

Research Article

# Effectiveness of Auricular Acupressure for Post-Stroke Constipation: A Systematic Review and Meta-Analysis

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## Abstract

**Background:** Post-stroke constipation was very common in clinical setting. Auricular acupressure was increasingly being used in the management of functional constipation.

**Objective:** This study aimed to systematically examine the effectiveness of auricular acupressure in the management of post-stroke constipation.

**Method:** A systematic search of the following databases was conducted: Cochrane Library, Pubmed, Web of science, China National Knowledge Infrastructure (CNKI), Wan Fang database, Chinese Biomedical Literature (CBM), and China Science and Technology Journal to identify relevant studies of randomized controlled trials on the efficacy of auricular acupressure in the treatment of constipation among stroke patients from inception of the database to April 2021. Quality of the included studies was evaluated using Cochrane Reviewer's Handbook 5.1.0. Data were analyzed using RevMan 5.3 software.

**Result:** A total of 899 patients were included in the ten randomized controlled trials. The experimental group treated with auricular acupressure had a better overall clinical effectiveness rate than the control group (OR=5.15, 95% CI [3.45, 7.69],  $P < 0.00001$ ). Three studies used the clinical symptom score for constipation post intervention as an evaluation index. The experimental group was also superior to the control group. In addition, compared with the control groups, auricular acupressure had fewer adverse effects.

**Conclusion:** The preliminary findings of this study concluded that auricular acupressure was an effective and safe measure of intervention for the management of post-stroke constipation. We are hop-

ing to see more high-quality studies to validate this result to disseminate the evidence-based practice of Traditional Chinese medicine (TCM).

**Keywords:** Auricular Acupressure; Meta-analysis; Post-Stroke Constipation; Traditional Chinese Medicine; Stroke

## Introduction

Stroke now ranked as the second leading cause of death and the primary cause of disability around the globe, with dramatically increased burden [1,2]. Many gastrointestinal complications could occur in stroke patients, such as dysphagia, constipation, gastroduodenal ulcers, and fecal incontinence. Of note, post-stroke constipation was very common in clinical setting [3]. A systematic review showed that the prevalence of constipation in stroke patients was 48% [4]. This complication could reduce the quality of life, increase hospital length of stay, and even cause the recurrence of cerebrovascular diseases [3,5,6].

Currently, there was still a lack of fundamental solution for post-stroke constipation globally. Western medical treatments such as oral laxatives, glycerin anal suppositories, and enemas could partially relieve constipation symptoms, but could not essentially improve the patient's bowel function. These strategies usually had many side effects [7]. Lifestyle or diet modifications were found to improve the condition [8]. However, hemiplegia and dysphagia often occurred among stroke patients, making these methods more difficult to implement.

To date, with the rapid development of auricular acupressure, it was increasingly used in the management of functional constipation [9,10]. Auricular acupressure guided by the theory of Traditional Chinese Medicine (TCM), used small hard and smooth seeds or pills to apply pressure to ear acupuncture points and stimulate these points with mechanism of action similar to that of acupuncture therapy [11]. Our literature search did not find any systematic review and meta-analysis on the effectiveness and credibility of this treatment method. Therefore, the purpose of this study aimed to systematically examine the effectiveness of auricular acupressure in the management of post-stroke constipation to provide empirical evidence for clinical practice.

## Methods

### Search strategy

The following database were searched for relevant studies in the Chinese and English languages: Cochrane Library, Pubmed, Web of Science, China National Knowledge Infrastructure (CNKI), Wan Fang Database, Chinese Biomedical Literature (CBM), and China Science and Technology Journal Database from their inception to April 2021. The search strategy included MeSH terms and their associated free words. The Chinese search terms were: "cu zhong" (stroke) and "zhong feng" (stroke); "bian mi" (constipation), and "pai biankun nan" (difficult defecation); "er xue" (ear points), "er ya" (ear

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**Citation:** Li Y, Chen L, Su IJ (2021) Effectiveness of Auricular Acupressure for Post-Stroke Constipation: A Systematic Review and Meta-Analysis. J Altern Complement Integr Med 7: 213.

