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Effectiveness of Invegorating Qi and Activating Blood Treatment on Carotid Atherosclerosis: A Meta-analysis

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Abstract

Background: Carotid arteriosclerosis-associated symptoms are common, but treatment is not specifically targeted to relieve clinical symptoms. According to traditional Chinese medicine (TCM) theory, Qi deficiency and blood stasis constitute the main pathogenesis of carotid atherosclerosis, and invigorating Qi and activating blood (IQAB) is one of the most commonly used treatments. However, the effectiveness of the IQAB has not been fully studied. *Objective:* This meta-analysis was conducted to evaluate the efficacy and safety of the IQAB in the treatment of carotid atherosclerosis (CAS). *Methods:* Four databases, including CNKI, WanFang Data, VIP, and PubMed, were searched electronically from database establishment to November 2023 to select studies on the intervention of CAS with herbs related to supplementing qi and promoting blood circulation. The languages were restricted to Chinese and English. The study performed bias risk assessment via the Cochrane Collaborative bias risk assessment tool and used ReviewManager 5.4 for meta-analysis. *Results:* A total of 27 randomized controlled trials of IQAB in the treatment of CAS were included, with a sample size of 2803 cases. The results of the meta-analysis revealed that, compared with conventional Western medicine, IQAB can reduce IMT (SMD = -0.94, 95% CI[-1.18,0.70], Z = 7.71, $P < 0.00001$), reduced plaque integral (SMD = -1.02, 95% CI[-1.46, -0.57], Z = 4.50, $P < 0.00001$), decreased plaque area (SMD = -1.01, 95% CI[-1.29, -0.73], Z = 7.03, $P < 0.00001$) and reduced the TCM symptom score (SMD = -1.67, 95% CI[-2.41, -0.94], Z = 4.48, $P < 0.00001$). *Conclusion:* IQAB can effectively reduce the IMT, plaque score, and plaque area and improve the TCM symptom score.

Keywords

Carotid atherosclerosis

IQAB

Meta-analysis

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1. Introduction

Carotid atherosclerosis (CAS), a disease of atherosclerosis, increases the risk of myocardial infarction, stroke and other cardiovascular diseases (CVDs), which seriously affects quality of life. Statin and surgical treatment of CAS have some drawbacks due to side effects and have little effect on improving quality of life. TCM doctors believe that Qi deficiency and blood

stasis are the main pathogeneses of carotid atherosclerosis and that IQAB is one of the most commonly used treatments. Studies have shown that the herbs of IQAB reduce blood viscosity, remove free radicals, and provide neuroprotection. Therefore, this study analyzed studies related to the treatment of CAS via the IQAB method, evaluated the quality of the report via the GRADE approach, and evaluated the efficacy of the IQAB in TCM treatment at the CAS to provide evidence for the clinical decision-making of the IQAB with the CAS.

2. Data and methods

2.1. Protocol registration and reporting format

The protocol of the present review was registered, and the identification number was allocated. CRD42023457409 in the PROSPERO database. This manuscript was prepared following the Cochrane Collaboration guidelines and is reported in accordance with the Preferred Reporting Items for Systematic reviews and Meta-Analysis Extension (PRISMA) statement for systematic reviews incorporating network meta-analyses for health care interventions.

2.2. Search strategy

Databases, including CNKI, WanFangData, VIP, and PubMed, were searched from database establishment to November 2023. Languages were restricted to English and Chinese. To supplement this study, a manual search of the references included in the literature was carried out. EndNote was used for the literature review. The keywords "carotid atherosclerosis," "carotid plaque," "invigorating Qi and activating blood," "invigorating Oi and activating blood," and "removing blood stasis" were searched. The full search strategy is available in **Table 1**.

Table 1. Database establishment to 2023.11.1

Searches	Results
PubMed database	
("Carotid Artery Diseases"[Title/Abstract] OR "Atherosclerosis"[Title/Abstract] OR "Carotid plaque"[Title/Abstract] OR "Atherosclerosis of the carotid artery"[Title/Abstract] OR "Carotid arteriosclerosis"[Title/Abstract] OR "Carotid Artery Disorders"[Title/Abstract] OR "Internal Carotid Artery Diseases"[Title/Abstract] OR "Internal Carotid Artery Diseases"[MeSH Terms])	140,597
("Invegorating Qi and Activating Blood"OR"bu-qi-huo-xue"[Title/Abstract] OR "Supplementing Qi and promoting blood circulation"[Title/Abstract] OR "Invigorating qi and promoting blood circulation"[Title/Abstract] OR "qi deficiency and blood stasis"[Title/Abstract] OR "yi-qi-huo-xue"[Title/Abstract] OR"TCM"OR "Traditional Chinese Medicine"[MeSH Terms])	35307
("randomized controlled trial"[Publication Type] OR "randomized"[Title/Abstract] [Title/Abstract])	951,627
1 AND 2 AND 3	26
CNKI database	
SU = Carotid Atherosclerosis + Carotid Arteriosclerosis + Carotid Plaque + Carotid Artery Disease + Cervical Vascular Disease	17979
SU = Invegorating Qi and Activating Blood + Supplementing Qi and Promoting Blood Circulation + Invegorating Qi + Activating Blood + Qi Deficiency and Blood Stasis + Qi Deficiency + Blood Stasis	294828
1 AND 2	575
Wanfang database	
("Carotid Atherosclerosis" or "Carotid Arteriosclerosis" or "Carotid Plaque" or "Carotid Artery Disease" or "Cervical Vascular Disease")	27629
("Invegorating Qi and Activating Blood" or "Supplementing Qi and Promoting Blood Circulation" or "Invegorating Qi" or "Activating Blood" or "Qi Deficiency and Blood Stasis" or "Qi Deficiency" or "Blood Stasis")	289495
1 AND 2	766
VIPs database	
(K = (Carotid Atherosclerosis OR Carotid Arteriosclerosis OR Carotid Plaque OR Carotid Artery Disease OR Cervical Vascular Disease))	11665
(K = (nvegorating Qi and Activating Blood OR Supplementing Qi and Promoting Blood Circulation OR Invegorating Qi OR Activating Blood OR Qi Deficiency and Blood Stasis OR Qi Deficiency OR Blood Stasis))	71239
1 AND 2	151

2.3. Eligibility criteria

2.3.1. Research types

Randomized controlled trials in the treatment of Qi deficiency and blood stasis-type carotid atherosclerosis.

