



## Research article

# Comparison of efficacy of acupuncture-related therapies in treating Acute Gouty Arthritis: A Network Meta-Analysis of Randomized Controlled Trials

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## ABSTRACT

**Background:** and purpose: Acupuncture and moxibustion, as a complementary and alternative therapy, has been widely used in the treatment of acute gouty arthritis (AGA). However, there are various forms of acupuncture and moxibustion, and the curative effect of different forms is different. This study evaluated the clinical efficacy of different acupuncture therapies in treating AGA by network meta-analysis.

**Methods:** Computer searches of English databases (including PubMed, The Cochrane Central Register of Controlled Trials (CENTRAL), Web of Science, Embase) and Chinese databases (including China National Knowledge Infrastructure (CNKI), VIP Database, Wanfang Database and China Biomedical Literature Database) were conducted for randomized controlled trials (RCTs) of acupuncture therapies in treating AGA. We set the search time from the database establishment to May 2022. Data analysis was performed using Stata14.2 software.

**Results:** Thirty-two RCTs involving 2434 patients with AGA were screened out. The results showed that in terms of the improvement of pain visual analogue scale (VAS) scores, the top ones were acupoint application (100%), electroacupuncture + Western medicine (73.5%) and acupuncture + Western medicine (69.2%); In terms of total effective rate, acupoint application (85.2%), acupuncture (75.2%) and acupuncture + Western medicine (63%) ranked the top; In terms of reducing serum uric acid (SUA) levels, the top ones were acupoint application (95%), acupuncture + Western medicine (87.5%) and acupuncture (66.2%); In terms of the reduction of erythrocyte sedimentation rate (ESR), acupuncture (95%), acupoint application (84.7%), and electroacupuncture + Western medicine (52.8%) were the most prominent.

**Conclusion:** The existing evidence shows that acupoint application has more advantages in improving the total effective rate, improving pain and reduce SUA levels, and acupuncture has an advantage in reducing ESR levels and adverse events. However, due to the low qualities of the original studies, the quality of this evidence is poor. Therefore, it is recommended that more scientific research be performed to confirm the efficacy of acupuncture.

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## 1. Introduction

Acute Gouty arthritis (AGA) is an abnormally elevated serum uric acid (SUA) levels due to disordered purine metabolism or renal excretion disorder, resulting eventually uric acid deposition in the joint and inflammatory reaction of the joint [1,2]. Its clinical manifestations is sudden severe pain and swelling in one or more joints [3]. The prevalence of AGA is gradually increasing worldwide [4], which not only limits patients' daily activities, but also seriously affects their quality of life [5]. The dominant purpose of treatment for AGA is to reduce joint pain and swelling and improve joint function [6]. In 2021, the Asia Pacific League of Associations for Rheumatology recommended anti-inflammatory analgesics for the treatment of AGA [7]. The commonly used anti-inflammatory analgesic drugs in clinical practice include Colchicine and nonsteroidal anti-inflammatory drugs (NSAIDs). Although these drugs can control symptoms in the short term, they are accompanied by long-term potential adverse reactions, such as gastrointestinal and cardiovascular problems [8,9]. Therefore, it is a current research trend to find a therapeutic regimen with good efficacy and few adverse reactions.

AGA belongs to the "Bi syndrome" in traditional Chinese medicine (TCM), which is caused by dampness-heat accumulation and qi-blood stasis in the channels [10]. Based on the theory of TCM, the treatment of AGA should follow the principle of clearing dampness-heat and dredging meridians. The mechanism is to inhibit inflammatory factors in the joint fluid, reduce serum uric acid, regulate immune function, and block peripheral nerve pain [11]. Acupuncture and moxibustion based on meridians theory exerts great significance in complementary and alternative therapies [12]. The global research trend report of acupuncture and moxibustion in 2010 shows [13] that improving pain and controlling inflammation have always been the focus of acupuncture and moxibustion research, and acupuncture and moxibustion has been widely borrowed for treatment of joint, muscle and other related diseases. Its anti-inflammatory and analgesic effects have been confirmed by clinical studies [14–18]. At present, many clinical studies on acupuncture therapies in treating AGA have been carried out in China, including acupuncture, moxibustion, electroacupuncture, blood-letting, fire acupuncture and so on [19,20]. Previous studies have shown that acupuncture and moxibustion can reduce the formation of uric acid by inhibiting the purine synthesis pathway and reducing the purine metabolism, and can also reduce the content of interleukin-1 $\beta$ , interleukin-8, tumor necrosis factor- $\alpha$  and prostaglandin E2 in serum, thus reducing inflammatory response. It can also regulate the immune system of the body by reducing the levels of immunoglobulin M and immunoglobulin A [21]. The latest systematic reviews have shown that acupuncture and moxibustion related therapies (including acupuncture, electroacupuncture, blood-letting, fire acupuncture, etc.) are effective for AGA. They can reduce the SUA levels, erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP), and alleviate pain in AGA [22,23]. These studies indicated that acupuncture-related therapies exert superiority compared with Western medicine. However, these studies focused on the comparison of acupuncture therapies with conventional Western medicine, rather than the comparison of the efficacy of different acupuncture therapies. Therefore, it is controversial to choose which acupuncture therapy to treat AGA in clinical practice. Our study used Network Meta-analysis (NMA) to compare different efficacy of various acupuncture and moxibustion therapies in treating AGA to provide evidence-based evidence for selection of the optimal collocation scheme in treating AGA clinically.

## 2. Methods

### 2.1. Study registration

The systematic review protocol was developed using guidance from the Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P) statement [24], and we followed PRISMA for NMA to report the results [25], see Table S1 for details. The research protocol has been registered on PROSPERO at [https://www.crd.york.ac.uk/prospero/display\\_record.php?RecordID=310370](https://www.crd.york.ac.uk/prospero/display_record.php?RecordID=310370). Registration number: CRD42022310370.

### 2.2. Eligibility criteria

- (1) Study type: Published parallel randomized controlled trials (RCTs), with no restriction on the use of blinding method.
- (2) Subjects: Patients with a definite diagnosis of AGA, the diagnostic criteria were based on the 2015 American College of Rheumatology diagnostic criteria for acute gouty arthritis [26], or other official diagnostic criteria. The patient's gender and age were not restricted.
- (3) Interventions:

The treatment group: acupuncture alone or combined with Western medicine. Acupuncture therapy was a acupoint stimulation technique based on meridian theory, including any of the following therapies: acupuncture, warm acupuncture, electroacupuncture, fire acupuncture, blood-letting, moxibustion, acupoint application, acupoint injection;

The control group: Western medicine alone, same as in the treatment group. And the Western medicine should be 2021 *Asia-Pacific League of Associations for Rheumatology Clinical Practice Guideline for Treatment of Gout* recommended first-line anti-inflammatory and analgesic drugs [7]. Uric acid lowering drugs such as febuxostat and benbromarone should not be used in the treatment and control groups.

- (4) Outcome measures: improvement of pain visual analogue scale (VAS) scores as the primary outcome indicator: changes in the pain VAS scores at baseline and after treatment.

Secondary outcome indicators: (1) Total effective rate, which was based on the evaluation of the overall efficacy, was based on the *Guiding Principles for Clinical Research of New Chinese Medicines* [27]. Total effective rate = effective number/total number \*100%. (2) Laboratory indicators, including SUA, ESR and CRP; (3) Incidence of adverse events (adverse events included discomfort symptoms related to treatment during the study, including needle sickness, skin redness, gastrointestinal discomfort, liver and kidney injury, etc.).

### 2.3. Literature search strategy

We conducted a comprehensive search of published RCTs of acupuncture-related therapies for AGA. English databases included PubMed, The Cochrane Central Register of Controlled Trials (CENTRAL), Web of Science, Embase, Chinese databases included China National Knowledge Infrastructure (CNKI), WanFang Data, VIP, and China Biomedical Literature Database (CBM). Set the search time from the database establishment to May 2022. We used the method of subject words combined with free words. The Chinese search terms included “zhen jiu”, “zhen ci”, “dian zhen”, “wen zhen jiu”, “huo zhen”, “ci luo fang xie”, “ai jiu”, “xue wei zhu she”, “xue wei tie fu”, “xue wei mai xian”, “ji xing tong feng xing guan jie yan”. The English search terms included “acupuncture”, “electroacupuncture”, “warm acupuncture”, “fire acupuncture”, “blood-letting”, “moxibustion”, “acupoint injection”, “acupoint application”, “acute gouty arthritis”, “AGA”. The retrieval strategies for different databases were presented in [Table S2](#).

### 2.4. Literature screening and data extraction

Import the final bibliography into EndNote X9 software, and two independent reviewers screened the search results after they read title and abstract. The remaining studies were further evaluated by reading full text to exclude those not meet the inclusion criteria. Finally, data extraction was completed for the final studies. Data extraction content included title, author, publication time, number of patients, type of intervention and treatment time, outcome indicators, etc. In the process of literature screening and data extraction, if there was a disagreement between the two reviewers, the discussion was conducted with a third reviewer.

### 2.5. Risk of bias assessment of the included studies

The RCT risk of bias assessment tool in the Cochrane System Evaluation Manual version 5.1.0 [28] was used by two reviewers independently to perform a back-to-back evaluation of the included studies, the contents of the evaluation included random sequence generation, outcome allocation concealment, blinding of participants and personnel, blinding of assessment, incomplete outcome data, selective reporting bias and other bias, and finally made an evaluation of “high”, “low” or “unclear” risk. If there was a disagreement between the two examiners, it would be resolved after consultation with the third examiner.

### 2.6. Statistic analysis

#### 2.6.1. Direct comparison

If the number of studies comparing the same intervention was less than 2, descriptive analyses were used to report the results. In contrast, by using Stata14.2 software, if  $\geq 2$ , we performed a direct comparative meta-analysis. For continuous variables, use standard mean difference (SMD) for analysis, and for dichotomous variables, use relative risk (RR) for analysis. Heterogeneity analysis among the included studies relied on  $\chi^2$  test, and determined by  $I^2$ . If  $P \geq 0.10$  and  $I^2 \leq 50\%$ , no significant heterogeneity among studies was considered, and we used a fixed effect model for meta-analysis. If  $P < 0.10$ ,  $I^2 > 50\%$ , indicating significant inter-study heterogeneity, and we used a random effect model after excluding clinical and methodological heterogeneity.

#### 2.6.2. Network meta-analysis

A network of direct and indirect comparisons was drew using stata14.2 software between the outcomes of different treatment measures. The inconsistency test of the included studies was carried out using the node splitting method. The consistency model was used for analysis if  $P \geq 0.05$ . For each outcome measure, the effectiveness of the interventions was ranked using Surface under the Cumulative Ranking curve (SUCRA) values. We performed the publication bias assessment of the included studies using comparison and correction funnel plots.

## 3. Results

### 3.1. Literature search results

In total, 3758 relevant articles were found out. After initial screening and rescreening, 32 RCTs [29–60] were finally included, involving 2434 patients. See the literature screening process in [Fig. 1](#).

3.2. Basic characteristics of the included studies

Among the 32 included studies, a total of 8 treatments were involved, including 14 studies on acupuncture [29,30,33,40,45,46, 48–51,53,55,59,60], 7 studies on blood-letting [32,34,39,42,43,52,58], 1 study on fire acupuncture [54], 1 study on acupoint application [54], 3 studies on acupuncture + Western medicine [31,37,44], 4 studies on blood-letting + Western medicine [35,41,56, 57], 2 studies on electroacupuncture + Western medicine [38,47], and 32 studies on Western medicine [29–60]. All studies were 2-arm studies. 20 studies reported total effective rate [26–29,34,37,40–45,48–54,56] and 14 studies reported pain improvements [30, 32,35,36,38,39,41,44,47,48,54,56,57,59]. 21 studies reported SUA levels [31,35–38,41,42,44–46,48,49,51–58,60], 10 studies reported CRP levels [36,37,42,46–48,54–57], and 9 studies reported ESR levels [36,38,41,42,46,48,54,56,57], 16 studies reported incidence of adverse events [30,32,35,36,38,39,41,42,44,45,47,48,52,55,56,59]. See the basic characteristics of the included studies and the interventions in Tables 1 and 2, respectively.