**Received:** December 16, 2021; **Accepted:** December 22, 2021; **Published:** December 29, 2021

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pressure), “er xue tie ya” (auricular acupressure), “er xueyadou” (ear acupressure bean), and “er xuezhiliao” (auricular point treatment). The English search terms were: “stroke”, “cerebrovascular accident”, “apoplexy”, and “brain vascular accident”; “constipation”, “dyschezia”, “colonic inertia”, and “astriktion”; “auricular point”, “ear point”, “semen vaccariae”, “auricular point sticking”, “auricular point pressing”, “auricular plaster therapy”, and “application of auricular pressure”.

### Selection criteria and literature data extraction

**Inclusion criteria:** (1) Study type: Randomized controlled clinical trials. (2) Study subjects: Patients with post-stroke constipation. (3) Intervention: Auricular acupressure. (4) Control: Blank control or conventional care according to guidelines (details shown in table 1 in section 3.3.) (5) Primary outcome: Clinical effectiveness rate; Secondary outcome: Constipation symptom score and adverse effects.

**Exclusion criteria:** (1) Unpublished or duplicate studies, conference abstracts, and case reports. (2) Study with unclear evaluation criteria for efficacy. (3) Study without primary outcome. (4) Studies with combination of auricular acupressure and other TCM treatment methods.

Two investigators independently conducted literature screening based on the inclusion criteria and extracted data from included studies. In the case of disagreement or discrepancy, the investigators would discuss to negotiate a solution until an agreement was reached. The following information was extracted: author, year of publication, number of participants, average ages, acupoint selection, type of stimulator, method of seed taping on ear, time and frequency of acupressure, frequency of seed replacement, clinician who applied the intervention, and outcome indicators.

### Methodological quality

The quality assessment criteria for randomized controlled trials was based on the Cochrane Reviewers’ Handbook [12], which included the following six items: random sequence generation, allocation concealment, blinding of participants, blinding of outcome assessment, incomplete outcome data, selective reporting, and other concerns about bias. Two investigators independently rated the above areas as “low risk” (low degree of bias), “high risk” (high degree of bias), and “unclear” (lack of relevant information or uncertain bias). If there was a disagreement, it would be resolved through discussion or the assistance of a third evaluator.

### Statistical analysis

Data were analyzed using RevMan 5.3 software. Continuous variables were analyzed using the weighted mean difference (WMD) and its 95% confidence interval (CI) as the indicator statistic. The odds ratio (OR) was adopted for dichotomous variables, and 95% CI was calculated. The results of the included studies were examined for heterogeneity using the  $\chi^2$  test. When there was no heterogeneity or low heterogeneity ( $P \geq 0.1$  or  $I^2 \leq 50\%$ ), the fixed effects model was used. Conversely, when there was significant heterogeneity ( $P < 0.1$  or  $I^2 > 50\%$ ), the random effects model was used. In addition, a funnel plot was used to analyze whether there was a publication bias.

## Results

### Study selection

377 articles were identified. Duplicate articles were excluded ( $n=271$ ). The initial screening excluded 90 articles based on the

abstract or title alone. After reading 16 full-text articles, 10 articles published in the Chinese language were retained strictly in accordance with the inclusion criteria and none in English was selected. The PRISMA flow chart is shown in figure 1 [13].