2.3.2. Research participants

(1) Diagnosis: carotid intima thickness (IMT) on carotid artery ultrasound is used as the criterion for determining carotid atherosclerosis; IMT ≥ 1.0 mm indicates intima thickening, and IMT ≥ 1.2 mm indicates plaque formation [1].

(2) TCM diagnosis: The TCM diagnostic criteria for Qi deficiency and blood-stasis syndrome refer to the "TCM Diagnosis and Treatment Plan for 24 Specialties and 104 Diseases of the State Administration of TCM Medicine", which include dizziness, pale and dull complexion, unwillingness to speak, palpitations, shortness of breath, aggravated movement, chest discomfort, or dull pain in the chest; local pain, such as stinging, pale tongue or ecchymosis; and heavy and astringent pulses.

2.3.3. Intervention measures

The control group was treated with a placebo or conventional medicine according to the guidelines, including lipid-lowering, antiplatelet, etc. The observation group was given conventional plus IQAB treatment. The efficacy of traditional Chinese medicine must involve IQAB drugs or their main components, which are IQAB drugs. The preparations included decoctions, proprietary Chinese medicines, and external drugs. The administration methods included oral and external use, and there was no limit on the dosage or intervention time.

2.3.4. Outcome indicators

(1) Carotid ultrasound: IMT, plaque score, and plaque area.

(2) TCM symptom score.

2.3.5. Exclusion criteria

(1) Repeated publications;

(2) Incomplete data by publication.

2.4. Study selection

First, two researchers (ZSY and SPY) independently screened the titles and abstracts of each study, excluded irrelevant papers, and decided which articles to include. Second, data extraction will be performed from the original study and by the consensus of 2 independent investigators. The extracted information mainly includes the following four aspects: literature identification (research title, journal, author, country and sponsor organization, publication year, and research sponsor); methodological characteristics (type of study design, sample characteristics, specific details of intervention in the control group and experimental group, follow-up); result index and conclusion; and key elements of biased risk assessment. Additionally, 2 investigators (ZTY and ZYZ) cross-checked the data during the data extraction process. In the event of any disagreement, a third reviewer made the final decision.

2.5. Data extraction

Data extraction included basic information about the included studies, such as the author and year of publication, as well as relevant details about the studies, such as sample size and average age; interventions and timing; bias risk assessment; and outcome indicators.

2.6. Risk of bias assessment

The collaborative bias risk tool (CochraneROB) was used to assess the risk of bias. The Cochrane ROB tool includes the following six items: selection bias, performance deviation, detection deviation, worn prejudice, bias in reporting, and other potential biases. Bias risk was divided into 3 levels: low bias risk, uncertainty of bias risk, and high risk of bias. Two reviewers independently assessed the risk of bias. Any objections were resolved by a third researcher. The quality evaluation table and risk bias chart were drawn with RevMan 5.4 software.

2.7. Quality assessment

The quality assessment included selection bias (random sequence generation and allocation concealment), implementation bias (blinding of investigators and participants), measurement bias (blinding of study results), follow-up bias (completeness of outcome data), and reporting bias (selective reporting of study results).

All of the above items can be classified as “low risk,” “unclear,” or “high risk,” and any discrepancies can be resolved by consulting a third assessor.

2.8. Other analyses

Statistical analysis: ReviewManager 5.4 software was used for the meta-analysis, and standardized mean differences were used for the measurement data. Both types of data analyses yield 95% confidence intervals (CIs). Cochrane’s Q test was used for the included studies, and I^2 was used to determine heterogeneity. When $P <$ 50%, the heterogeneity between studies was low, and a fixed-effects model was used to combine effect sizes. The effect size with high heterogeneity was further analyzed, and the relevant literature was removed to reduce the heterogeneity to a small range. An inverted funnel plot was used to evaluate publication bias.

3. Results

3.1. Literature search

After a preliminary search [2–28], approximately 29,000 related articles were obtained. Eighty-eight clinical trials that focused on Qi deficiency and blood-stasis carotid atherosclerosis were selected by two people through a review of the title and abstract. After the full texts were read and the studies that did not meet the criteria, missing data, duplicate studies, incomplete clinical trials, and studies with no reference significance for a long period were excluded, 27 studies were ultimately included. This study followed the PRISMA criteria, and the literature screening process and results are shown in **Figure 1**.

3.2. Study characteristics

A total of 27 papers were included, and the sample size was 2179 cases. The screening flow chart is shown in **Table 2**.

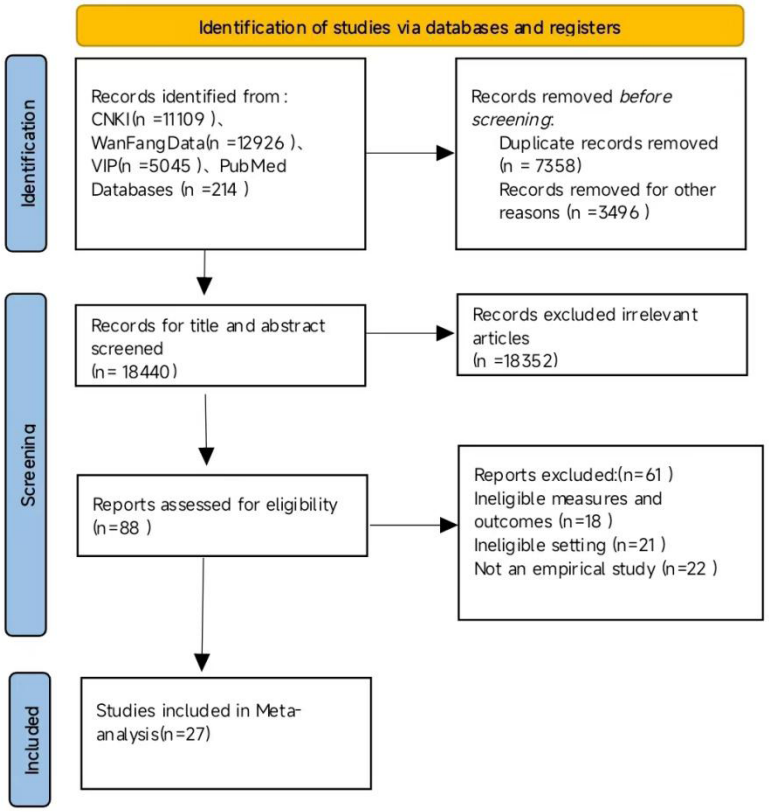

Figure 1. Selection process and results.

