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Acupuncture for Spasmodic Torticollis Selection Based on Complex Network Analysis

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Abstract: *In order to use complex network technology to explore the acupoint selection rules for acupuncture treatment of spasmodic torticollis. We retrieved the relevant clinical research literature of Chinese database CNKI, Wanfang, Weipu and PubMed until August 1, 2023 for acupuncture treatment of spasmodic torticollis, strictly followed the screening criteria, and extracted acupuncture prescriptions. We used Excel to establish a prescription database for acupuncture treatment of spasmodic torticollis, and counted the frequency, meridians and specific acupoints. We used Gephi 0.10.1 to complete complex network modeling, and carried out topology analysis, acupoint colineal network and core acupoint analysis. Resultly, adult spasmodic torticollis (ST) included a total of 26 documents, including 38 acupuncture prescriptions, involving 96 acupuncture points, and the total frequency of acupuncture points was 443 times. The first five high-frequency acupuncture points are Baihui, Fengchi, Shuigou, Tianzhu and Yintang; the first three high-frequency acupuncture points are Baihui-Shuigou, Baihui-Yantang, Shuigou-Yongquan; 36 core acupuncture points such as Baihui, Shuigou, Fengchi, Tianzhu, Taichong, Yongquan and Zusanli were screened through k-core hierarchical analysis. In conclusion, acupuncture treatment of spasmodic torticollis is mainly based on specific acupoints, especially the Five Shu points, mostly using the upper and lower acupoint method and Shu-Mu Acupuncture. Clinical syndrome focuses on syndrome differentiation and treatment, which can provide reference for clinical acupuncture treatment of torticollis.*

Keywords: *Spasmodic torticollis; acupuncture; acupoint selection rules; complex network*

1. Introduction

Spasmodic Torticollis (ST), also known as cervical muscle tonia, is a localized muscle tone disorder, which mainly involves the neck muscles, and is obviously affected by the sternocleiomyoid muscle, trapezius muscle and cervical clip muscle. The epidemiological survey results show that the incidence of spasmodic torticollis in Europe is 5.7/100,000, with more female patients than men, with an average age of 42.9 years for women and 39.2 years for men [1]. At present, Western medicine mainly uses type A botulinum toxin injection [2] and surgical treatment [3], but the treatment effect and recurrence rate have not achieved the desired effect. Traditional Chinese medicine is mainly acupuncture, followed by traditional Chinese medicine and massage. Combined therapy combines acupuncture and acupuncture combined with other therapies (such as small acupuncture, moxibustion, bloodletting, etc.). Although the study of spasmodic torlicollis in traditional Chinese medicine is insufficient in its depth, breadth and dimension, it can be found that the amount of literature on the study of spasmodic torticollis in traditional Chinese medicine has been increasing in the past 30 years. From 1990 to 2020, the number of literature on spasmodic tortic torticollis in traditional Chinese medicine shows a fluctuating growth trend, but compared with other The number of literature in the field of disease research is small, indicating that acupuncture still has a huge space and development prospects for the study of spasmodic torticollis, which is worth in-depth study [4]. This study uses complex network technology to analyze the acupoint selection rule of acupuncture treatment, in order to provide reference for clinical acupoint selection.

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2. Information and methods

2.1. Source of literature

We searched relevant documents in the Chinese database CNKI, Wanfang, Weipu and PubMed with "spasmodic torticollis" and "acupuncture" as the theme words and keywords. The retrieval time was from the establishment of the database to August 1, 2023.

2.2. Literature screening criteria

2.2.1. Incorporated standards

(1) Traditional Chinese medicine or Western medicine clearly diagnose spasmy torticollis; (2) Intervention measures are acupuncture or acupuncture combined with other treatment measures; (3) The prescription of acupuncture points is complete and clear; (4) The acupuncture points are the 14 meridian points and the external points, as well as the empirical effects of clinical evidence.

2.2.2. Exclusion Criteria

(1) Literature combined with other non-acupuncture therapies were excluded, such as western medicine and traditional Chinese medicine; (2) Animal experiments were excluded; (3) Repeatedly published literature were excluded, while we select the most comprehensive researchers; (4) Literature with clinical cases were excluded.