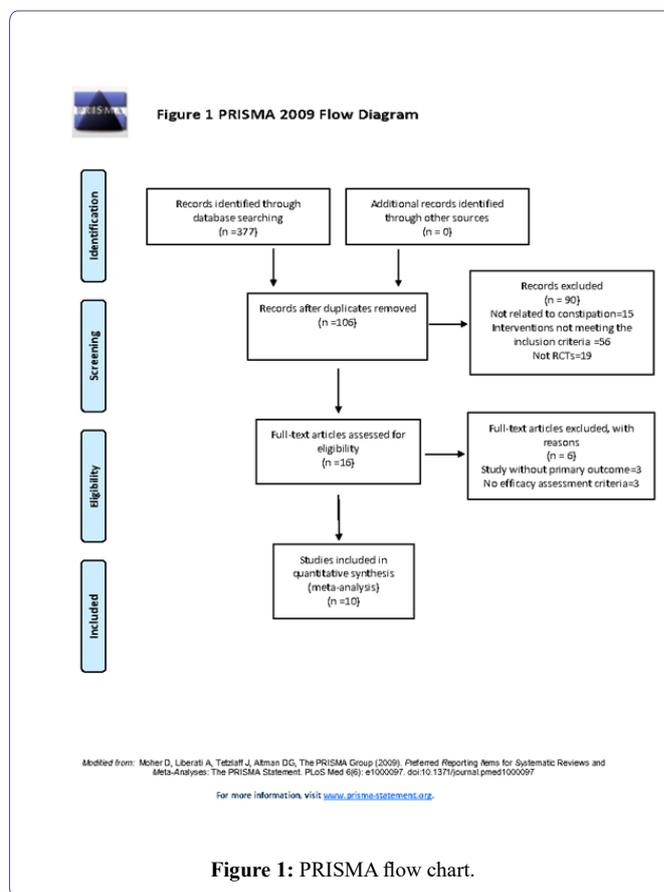


Figure 1: PRISMA flow chart.

### Methodological quality

The 10 included studies were evaluated for literature quality. Details of the quality assessment of all included studies are shown in figure 2.

### Characteristics of studies

A total of 899 patients were included in the ten randomized controlled trials with 340 women and 559 men [14-23]. These research subjects were all hospitalized patients in general hospitals or hospitals of Chinese medicine. Because the control group utilized a variety of conventional treatment methods, table 1 offers a brief summary. The experimental group added auricular acupressure to the conventional interventions. This study evaluated 3 outcome indicators: clinical effectiveness rate, clinical symptom score of constipation, and adverse effects. The included studies used two methods to grade the clinical efficiency. Three of these studies [15,18,21] adopted the Guidelines for Clinical Research on New Chinese Medicines and seven studies [14,16,17,19,20,22,23] adopted the Diagnostic and Efficacy Criteria for Chinese Medical Evidence. Based on the Guidelines for Clinical Research on New Chinese Medicines [24], the criteria for cure would be met if defecation occurred within 2 days, with moistened stool, easy defecation, and resolution of related symptoms. The criteria for significant effects were: Defecation within 2 days, with moistened

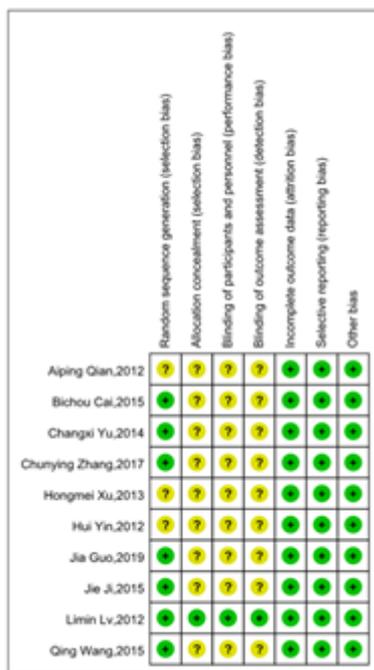


Figure 2: Risk of bias summary.

stool, difficult defecation, and relief of constipation symptoms. The criteria for effectiveness were: Defecation within 3 days, with dry stool followed by soft stool, difficult defecation, and relief of constipation symptoms. Ineffectiveness was no improvement of constipation symptoms. According to the Diagnostic Efficacy Criteria for Chinese Medicine [25], the criteria for cure were one bowel movement within 2 days, with moistened stool, and easy defecation with no short-term recurrence of symptoms. The criteria for improvement were bowel movement within 3 days, with moistened stool, and difficult defecation. The criteria for failure to cure were no improvement in symptoms. Three studies used clinical symptom scores for constipation, which included time of first defecation, urge to defecate, degree of difficulty, defecation speed, characteristics of stool, and time between bowel movements. Only two studies [18,20] reported adverse effects. Specific characteristics of the included studies are shown in table 2.