Table 2. Baseline characteristics of the included studies

Study	Intervention object	Sample size		Age		intervention	Treatment (months)	Ending indicators
		T	C	T	C			
Xie et al., 2023	Patients with CAS	45	45	56.78 ± 8.36	58.02 ± 7.13	con + Buyanghuanwu decoction	4 months	①②③
Wu et al., 2022	Elderly patients with CAS	35	35	56.48 ± 9.7	59.06 ± 6.79	con + Supplementing Qi and activating blood powder	2 months	①②
Sun and Chen, 2022	Cerebral infarction with carotid atherosclerotic plaque	46	46	67.24 ± 2.68	66.61 ± 2.33	con + Yiqi Huoxue Huatan Tongluo formula	Not mentioned	①③
Kong and Zhang, 2022	Qi-deficiency and blood-stasis type CAS patients	30	30	62.0 ± 6.0	62.6 ± 6.3	con + Wuzha Tongluo capsule	3 months	①②③④
Peng et al.,2021	Cerebral infarction with carotid atherosclerosis	60	60	66.12 ± 7.12	66.01 ± 7.11	con + Self-made Chinese medicine	3 months	④
Yang, 2021	Hypertensive patients with CAS	25	25	54.16 ± 7.66	53.98 ± 7.12	con + Yiqi Huatan Huoxue formula	6 months	①③④
Sun Y, 2020	Cerebral infarction with carotid atherosclerosis	42	42	63.05 ± 5.72	62.91 ± 5.64	con + Yiqi Huoxue Huatan Tongluo decoction	2 months	①③
Sun, K et al., 2020	Qi-deficiency and blood-stasis type hypertension with CAS patients	60	60	54.60 ± 4.67	54.38 ± 4.71	con + Yiqi Huoxue Tongmai Decoction	6 months	①③④
Cao, 2020	H-type hypertensive CAS patients	40	40	66.4 ± 10.4	67.2 ± 10.2	con + Tongxinluo capsule	12 months	①
Xiao, 2020	Patients with ischemic stroke	48	48	68.93 ± 3.87	69.02 ± 3.11	con + Self-designed Yiqi activating blood decoction	1 months	①②
Ma et al., 2019	Cerebral infarction with carotid atherosclerosis	35	35	70.1 ± 4.5	70.1 ± 4.1	con + Yiqi Huoxue Huatan Tongluo formula	1 months	①③
Yuan, 2019	Hypertensive patients with carotid atherosclerosis	45	45	56.4 ± 3.1	54.5 ± 3.8	con + Yiqi Huoxue formula	2 months	①③
Chen and Lin, 2018	Qi-deficiency and blood-stasis type coronary heart disease complicated with CAS	42	42	71.4 ± 5.8	72.3 ± 6.2	con + Heart and brain clearing collaterals liquid	3 months	①②
Guo et al., 2017	Cerebral infarction complicated with metabolic syndrome complicated with carotid atherosclerotic plaque	40	40	62.97 ± 7.88	62.40 ± 7.69	Yiqi Huoxue formula	6 months	①③
Song, 2017	H-type hypertensive carotid atherosclerosis patients	63	63	63.10 ± 7.38	64.67 ± 9.72	con + Tongxinluo capsule	Not mentioned	①②

Table 1 (Continued)

Study	Intervention object	Sample size		Age		intervention	Treatment (months)	Ending indicators
		T	C	T	C			
Wang et al., 2017	Qi deficiency and blood stasis type cerebral infarction complicated with carotid atherosclerosis	31	30	60.09 ± 10.96	63.13 ± 9.00	Yiqi Huoxue formula	6 months	①②④
Shi and Du., 2017	Qi-deficiency and blood-stasis type CAS patients	40	38	52.23 ± 6.86	51.79 ± 7.16	con + Yiqi Huayu capsule	4 months	①
Wang et al., 2016	Qi-deficiency and blood-stasis type carotid atherosclerosis CAS patients	31	32	57.06 ± 6.79	58.48 ± 9.70	con + Supplementing Qi and activating blood powder	6 months	①④
Shi and Liu, 2016	Qi-deficiency and blood-stasis type carotid atherosclerosis patients	40	38	50.38 ± 3.69	48.17 ± 4.28	con + Yiqi Huayu capsule	2 months	①
Zhu and Zhu, 2016	H-type hypertensive carotid atherosclerosis patients	30	30	58.63 ± 8.27	60.95 ± 7.56	con + Tongxinluo capsule	12 months	①②
Ji, 2016	Carotid atherosclerotic plaque in patients with cerebral infarction of Qi deficiency and blood stasis type	45	45	63.8 ± 9.4	63.1 ± 9.3	con + Buyanghuanwu decoction	2 months	①③
Ding, 2015	Carotid atherosclerotic plaque in patients with acute myocardial infarction of Qi deficiency and blood stasis type	40	40	-	-	con + Shenqi Fumai formula	6 months	①②
Jiang et al., 2015	H-type hypertensive carotid atherosclerosis patients	37	33	62.38 ± 5.99	60.12 ± 5.45	con + Tongxinluo capsule	12 months	①②③
Pan and Zeng, 2015	Qi-deficiency and blood-stasis type CAS patients	28	28	63.1 ± 1.5	63.0 ± 1.1	con + Buyanghuanwu decoction	1 months	①
Ji, 2014	Qi-deficiency and blood-stasis type CAS patients	56	48	-	-	con + Supplemented Wuzhusan capsule	6 months	①②
Leng et al., 2013	Carotid atherosclerosis in patients with acute myocardial infarction of Qi deficiency and blood stasis type	20	21	72 ± 5	75 ± 7	Shenqi Fumai formula	6 months	①②④
Chen, 2014	Qi-deficiency and blood-stasis type CAS patients	43	43	61.5 ± 1.1	61.3 ± 1.2	con + Buyanghuanwu decoction	1 months	①

Notes: T, intervention groups; C, control groups; Con, control groups; (1) IMT; (2) crouse score; (3) Carotid plaque area; (4) TCM symptom score.