3.3. Risk of bias assessment results of included studies

(1) Random sequence generation: 15 RCTs used random number table [30,32,35,36,38,39,41,43,47,50,52,54,55,57,60], 1 study used lottery method [34], so they were evaluated as low risk; 2 RCTs used case number of visit [37,48] and high risk was evaluated; The remaining 14 RCTs described nothing about the details of random sequence generation [29,31,33,40,42,44–46,49,51,53,56,58, 59], so the evaluation was unclear; (2) Allocation concealment: 2 studies used sealed and opaque envelopes [32,43], so low risk was evaluated; the other 30 studies did not mention allocation concealment [29–31,33–36,38–42,44–47,49–60], so the evaluation was

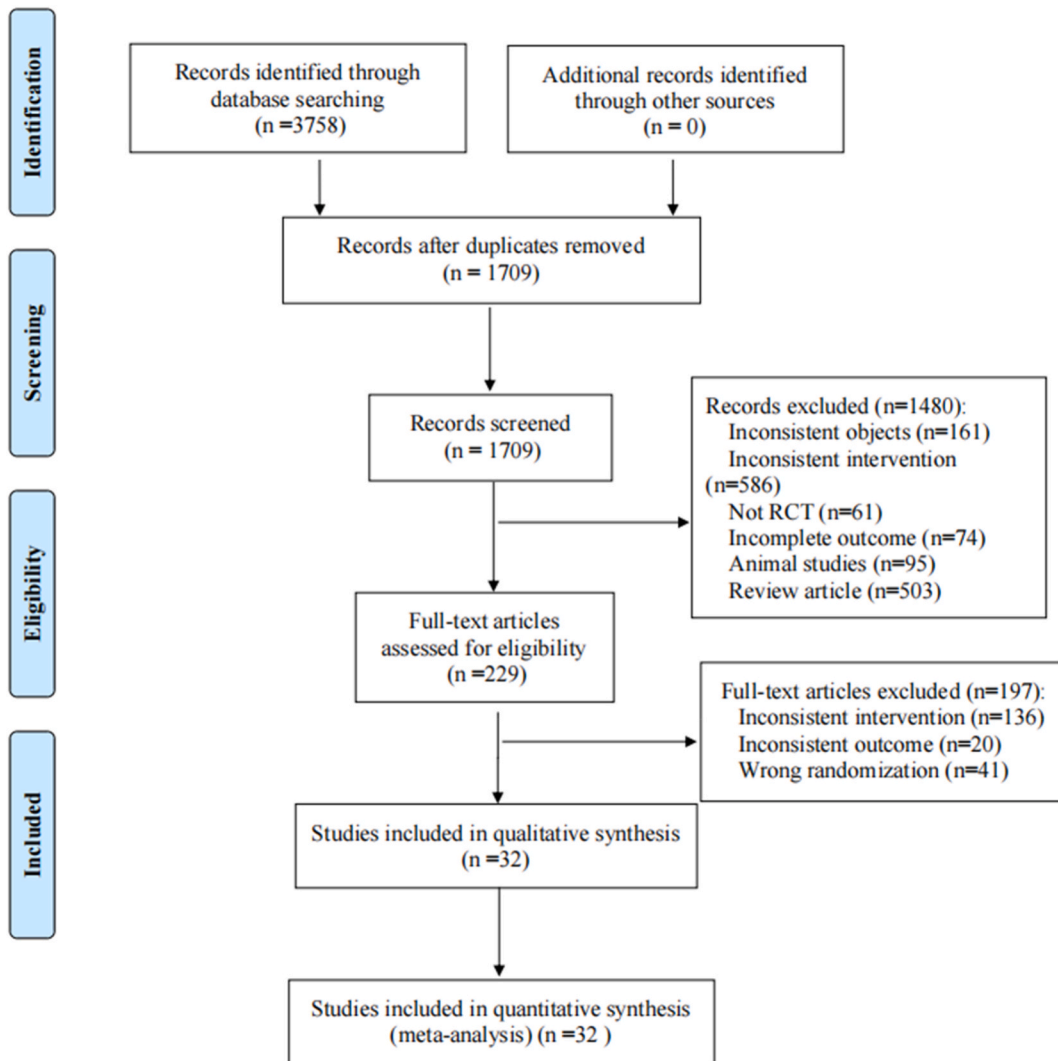


Fig. 1. Flow chart of literature screening.

**Table 1**  
Basic characteristics of the included studies.

Included studies	Randomization method	Sample size (T/C)	Gender (M/F)	Age (year)	Course of disease
Chen HQ 2015 [29]	Not described	44/44	T:37/7 C:38/6	T:43.40 ± 4.30 C:42.80 ± 4.10	T:6.50 ± 1.50 (day) C:6.10 ± 1.40
Chen ZF 2019 [30]	Random number table	46/46	T:42/4 C:41/5	T:48.60 ± 13.10 C:49.70 ± 12.80	T:NA C:NA
Duan YP 2019 [31]	Not described	60/60	T:37/23 C:25/35	T:50.74 ± 6.65 C:50.41 ± 6.53	T:NA C:NA
Fu LL 2016 [32]	Random number table	26/26	T:22/4 C:21/5	T:55.04 ± 8.60 C:52.58 ± 11.58	T:5.81 ± 3.10 (year) C:5.19 ± 3.36
Gong MF 2016 [33]	Not described	38/38	T:21/17 C:22/16	T:45.80 ± 2.30 C:45.90 ± 2.40	T:6.70 ± 0.30 (day) C:6.80 ± 0.40
Dong H 2013 [34]	Lottery method	40/40	T:31/9 C:23/17	T:47.80 ± 19.50 C:49.20 ± 16.00	T:10.5 ± 9.2 (year) C:10.6 ± 8.7
Hai K 2016 [35]	Random number table	30/30	T:28/2 C:27/3	T:45.97 ± 9.37 C:47.33 ± 9.75	T:NA C:NA
Hong MY 2021 [36]	Random number table	25/25	T:18/7 C:19/6	T:44.12 ± 2.76 C:43.08 ± 2.53	T:10.59 ± 1.56 (year) C:9.60 ± 1.48
Hu NX 2022 [37]	Case number of visit	58/58	T:36/22 C:35/23	T:57.34 ± 11.97 C:56.81 ± 12.24	T:NA C:NA
Lan SZ 2018 [38]	Random number table	25/25	T:20/5 C:21/4	T:47.44 ± 8.28 C:45.12 ± 9.24	T:24.16 ± 10.23(h) C:25.52 ± 9.86
Li FZ 2011 [39]	Random number table	65/43	T:60/5 C:40/3	T:31.60 ± 4.80 C:32.10 ± 4.30	T:5.80 ± 1.90 (year) C:6.10 ± 1.30
Li GS 2016 [40]	Not described	40/40	T:36/4 C:34/6	T:43.10 C:45.00	T:NA C:NA
Liao JX 2021 [41]	Random number table	20/20	T:19/1 C:20/0	T:53.55 ± 13.35 C:50.75 ± 13.78	T:21.45 ± 6.33(h) C:20.95 ± 9.71
Liu SJ 2015 [42]	Not described	29/30	T:27/2 C:25/5	T:39.79 ± 6.90 C:39.43 ± 7.82	T:3.14 ± 1.60 (year) C:3.95 ± 5.69
Mo LM 2021 [43]	Random number table	32/32	T:28/3 C:27/4	T:47.81 ± 9.82 C:46.28 ± 9.35	T:NA C:NA
Shen WJ 2020 [44]	Not described	60/60	T:38/22 C:39/21	T:46.18 ± 7.52 C:46.34 ± 7.68	T:1.24 ± 0.23 (year) C:1.26 ± 0.21
Wan HY 2020 [45]	Not described	49/49	T:NA C:NA	T:49.10 ± 10.70 C:48.9 ± 11.40	T:38.04 ± 10.49 (day) C:37.54 ± 9.74
Wang GF 2019 [46]	Not described	60/60	T:40/20 C:39/21	T:40.12 ± 1.32 C:40.56 ± 1.87	T:NA C:NA
Wu BQ 2021 [47]	Random number table	43/43	T:30/13 C:31/12	T:51.28 ± 5.62 C:52.70 ± 6.10	T: 18.65 ± 6.48(h) C:20.36 ± 7.52
Wu R 2020 [48]	Case number of visit	36/36	T:24/12 C:26/10	T:68.78 ± 5.21 C:69.33 ± 4.89	T:6.44 ± 2.43 (year) C:6.74 ± 1.92
Wu SL 2016 [49]	Not described	47/47	T:38/9 C:34/13	T:45.98 ± 7.63 C:46.17 ± 8.04	T:NA C:NA
Xu XL 2011 [50]	Random number table	30/30	T:28/2 C:27/3	T:42.50 C:44.00	T:NA C:NA
Yang LN 2021 [51]	Not described	45/45	T:24/21 C:23/22	T:42.50 ± 10.50 C:42.00 ± 10.50	T:NA C:NA
Yi JJ 2010 [52]	Random number table	30/30	T:24/6 C:23/7	T:48.40 ± 11.70 C:50.30 ± 10.80	T:8.80 ± 7.10 (year) C:9.50 ± 6.60
Yu M 2020 [53]	Not described	30/30	T:25/5 C:24/6	T:46.80 ± 3.40 C:45.70 ± 4.80	T:NA C:NA
Yu M 2019 [54]	Random number table	35/35	T:30/5 C:32/3	T:48.86 ± 14.01 C:46.20 ± 12.25	T:NA C:NA
Yu SM 2019 [55]	Random number table	32/30	T:30/2 C:29/1	T:48.31 ± 4.95 C:49.63 ± 3.84	T:NA C:NA
Yuan Y 2019 [56]	Not described	28/27	T:27/1 C:25/2	T:45.61 ± 10.91 C:46.01 ± 8.64	T:6.41 ± 9.33 (year) C:7.28 ± 9.20
Zhang JP 2021 [57]	Random number table	30/30	T:30/0 C:30/0	T:42.07 ± 5.88 C:41.97 ± 6.35	T:3.98 ± 1.93 (day) C:4.02 ± 1.95
Zhang ZM 2012 [58]	Not described	30/30	T:24/6 C:22/8	T:59.60 C:56.50	T:6.40 (year) C:5.60
Zhao HD 2021 [59]	Not mentioned	36/36	T:18/18 C:20/16	T:45.30 ± 10.30 C:48.20 ± 12.10	T:1.30 ± 0.50 C:1.20 ± 0.40 (year)
Zhou B 2019 [60]	Random number table	30/30	T:23/7 C:24/6	T:49.82 ± 11.45 C:48.73 ± 12.81	T:NA C:NA

Note: T: treatment group; C: control group; M: male; F: female; NA: not mentioned.