2.3. Literature screening and data extraction

Literature screening: According to the inclusion standards and document arrangement, we used NoteExpress3.9 to remove duplicate literature; researchers first read and initially reviewed the abstract, then read the full text and checked it repeatedly. We imported the data into NoteExpress3.9 and established a corresponding database for literature statistics. The above steps were carried out by two people at the same time, and finally checked each other to ensure that the screened literature was correct and the results were true.

Data management: We established a database, including the title of the article in the index literature, the name of the first author, treatment intervention method, grouping situation, acupuncture point and method, etc. If the selection of acupoint in the literature involved acupoint matching on the basis of the main point, then followed the "one group of main point + one group of acupoint matching point = one prescription" [5]. The method was entered in pieces. We strictly referred to the national standard "Name and Location of Acupoints" (GB /T12346 - 2006) [6], and standardized and corrected the names of acupuncture points contained in the literature.

2.4. Data analysis

Excel is used to count the frequency, meridian, and application of specific acupuncture points included in the literature prescription. On the basis of frequency analysis, complex network technology is used to mine the data, and the data source is imported into the complex network analysis software Gephi0.10.1 to obtain the topology of the complex network. K-core is used to decompose and screen the core acupoints, and analyze the parts, meridians and specific points of the core acupoints.

3. Results

3.1. Literature search results

A total of 227 documents were retrieved, including 217 Chinese documents and 10 English documents. 135 duplicate documents were removed, and the initial screening and re-screening were carried out in strict accordance with the literature screening standards, and 26 articles were finally included. Among them, there are 3 articles in English and 23 articles in Chinese. The document screening process is shown in Figure 1.

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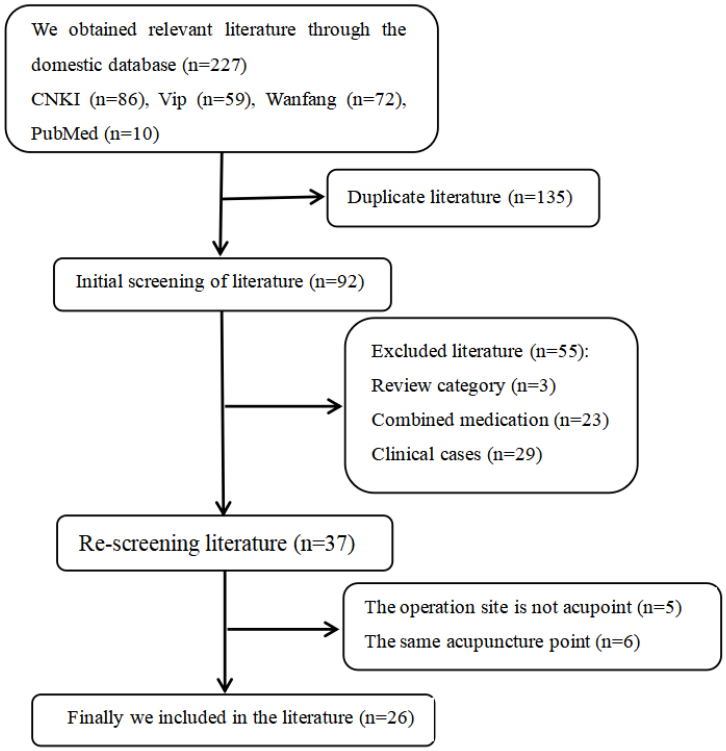

Figure 1: Literature screening process

3.2. Frequency analysis

3.2.1. Frequency analysis of acupoints

A total of 38 acupuncture prescriptions were extracted, involving 96 acupuncture points. The total frequency of use is 443 times, and the highest frequency of acupuncture points is Baihui (26 times, 68.42%). The first 10 high-frequency acupuncture points are shown in Table 1.