3.3. Literature bias and quality assessment

A total of 27 studies were included, of which 10 used the correct randomization method [4,6,7,10–12,15,16,22,25,27] (random number table method), the remaining 12 mentioned only "randomization" but did not specify the specific method [2,3,5,8,13,18–20,23,24,26,28], and 4 [9,14,17,21] used the wrong randomization method (in order of hospitalization time). The remaining deviation risks are shown in **Figure 2** and **Figure 3**.

3.4. Results of the meta-analysis

3.4.1. Thickness of the intima–media of the carotid artery (IMT)

A total of 26 studies [2–4,6–28] were included. Before treatment, there was little heterogeneity among the studies (P = 0.75, I^2 = 0%), and the IMTs of the treatment group and the control group were roughly the same. 0.02 [-0.06, 0.11], Z = 0.52, P = 0.60 > 0.05, and there was no statistically significant difference between the groups. After treatment, the heterogeneity of the results was high (P < 0.00001, I^2

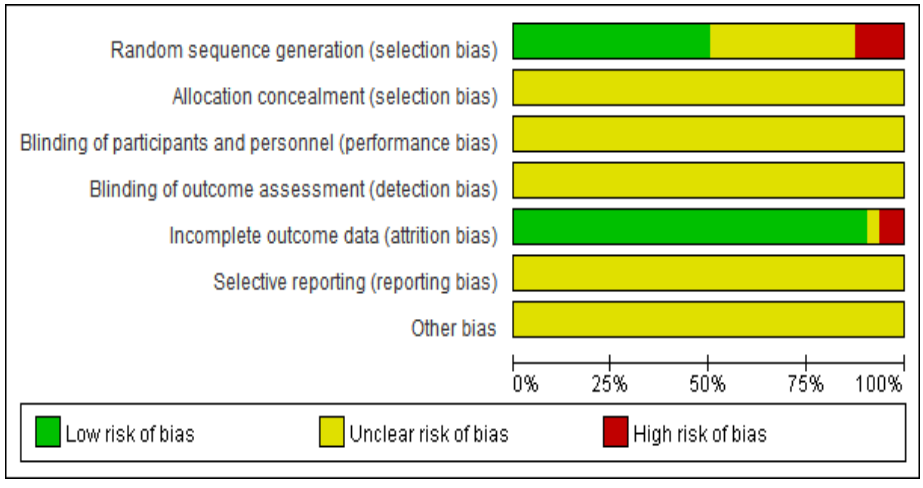

Figure 2. Proportion of projects with a risk of bias in the included literature.

Figure 3. Each deviation risk included in the literature.

= 86%). Because $P < 0.00001$, the random effects model was adopted, and the combined effect analysis results showed that Z = 7.71, $P < 0.00001$, and the overall 95% CI of the SMD was [-1.18, -0.70]. The forest map is shown in **Figure 4**. After treatment, the heterogeneity of the IMT studies was high. After factors such as age and publication year were excluded, 11 studies with large publication bias were excluded, and a heterogeneity test was subsequently conducted. The results revealed $P = 0.02$ and $I^2 = 47\%$, indicating low heterogeneity. The results of the mesh meta-analysis after combining the effect sizes of the remaining 15 studies for reference are shown in **Figure 5**. The SMD = -0.58[-0.74, 0.42], < 0.00001, indicating a significant difference between the two groups.

3.4.2 Carotid Crouse scale score

A total of 12 trials [2,3,11–13,16,21–23,25,27,28] were included. Before treatment, there was little heterogeneity among the studies ($P = 0.98$, $I^2 = 0\%$). The plaque scores of IQAB patients were roughly the same as those of conventional Western

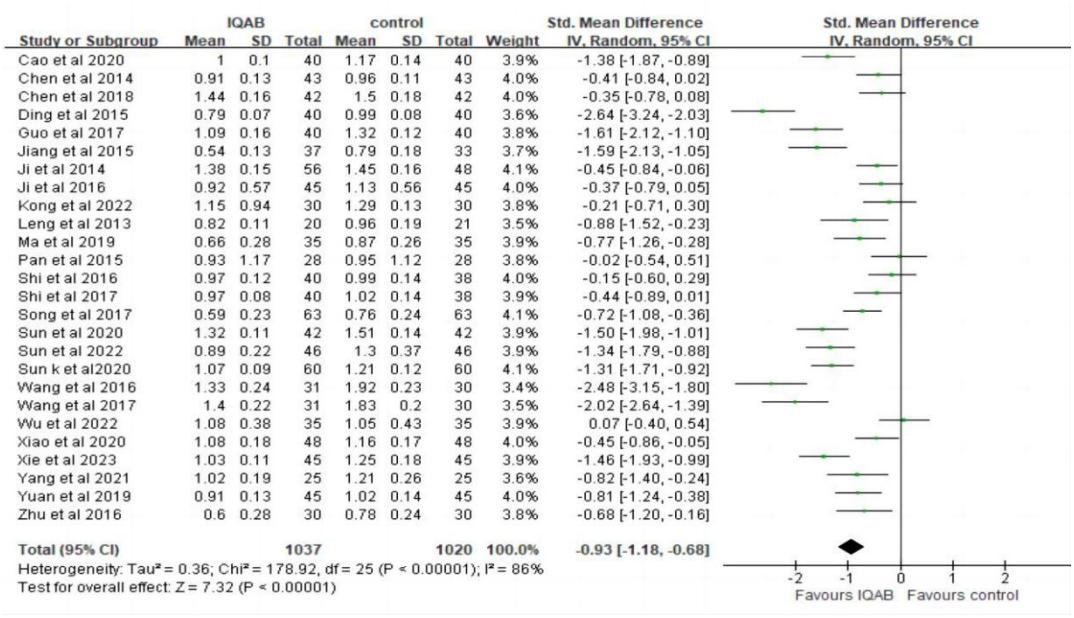

Figure 4. Forest plot of IMT after treatment.