**Table 2**  
Characteristics of the interventions included in the study.

Included studies	Study type	Interventions		Course of treatment (days)	Outcome indicators
		Treatment group	Control group		
Chen HQ 2015 [29]	Two arms	Acupuncture: Ashi point, Xiyan (EX-LE5), Yanglingquan (GB34), Yangchi (SJ4), Waiguan (SJ5), Quchi (LI11), Hegu (LI4), once a day	Naproxen Injection 150mg/time, qd	20	①
Chen ZF 2019 [30]	Two arms	Acupuncture: Zusanli (ST36), Sanyinjiao (SP6), Yinlingquan (SP9), Quchi (LI11), Ashi point, once a day, stop for 2 days after every 5 days	Indometacin Enteric-coated Tablets 75mg/time, bid	10	①②③
Duan YP 2019 [31]	Two arms	Indometacin Enteric-coated Tablets, 75mg/time, bid; Acupuncture: Zhigou (SJ6), Sanyinjiao (SP6), Neiting (ST44), Zusanli (ST36), Ashi point, Yanglingquan (GB34), Xiangyu (ST43), once a day	Indometacin Enteric-coated Tablets, 75mg/time, bid	10	①④
Fu LL 2016 [32]	Two arms	Blood-letting: Where tenderness is intense and redness and swelling are most evident, and distal finger abdomen, once a day	Etoricoxib 90mg/time, qd	3	①②③
Gong MF 2016 [33]	Two arms	Acupuncture: Ashi point, Yanglingquan (GB34), Xiyan (EX-LE5), Waiguan (SJ5), Yangchi (SJ4), Hegu (LI4), Quchi (LI11), once a day	Naproxen Injection 150mg/time, qd	20	①
Dong H 2013 [34]	Two arms	Blood-letting: Taichong (LR3), Taibai (SP3), Xiyan (EX-LE5), Xuehai (SP10), Sanyinjiao (SP6), Qiuxu (GB40), once two days	Indomethacin, 25mg/time, tid	10	①③
Hai K 2016 [35]	Two arms	Losoloprofen sodium tablets, 60 mg, Tid; Blood-letting: Ashi point, Taibai (SP3), Taichong (LR3), Neiting (ST44), Yanglingquan (GB34), Weizhong (BL40), once two days	Losoloprofen sodium tablets, 60 mg, tid	7	①②③④
Hong MY 2021 [36]	Two arms	Diclofenac sodium double release enteric capsule 75mg/time, qd; Acupoint application: Ashi point, Yinlingquan (SP9), Quchi (LI11), Taibai (SP3), once a day	Diclofenac sodium double release enteric capsule 75mg/time, qd	10	①②③④⑤⑥
Hu NX 2022 [37]	Two arms	Indometacin Enteric-coated Tablets, no dose, bid; Acupuncture: Shangqiu (SP5), Dadu (SP2), Xuehai (SP10), Yinbai (SP1), Taibai (SP3), Yinlingquan (SP9), Diji (SP8), Gongsun (SP4), Sanyinjiao (SP6), once a day	Indometacin Enteric-coated Tablets, no dose, bid	10	①③④⑥
Lan SZ 2018 [38]	Two arms	Etoricoxib,120mg/time, qd; Electroacupuncture: Ashi point, Sanyinjiao (SP6), Yinlingquan (SP9), Zusanli (ST36), Fenglong (ST40), Quchi (LI11), Neiting (ST44), Taixi (KI3), once a day	Etoricoxib,120mg/time, qd	7	①②③④⑤
Li FZ 2011 [39]	Two arms	Blood-letting: "Mei Hua point + Guan Chang point" in Zhuang medicine, once a day	Diclofenac sodium double release enteric capsule 75mg/time, qd	5~7	①②③
Li GS 2016 [40]	Two arms	Acupuncture: Sanyinjiao (SP6), Zhigou (SJ6), Zusanli (ST36), Neiting (ST44), Yinlingquan (SP9), Ashi point, Xiangyu (ST43), Hegu (LI4), Quchi (LI11), Yanglingquan (GB34), Xuehai (SP10), Xiyan (EX-LE5), Taichong (LR3), Waiguan (SJ5), Yangchi (SJ4), Hegu (LI4), once a day	Indometacin Enteric-coated Tablets 75mg/time, bid	10	①
Liao JX 2021 [41]	Two arms	Celecoxib Capsules, 0.2 g/time, bid; Blood-letting: Wenliu (LI7), Yanglao (SI6), Huizong (SJ7), Liangqiu (ST34), Jinmen (BL36), Waiqiu (GB36), once two days	Celecoxib Capsules, 0.2 g/time, bid	7	①②③④⑤
Liu SJ 2015 [42]	Two arms	Blood-letting: superficial choroid near the site of pain, once two days	Etoricoxib 60mg/time, qd	7	①③④⑤⑥
Mo LM 2021 [43]	Two arms	Blood-letting: Ashi point, Neiting (ST44), Taibai (SP3), once two days	Etoricoxib,120mg/time, qd	7	①②③
Shen WJ 2020 [44]	Two arms	Indometacin Enteric-coated Tablets 75mg/time, bid; Acupuncture: Ashi point, Zusanli (ST36), Quchi (LI11), Sanyinjiao (SP6), Yinlingquan (SP9), once a day, 5 times/week	Indometacin Enteric-coated Tablets 75mg/time, bid	28	①②③④
Wan HY 2020 [45]	Two arms	Acupuncture: Zusanli (ST36), Sanyinjiao (SP6), Yinlingquan (SP9), Quchi (LI11), Ashi point, Yanglingquan (GB34), Xuehai (SP10), Xiyan (EX-LE5), Hegu (LI4), Kunlun (BL60), Jixi (ST41), Yangchi (SJ4), Waiguan (SJ5), once a day	Indometacin Enteric-coated Tablets 75mg/time, bid	10	①②③④
Wang GF 2019 [46]	Two arms	Acupuncture: Zhubin (KI9), Neiting (ST44), Sanyinjiao (SP6), Zusanli (ST36), Yinlingquan (SP9), Zhigou (SJ6), Ashi point, once a day	Indometacin Enteric-coated Tablets 75mg/time, bid	10	④⑤⑥
Wu BQ 2021 [47]	Two arms	Loxoprofen Sodium Tablets, 60 mg, Tid; Electroacupuncture: Zusanli (ST36), Yinlingquan (SP9), Taichong (LR3), Sanyinjiao (SP6), Ashi point	Loxoprofen Sodium Tablets, 60 mg, tid	7	①②③⑥
Wu R 2020 [48]	Two arms	Acupuncture: Taibai (SP3), Xiyangguan (GB33), Qiuxu (GB40), Quchi (LI11), once three days	Etoricoxib,120mg/time, qd	3	②③④⑤⑥

(continued on next page)

Table 2 (continued)

Included studies	Study type	Interventions		Course of treatment (days)	Outcome indicators
		Treatment group	Control group		
Wu SL 2016 [49]	Two arms	Acupuncture: Ashi point, Sanyinjiao (SP6), Liangqiu (ST34), Yinlingquan (SP9), Taixi (KI3), Zusanli (ST36), Hegu (LI4), Quchi (LI11), once a day	Indometacin Enteric-coated Tablets 25mg/time, tid	21	①④
Xu XL 2011 [50]	Two arms	Acupuncture: Ashi point, Zusanli (ST36), Yinlingquan (SP9), Zhubin (KI9), Zhigou (SJ6), Neiting (ST44), Xiangu (ST43), Sanyinjiao (SP6), once a day	Indometacin Enteric-coated Tablets 75mg/time, bid	10	①
Yang LN 2021 [51]	Two arms	Acupuncture: Zusanli (ST36), Yinlingquan (SP9), Sanyinjiao (SP6), Ashi point, Quchi (LI11), once a day, stop for 2 days after every 5 days	Indometacin Enteric-coated Tablets 75mg/time, bid	10	①④
Yi JJ 2010 [52]	Two arms	Blood-letting: Taichong (LR3), Taibai (SP3), Xingjian (LR2), Xiyan (EX-LE5), Yanglingquan (GB34), Xuehai (SP10), Jiexi (ST41), Sanyinjiao (SP6), Qiuxu (GB40), once two days	Indomethacin 25mg/time, tid	10	①②③④
Yu M 2020 [53]	Two arms	Acupuncture: Ashi point, Taichong (LR3), Neiting (ST44), Quchi (LI11), Yangxi (LI5), Yangchi (SJ4), Qiuxu (GB40), Taichong (LR3), Taixi (KI3), Xuehai (SP10), Yanglingquan (GB34), once or twice a day	Indometacin Enteric-coated Tablets 25mg/time, tid	NA	①④
Yu M 2019 [54]	Two arms	Fire acupuncture: Ashi point, Zusanli (ST36), Yinlingquan (SP9), Dazhui (DU14), once a day	Etoricoxib, 120mg/time, qd	7	①②③④⑤⑥
Yu SM 2019 [55]	Two arms	Acupuncture: Sanyinjiao (SP6), Chongyang (ST42), Fenglong (ST40), Yinlingquan (SP9), Quchi (LI11), Dadu (SP2), Xingjian (LR2), once a day	Diclofenac Sodium Sustained-release Tablets 100mg/time, qd	7	①④⑤⑥
Zhao HD 2021 [56]	Two arms	Acupuncture: Ashi point, once a day	Diclofenac Sodium Sustained-release Tablets 75mg/time, qd	10	①②③
Zhou B 2019 [57]	Two arms	Acupuncture: Taichong (LR3), Neiting (ST44), Ashi point, Quchi (LI11), Yangchi (SJ4), Qiuxu (GB40), Taichong (LR3), Taixi (KI3), Yangxi (LI5), Xuehai (SP10), Yanglingquan (GB34), once a day, every 10 times after the interval of 3 days	Indometacin Enteric-coated Tablets 25mg/time, tid	30	①④
Yuan Y 2019 [58]	Two arms	Diclofenac sodium double release enteric capsule 75mg/time, qd; Blood-letting: Foot Yi Chong point, once three days	Diclofenac sodium double release enteric capsule 75mg/time, qd	9	①②③④⑤⑥
Zhang JP 2021 [59]	Two arms	Diclofenac sodium sustained-release tablets 50mg/time, tid; Blood-letting: Taichong (LR3), Sanyinjiao (SP6), Yinlingquan (SP9), Zusanli (ST36), Ashi point, once two days	Diclofenac sodium sustained-release tablets 50mg/time, tid	12	①②④⑤⑥
Zhang ZM 2012 [60]	Two arms	Blood-letting: Xingjian (LR2), Taichong (LR3), Neiting (ST44), Xiangu (ST43), Ashi point, once three days	Adindomexin tablets, 25mg/time, tid	10	1 ④

Note: ①: total effective rate, ②: improvement of pain VAS scores, ③: incidence of adverse events, ④: serum uric acid, ⑤: erythrocyte sedimentation rate, ⑥: C-reactive protein, qd: quaque die, bid: bis in die, tid: ter in die.

unclear; (3) Blinding of participants and personnel: Due to the limitation of intervention methods, all studies were not double-blinded, so the high risk was evaluated; (4) Blinding of assessment: 2 studies described blinding outcome assessors [38,52], so low risk was evaluated; other studies did not mention it, so the evaluation was unclear; (5) Incomplete outcome data and other bias: the outcome data of all studies were complete, and all studies were without other bias, so the evaluation was low risk; (6) Selective reporting bias: Because these clinical studies were not registered on the public platform in advance, it was impossible to judge whether there was selective reporting, so the evaluation was unclear. See the evaluation results in Fig. 2.

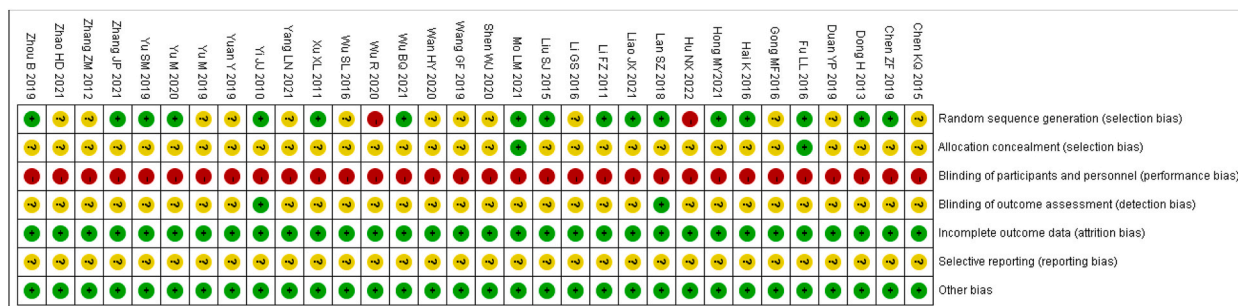


Fig. 2. Risk of bias for included studies.