Table 1: The top10 rankings of the frequency of acupuncture treatment of ST acupoints

Acupuncture point	Rate of recurrence	Percentage(%)
Baihui	26	68.42
Shuigou	18	47.37
Fengchi	17	44.74
Tianzhu	16	42.11
Yintang	16	42.11
Yongquan	14	36.84
Taichong	13	34.21
Laogong	12	31.57
Fenglong	12	31.57
Heyan	10	26.32

3.2.2. Statistics of acupoints

96 acupuncture points for the treatment of ST are counted as meridians, among which Ashi acupoints, Xinshe acupoints, Jiankang acupoints, and Jingluan acupoints have no return to meridians, (Xinshe acupoints: empirical effect points, straight down from Fengchi acupoints, about 3.3 cm between the 3rd and 4th cervical vertebraes, depression on the lateral side of the oblique muscle, a total of two acupuncture points on the left and right [7]; Jiankang points: experience Effect point, located between the 3rd and 4th metarsal bone and the lateral wedge joint [8]; Jingluan acupoints: empirical effect point, 1 inch below the midpoint of the small head of the fibula and the foot three miles, a total of two points [9]) There are 15 other meridians of the remaining acupoints, and the first three meridians of frequency are the conception vessel, the bladder meridian of foot-taiyang, and the gallbladder meridian of foot-shaoyang, see Table 2.

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Table 2: Statistics on the frequency of acupuncture in the treatment of spasmotic torticollis

Main and collateral channels	Number of acupoints	Frequency	Percentage(%)	Selected acupoints(frequency)
Conception vessel	16	98	23.39	Baihui(26),Shuigou(17),Yintang(16),Shangxing(10),Shenting(6),Fengfu(5),Dazhui(4),Yamen(4),Jinsuo(3),Yinjiao(1),Shenzhu(1),Qianding(1),Houding(1),Yaoyanguan(1),Zhiyang(1),Naohu(1)
Bladder meridian of foot-taiyang	12	47	11.22	Tianzhu(16),Shenmai(9),Dazhu(4),Ganshu(4),Shenshu(4),Zhiyin(3),Jingming(2),Yuzhen(1),Feishu(1),Xinshu(1),Geshu(1),Pishu(1)
Gallbladder meridian of foot-shaoyang	10	44	10.50	Fengchi(17),Yanglingquan(9),Jianjing(5),Heyan(3),Wangu(3),Qiuxu(2),Zulinqi(2),Xuanzhong(1),Waiqiu(1),Yangjiao(1)
Kidney meridian of foot-shaoyin	5	32	7.64	Yongquan(14),Taixi(7),Zhaohai(7),Fuliu(3),Zhubin(1)
Stomach meridian of foot-yangming	8	30	7.16	Zusanli(9),Fenglong(8),Renying(3),Neiting(3),Lidui(2),Touwei(2),Tianshu(2),Xiangu(1)
Large intestine median of hand-yangming	9	30	7.16	Hegu(8),Tianding(7),Quchi(6),Sanjian(4),Wenliu(1),Zhouliao(1),Jianyu(1),Futu(1),Jugu(1)
Pericardium meridian of hand-jueyin	3	26	6.21	Laogong(12),Ximen(10),Neiguan(4)
Small intestine meridian of hand-taiyang	7	20	4.77	Houxi(8),Tianrong(4),Jianzhongshu(2),Jianwaishu(2),Tianchuang(2),Tianzong(1),Bingfeng(1)
Triple energizer meridian of hand-shaoyang	7	18	4.30	Waiguan(5),Tianyou(5),Zhongzhu(3),Zhigou(2),Huizong(1),Sanyangluo(1),Jianliao(1)
Extra-meridian points	4	18	4.30	Jingjiaji(9),Sishencong(4),Ashixue(4),Taiyang(1)
Liver median of foot-jueyin	3	16	3.82	Taichong(13),Ququan(2),Xingjian(1)
Conception vessel	6	13	3.10	Guanyuan(3),Qihai(3),Lianquan(3),Zhongwan(2),Jiuwei(1),Chengjiang(1)
Spleen meridian of foot-taiyin	2	11	2.63	Sanyinjiao(6),Yinlingquan(5)
Lung median of hand-taiyin	2	7	1.67	Lieque(6),Taiyuan(1)
Heart meridian of hand-shaoyin	1	5	1.19	Shenmen(5)

3.2.3. Statistics of specific acupuncture points

The statistics of 96 acupuncture points for ST are carried out. The highest frequency of specific points is Five Shu points (130 times), accounting for 31.03% of the total frequency, followed by Crossing points (130 times), as shown in Table 3.

