion and exclusion criteria, the prescriptions for treating postpartum abdominal pain were collected and screened by referring to the Dictionary of Traditional Chinese Medicine Prescriptions, CNKI, Wanfang, Vip database, Chaoxing database, CBM and other databases. Then, the traditional Chinese medicinal materials were analyzed by ancient and modern medical cases cloud platform. **Results:** 295 first prescriptions were included, involving 248 kinds of traditional Chinese medicine, and the usage frequency of traditional Chinese medicine reached 2,189 times. The efficacy of the top 22 herbs with the highest use frequency is mainly tonic drugs and drugs for promoting blood circulation and removing blood stasis, mainly with the nature of warmness and spiciness, and the channel tropisms mainly include liver meridians, spleen meridians, and heart meridians. The association rule analysis shows 17 high-frequency traditional Chinese medicine combinations with the support ≥ 0.1 and the confidence ≥ 0.8 . Three new drug combinations were obtained through cluster mining; both of them took supplementing qi and nourishing blood, promoting blood circulation, and removing stasis as the main treatments. **Conclusions:** The basic principle of treatment is strengthening the body resistance to eliminate pathogenic factors. Therefore, when treating postpartum abdominal pain to promote postpartum recovery, it mainly combines the drugs for benefiting Qi and nourishing blood, invigorating blood circulation, and eliminating stasis.

Keywords: Data mining; Postpartum abdominal pain; Traditional Chinese medicine; Medication rules

I. Introduction

Postpartum abdominal pain refers to the abdomen pain related to the period of childbirth or puerperium. It is also called "afterpains", "afterpains in abdominal part", "postpartum abdominal pain" and so on. The pain of most patients disappeared naturally for 2-3 days, but for pregnant women, the strong pain will accompany them for a long period, which seriously affected their quality of life [1]. Western medicine believes that postpartum abdominal pain is caused by the continuous spasm of uterine contractions which leads to poor blood supply within the uterine wall, ischemia, and hypoxia in local tissues, compression of nerve fibers, and finally produces continuous severe pain [2] while traditional Chinese medicine is effective in treating postpartum abdominal pain which is safe and cheap [3]. The Dictionary of Traditional Chinese Medicine Prescriptions [4] is a set of books with a large scale of prescriptions mainly edited by professor Peng Huairan and other experts. It collects and sorts out more than 1,800 kinds of famous prescriptions from traditional Chinese medicine literature related to the period from the Qin and Han dynasties to the end of 2010. Based on ancient Chinese medical books and modern literature, this study systematically summarized the treatment of postpartum abdominal pain by traditional Chinese medicine using the cloud platform of ancient and modern medical records, aiming to provide a reference for clinical treatment of postpartum abdominal pain.

II. Material and Methods

Sources of related materials

The author, according to the index of indications in the appendix of "Dictionary of Traditional Chinese Medicine Prescriptions" collected Chinese medicine prescriptions for postpartum abdominal pain and use "Postpartum abdominal pain" + "Chinese medicine/integrated Chinese and Western medicine" as keywords to search CNKI, Wanfang, Vip database, Chaoxing data base, CBM and other eight Chinese databases to obtain relevant documents from the establishment of the database to December 31, 2020

The criteria of inclusion and exclusion

The criteria of inclusion

1) The literature states that people clearly diagnosed as having postpartum abdominal pain could use medicinal herbs for oral administration as a treatment method; 2) treating postpartum abdominal pain by using traditional Chinese medicine proves to be effective in the modern literature ($p < 0.05$); 3) repetitive articles or identical prescriptions are only included in the oldest literature; 4) the information of TCM prescriptions is perfect, and the compositions of prescriptions are complete.

The criteria of exclusion

1) Someone was diagnosed with non-postpartum abdominal pain in the literature; 2) someone was clinically determined to be ineffective in the modern literature ($p > 0.05$); 3) the literature on curative effect observation taking Western medicine and Chinese patent medicine as the main part; 4) the literature derives from pure animal experiment, reviews, individual cases, ethnic minority medicines, noted doctors' experiences and empirical theories; 5) the literature merely has no original documents; 6) the prescription information is absent, the prescription composition is repeated, and the medicinal herbs are used externally.

Data input and processing

The establishment of the database: a double person entry method was used, according to the above-mentioned relevant criteria to extract information such as the name of the source literature, the name of the formula, the composition of the formula as well as the number of drugs into the excel and to proofread the data, ensuring

that the accuracy rate of data entry was 100%.