### 3.4. Directly compared results

#### 3.4.1. Direct comparison of improvement of pain VAS scores

In the direct comparison of improvement of pain VAS scores, meta-analysis results showed that acupuncture, blood-letting + Western medicine and electroacupuncture + Western medicine were better than Western medicine alone ( $P < 0.05$ ), and no statistical difference was found between blood-letting and Western medicine alone ( $P > 0.05$ ). The descriptive analysis results indicated better efficacy of acupoint application and acupuncture + Western medicine than Western medicine alone ( $P < 0.05$ ), while there was no statistical difference between fire acupuncture and Western medicine alone ( $P > 0.05$ ), as shown in Table S3 in Supplementary materials.

#### 3.4.2. Direct comparison of total effective rate

In the direct comparison of total effective rate, meta-analysis results indicated superior efficacy of acupuncture, acupuncture + Western medicine and blood-letting + Western medicine than Western medicine alone ( $P < 0.05$ ), and no statistical difference was seen between blood-letting and Western medicine alone ( $P > 0.05$ ). The results of descriptive analysis showed that acupoint application was superior to Western medicine alone ( $P < 0.05$ ), and no statistical difference was found between electroacupuncture + Western medicine and Western medicine alone ( $P > 0.05$ ), as shown in Table S3 in Supplementary materials.

#### 3.4.3. Direct comparison of SUA levels

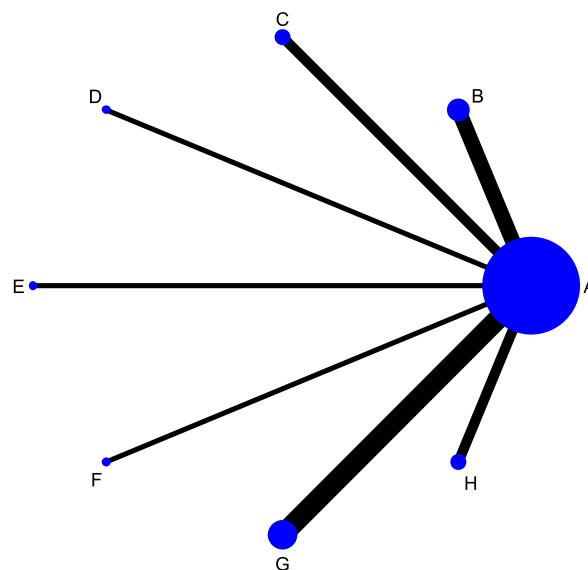
In the direct comparison of SUA levels, the results of meta-analysis showed better efficacy of acupuncture and acupuncture + Western medicine than Western medicine alone ( $P < 0.05$ ), and no significant difference could be found between blood-letting and blood-letting + Western medicine and Western medicine alone ( $P > 0.05$ ). The descriptive analysis results showed better efficacy of acupoint application and fire acupuncture than Western medicine alone ( $P < 0.05$ ), and no statistical difference was found between electroacupuncture + Western medicine and Western medicine alone ( $P > 0.05$ ), as shown in Table S3 in Supplementary materials.

#### 3.4.4. Direct comparison of CRP levels

In the direct comparison of CRP levels, the meta-analysis results showed superior efficacy of blood-letting + Western medicine to Western medicine alone ( $P < 0.05$ ), and no significant difference was found between acupuncture and Western medicine alone ( $P > 0.05$ ). The descriptive analysis results indicated better efficacy of acupoint application, acupuncture + Western medicine and electroacupuncture + Western medicine than Western medicine alone ( $P < 0.05$ ), and no statistical difference was found between blood-letting and fire acupuncture and Western medicine alone ( $P > 0.05$ ), as shown in Table S3 in Supplementary materials.

#### 3.4.5. Direct comparison of ESR levels

In the direct comparison of ESR levels, the meta-analysis results showed superior efficacy of acupuncture to Western medicine alone ( $P < 0.05$ ), and no significant difference was found between blood-letting + Western medicine and Western medicine alone ( $P > 0.05$ ). The descriptive analysis results indicated better efficacy of blood-letting, acupoint application and electroacupuncture + Western medicine than Western medicine alone ( $P < 0.05$ ), while fire acupuncture and acupuncture + Western medicine had no



**Fig. 3.** Evidence network of improvement of pain VAS scores in AGA treated with different acupuncture treatments. Note: A: Western medicine, B: acupuncture, C: blood-letting, D: acupoint application, E: fire acupuncture, F: acupuncture + Western medicine, G: blood-letting + Western medicine, H: electroacupuncture + Western medicine.



statistical difference compared with Western medicine alone ( $P > 0.05$ ), as shown in Table S3 in Supplementary materials.

### 3.4.6. Direct comparison of incidence of adverse events

In the direct comparison of the incidence of adverse events, the meta-analysis results showed better efficacy of acupuncture and blood-letting than Western medicine alone ( $P < 0.05$ ), while blood-letting + Western medicine and electroacupuncture + Western medicine had no statistical difference compared with Western medicine alone ( $P > 0.05$ ). The descriptive analysis results showed no statistical difference between acupoint application and acupuncture + Western medicine and Western medicine alone ( $P > 0.05$ ), as shown in Table S3 in Supplementary materials.

## 3.5. Results of network meta-analysis

### 3.5.1. Network meta-analysis of improvement of pain VAS scores

Fourteen studies reported improvement of pain VAS scores [30,32,35,36,38,39,41,44,47,48,54,56,57,59], involving 8 treatment regimens, with no closed loop between the regimens. See Fig. 3 for the evidence network diagram. Because all pairwise comparisons between treatment regimens were derived from indirect comparisons, no inconsistency tests were required. Statistical analysis was carried out under the consistency model, and the results showed better efficacy of acupoint application than acupuncture, acupuncture + Western medicine, electroacupuncture + Western medicine, blood-letting + Western medicine, blood-letting, fire acupuncture and Western medicine alone. Superior efficacy was seen of acupuncture, acupuncture + Western medicine, electroacupuncture + Western medicine and blood-letting to Western medicine alone, and there was no statistical difference in the comparison of other treatment plans (Table 3). The SUCRA ranking results of pain improvement were: Acupoint application (100%) > electroacupuncture + Western medicine (73.5%) > acupuncture + Western medicine (69.2%) > acupuncture (61%) > fire acupuncture (32.3%) > blood-letting (32%) > blood-letting + Western medicine (29.1%) > Western medicine (3%). The ranking diagram of SUCRA is shown in Fig. 4(A-H).

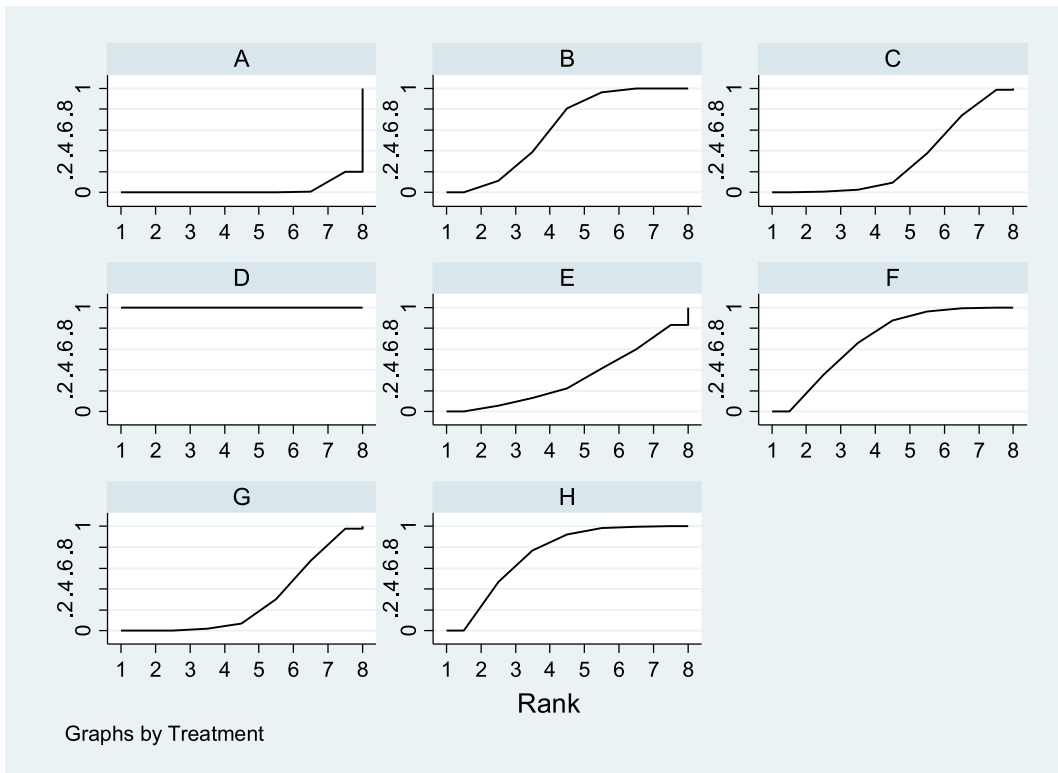
### 3.5.2. Network meta-analysis of the total effective rate

Twenty studies reported total effective rate [26–29,34,37,40–45,48–54,56], involving 7 treatment regimens, with no closed loops between the regimens. The evidence network diagram is shown in Fig. 5. Because all pairwise comparisons between treatment regimens were from indirect comparisons and no direct comparison results were available, no inconsistency tests were required. Statistical analysis was carried out under the consistency model, the results showed better efficacy of acupoint application than acupuncture, acupuncture + Western medicine, electroacupuncture + Western medicine, blood-letting + Western medicine, blood-letting and Western medicine alone; Acupuncture was better than acupuncture + Western medicine, electroacupuncture + Western medicine, blood-letting + Western medicine, blood-letting and Western medicine alone; Acupuncture + Western medicine was better than electroacupuncture + Western medicine, blood-letting + Western medicine, blood-letting and Western medicine alone; Electroacupuncture + Western medicine was better than blood-letting + Western medicine, blood-letting and Western medicine alone; blood-letting + Western medicine was better than blood-letting and Western medicine alone; blood-letting was superior to Western medicine alone, as shown in Table 4. The SUCRA ranking results of total effective rate were: acupoint application (85.2%) > acupuncture (75.2%) > acupuncture + Western medicine (63%) > electroacupuncture + Western medicine (53.1%) > blood-letting +

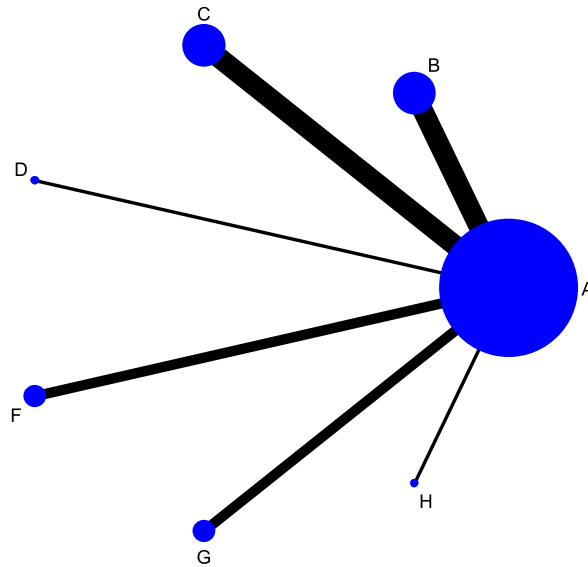
**Table 3**  
Network meta-analysis results of improvement of pain VAS scores.