### Effectiveness of auricular point acupressure for constipation

**Comparison of clinical effectiveness rate:** All included studies used the overall effective rate as an evaluation indicator. Of the 899 patients included in the studies, 450 were in the experimental group and 449 were in the control group respectively. No significant heterogeneity was observed among these studies ( $P=0.28$ ,  $I^2=18\%$ ). Therefore, the fixed effects model was used. The results showed that the group using auricular point acupressure had a better overall clinical effectiveness rate than the control group ( $OR=5.15$ ,  $95\% CI [3.45, 7.69]$ ,  $P < 0.00001$ , Figure 3).

**Constipation symptom score:** Constipation symptom scores were used by three studies, two of which [14,17] reported the score of constipation clinical symptoms post intervention with the finding of a statistically significant difference between the experimental and

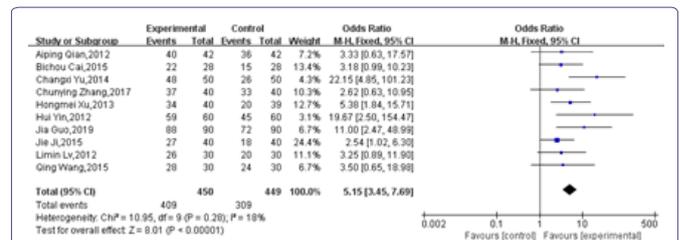


Figure 3: Forest plot of total effective rate.

control groups ( $WMD=-1.11$ ,  $95\% CI [-1.15, -1.07]$ ,  $P < 0.00001$ , Figure 4). In addition, one study [18] reporting individual symptoms of constipation found no statistically significant differences in terms of characteristics of stool between the experimental and control groups while other symptom categories demonstrated statistically significant differences.

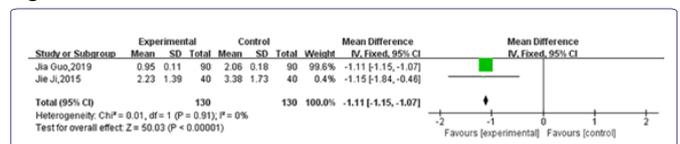


Figure 4: Forest plot of constipation symptom score.

### Reports of adverse events

One study [20] reported that two patients in the experimental group had mild itching of the skin at the ear points due to alcohol allergy during the intervention period, with resolution of the discomfort after discontinuation of the use of alcohol swabs. Another study [18] found the difference between the two groups in terms of diarrhea or recurrence of constipation after stopping the intervention was statistically significant. Overall, the experimental group had fewer adverse events than the control group.

### Publication bias

A funnel plot analysis of clinical effective rate was performed as displayed in figure 5. The results showed that there was no publication bias in the clinical efficacy of constipation treatment.

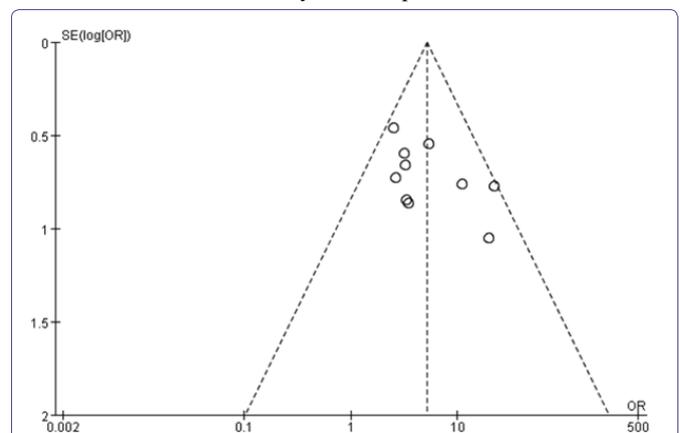


Figure 5: Funnel plot of publication bias.