Data pre-processing: the expression of TCMs differed because the data originated from different times and spaces, so as to facilitate statistical analysis of the data, according to the 2020 edition of *Pharmacopoeia of the People's Republic of China* [5] and *Chinese pharmacy* edited under the guideline of 13th Five-Year Plan [6], the names of Chinese medicinal herbs were standardized. Such as "Yuanhuso (Rhizoma Corydalis, RC)" is unified as "Rhizoma Corydalis", "Nvwei (Clematis Apiifolia, CA)" is unified as "Yuzhu (Polygonatum Odoratum, PO)", and "Baidoukou (Amomum Cardamomum, AC)" is unified as "Doukou (Amomum Kravanh, AK)", etc.

Statistical analysis

The data analysis software is the "ancient and modern medical case cloud platform (v2.3.9)" provided by the China Academy of Chinese Medical Sciences, which can analyze data through the module functions of "attributes of Chinese herbs", "association analysis" and "cluster analysis" of the platform [7].

Analysis of the frequency

The frequency of all herbs contained in the prescriptions of module attributes provided by the "ancient and modern medical case cloud platform" was exported in descending order.

Rules of association analysis

The Apriori algorithm provided by the ancient and modern medical record cloud platform has been used to analyze the relationship between drugs. The module is equipped with support, confidence, and promotion to describe the obtained rules. The support represents the occurrence frequency of the rules, and the confidence is the occurrence's probability of the subsequent items of the rules when the previous items of the rules appear, which can reflect the credibility of the rules. The degree of promotion reflects the degree of association between traditional Chinese medicines contained in the rules. The degree of promotion > 1 , and the greater the degree of promotion, the stronger the association between a and b [8]. Therefore, considering these three indexes at the same time can better tap the combination rules of common drugs.

Cluster analysis

Clustering by adopting the complex systematic entropy of cluster analysis from the ancient and modern medical case cloud platform; improving entropy mutual information method and unsupervised entropy hierarchical clustering analysis [9]; finding out the hidden rules among drugs and new herbal combinations by selecting the appropriate distance type and clustering method according to the sample size.

III. Results

After searching and screening, 295 prescriptions were obtained in total. The prescriptions include classical prescriptions and draw-up prescriptions and Chinese medical herbs include Chinese material medical decoction, powders, formula granules, and hospital formulations.

Distribution of high-frequency drug use

The statistical results show that there were 248 kinds of Chinese medicinal herbs involved. The use frequency of Chinese herbs is 2,189 times. The use frequency ≥ 31 is Danggui (Angelica Sinensis, AS), Chuanxiong (Chuanxiong Rhizome, CR), Gancao (Licorice Root, LR), Taoren (Peach Kernel, PK), Guizhi (Cassia Twig, CT), etc, containing 22 herbs in total. The use frequency of the above herbs reaches 1,271 times occupying 58.06% of the total use frequency (2,189 times).

Table 1: Distribution of high-frequency herbs for treating postpartum abdominal pain

No.	Herbs	Frequency (Times)	Use frequency compared to total prescriptions (%)	Use frequency compared to total herbs (%)	Accumulated frequency (%)
1	Angelica Sinensis	213	72.20%	9.73%	9.73%
2	Chuanxiong rhizome	116	39.32%	5.30%	15.03%
3	Licorice root	109	36.95%	4.98%	20.01%
4	Peach kernels	77	26.10%	3.52%	23.53%
5	Cassia twig	76	25.76%	3.47%	27.00%
6	Baishao (White Peony Root, WPR)	63	21.36%	2.88%	29.88%
7	Rhizoma corydalis	60	20.34%	2.74%	32.62%
8	Rougui (Cinnamon)	46	15.59%	2.10%	34.72%
9	Paojiang (Fried Ginger, FG)	45	15.25%	2.06%	36.78%
10	Puhuang (Pollen Typhae, PT)	40	13.56%	1.83%	38.61%
11	Yimucao (Motherwort)	39	13.22%	1.78%	40.39%
12	Chenpi (Tangerine Peel, TP)	39	13.22%	1.78%	42.17%
13	Shengdihuang (Radix Rehmanniae Recen, RRR)	38	12.88%	1.74%	43.91%
14	Chishao (Red Peony Root, RPR)	38	12.88%	1.74%	45.65%
15	Honghua (Safflower)	37	12.54%	1.69%	47.34%
16	Muxiang (Costustoot)	37	12.54%	1.69%	49.03%
17	Ganjiang (Dried Ginger, DG)	36	12.20%	1.64%	50.67%
18	Renshen (Ginseng)	34	11.53%	1.55%	52.22%
19	Huangqi (Astragalus Membranaceus, AM)	33	11.19%	1.51%	53.73%
20	Mudanpi (Moutan Bark, MB)	32	10.85%	1.46%	55.19%
21	Baizhu (Atractylodes Macrocephala Koidz, AMK)	32	10.85%	1.46%	56.65%
22	Moyao (Myrrh)	31	10.51%	1.42%	58.07%