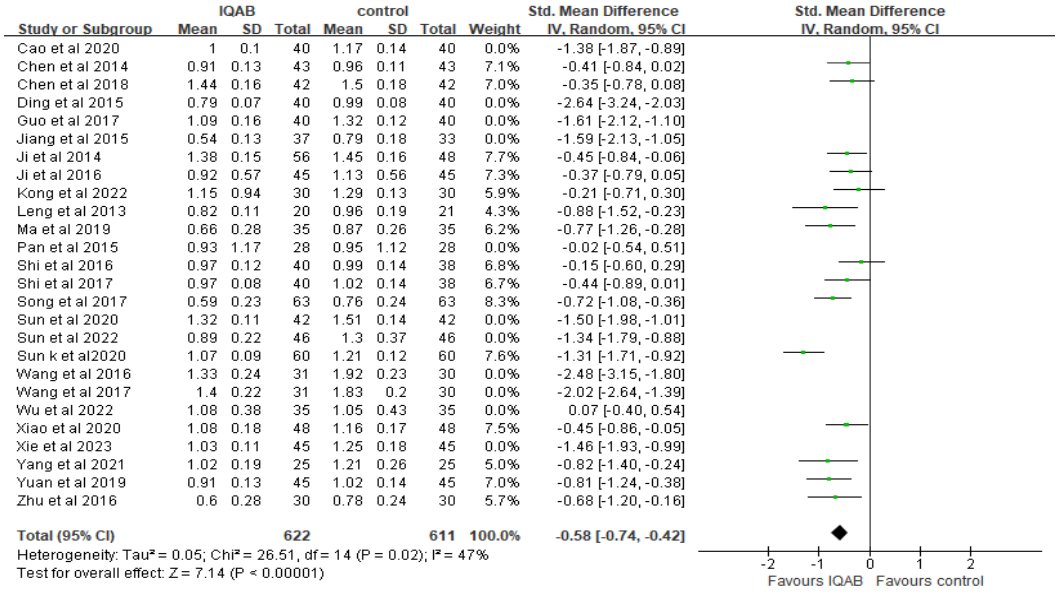

Figure 5. Forest plot of IMT after treatment (date with large deviation were excluded).

medicine patients (SMD = 0.00 [-0.12, 0.13], Z = 0.06, P = 0.95 > 0.05), and there was no statistically significant difference between the groups. The forest map is shown in **Figure 6**. After treatment, the heterogeneity of the results was high (P < 0.0001, I^2 = 90%), so the random effects model was adopted, SMD = -1.02 [-1.46, -0.57], and the forest map is shown in **Figure 7**. After treatment, the heterogeneity of plaque scores among various studies was high. After factors such as age, publication, and year were excluded, the 3 studies with large publication bias were excluded, and a heterogeneity test was subsequently conducted. The results showed P = 0.34 and I^2 = 11%, and the heterogeneity was small. After the effect sizes of the remaining 9 studies were combined, the results of the mesh

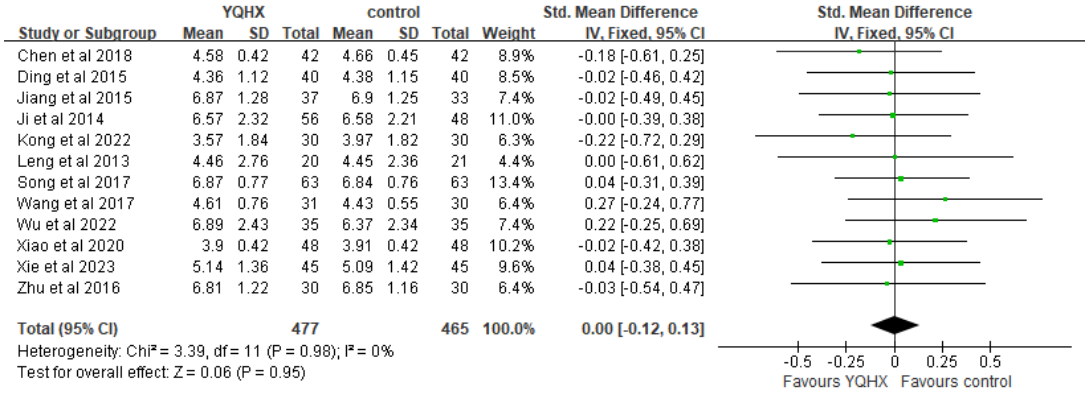

Figure 6. Forest plot of Crouse score before treatment.

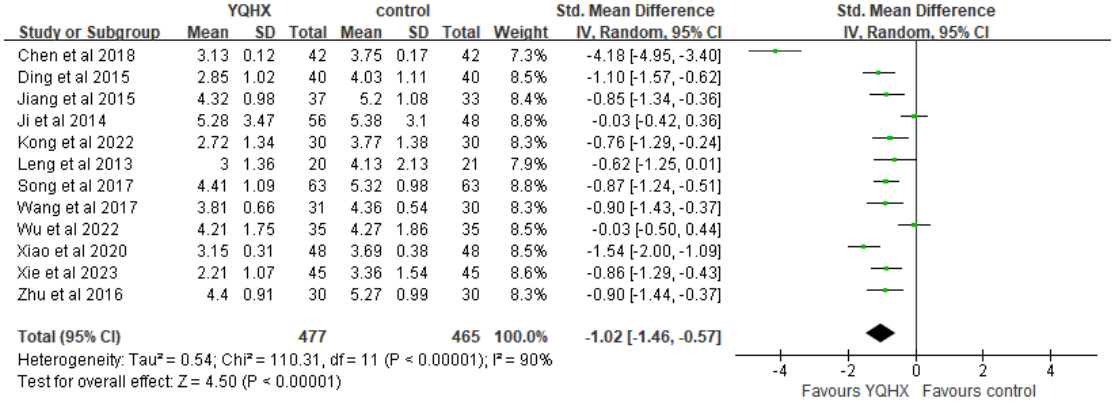

Figure 7. Forest plot of Crouse score after treatment.