Acupoint application	1.66 (0.80,2.52)	1.74 (0.85,2.63)	1.90 (1.17,2.64)	2.46 (1.14,3.78)	2.41 (1.57,3.25)	2.47 (1.63,3.31)	3.03 (2.41,3.65)
<b>-1.66</b> (-2.52,-0.80)	Electroacupuncture + Western medicine	0.08 (-0.80,0.96)	0.24 (-0.48,0.96)	0.80 (-0.51,2.11)	0.75 (-0.07,1.58)	0.81 (-0.02,1.64)	1.37 (0.77,1.97)
<b>-1.74</b> (-2.63,-0.85)	-0.08 (-0.96,0.80)	Acupuncture + Western medicine	0.16 (-0.60,0.93)	0.72 (-0.62,2.06)	0.67 (-0.19,1.54)	0.73 (-0.13,1.60)	1.29 (0.64,1.94)
<b>-1.90</b> (-2.64,-1.17)	-0.24 (-0.96,0.48)	-0.16 (-0.93,0.60)	Acupuncture	0.56 (-0.68,1.80)	0.51 (-0.19,1.21)	0.57 (-0.13,1.27)	1.13 (0.72,1.53)
<b>-2.46</b> (-3.78,-1.14)	-0.80 (-2.11,0.51)	-0.72 (-2.06,0.62)	-0.56 (-1.80,0.68)	Fire acupuncture	-0.05 (-1.35,1.25)	0.01 (-1.29,1.31)	0.57 (-0.60,1.74)
<b>-2.41</b> (-3.25,-1.57)	-0.75 (-1.58,0.07)	-0.67 (-1.54,0.19)	-0.51 (-1.21,0.19)	0.05 (-1.25,1.35)	Blood-letting	0.06 (-0.75,0.86)	0.62 (0.05,1.19)
<b>-2.47</b> (-3.31,-1.63)	-0.81 (-1.64,0.02)	-0.73 (-1.60,0.13)	-0.57 (-1.27,0.13)	-0.01 (-1.31,1.29)	-0.06 (-0.86,0.75)	Blood-letting + Western medicine	0.56 (-0.01,1.13)
<b>-3.03</b> (-3.65,-2.41)	<b>-1.37 (-1.97,-0.77)</b>	<b>-1.29 (-1.94,-0.64)</b>	<b>-1.13 (-1.53,-0.72)</b>	-0.57 (-1.74,0.60)	<b>-0.62 (-1.19,-0.05)</b>	-0.56 (-1.13,0.01)	Western medicine

Notes: The above data represented the confidence interval. Data in bold indicated statistical differences in efficacy between the two treatments.



**Fig. 4.** SUCRA ranking diagram of the improvement of pain VAS score by different treatments. Note: In the diagram, RANK was the abscissa, representing the possible position, Cumulative Probabilities was the ordinate, representing the probability corresponding to the position, and the area under the curve represented the possible overall probability of the treatment; A: Western medicine, B: acupuncture, C: blood-letting, D: acupoint application, E: fire acupuncture, F: acupuncture + Western medicine, G: blood-letting + Western medicine, H: electroacupuncture + Western medicine.



**Fig. 5.** Evidence network diagram of total effective rate of different acupuncture treatments for AGA. Note: A: Western medicine, B: acupuncture, C: blood-letting, D: acupoint application, F: acupuncture + Western medicine, G blood-letting + Western medicine, H: electroacupuncture + Western medicine.

**Table 4**

Network meta-analysis results of total effective rate.

Acupoint application	-0.10 (-0.41,0.20)	-0.14 (-0.44,0.17)	-0.16 (-0.54,0.21)	-0.18 (-0.50,0.13)	-0.24 (-0.55,0.06)	-0.30 (-0.60,-0.01)
<b>0.10(-0.20,0.41)</b>	Acupuncture	-0.03 (-0.15,0.09)	-0.06 (-0.30,0.19)	-0.08 (-0.22,0.06)	-0.14 (-0.24,-0.03)	-0.20 (-0.28,-0.12)
<b>0.14(-0.17,0.44)</b>	<b>0.03(-0.09,0.15)</b>	Acupuncture + Western medicine	-0.03 (-0.27,0.22)	-0.05 (-0.17,0.07)	-0.10 (-0.22,0.01)	-0.17 (-0.25,-0.08)
<b>0.16(-0.21,0.54)</b>	<b>0.06(-0.19,0.30)</b>	<b>0.03(-0.22,0.27)</b>	Electroacupuncture + Western medicine	-0.02 (-0.27,0.22)	-0.08 (-0.32,0.16)	-0.14 (-0.37,0.09)
<b>0.18(-0.13,0.50)</b>	<b>0.08(-0.06,0.22)</b>	<b>0.05(-0.07,0.17)</b>	<b>0.02 (-0.22,0.27)</b>	Blood-letting + Western medicine	-0.06 (-0.17,0.06)	-0.12 (-0.23,-0.00)
<b>0.24(-0.06,0.55)</b>	<b>0.14 (0.03,0.24)</b>	<b>0.10(-0.01,0.22)</b>	<b>0.08 (-0.16,0.32)</b>	<b>0.06 (-0.06,0.17)</b>	Blood-letting	-0.06 (-0.13,0.01)
<b>0.30 (0.01,0.60)</b>	<b>0.20 (0.12,0.28)</b>	<b>0.17(0.08,0.25)</b>	<b>0.14 (-0.09,0.37)</b>	<b>0.12 (0.00,0.23)</b>	<b>0.06 (-0.01,0.13)</b>	Western medicine

Notes: The above data represented the confidence interval. Data in bold indicated statistical differences in efficacy between the two treatments.

Western medicine (44.8%) > blood-letting (25.1%) > Western medicine alone (3.6%). The ranking of SUCRA is shown in Fig. 6(A-H).

3.5.3. Network meta-analysis of SUA levels

Twenty-one studies reported SUA levels [31,35–38,41,42,44–46,48,49,51–58,60], involving 8 treatment regimens, with no closed loop between the regimens. The evidence network diagram is shown in Fig. 7. Since all the pairwise comparisons between treatment plans were from indirect comparisons, there was no need for inconsistency test. Statistical analysis was conducted under the consistency model. The results showed that acupoint application and acupuncture + Western medicine were better than blood-letting and Western medicine, electroacupuncture + Western medicine, blood-letting and Western medicine alone. Acupuncture was better than blood-letting + Western medicine, blood-letting and Western medicine alone; No statistical difference among the other treatment regimens was found (Table 5). The SUCRA ranking results of SUA levels were: Acupoint sticking (95%) > acupuncture + Western medicine (87.5%) > acupuncture (66.2%) > fire acupuncture (55.5%) > blood-letting + Western medicine (36.9%) > electroacupuncture + Western medicine (31.2%) > blood-letting (14.7%) > Western medicine (13%), The SUCRA ranking diagram is shown in Fig. 8(A-H).

3.5.4. Network meta-analysis of the CRP levels

CRP levels were reported in 10 RCTs [36,37,42,46–48,54–57], involving 8 treatment regimens, with no closed loop between treatment regimens. The evidence network diagram is shown in Fig. 9. Since all the pairwise comparisons between all the treatment plans came from indirect comparisons, there was no need for inconsistency test. Statistical analysis was carried out under the consistency model, and the results showed no statistical difference in CRP levels among the treatment plans (Table 6). The SUCRA ranking results were: acupuncture (75.3%) > blood-letting + Western medicine (53.6%) > acupuncture + Western medicine (50.9%) > acupoint application (49.2%) > electropuncture + Western medicine (47.3%) > blood-letting (45.3%) > fire acupuncture (41.9%) > Western medicine alone (36.5%), The SUCRA ranking diagram is shown in Fig. 10(A-H).

3.5.5. Network meta-analysis of the ESR levels

Nine studies reported ESR levels [36,38,41,42,46,48,54,56,57], involving 8 treatment regimens, and there was no closed loop between the regimens. The evidence network diagram is shown in Fig. 11. The consistency model analysis results indicated better efficacy of acupuncture than acupuncture + Western medicine, blood-letting, blood-letting + Western medicine, fire acupuncture and

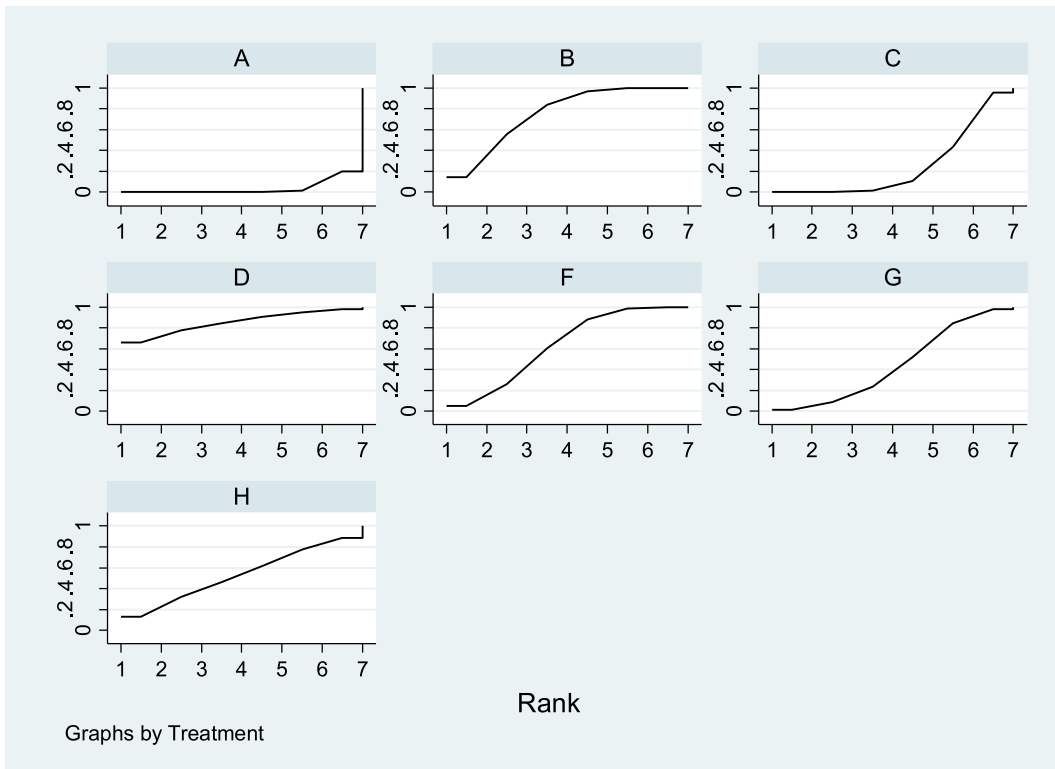
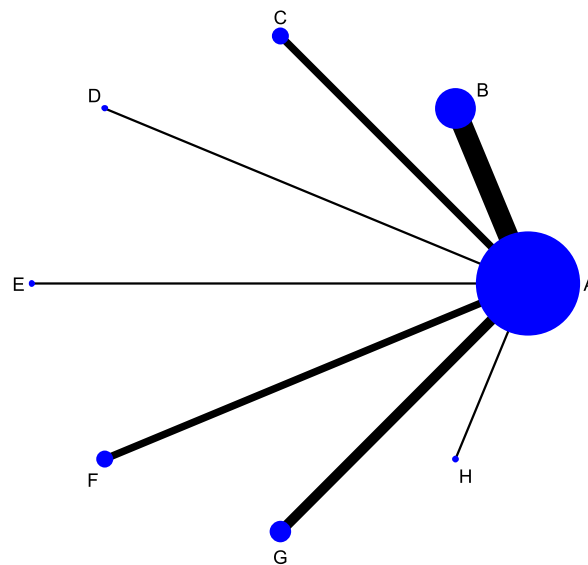


Fig. 6. SUCRA ranking diagram of total effective rate for different acupuncture therapies. Note: In the diagram, RANK was the abscissa, representing the possible position, Cumulative Probabilities was the ordinate, representing the probability corresponding to the position, and the area under the curve represented the possible overall probability of the treatment; A: Western medicine, B: acupuncture, C: blood-letting, D: acupoint application, F: acupuncture + Western medicine, G blood-letting + Western medicine, H: electroacupuncture + Western medicine.