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Table 3: Frequency of use of specific acupoints for acupuncture and moxibustion for the treatment of spasmotic torticollis

Specific points	Number of acupoints	Frequency	Percentage(%)	Acupoints(frequency)
Five Shu Points	22	130	31.03	Xingjian(16),Yongquan(14),Taichong(13),Laogong(12),Zusanli(9),Yanglingquan(9),Houxi(8),Taixi(7),Quchi(6),Yinlingquan(5),Shenemen(5),Sanjian(4),Zhongzhu(3),Neiting(3),Zhiyin(3),Fuliu(3),Ququan(2),Zhigou(2),Lidui(2),Zulinqi(2),Taiyuan(1),Xiangu(1)
Crossing Point	23	130	31.03	Baihui(26),Shuigou(17),Fengchi(17),Shenmai(9),Zhaohai(7),Sanyinjiao(6),Shenting(6),Jianjing(5),Fengfu(5),Dazhui(4),Yamen(4),Dazhu(4),Lianquan(3),Guanyuan(3),Heyan(3),Zhongwan(2),Jingming(2),Touwei(2),Chengjiang(1),Zhubin(1),Naohu(1),Jianyu(1),Jugu(1)
Eight Confluence Points	7	41	9.79	Shemai(9),Houxi(8),Zhaohai(7),Lieque(6),Waiguan(5),Neiguan(4),Zulinqi(2)
Source Point	6	36	8.59	Taichong(13),Hegu(8),Taixi(7),Shenmen(5),Qiuxu(2),Taiyuan(1)
Luo-Connecting Acupoint	4	23	5.49	Fenglong(8),Lieque(6),Waiguan(5),Neiguan(4)
Lower He-sea point	2	18	4.30	Yinlingquan(9),Zusanli(9)
Eight Influential Point	6	18	4.30	Yanglingquan(9),Dazhu(4),Zhongwan(2),Geshu(1),Taiyuan(1),Xuanzhong(1)
Xi-Cleft Acupoint	4	13	3.10	Ximen(10),Zhubin(1),Wenliu(1),Waiqiu(1)
Back-Shu Point	5	11	2.63	Ganshu(4),Shenshu(4),Feishu(1),Xinshu(1),Pishu(1)
Front-Mu Point	3	7	1.67	Guanyuan(3),Tianshu(2),Zhongwan(2)

4. Complex network analysis of acupuncture points

4.1. Analysis of association rules

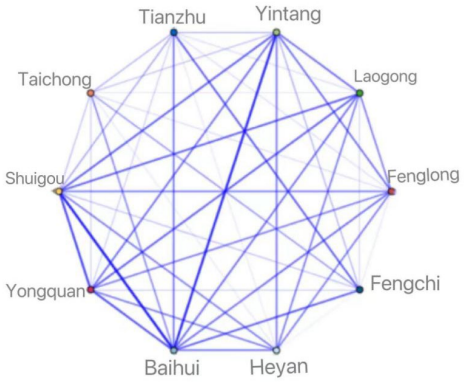

Figure 2: 38 acupuncture treatment ST prescription core acupoint associated network (Note: The solid line indicates that the acupoint compatibility frequency is high and the correlation is strong; The dotted line indicates that the frequency of acupoint compatibility is low and the correlation is weak)

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Association rule analysis can find potential and useful dependencies between data items. Support and confidence are their important indicators. By setting the lowest threshold for support and confidence, the strongest association rules are obtained [10]. SPSS Modeler 18.0 software is used to analyze the association rules of 10 high-frequency acupuncture points with a frequency of >26%, and obtain the core association network of acupuncture points such as Baihui, Shuigou and Fengchi, as shown in Figure 2.