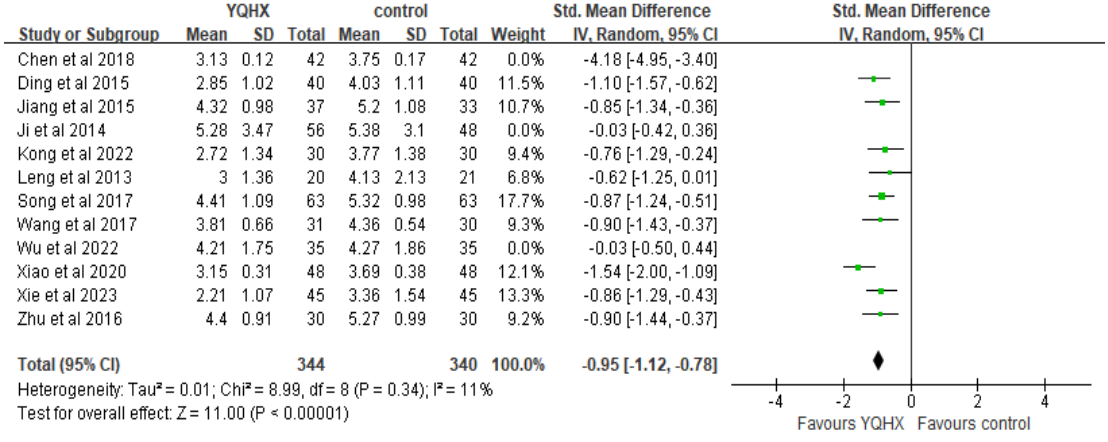

Figure 8. Forest plot of Crouse score after treatment (dates with large deviation were excluded).

meta-analysis were provided for reference, as shown in **Figure 8**. SMD = -0.95[-1.12, 0.78], < 0.00001.

3.4.3. Carotid plaque area

A total of 11 studies [2–4,6,7,9,10,15,19,21,26] were included. Before treatment, there was little heterogeneity among the studies (P = 0.82, I^2 = 0%). The plaque area in the YQi-Huoxue treatment group was roughly the same as that in the conventional Western medicine treatment group (SMD = 0.04 [-0.09, 0.17], Z = 0.65, P = 0.95 > 0.05), and there was no statistically significant difference between the groups. The forest map is shown in **Figure 9**. After treatment, the heterogeneity of the results was high (P < 0.00001, I^2 = 80%), so the random effects model was adopted, with SMD = -1.00 [-1.31, -0.69], and the forest map is shown in **Figure 10**. After treatment, the plaque area was highly heterogeneous among various studies. After factors such as age, publication, and year were excluded, the two studies with large publication bias were excluded, and a heterogeneity test was subsequently

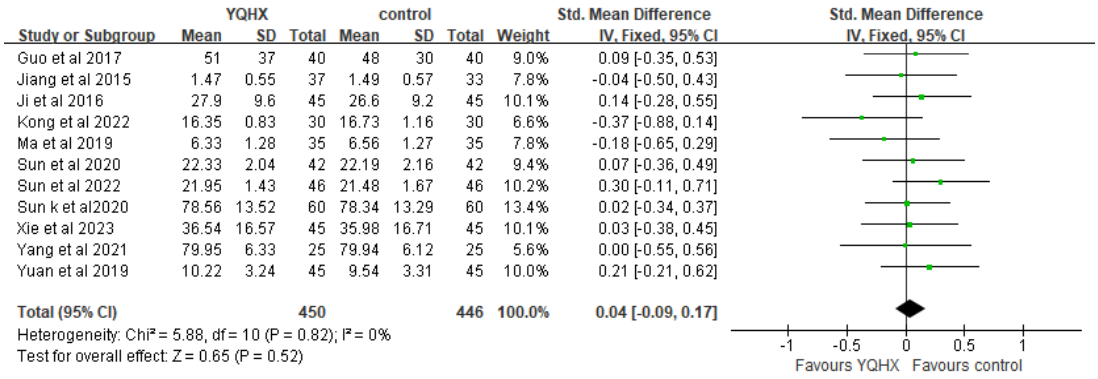

Figure 9. Forest plot of plaque area before treatment.

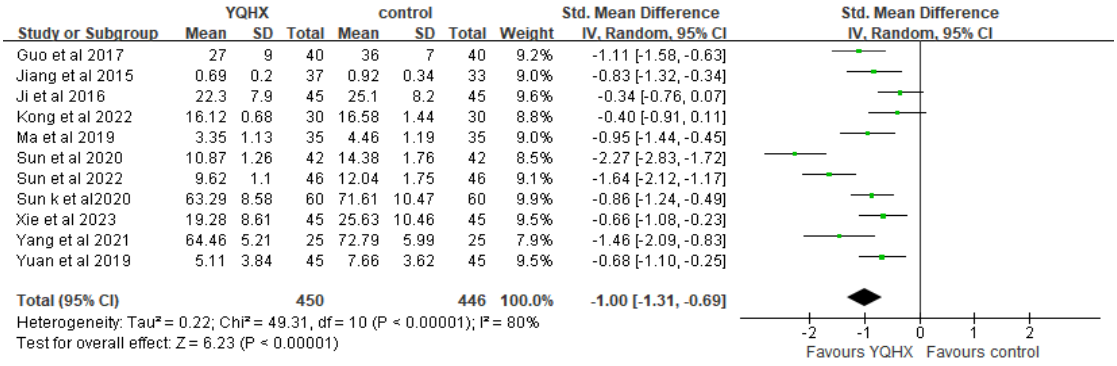

Figure 10. Forest plot of plaque area after treatment.