Distribution of efficacy categories of high-frequency drugs

The statistical results show that the efficacy categories of drugs with the use frequency ≥ 31 are classified into seven sorts, including the tonifying deficiency drugs, the drugs for invigorating the circulation of blood, the heat-clearing drugs, and the hemostatic drugs, etc. The accumulated use frequency of the above drugs reached 1,161 times, occupying 53.04% of the total frequency (2,189 times). The statistical results are shown in Table 2.

Statistics of channel tropisms on the nature and flavor of Chinese medicinal herbs

The statistical results show that the drugs with the use frequency ≥ 31 , from high to low, include warm-nature drugs, even-nature drugs, cold-nature drugs, and heat-nature drugs, with four sorts of drugs in total; the cumulative use frequency of the above medicinal drugs are 1,633 times, cumulatively accounting for 74.60% of the drugs with different natures. The use frequency of drugs with five flavors ≥ 31 , ordered from high to low, is spicy drugs, sweet drugs, bitter drugs, and sour drugs which practically include four flavors; the accumulative use frequency of the above drugs reaches 2,534 times, occupying 72.89% of the total use frequency of five-flavor drugs (3,476 times) cumulatively. The use frequency of drugs on channel tropisms is spleen meridian, liver meridian, heart meridian, lung meridian, stomach meridian, kidney meridian, large intestine meridian, gall bladder meridian, pericardial meridian, bladder meridian, and triple energizer meridian from high to low, totally with 11 meridians; the cumulative use frequency of the above meridian drugs is 4,010 times, accounting for 71.55% of the total frequency (5,605 times). From the above results, it can be concluded that the characteristics of postpartum abdominal pain syndrome are mainly expressed as the deficiency and cold of the liver and spleen, and the medication is to calm and warm up. The statistical results are shown in Table 3, Table 4, and Table 5.

Analysis of the rules of formulations based on the association rules

Through the pre-reading data, it is found that when the confidence is low, the compatibility rules of traditional Chinese medicine are complex, and it is difficult to clarify the core formula rules; after gradually increasing the confidence, when the support is 0.1 and the confidence is 0.8, it can better reflect the potential compatibility rules of traditional Chinese medicine; Through complex network analysis, when the confidence is 0.9 and using network view, we can more intuitively understand the core traditional Chinese medicine of prescriptions [10]. The statistical results are shown in Table 6 and Figure 1.

New drugs' combinations based on unsupervised entropy hierarchical clustering analysis

The research on the compatibility rules of traditional Chinese medicine is to find a more effective prescription combination in clinical medication. Therefore, selecting the lance distance from the cluster analysis algorithm and the long-distance method from different distance types, then analyzing the data of traditional

Chinese medicine with the frequency ≥ 37 times to obtain tree chart 2. The abscissa in the figure represents the corresponding traditional Chinese medicine variables, and the ordinate represents the "distance" between traditional Chinese medicine. When interpreting the tree chart, traditional Chinese medicine with a small "distance" is classified into one category. The larger traditional Chinese medicines with longer distances are classified into different categories. At the same time, the distance can be used to evaluate the homogeneity of the obtained drug collection, that is, the shorter the "distance" the closer the relationship between the two drugs [11-12]. Combined with the rules of traditional Chinese medicine prescriptions and the results of cluster analysis, when the distance reaches 100, three new drug combinations are obtained. The statistical results are shown in Figure 2 and Table 7.