4.2. Basic structure and analysis of complex networks

The network cluster structure in the topology properties of complex networks has the characteristics of dense interconnection of same cluster nodes and loose connection of heterogeneous cluster nodes. Using the complex network clustering method, the compatibility relationship between acupuncture points can be expressed in the form of complex network diagrams [11]. Gephi0.10.1 is used to build a complex network model of prescription acupuncture points. The nodes represent acupuncture points, and the edges represent the connection between acupuncture points. The degree value and weight indicate the compatibility and frequency of acupuncture points. Through the degree value and weight of the node, the overall analysis of the acupuncture point is visualized, and the K-core [12] level is used. The analysis method analyzes the core acupuncture points and compatibility intensity of the prescription, conducts community identification and analysis of the data through statistical modularization, and builds a complex network [13-15].

4.2.1. Basic structure and acupoint co-prospee network

The network includes 96 nodes and 1602 edges, with an average value of 33.375, a network diameter of 3, an average path length of 1.669, and an average clustering coefficient of 0.815, indicating that the network involves 96 acupoints and 1602 pairs of matching combinations, and the average compatibility between acupoints and acupoints is at least There are 33.375, and the maximum distance between any two acupuncture points is 3 edges, and the average distance value is 1.669, indicating that the overall network connection is high. The resulting network of acupoints is shown in Table 4 and Figure 3.

Table 4: Topology Parameters of Complex Networks

Serial number	Attribute	Numerical value
1	Node	96
2	Edge	1602
3	Average degree	33.375
4	Network diameter	3
5	Averagr clustering coefficient	0.815
6	Averagr path length	1.669

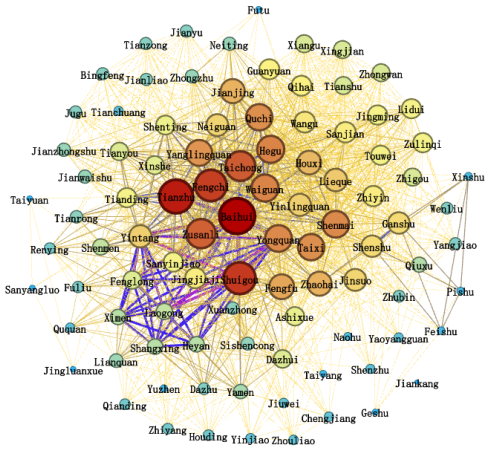

Figure 3: Acupuncture treatment of ST acupoint co-existing network (Note: The size and color of the node represent the acupoint value)

4.2.2. Analysis of core nodes of complex networks

We selected filtering in Gephi0.10.1 Software and used The "K-core Operation" in the topology. When the K-core value was 37, the image disappears, that Is, the maximum value was 36. At this time,

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the Network included 37 nodes and 666 edges. The core acupuncture points were Baihui, Shuigou, Fengchi, Tianzhu, Taichong, Yongquan and Zusanli, as shown in Figure 4.

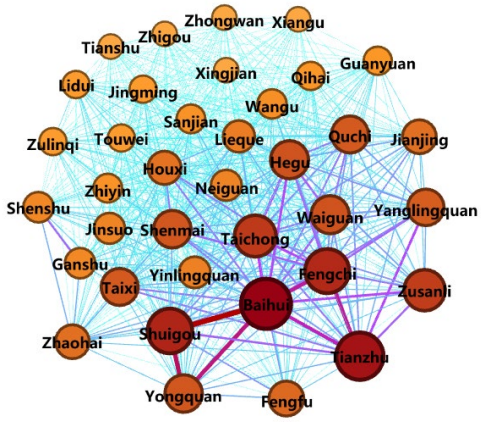

Figure 4: ST k-core network diagram for acupuncture treatment (k=36) (Note: The node size represents the acupoint value, and the larger the node, the higher the degree value; The thickness of the line indicates the strength of the compatibility between the acupuncture points. The thicker the line, the more times it is)

5. Discussion

As a kind of data mining technology, complex network technology has the characteristics of small world, cluster and power law characteristics. It is a method for scientific processing of complex data and abstract problems [16-18]. In recent years, it has been increasingly used in the field of traditional Chinese medicine [19-21]. Acupuncture treatment takes meridians and acupoints as carriers, and the curative effect is positive. However, due to the inconsistency of doctors' acupuncture points, the mystery of acupuncture and moxibustion treatment is not seen in the world. Complex network technology can analyze big data, find the rules, find out the acupuncture points with high frequency of use, and find the compatibility relationship between them.