**Fig. 7.** Evidence network diagram of SUA levels in treating AGA with different acupuncture treatments

Note: A: Western medicine, B: acupuncture, C: blood-letting, D: acupoint application, F: acupuncture + Western medicine, G blood-letting + Western medicine, H: electroacupuncture + Western medicine.

Western medicine alone; Acupoint application was better than blood-letting + Western medicine and Western medicine alone; However, no statistical difference was found between acupuncture and acupoint application, and no statistical difference could be found between other treatment programs (Table 7). The SUCRA ranking results were: acupuncture (95%) > acupoint application (84.7%) > electroacupuncture + Western medicine (52.8%) > acupuncture + Western medicine (45.3%) > blood-letting (40.1%) > blood-letting + Western medicine (31.6%) > fire acupuncture (28.7%) > Western medicine alone (21.8%), The SUCRA ranking diagram is shown in Fig. 12(A-H).

### 3.5.6. Network meta-analysis of the incidence of adverse events

Sixteen studies reported adverse events [30,32,35,36,38,39,41,42,44,45,47,48,52,55,56,59], involving 7 treatment regimens, with no closed loop between treatment regimens. See Fig. 13 for the evidence network diagram. The consistency model analysis results indicated better efficacy of acupuncture than acupuncture + Western medicine, blood-letting + Western medicine, electroacupuncture + Western medicine and Western medicine alone; Blood-letting was better than electroacupuncture + Western medicine and Western medicine alone; Acupuncture + Western medicine, blood-letting + Western medicine and electroacupuncture + Western medicine were all superior to Western medicine alone, and there was no statistical difference in the comparison of other treatment plans, as shown in Table 8. The SUCRA ranking results of the incidence of adverse events were: Acupuncture (83.1%) > blood-letting (66.7%) > acupoint application (60.4%) > acupuncture + Western medicine (51.2%) > blood-letting + Western medicine (42.9%) > electroacupuncture + Western medicine (33.2%) > Western medicine alone (12.4%). The SUCRA ranking diagram is shown in Fig. 14 (A-H). The specific adverse events in the treatment and control groups were listed (Table 9). Adverse events related to acupuncture therapies were mainly needle dizziness, skin redness and swelling and subcutaneous hematoma, while the adverse events related to Western medicine were mainly digestive system discomfort and dizziness.

### 3.5.7. Publication bias

Stata 14.2 software was used to plot the comparison-corrected funnel plots for improvement of pain VAS scores, the primary outcome indicator. The funnel plots showed significant asymmetry, indicating existing publication bias or small-sample effects (Fig. 15).

## 4. Discussion

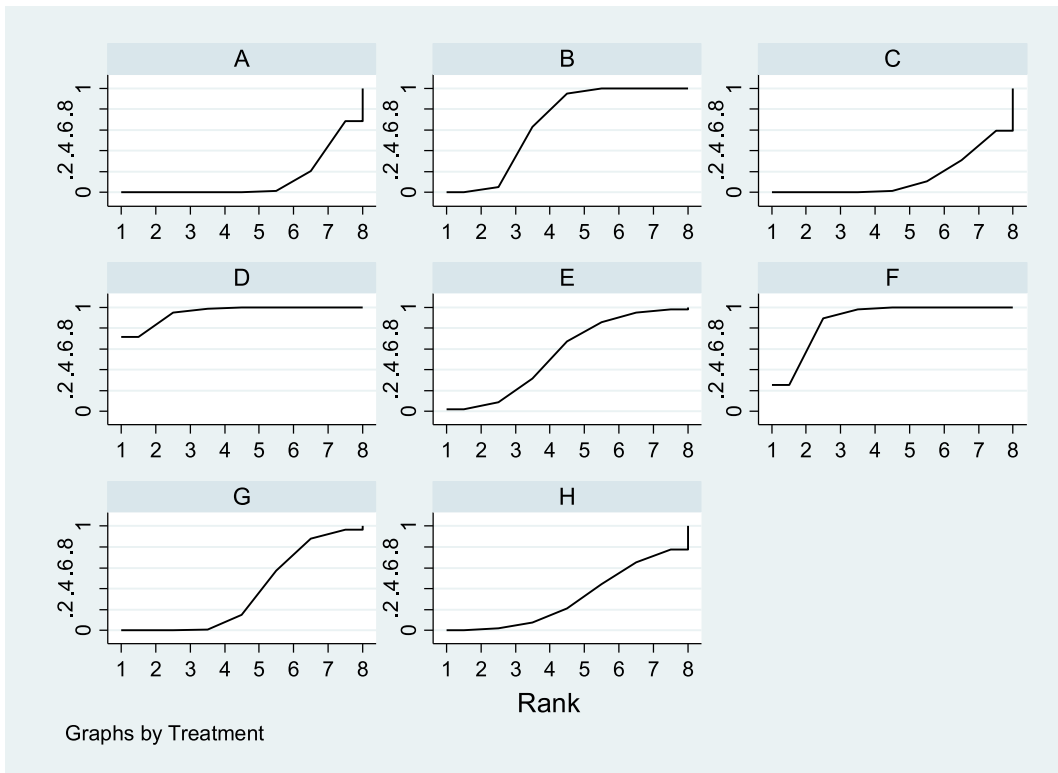
This network meta-analysis included 32 RCTs, involving 8 treatment programs, including acupuncture, blood-letting, acupoint application, fire acupuncture, acupuncture + Western medicine, blood-letting + Western medicine, electroacupuncture + Western medicine, and Western medicine alone. In terms of improvement of pain VAS scores, increasing total effective rate and reducing SUA levels, acupoint application may be the best treatment plan. In terms of improvement of pain VAS scores, besides acupoint application, electroacupuncture + Western medicine is also the second treatment plan. Acupuncture may be the best treatment for reducing ESR levels and for safety. No statistically significant differences was found between regimens in reducing CRP levels. According to Table 9, it can also be concluded that acupuncture treatment has no serious adverse reactions and is suitable for clinical promotion.

Acupoint application applies the prepared Chinese herbal medicine paste to specific acupoints, which can not only stimulate the

**Table 5**  
Network meta-analysis results of SUA levels.

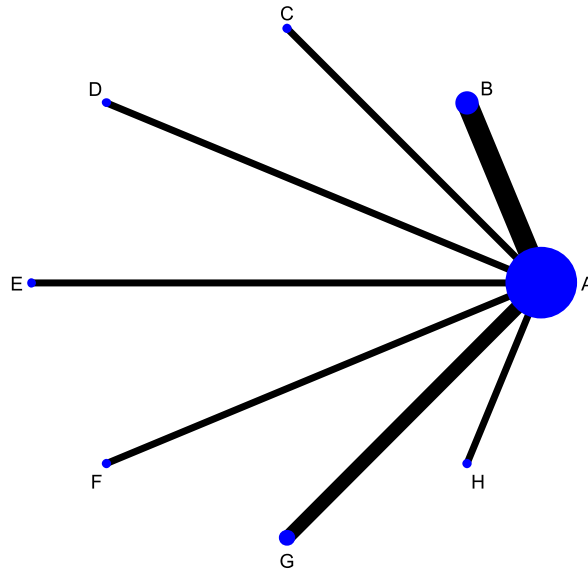
Acupoint application	13.03 (-27.40,53.47)	35.70 (-0.16,71.56)	44.88 (-5.34,95.10)	61.83 (22.05,101.61)	66.81 (12.34,121.28)	78.61 (37.56,119.66)	78.75 (45.43,112.07)
-13.03 (-53.47,27.40)	Acupuncture + Western medicine	22.67 (-4.02,49.36)	31.85 (-12.17,75.86)	48.80 (17.04,80.56)	53.78 (4.97,102.58)	65.58 (32.74,98.41)	65.72 (42.80,88.63)
-35.70 (-71.56,0.16)	-22.67 (-49.36,4.02)	Acupuncture	9.18 (-30.68,49.03)	26.13 (0.76,51.50)	31.11 (-13.98,76.20)	42.91 (15.29,70.52)	43.05 (29.77,56.32)
-44.88 (-95.10,5.34)	-31.85 (-75.86,12.17)	-9.18 (-49.03,30.68)	Fire acupuncture	16.95 (-26.47,60.36)	21.93 (-35.24,79.10)	33.73 (-10.85,78.31)	33.87 (-3.71,71.45)
<b>-61.83 (-101.61,-22.05)</b>	<b>-48.80 (-80.56,-17.04)</b>	<b>-26.13 (-51.50,-0.76)</b>	-16.95 (-60.36,26.47)	Blood-letting + Western medicine	4.98 (-43.28,53.25)	16.78 (-15.76,49.32)	16.92 (-4.82,38.66)
<b>-66.81 (-121.28,-12.34)</b>	<b>-53.78 (-102.58,-4.97)</b>	-31.11 (-76.20,13.98)	-21.93 (-79.10,35.24)	-4.98 (-53.25,43.28)	Electroacupuncture + Western medicine	11.80 (-37.52,61.12)	11.94 (-31.15,55.03)
<b>-78.61 (-119.66,-37.56)</b>	<b>-65.58 (-98.41,-32.74)</b>	<b>-42.91 (-70.52,-15.29)</b>	-33.73 (-78.31,10.85)	-16.78 (-49.32,15.76)	-11.80 (-61.12,37.52)	Blood-letting	0.14 (-23.85,24.13)
<b>-78.75 (-112.07,-45.43)</b>	<b>-65.72 (-88.63,-42.80)</b>	<b>-43.05 (-56.32,-29.77)</b>	-33.87 (-71.45,3.71)	-16.92 (-38.66,4.82)	-11.94 (-55.03,31.15)	-0.14 (-24.13,23.85)	Western medicine

Notes: The above data represented the confidence interval. Data in bold indicated statistical differences in efficacy between the two treatments.



**Fig. 8.** SUCRA ranking diagram of SUA for different acupuncture therapies

Note: In the diagram, RANK was the abscissa, representing the possible position, Cumulative Probabilities was the ordinate, representing the probability corresponding to the position, and the area under the curve represented the possible overall probability of the treatment; A: Western medicine, B: acupuncture, C: blood-letting, D: acupoint application, F: acupuncture + Western medicine, G blood-letting + Western medicine, H: electroacupuncture + Western medicine.



**Fig. 9.** Evidence network diagram of CRP levels in AGA treated by different acupuncture treatments

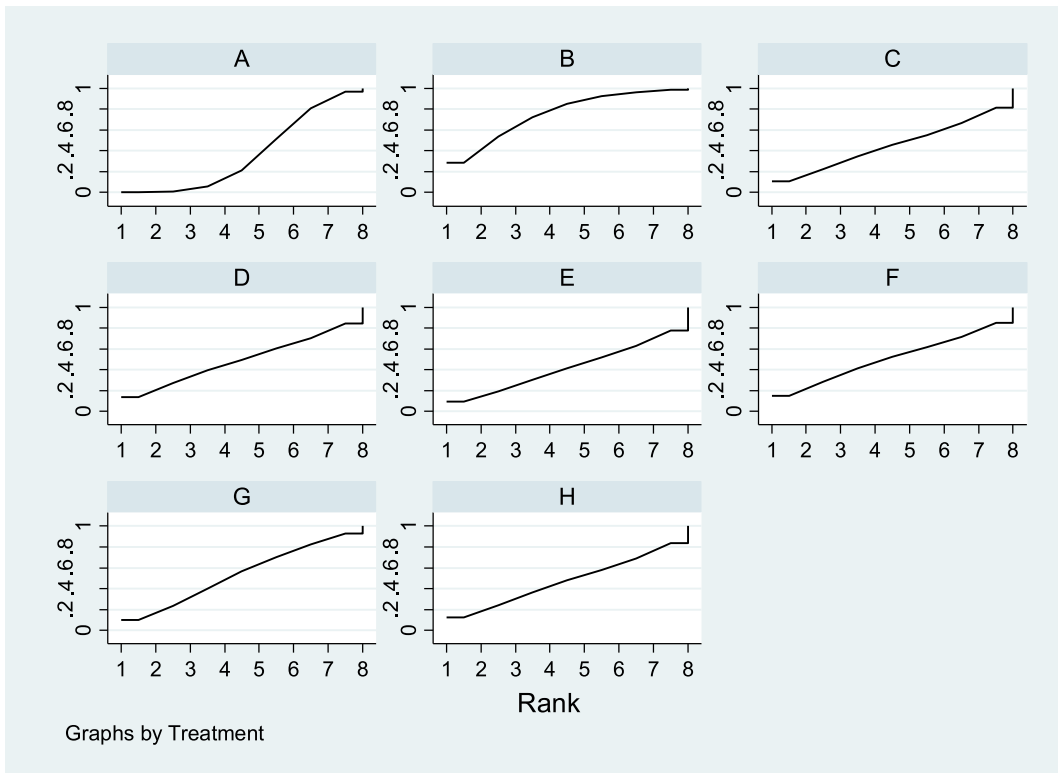
Note: A: Western medicine, B: acupuncture, C: blood-letting, D: acupoint application, F: acupuncture + Western medicine, G blood-letting + Western medicine, H: electroacupuncture + Western medicine.