IV. Discussions

Postpartum abdominal pain is a common postpartum disease, the disease was firstly recorded in "*Synopsis of Prescriptions of the Golden Chamber-Combined Treatment of Postpartum Diseases and Pulses for Women*" [13] " Postpartum abdominal pain...". Regarding its etiology and pathogenesis, the physicians from the past dynasties mainly differentiated treatments from the aspects of deficiency of Qi and blood, blood stasis, chill, etc. Wan Quan from the Ming dynasty said in "*Wan's Gynecology · The Chapter of Postpartum*" [14]: "There is a lump in the abdomen... which is caused by blood gathering before childbirth and Qi deficiency after it..."; Shen Youpeng from the Qing dynasty deems that "blood deficiency, blood stasis, and cold..." would cause postpartum abdominal pain stated in *Shen's Gynecology*. Parturient women often lose blood and Qi during childbirth, they would be weak after childbirth. Sometimes they might be negative and suffer the pathogenic factors mainly causing the poor circulation of Qi and blood, the insufferable pain if Qi and blood circulation are diminished and the insufferable pain due to the blocking during the circulation of Qi and blood. Based on the above data, the author will make the following discussions under the rules of medications for postpartum abdominal pain.

Drug frequency analysis

It can be seen from Table 1 that the top 7 Chinese medicinal herbs commonly used in the clinical treatment of postpartum abdominal pain: Angelica Sinensis, Chuanxiong Rhizome, Licorice Root, Peach

Table 2: Distribution list for classifying the drugs' efficacy for treating postpartum abdominal pain

No.	Efficacy of TCM(s)	Numbers of TCM(s)	Frequency (times)	Use frequency of TCM (%)	Accumulated frequency (%)	Names of herbs
1	Tonify deficiency drugs	6	484	22.11%	22.11%	Angelica Sinensis , Licorice Root, Ginseng, White Peony Root, Astragalus

						Membranaceus, Atractylodes Macrocephala Koidz
2	Blood-activating and stasis-eliminating drugs	6	360	16.45%	38.56%	Chuanxiong Rhizome, Rhizoma Corydalis, Peach Kernels, Safflower,Motherwort, Myrrh
3	Heat-clearing and blood-cooling drug	3	108	4.93%	43.49%	Radix Rehmannia Recen, Red Peony Root, Moutan Bark
4	Hemostatic drugs	2	85	3.88%	47.37%	Pollen Typhae, Fried Ginger
5	Interior-warming drugs	2	82	3.75%	51.12%	Cinnamon, Dried Ginger
6	Qi-regulating drugs	2	76	3.47%	54.59%	Tangerine Peel, Costustoot
7	Drugs for relieving exterior disorder	1	76	3.47%	58.06%	Cassia Twig

Table 3 : Table of drug classification distribution for treating postpartum abdominal pain

No.	Nature of TCM(s)	Numbers of TCM(s)	of Frequency	Use frequency (%)	Accumulative use frequency (%)	Names of herbs
1	Warm	10	677	31.71%	31.71%	Angelica Sinensis, Ginseng, Astragalus Membranaceus, Atractylodes Macrocephala Koidz, Chuanxiong Rhizome, Rhizoma Corydalis, Safflower, Tangerine Peel, Costustoot , Cassia Twig
2	Even	4	257	12.04%	43.75%	Licorice Root, Peach Kernel, Myrrh, Pollen Typhae
3	Cold	5	210	9.84%	53.59%	White Peony Root, Motherwort, Radix Rehmanniae Recen, Red Peony Root, Moutan Bark
4	Heat	3	127	5.95%	59.54%	Fried Ginger, Cinnamon, Dried Ginger

Table 4: Classification distribution table of drugs' flavors for treating postpartum abdominal pain

No.	Flavors of TCM(s)	Numbers of TCM(s)	of Frequency (times)	Use frequency (%)	Accumulative use frequency (%)	Names of herbs
1	Spicy	13	807	23.22%	23.22%	Angelica Sinensis, Chuanxiong Rhizome, Rhizoma Corydalis, Safflower, Motherwort, Myrrh, Moutan Bark, Fried Ginger, Cinnamon, Dried Ginger, Tangerine Peel, Costustoot, Cassia Twig
2	Sweet	10	698	20.08%	43.30%	Angelica Sinensis, Licorice Root, Ginseng, Astragalus Membranaceus, Atractylodes Macrocephala Koidz, Peach Kernel, Radix

3	Bitter	11	482	13.87%	57.17%	Rehmanniae Recen, Pollen Typhae, Cinnamon, Cassia Twig Ginseng, White Peony Root, Atractylodes Macrocephala Koidz, Rhizoma Corydalis, Peach Kernel, Motherwort, Myrrh, Red Peony Root, Moutan Bark, Tangerine Peel, Costustoot
4	Sour	1	63	1.81%	58.98%	White Peony Root

Table 5 Classification distribution table of channel tropism for treating postpartum abdominal pain