Traditional Chinese medicine believes that spasmodic torticollis belongs to the category of "spasmodic syndrome" and "phlegm". In the "Jingyue Quanshu · Heal Theory", it is said: "Foolism is a disease, and it is also a disease that is strong and anti-encomity. The disease is in the veins, and the veins are urgent, so it is reversed; the disease is in the blood, and the blood is dry, so the muscles are contuls. Outside the disease, wind, cold and dampness, block the meridians, stay between the muscles, and hinder the local operation of qi and blood. Inside, there is a loss of tendons and veins, yin deficiency and dryness, meridians gathering is impermanence, relaxation and confusion, or wind syndrome and spasm caused by the patient's body yin deficiency and yang hyperfunction, and wind and qi internal movement [22]. From the rule of acupuncture treatment of spasmic tortical point selection, Dumai selected the most acupuncture points and used the most frequently. The Dumai is connected to the neck, and the Dumai disease is common for strong spinal pain, anal arch inverse tension, local disease of the head, etc. The acupuncture point on the vein can mobilize the body's meridian qi, and Tongdu can nourish the tendon, which is the basis. The governor's vein is also a strange meridian, which has the effect of regulating the qi and blood of the twelve meridians.At the same time, the governor vein and the hand and foot Yangming meridian meet in the water ditch point, and the Yangming meridian is a multi-qi and bloody meridian [23], so it takes the head acupuncture point Baihui, Shuigou, Yintang, Shangxing to wake up the brain and adjust the mind, supervises the Yang meridian, and injects qi and blood into the brain; Tianzhu and Fengchi are both pathological local acupuncture points, which can dredge the local qi and blood meridians, and can stimulate it. Deep sympathetic nerve and brachial plexus nerve, so as to adjust the local functional form. The wind pool is also used to dispel wind and dissipate cold, which plays the role of dissipating cold and relieving spasm. The combination of acupuncture points highlights the method of regulating the god, reflecting the importance of regulating the mind in the treatment of this disease [24]. In the Theory of the Sources of Diseases, it is said: "The evil guest in the contact of the sun makes people worry. The article "Su Wen·Bone Empty Theory" said: "The governor's vein is a disease, and the spine is strong and reversed. The foot sun enters the brain from the top and the ridge, and the Yangming Sutra is full of qi and blood. Therefore, the focus is on the supervision of the vein, the foot sun, and the hand and foot Yangming Sutra [25].

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"Su Wen · Nine Needles and Twelve Originals" says: "The meridian twelve, the collateral vein is fifteen, if there are more than twenty-seven, what comes out is the well, what slips is the slip, what is the note is the loss, the behavior is the combination. Twenty-seven gas is full of five acupuncture points. It shows that the five acupuncture points show that the five acupuncture points have an incomparable effect compared with other acupuncture points in adjusting the operation of meridians, qi and blood (twenty-seven qi). Therefore, in the analysis of specific acupuncture points in this study, the five acupuncture points are selected with the most acupuncture points and the highest frequency.

To sum up, acupuncture treatment of spasmotic torticollic neck is mainly based on specific acupoints, paying attention to the upper and lower acupuncture point matching method and Yu Qian acupuncture point matching method. This study summarizes the core acupoints of acupuncture for the treatment of spasmodic torticollis, and analyzes the core acupoints, specific acupoint attributes, and high-frequency acupoints, which has a certain guidance and provides a certain reference for the clinical selection of spasmotic torticollis. There are still shortcomings in this study, such as single intervention measures and the inclusion of the literature part without syndrome differentiation. It is needing to improve the research methods in the future and include higher-quality clinical research evidence to better serve the clinic.

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