**Table 6**  
Network meta-analysis results of CRP levels.

Acupuncture	6.27 (-15.11,27.66)	7.03 (-19.58,33.65)	7.70 (-18.90,34.31)	8.04 (-18.56,34.65)	9.04 (-17.81,35.89)	10.03 (-16.57,36.64)	10.26 (-3.94,24.46)
-6.27 (-27.66,15.11)	<b>Blood-letting + Western medicine</b>	0.76 (-26.86,28.38)	1.43 (-26.17,29.03)	1.77 (-25.83,29.37)	2.77 (-25.07,30.61)	3.76 (-23.84,31.36)	3.99 (-12.00,19.98)
-7.03 (-33.65,19.58)	-0.76 (-28.38,26.86)	<b>Acupuncture + Western medicine</b>	0.67 (-31.16,32.50)	1.01 (-30.82,32.84)	2.01 (-30.02,34.04)	3.00 (-28.83,34.83)	3.23 (-19.28,25.74)
-7.70 (-34.31,18.90)	-1.43 (-29.03,26.17)	-0.67 (-32.50,31.16)	<b>Acupoint application</b>	0.34 (-31.48,32.16)	1.34 (-30.68,33.36)	2.33 (-29.49,34.15)	2.56 (-19.94,25.06)
-8.04 (-34.65,18.56)	-1.77 (-29.37,25.83)	-1.01 (-32.84,30.82)	-0.34 (-32.16,31.48)	<b>Electroacupuncture + Western medicine</b>	1.00 (-31.02,33.02)	1.99 (-29.83,33.81)	2.22 (-20.28,24.72)
-9.04 (-35.89,17.81)	-2.77 (-30.61,25.07)	-2.01 (-34.04,30.02)	-1.34 (-33.36,30.68)	-1.00 (-33.02,31.02)	<b>Blood-letting</b>	0.99 (-31.03,33.01)	1.22 (-21.57,24.01)
-10.03 (-36.64,16.57)	-3.76 (-31.36,23.84)	-3.00 (-34.83,28.83)	-2.33 (-34.15,29.49)	-1.99 (-33.81,29.83)	-0.99 (-33.01,31.03)	<b>Fire acupuncture</b>	0.23 (-22.27,22.73)
-10.26 (-24.46,3.94)	-3.99 (-19.98,12.00)	-3.23 (-25.74,19.28)	-2.56 (-25.06,19.94)	-2.22 (-24.72,20.28)	-1.22 (-24.01,21.57)	-0.23 (-22.73,22.27)	<b>Western medicine</b>

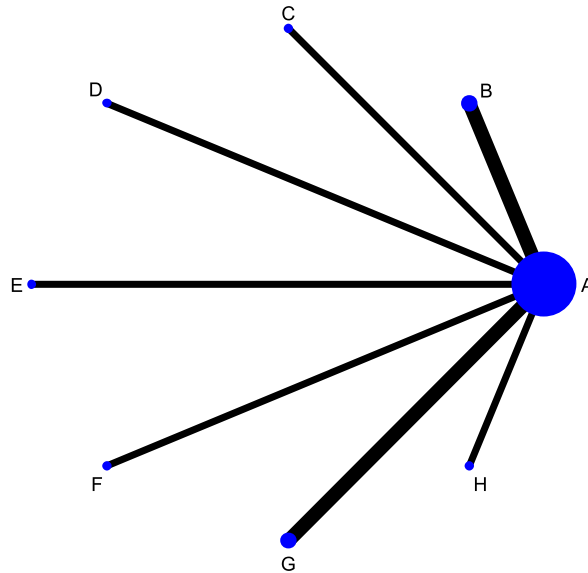
Notes: The above data represented the confidence interval. Data in bold indicated statistical differences in efficacy between the two treatments.





**Fig. 10.** SUCRA ranking diagram of CRP for different acupuncture therapies

Note: In the diagram, RANK was the abscissa, representing the possible position, Cumulative Probabilities was the ordinate, representing the probability corresponding to the position, and the area under the curve represented the possible overall probability of the treatment; A: Western medicine, B: acupuncture, C: blood-letting, D: acupoint application, E: acupuncture + Western medicine, F: acupuncture + Western medicine, G: blood-letting + Western medicine, H: electroacupuncture + Western medicine.



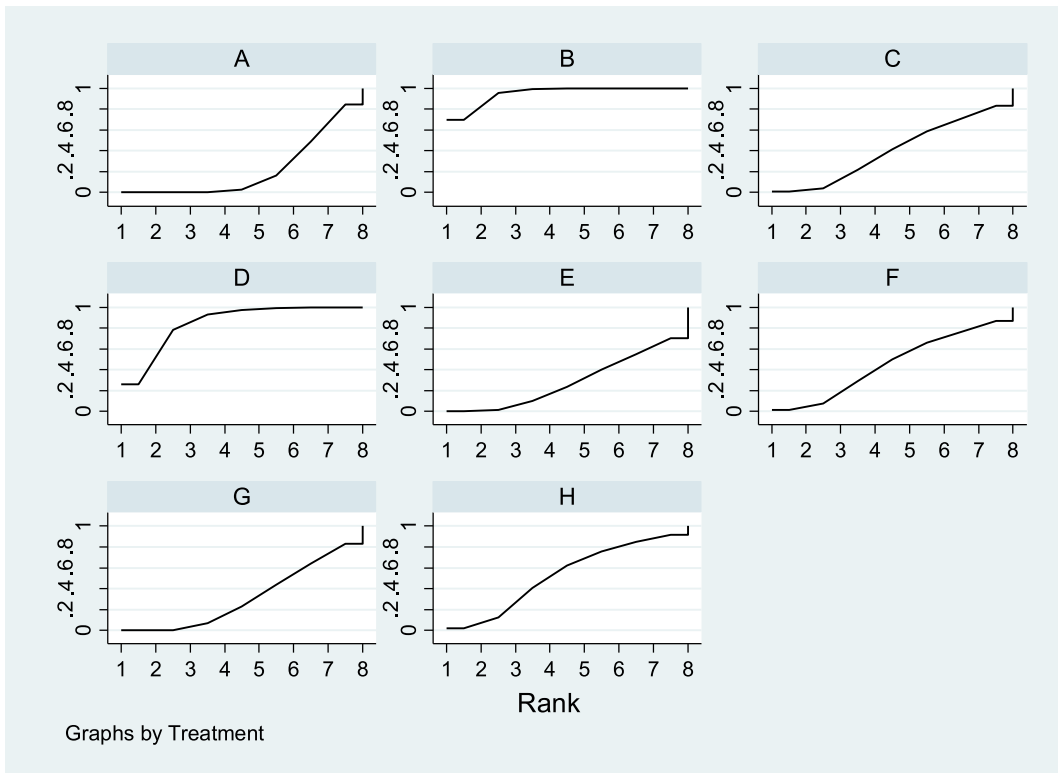
**Fig. 11.** Evidence network diagram of ESR levels in AGA treated by different acupuncture treatments

Note: A: Western medicine, B: acupuncture, C: blood-letting, D: acupoint application, E: acupuncture + Western medicine, F: acupuncture + Western medicine, G: blood-letting + Western medicine, H: electroacupuncture + Western medicine.

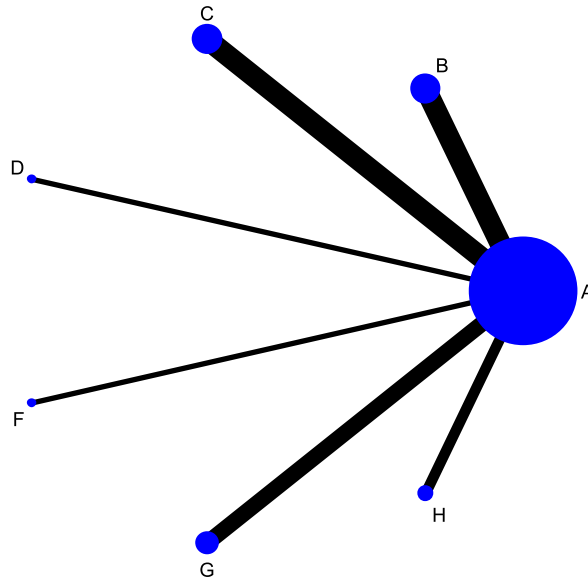
**Table 7**  
Network meta-analysis results of ESR levels.

Acupuncture	2.60 (-6.02,11.22)	8.45 (-0.88,17.78)	9.66 (0.25,19.07)	10.27 (1.09,19.45)	11.47 (4.26,18.68)	11.93 (3.22,20.64)	12.31 (7.01,17.61)
-2.60 (-11.22,6.02)	Acupoint application	5.85 (-4.40,16.10)	7.06 (-3.27,17.39)	7.67 (-2.45,17.79)	8.87 (0.48,17.25)	9.33 (-0.36,19.02)	9.71 (2.92,16.50)
-8.45 (-17.78,0.88)	-5.85 (-16.10,4.40)	Electroacupuncture + Western medicine	1.21 (-9.72,12.14)	1.82 (-8.91,12.55)	3.02 (-6.09,12.13)	3.48 (-6.85,13.81)	3.86 (-3.81,11.53)
<b>-9.66 (-19.07,-0.25)</b>	-7.06 (-17.39,3.27)	-1.21 (-12.14,9.72)	Acupuncture + Western medicine	0.61 (-10.19,11.41)	1.81 (-7.39,11.01)	2.27 (-8.13,12.67)	2.65 (-5.13,10.43)
<b>-10.27 (-19.45,-1.09)</b>	-7.67 (-17.79,2.45)	-1.82 (-12.55,8.91)	-0.61 (-11.41,10.19)	Blood-letting	1.20 (-7.77,10.16)	1.66 (-8.54,11.86)	2.04 (-5.46,9.54)
<b>-11.47 (-18.68,-4.26)</b>	<b>-8.87 (-17.25,-0.48)</b>	-3.02 (-12.13,6.09)	-1.81 (-11.01,7.39)	-1.20 (-10.16,7.77)	Blood-letting + Western medicine	0.46 (-8.02,8.94)	0.84 (-4.07,5.76)
<b>-11.93 (-20.64,-3.22)</b>	-9.33 (-19.02,0.36)	-3.48 (-13.81,6.85)	-2.27 (-12.67,8.13)	-1.66 (-11.86,8.54)	-0.46 (-8.94,8.02)	Fire acupuncture	0.38 (-6.53,7.29)
<b>-12.31 (-17.61,-7.01)</b>	<b>-9.71 (-16.50,-2.92)</b>	-3.86 (-11.53,3.81)	-2.65 (-10.43,5.13)	-2.04 (-9.54,5.46)	-0.84 (-5.76,4.07)	-0.38 (-7.29,6.53)	Western medicine

Notes: The above data represented the confidence interval. Data in bold indicated statistical differences in efficacy between the two treatments.