No.	Channel tropism of TCM(s)	Numbers of TCM(s)	Frequency (times)	Use frequency (%)	Accumulative use frequency (%)	Names of herbs
1	Liver	13	830	14.81%	14.81%	Angelica Sinensis, White Peony Root, Chuanxiong Rhizome, Rhizoma Corydalis, Peach Kernel, Safflower, Motherwort, Myrrh, Rehmannia Glutinosa, Red Peony Root, Moutan Bark, Pollen Typhae, Cinnamon
2	Spleen	13	778	13.88%	28.69%	Angelica Sinensis, Licorice Root, Ginseng, White Peony Root, Astragalus Membranaceus, Atractylodes Macrocephala Koidz, Rhizoma Corydalis, Myrrh, Fried Ginger, Cinnamon, Dried Ginger, Tangerine Peel, Costustoot
3	Heart	11	729	13.01%	41.70%	Angelica Sinensis, Licorice Root, Ginseng, Peach Kernel, Safflower, Myrrh, Radix Rehmannia Recen, Moutan Bark, Cinnamon, Dried Ginger, Cassia Twig
4	Lung	6	327	5.83%	47.53%	Licorice Root, Ginseng, Astragalus Membranaceus, Dried Ginger, Tangerine Peel, Cassia Twig
5	Stomach	5	256	4.57%	52.10%	Licorice Root, Atractylodes Macrocephala Koidz, Fried Ginger,

6	Kidney	6	231	4.12%	56.22%	Dried Ginger, Costustoot Ginseng, Radix Rehmanniae Recen, Moutan Bark, Fried Ginger, Cinnamon, Dried Ginger
7	Pericardium	3	195	3.48%	59.70%	Chuanxiong Rhizome, Motherwort, Pollen Typhae
8	Gallbladder	2	153	2.73%	62.43%	Chuanxiong Rhizome, Costustoot
9	Bladder	2	115	2.05%	64.48%	Motherwort, Cassia Twig
10	Large intestine	2	114	2.03%	66.51%	Peach Kernel, Costustoot
11	Triple energizers	1	37	0.66%	67.17%	Costustoot

Table 6 : Association rules table for the treatment of postpartum abdominal pain drugs

No	Association rules	Frequency(times)	Support	Confide	Enhancement	
.	Former term	Latter term		nce		
1	Chuanxiong Rhizome	Angelica Sinensis	111	0.38	0.96	1.33
2	Licorice Root	Angelica Sinensis	93	0.32	0.85	1.18
3	Peach Kernel	Angelica Sinensis	68	0.23	0.88	1.22
4	Cassia Twig	Angelica Sinensis	64	0.22	0.84	1.16
5	White Peony Root	Angelica Sinensis	54	0.18	0.86	1.19
6	Rhizoma Corydalis	Angelica Sinensis	52	0.18	0.87	1.2
7	Fried Ginger	Angelica Sinensis	41	0.14	0.93	1.29
8	Cinnamon	Angelica Sinensis	40	0.14	0.87	1.2
9	Fried Ginger	Chuanxiong Rhizome	40	0.14	0.91	2.31
10	Pollen Typhae	Angelica Sinensis	37	0.13	0.93	1.29
11	Fried Ginger	Licorice Root	36	0.12	0.82	2.22
12	Motherwort	Angelica Sinensis	34	0.12	0.87	1.2
13	Red Peony Root	Angelica Sinensis	33	0.11	0.87	1.2

14	Safflower	Angelica Sinensis	32	0.11	0.86	1.19
15	Astragalus Membranaceus	Angelica Sinensis	31	0.11	0.94	1.3
16	Dried Ginger	Angelica Sinensis	30	0.1	0.83	1.15
17	Ginseng	Angelica Sinensis	29	0.1	0.85	1.18

Table 7: Summarizing new drugs' combinations for the treatment of postpartum abdominal pain based on cluster analysis

No.	Combinations of new drugs
1	Angelica Sinensis
2	Chuanxiong Rhizome, Licorice Root, Peach Kernel, Cassia Twig, White Peony Root, Rhizoma Corydalis
3	Cinnamon, Fried Ginger, Pollen Typhae, Motherwort, Tangerine Peel, Radix Rehmannia Recen, Red Peony Root, Safflower, Costustoot