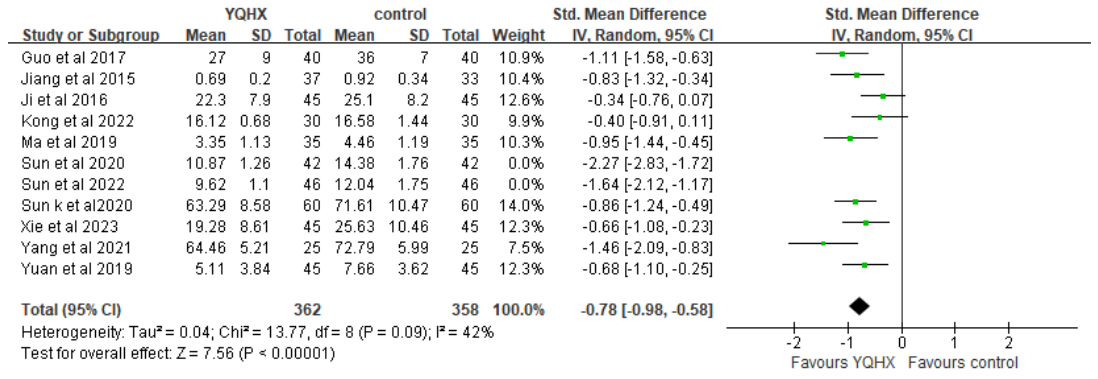

Figure 11. Forest plot of plaque area after treatment (date with large deviation were excluded).

conducted. The results showed that $P = 0.09$ and $I^2 = 42\%$, and the heterogeneity was small. The results of the mesh meta-analysis after combining the effect sizes of the remaining 9 studies for reference are shown in **Figure 11**. SMD = -0.78[-0.98, 0.58], $P < 0.00001$.

3.4.4. TCM symptom score

A total of 7 studies [3–5,12,17,25] were included. Before treatment, there was little heterogeneity among the studies ($P = 0.83$, $I^2 = 0\%$). The plaque area of the YQi-Huo-blood therapy group was roughly the same as that of the conventional Western medicine treatment group (SMD = 0.17 [-0.01, 0.34], Z = 1.89, $P = 0.06 > 0.05$), and there was no statistically significant difference between the groups. The forest map is shown in **Figure 12**. After treatment, the heterogeneity of the results was high ($P < 0.00001$, $I^2 = 92\%$), so the random effects model was adopted, with SMD = -1.67 [-2.41, -0.94], and the forest map is shown in **Figure 13**. After treatment, the heterogeneity of TCM symptom scores among various studies was high. After factors such as age, publication, and year were excluded, the two studies with large publication bias were excluded, and a heterogeneity test was carried out. The results showed $P = 0.16$ and $I^2 = 39\%$, indicating low heterogeneity. After the effect sizes of the remaining 5 studies were combined, the results of the mesh meta-analysis were provided for reference, as shown in **Figure 14**. SMD = -1.04[-1.34, 0.74], $P < 0.00001$.

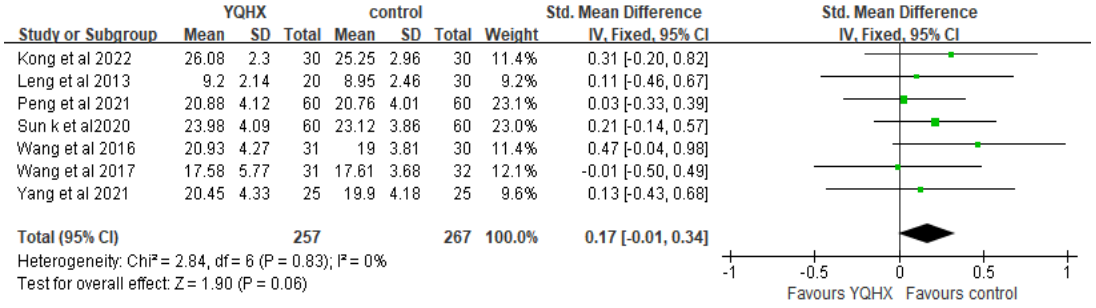

Figure 12. Forest plot of TCM symptom score before treatment.

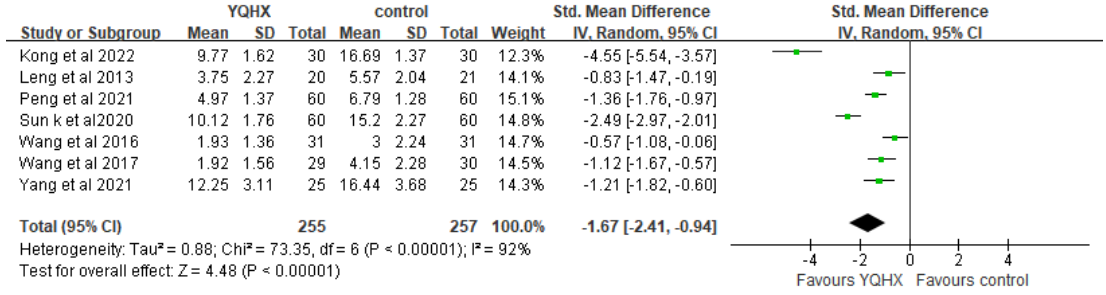

Figure 13. Forest plot of TCM symptom score after treatment.