**Fig. 12.** SUCRA ranking diagram of ESR levels for different acupuncture therapies  
 Note: In the diagram, RANK was the abscissa, representing the possible position, Cumulative Probabilities was the ordinate, representing the probability corresponding to the position, and the area under the curve represented the possible overall probability of the treatment; A: Western medicine, B: acupuncture, C: blood-letting, D: acupoint application, F: acupuncture + Western medicine, G blood-letting + Western medicine, H: electroacupuncture + Western medicine.



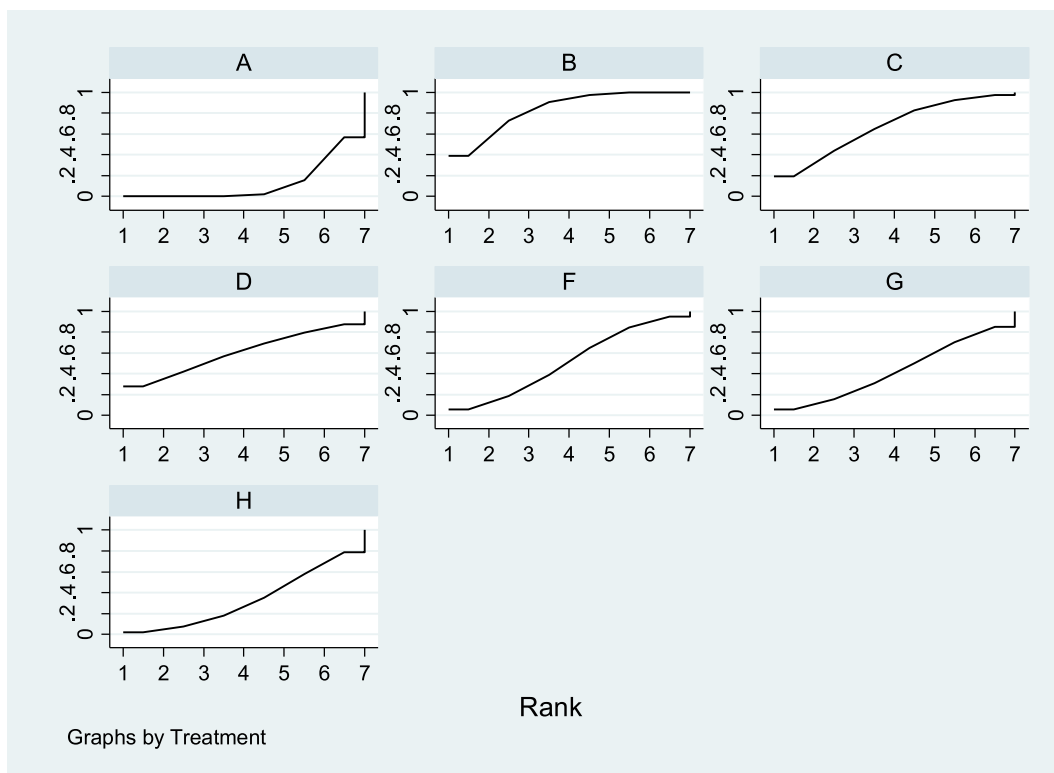
**Fig. 13.** Evidence network diagram of the incidence of adverse events in treating AGA with different acupuncture treatments  
 Note: A: Western medicine, B: acupuncture, C: blood-letting, D: acupoint application, F: acupuncture + Western medicine, G blood-letting + Western medicine, H: electroacupuncture + Western medicine.

**Table 8**

Network meta-analysis results of the incidence of adverse events.

Acupuncture	0.39 (-1.14,1.92)	0.46 (-1.90,2.82)	0.75 (-0.67,2.17)	0.94 (-0.70,2.58)	1.16 (-0.33,2.66)	1.56 (0.70,2.42)
-0.39 (-1.92,1.14)	Blood-letting	0.07 (-2.46,2.61)	0.36 (-1.33,2.05)	0.55 (-1.33,2.43)	0.77 (-0.98,2.53)	1.17 (-0.09,2.44)
-0.46 (-2.82,1.90)	-0.07 (-2.61,2.46)	Acupoint application	0.29 (-2.18,2.75)	0.48 (-2.12,3.08)	0.70 (-1.81,3.21)	1.10 (-1.10,3.29)
<b>-0.75 (-2.17,0.67)</b>	-0.36 (-2.05,1.33)	-0.29 (-2.75,2.18)	Acupuncture + Western medicine	0.19 (-1.60,1.98)	0.41 (-1.25,2.07)	0.81 (-0.31,1.93)
<b>-0.94 (-2.58,0.70)</b>	-0.55 (-2.43,1.33)	-0.48 (-3.08,2.12)	-0.19 (-1.98,1.60)	Blood-letting + Western medicine	0.22 (-1.63,2.07)	0.62 (-0.77,2.01)
<b>-1.16 (-2.66,0.33)</b>	<b>-0.77 (-2.53,0.98)</b>	-0.70 (-3.21,1.81)	-0.41 (-2.07,1.25)	-0.22 (-2.07,1.63)	Electroacupuncture + Western medicine	0.40 (-0.82,1.62)
<b>-1.56 (-2.42,-0.70)</b>	<b>-1.17 (-2.44,0.09)</b>	-1.10 (-3.29,1.10)	<b>-0.81 (-1.93,0.31)</b>	<b>-0.62 (-2.01,0.77)</b>	<b>-0.40 (-1.62,0.82)</b>	Western medicine

Notes: The above data represented the confidence interval. Data in bold indicated statistical differences in efficacy between the two treatments.

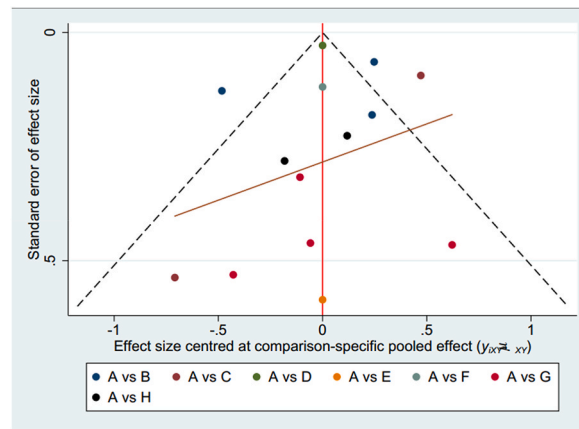


**Fig. 14.** SUCRA ranking diagram of incidence of adverse events for different acupuncture therapies  
 Note: In the diagram, RANK was the abscissa, representing the possible position, Cumulative Probabilities was the ordinate, representing the probability corresponding to the position, and the area under the curve represented the possible overall probability of the treatment; A: Western medicine, B: acupuncture, C: blood-letting, D: acupoint application, F: acupuncture + Western medicine, G blood-letting + Western medicine, H: electroacupuncture + Western medicine.

**Table 9**  
 Incidence of specific adverse events in the treatment group and the control groups.

Studies	Adverse events	
	Treatment group	Control group
Chen ZF 2019 [26]	Skin redness and swelling	Nausea, vomiting, lethargy, headache
Fu LL 2016 [41]	No adverse reactions	Loss of appetite, abdominal distension
Hai K 2016 [52]	Nausea, gastrointestinal discomfort	Nausea, gastrointestinal discomfort
Hong MY 2021 [48]	Gastrointestinal discomfort	Anaphylactic reaction
Lan SZ 2018 [38]	Dizziness	Nausea, dizziness
Li FZ 2011 [39]	No adverse reactions	Upper abdominal pain, and diarrhea
Liao JX 2021 [41]	No adverse reactions	No adverse reactions
Liu SJ 2015 [42]	Subcutaneous hematoma	Gastrointestinal discomfort
Shen WJ 2020 [44]	Nausea, vomiting, headache, lethargy	Nausea, vomiting, mouth sores, headaches, drowsiness
Wan HY 2020 [45]	Not described	Not described
Wu BQ 2021 [47]	Nausea, vomiting, dizziness, weakness	Nausea, vomiting, dizziness, weakness
Wu R 2020 [48]	Subcutaneous hematoma	Abdominal distension, abdominal pain, nausea, and vomiting
Yi JJ 2010 [52]	No adverse reactions	Loss of appetite, bloating, and nausea
Yu SM 2019 [55]	No adverse reactions	Not described
Yuan Y 2019 [56]	No adverse reactions	Vomiting, abdominal pain, palpitation, chest tightness
Zhao HD 2021 [59]	Needle dizziness	Gastrointestinal discomfort, dizziness, headache, and anemia

acupoint, but also play a pharmacological effect by absorbing the effective components of Chinese herbal medicine through the skin. In addition, acupoint application has a longer stimulation time than other acupuncture and moxibustion therapies [61]. This network meta-analysis showed that acupoint application was the best treatment for acute gouty arthritis, but the small sample size required further studies to confirm it. Electroacupuncture is a kind of therapy that connects low-frequency pulse current to the acupuncture point after filiform acupuncture, which can enhance the efficacy of acupuncture [59]. ST36 (Zusanli), SP9 (Yinlingquan) and A-shi points are commonly used for acupoint application and acupuncture treatment of AGA [62]. In modern studies, stimulation of ST36



**Fig. 15.** Corrected funnel plot- Comparison of improvement of pain VAS scores

Note: A: Western medicine, B: acupuncture, C: blood-letting, D: acupoint application, F: acupuncture + Western medicine, G blood-letting + Western medicine, H: electroacupuncture + Western medicine.

(Zusanli) has been confirmed to activate the vagal-adrenal anti-inflammatory pathway in mice and play an anti-inflammatory role [63]. Stimulation of SP6 (Yinlingquan) can decrease tumor necrosis factor (TNF)- $\alpha$  and interleukin (IL)-6 levels in Lipopolysaccharide-exposed mice, and achieve anti-inflammatory effect. Stimulation of A-shi points could inhibit the expression of phosphorylated c-Jun n-terminal kinase (P-JNK) in Dorsal root Ganglion in mice [64]. Acupuncture has the characteristics of multi-pathway and multi-target in the treatment of AGA. More studies are needed to reveal the underlying mechanism.

This study used network meta-analysis method to indirectly compare the efficacy of acupunctures-related therapies on AGA, which is valuable for clinicians to select appropriate acupuncture regimen for AGA treatment. However, this study has some limitations. First, due to the limitation of treatment protocol, none of the studies used blinding method, and most of the studies did not describe the details of allocation hiding and randomization methods, which may affect the results 's reliability. Second, Partial acupuncture therapy (acupoint application and fire-acupuncture) involves few researches, which may influence the research conclusion, and more high-quality clinical studies with large samples are needed to verify it in the future. Finally, although we included all patients with AGA, the severity of the disease may be different, and the types and dosages of painkillers and the choice of acupuncture points may be different. These factors may lead to increased clinical heterogeneity.

## 5. Conclusion

The existing evidence shows that acupoint application has more advantages in improving the total effective rate, improving pain and reduce SUA levels, and acupuncture has an advantage in reducing ESR levels and adverse events. Nevertheless, due to the lower quality of original research, the evidence quality of this conclusion is low, and high quality RCTs with larger sample sizes are still required to assess the efficacy of acupuncture-related therapies for AGA.

## Data availability statement

The data used to support the findings of this study are included with in the article and the supplementary information files.

## CRediT authorship contribution statement

**Yihua Fan:** Writing – original draft. **Chengcheng Zhu:** Data curation. **Yue Ji:** Data curation. **Jing Peng:** Software. **Guanran Wang:** Software. **Renhong Wan:** Methodology. **Wei Liu:** Writing – review & editing, Funding acquisition.

## Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Wei Liu reports financial support was provided by the National Natural Science Foundation of China. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.heliyon.2024.e28122>.

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