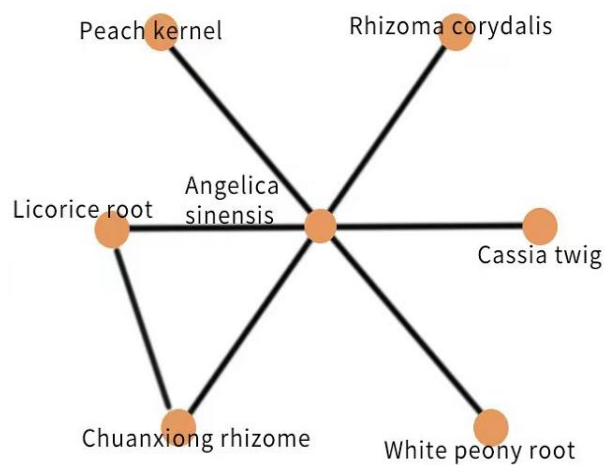


Figure 1: Network diagram of core traditional Chinese medicine for the treatment of postpartum abdominal pain

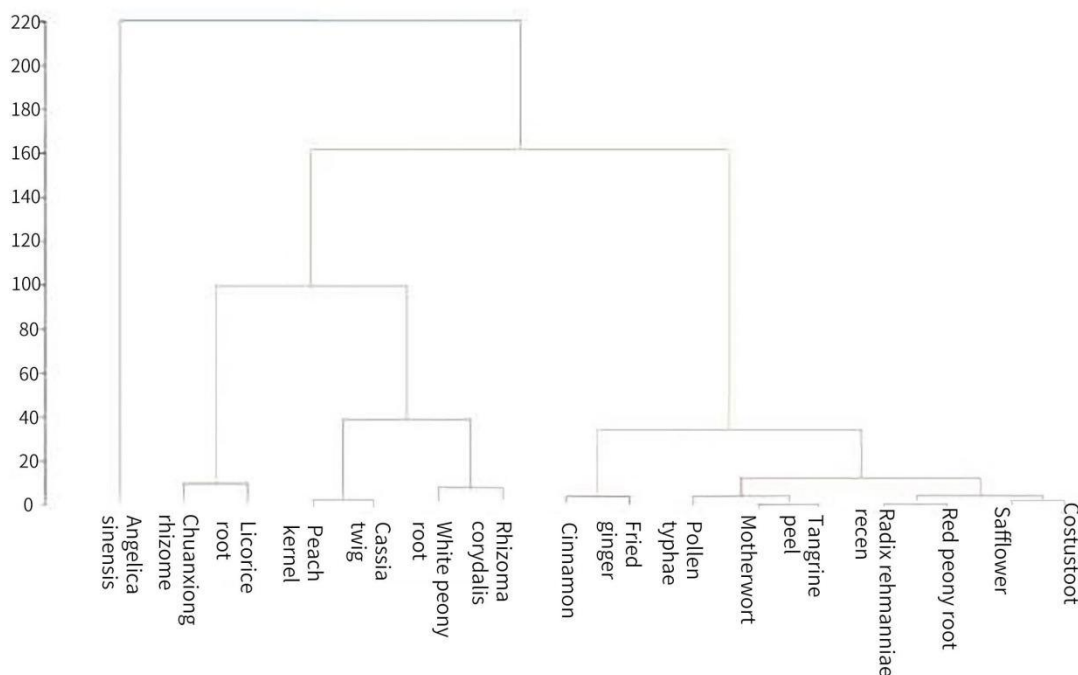


Figure 2: New drug combinations based on cluster analysis

Kernel, Cassia Twig, White Peony Root, and Rhizoma Corydalis, accounting for more than 20% of the prescriptions' use frequency. That is taking Four Herbs Decoction of Peach Kernels as the basic prescription, then adding or subtracting the use of other herbs. Four Herbs Decoction of Peach Kernels comes from *Wan's Gynecology*, which is a classic prescription used for benefiting Qi, nourishing blood, promoting blood circulation, and removing blood stasis. Among them, Angelica Sinensis and White Peony Root nourish the blood, promote blood circulation, regulate menstruation, and relieve pain; "*Chinese Materia Medica*" says: "Angelica Sinensis... is capable of nourishing blood, but also can make blood...it is also the holy medicine in blood". *Analogizing Chinese Medicines with Natural Phenomenon* says "White Peony Root is the holy medicine for treating abdominal pain". Chuanxiong Rhizome and Rhizoma Corydalis promote the circulation of blood and Qi, then relieve pain; "*Compendium of Materia Medica*" says: "Chuanxiong Rhizome is a medicine for promoting blood and Qi", "Rhizoma Corydalis promotes the circulation of stagnated Qi and blood. Licorice Root nourishes the spleen and nourishes Qi, clears away heat, and detoxifies. The Peach Kernel promotes blood circulation and removes blood stasis, and "*Discovering the Origins of Herbs(Bencaofengyuan)*" states that it is a special medicine for treating blood stasis and blood closure. Cassia Twig warms the meridians, helps the circulation of warmth, and transforms Qi. "*Sheng Nong's Herbal Classics*" says that "stagnation and uncomfortable of patients can be decreased and expelled", which is constant with the understanding of the etiology and pathogenesis of postpartum abdominal pain from Chinese medicine.