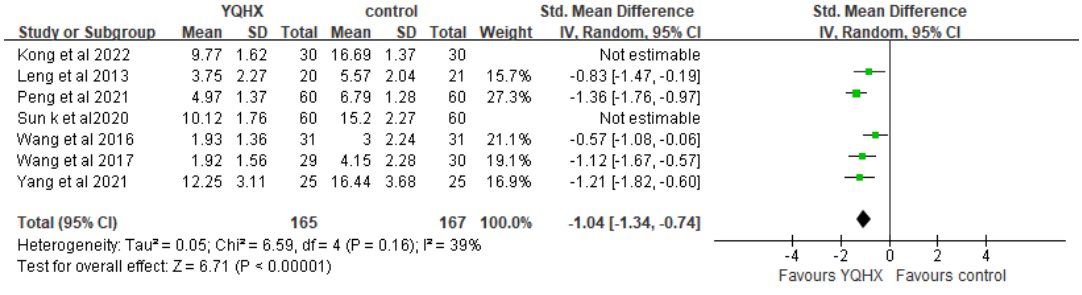

Figure 14. Forest plot of TCM symptom score after treatment (date with large deviation were excluded).

3.5. Sensitivity

The meta-analysis after treatment was highly heterogeneous after studies that might affect the results of the study were excluded and another meta-analysis was conducted. The results showed that the combined effect size was roughly the same as the previous combined effect size,, as shown in **Table 3**, **Table 4** and **Table 5**. indicating that the results of this meta-analysis were relatively stable.

4. Discussion

AS has a complex pathogenesis. The carotid artery, as one of the connecting vessels between the brain and heart, plays an important role in many vascular AS diseases because of the high incidence and severity of stroke and cardiovascular diseases. In Western medicine, AS can be explained by the inflammatory response and immune theory. Previous studies have focused on statins; although they can effectively improve blood lipid levels and stabilize plaques, in terms of improving quality of life, statins have limited effectiveness. In recent decades, traditional Chinese medicine has received increasing attention for its therapeutic effects and prospects. In traditional Chinese medicine, Qi deficiency is the main cause of AS because Qi can promote blood flow. When there is Qi deficiency, the blood flow becomes weak or even stops accumulating, and the blood stasis is attached to the blood vessel wall to induce AS. According to this pathogenesis, TCM considers the IQAB as a fundamental

Table 3. Meta-analysis results of outcome indicators before treatment

Outcome index	Sample size	Heterogeneity test result		Effect model	Meta-analysis results	
		p	I^2		Effect size (95%CI)	*p*
IMT	26	0.75	0	Fixed	SMD = 0.02[-0.06,0.11]	0.6
crouse score	12	0.98	0	Fixed	SMD = 0.00[-0.12,0.13]	0.95
Plaque area	11	0.82	0	Fixed	SMD = 0.04[-0.09,0.17]	0.52
TCM symptom score	7	0.83	0	Fixed	SMD = 0.17[-0.01,0.34]	0.06

Table 4. Meta-analysis results of outcome indicators after treatment

Outcome index	Sample size	Heterogeneity test result		Effect model	Meta-analysis results	
		p	I^2		Effect size (95%CI)	*p*
IMT	26	< 0.00001	86	R	SMD = -0.93[-1.18, -0.68]	< 0.00001
Crouse score	12	< 0.00001	90	R	SMD = -1.02[-1.46, -0.57]	< 0.00001
Plaque area	12	< 0.00001	78	R	SMD = -1.01[-1.29, -0.73]	< 0.00001
TCM symptom score	7	< 0.00001	92	R	SMD = -1.67[-2.41, -0.94]	< 0.00001

Table 5. Meta-analysis results of outcome indicators after treatment (data with large deviations were excluded)

Outcome index	Sample size	Heterogeneity test result		Effect model	Meta-analysis results	
		p value	I^2		Effect size (95%CI)	*p* value
IMT	15	= 0.02	47	R	SMD = -0.58[-0.74, -0.42]	< 0.00001
crouse score	9	= 0.34	11	R	SMD = -0.95[-1.12, -0.78]	< 0.00001
Plaque area	12	= 0.17	31	R	SMD = -0.89[-1.07, -0.70]	< 0.00001
TCM symptom score	5	= 0.16	39	R	SMD = -1.04[-1.34, -0.74]	< 0.00001

treatment for improving symptoms caused by CAS, further reducing the occurrence of cerebrovascular diseases.

On the basis of the principles of the Cochrane systematic review, this study systematically evaluated the efficacy and safety of the IQAB in the treatment of CAS. This study searched the literature on interventions to supplement qi and promote blood circulation in the CNKI, Wanfang, VIP and PubMed databases until November 1, 2023. The retrieved studies were screened and extracted according to the inclusion and exclusion criteria, and the risk of bias was assessed according to the Cochrane ROB. The effects of the IQAB on the IMT, plaque score, plaque area, and TCM symptom score of CAS patients with Qi deficiency and blood stasis were evaluated via meta-analysis. The results showed that supplementing Qi and promoting blood circulation could reduce the IMT, plaque score, and plaque area and improve TCM symptoms. Taken together, these results suggest that supplementing Qi and promoting blood circulation have a significant effect on carotid atherosclerosis, providing a greater level of evidence-based medical basis for supplementing qi and promoting blood circulation in the treatment of CAS.

Previous meta-analyses that focused on TCM treatment of CAS included fewer studies, and the analyses were not updated in the last five years and focused only on color ultrasound results such as IMT and plaque scores [29,30]. Compared with previous atherosclerosis meta-analyses, this study focused on evaluating the efficacy of the IQAB in the treatment of CAS and increased the outcome indicators related to the plaque area and TCM symptom score. The index of plaque area further reflects the local improvement in CAS plaque, and the TCM symptom score can better reflect the effects of IQAB on quality of life improvement.

The research has several limitations: (1) Due to the large interval of the study, the scoring standards of the TCM symptom score and total effective rate were not uniform. (2) The quality of the included studies was generally low. (3) Traditional Chinese medicine formulation, dosage, disease condition, severity, and intervention time were inconsistent, and the criteria for recovery from disease were also different.

5. Conclusion

This study revealed that IQAB can inhibit carotid IMT, reduce the plaque area and improve clinical efficacy. This study also revealed that IQAB can delay the CAS process and improve disease prognosis by inhibiting the inflammatory response and regulating lipids. This provides a new way of treating CAS in the future. In summary, the IQAB is suitable for the treatment and prevention of carotid atherosclerosis in patients with qi deficiency and blood stasis, improving the quality of life of patients with high safety. However, more high-quality RCTs should be conducted for verification.

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