Efficacy analysis of the four Qi, five flavors, and the channel tropism of the drugs.

It can be seen from Table 2, Table 3, Table 4, and Table 5 that the classification of high-frequency traditional Chinese medicine reflects the characteristics of treating postpartum abdominal pain mainly with drugs for supplementing Qi and nourishing blood, promoting blood circulation, and removing blood stasis, supplemented by drugs for clearing heat and cooling blood. The

proportion of four Qi mainly reflects the characteristics of temperature and cold and flat. The proportion of five flavors is the largest among spicy, sweet, and bitter drugs. The results show that traditional Chinese medicine mainly belongs to liver meridian, spleen meridian and heart meridian. The liver likes a sea of blood, which is the main function of dispersing and storing blood, regulating the Qi. "*Miraculous Pivot--Meridian Vessel*"[15] "states that "the upper tarsus of the foot is low, the medial side of the dorsum of the foot is high, and the lateral side is low, ...after passing through the vagina, it enters the abdomen..., the spleen is the foundation for people, women will be weak after childbirth. They should be based on strengthening the spleen, supplementing Qi, consolidating and protecting healthy Qi, so as to activate the biochemistry of Qi and blood." *Theory of Spleen and Stomach*. *Theory of the Rise and Fall of the Spleen and Stomach* all diseases are caused by the failure of the spleen and stomach", the heart governs the blood, and is the "master of the five internal organs" to regulate the circulation of Qi and blood; and the ancients expressed that "although the new birth is extremely deficient, removing blood stasis is the first meaning" and "postpartum is suitable." The academic thinking is consistent with the principle of nourishing Qi and blood, and the rest of the disease should never be the same.

Drug association rules and cluster analysis

It can be seen from Table 6 that the association table of traditional Chinese medicine combinations also reflects the characteristics of the treatment of nourishing Qi and nourishing blood, promoting blood circulation, and removing blood stasis. "*Fu Qingzhu's Gynecology*" said: "in the blood tonic, the method of removing blood stasis, the blood will not be consumed, and the blood stasis will also be eliminated." The treatment method is consistent. Modern pharmacological studies have also found that Chuanxiong Rhizome-Angelica Sinensis and Licorice Root-Angelica Sinensis can improve microcirculation, by inhibiting the smooth muscle contraction of the uterine, and have anti-inflammatory and analgesic effects. Combined with the complex network displayed in Figure 1, the core traditional Chinese medicines of postpartum

abdominal pain prescriptions, Angelica Sinensis, White Peony Root, Licorice Root to nourish Qi and blood, Rhizoma Corydalis, Peach Kernels, the Chuanxiong Rhizome to promote blood circulation and relieve pain, Cassia Twig can warm meridians, which will be combined with the basic treatment rules of postpartum abdominal pain.

It can be seen from Table 7 that from the analysis of the new prescription combination based on the cluster analysis, the new drug combination 1 is listed below: Angelica Sinensis nourishes blood and promotes blood circulation, regulates menstruation, and relieves pain. This can be applied to the entire disease process. New drug combination 2: White Peony Root and Licorice Root nourish blood and regulate menstruation, replenish spleen and Qi, and relieve pain in a timely manner; Chuanxiong Rhizome, Peach Kernel, and Rhizoma Corydalis are warm in nature, promoting blood circulation and Qi, removing blood stasis and relieving pain; Cassia Twigs warm the meridians and help Yang transform Qi. The combination of various drugs plays the function of warming meridians, activating blood circulation, removing blood stasis, and relieving pain. This prescription can treat patients with cold coagulation and blood stasis syndrome of postpartum abdominal pain. New drug combination 3: Motherwort, Safflower, promoting blood circulation and dredging meridians, dispersing blood stasis and relieving pain; Radix Rehmannia Recen and Red Peony Root can clear away heat and cool blood, disperse blood stasis and relieve pain; Fried Ginger and Pollen Typhae that can relieve pain, remove blood stasis and stop bleeding; Tangerine Peel and Costus root regulate Qi, strengthen the spleen, promote Qi and relieve pain; Cinnamon dispersing cold and relieving pain, warming and dredging meridians. Various drugs mainly enter the liver meridian, which is the pulse of foot Jueyin. Doctors of past dynasties believe that Jueyin disease syndrome is a disease development stage of confrontation between Yin and Yang and crisscross of cold and heat, and cold coagulation and Yang depression is its pathogenesis [16]; if a woman suffers from the syndrome of Jueyin meridian due to postpartum deficiency of healthy Qi, combined with the invasion of external pathogens and their own pathological products, this prescription can be used. All drugs play the functions of clearing heat, cooling blood, warming meridians, and relieving pain which can treat the mixed cold and heat syndrome of postpartum abdominal pain.

V. Conclusions

Through exploring the data on the prescriptions for the treatment of postpartum abdominal pain, this study summarizes and finds the rules of general compositions and potential compatibility relationship among traditional Chinese medicine, and defines the core traditional Chinese medicine for the treatment of postpartum abdominal pain. The compositions are based on the basic principle of strengthening the body resistance to eliminate pathogenic factors, and its medication is mainly used to reinforce Qi and enrich blood, invigorate blood and remove blood stasis, so as to make it strengthen the body resistance to eliminate pathogenic factors, which is conducive to the optimization of modern traditional Chinese medicine prescriptions, In order to better guide the clinical practice. The deficiency of this study lies in the lack of literature data on TCM clinical studies of this disease, and further analysis cannot be carried out. In the future, the rules of drug use of this disease can be further explored through the enrichment of literature data and the development of statistical

methods.

References

1. Tan Y, Deng GP, Feng XL, et al. *Gynecology of Tradit Chin Med*. 2016;215-218.
2. Liu XY, Yuan S, Zeng C, et al. On the treatment of women's pain evidence from Yin and Yang ping debugging in Fu Qingzhu Women's Medicine. *Global Chin Med*. 2020;13(05):843-845.
3. Yu CY, Zheng HW, Yao FX, et al. Analysis of the effect of Chinese medicine acupuncture care on postpartum uterine rejuvenation. *Guangming TCM*. 2018;10(33):3094-3097.
4. Peng HR, Wang XD, Wu CY, et al. *Dictionary of Chin Med Prescriptions*. 2015.
5. National Pharmacopoeia Committee. *Pharmacopoeia of the People's Republic of China (Part I)*. 2020;05.
6. Zhou ZX, Tang DC, Liu XM, et al. *Chin herb med*. 2016;08.
7. Wang W, Li ZH, Jiang SS, et al. A study on the pattern of medicine use in the cream prescription of famous doctor Qin Bowei based on the cloud platform of ancient and modern medical cases. *WTCM*. 2020;15(16):2494-2498.
8. Qi XJ, Zhang ZP, Zhang HZ, et al. Data mining-based analysis of the medication pattern of famous veteran Chinese medicine practitioners in treating infertility. *Chin J of Tradit Chin Med*. 2019;44(7):1491-1496.
9. Hahsler M, Grun B, Hornik K. Arules-a computational environment for mining association rules and frequent item sets. *J Stat Softw*. 2005;14(15):1-25.
10. Qi XJ, Chen YM, Chen GM, et al. Analysis of the grouping pattern of cream prescriptions for menstrual diseases based on data mining. *Chin J of Basic Chin Med*. 2020;26(02):248-253.
11. Li Y, Li R, Ouyang Z, et al. Herb network analysis for a famous tcm doctor's prescriptions on treatment of rheumatoid arthritis. *Evid Bas Comple Alter Med*. 2015;31(09):451-453.
12. Noh JD. Exact scaling properties of a hierarchical network model. *Phys Rev E Stat Nonlin Soft Matter Phys*. 2003;674 pt(2):045103.
13. Zhang ZJ. *Jin Kui Yao Lue*. 2005;02:360-361.
14. Wan Q. *Wan's gynecology*. 2020;03:274-275.
15. Liu HR. *Ling Shu Jing*. 2013;04:206-207.
16. Chen ZY, Li YS, Zhou H, et al. Treating syncretic diseases from the meaning of syncretic yin. *Chin J of Bas Chin Med*. 2017;11(23):1521-1523.