Figure 5: Funnel plot of publication bias.

First author, Year	Conventional interventions
Jia Guo,	Standard protocol to treat constipation for stroke patients as prescribed by the medical provider.
Aiping Qian	Routine guidance and health education: (1) Patient education such as cause of constipation. (2) Dietary guidelines. (3) Instruction for abdominal massage. (4) Provide a comfortable and secluded environment for patients and develop regular bowel habits. (5) Psychological support.
Hui Yin	Health guidance: (1) Psychological support. (2) Personalized dietary guidance. (3) Develop regular bowel habits.
Jie Ji	Explanation to patients and their families about the risk of constipation and its hazards. (2) Dietary guidelines. (3) Psychological support. (4) Medication protocol: Those who did not have a bowel movement for 3 days were given glycerine enema to assist with bowel movement.
Limin Lv	Routine therapeutic interventions: (1) Routine treatment of stroke according to guidelines. (2) Patient education on pathophysiology of the disease. (3) Psychological support. (4) Bowel training: Instruct patients to exercise their abdominal and pubicmuscles. (5) Timed bowel training. (6) Instruct patients on personalized rehabilitation exercises. (7) Develop a dietary plan. (8) Oral phenolphthalein, 2 tablets, once daily at bedtime for 2 weeks.
Qing Wang	Conventional method of care: (1) Daily care: Personalized strengthening exercise, meticulous hygiene practice. (2) Medication adherence: Lactulose oral solution 3 times daily as needed. (3) Dietary guidelines.
Chunying Zhang	Medication guidance: Take 2 laxative capsules orally at bedtime every night as prescribed. (2) Dietary guidelines. (3) Abdominal massage. (4) Psychological support.
Changxi Yu0	Routine care and health guidance: (1) Patient education on risks of constipation and hazards of straining for bowel movements. (2) Dietary guidelines. (3) Instruct patients on exercise and defecation habits in bed. (4) Instruct patients to develop good bowel habits.
Bichou Cai	(1) Dietary guidance. (2) Instruct patients to develop good bowel habits. (3) Abdominal massage.
Hongmei Xu	Routine nursing interventions: (1) Dietary guidelines. (2) Medication compliance with laxatives as prescribed.

**Table 1:** Description of conventional treatments in the control group.

First author & year	No. of participants (T/C)	Mean age $\pm$ SD in years at baseline (T/C)	Acupoint Selection	Stimulator	Method of Seeds Taped on Ear	Time and Frequency of Acupressure	Frequency of seed replacement	clinician who applied the intervention	Outcome indicators
Jia Guo	90/90	61.52 $\pm$ 4.88/ 61.51 $\pm$ 4.84	Subcortex, Spleen, Sanjiao, Rectum, Lung, Small intestine	Vaccaria seeds	NR	30 seconds for each acupoint, 4 times a day for 14 days	2-3d	Nurse	A, B
Aiping Qian	42/42	37.1/31.1	Large intestine, Sanjiao, Spleen, Abdomen, Digestive Systemic Subcortex, Lung, Sigmoid colon	Vaccaria seeds	Alternate ear	3 to 5 minutes each time, 2 to 3 times daily for 14 days	2-3d	NR	A
Hui Yin	60/60	NR	Large intestine, Small intestine, Rectum, Sanjiao, Endocrine, Lung, Spleen, Kidney	Vaccaria seeds	Alternate ear	60 seconds for each acupoint, 3 to 5 times a day for 60 days	NR	NR	A
Jie Ji	40/40	61.3 $\pm$ 8.6/ 59.6 $\pm$ 9.7	Rectum, Large intestine, Lung, Sanjiao, sympathy, Constipation point	Vaccaria seeds	Alternate ear	3 minutes each time, 3 times daily for 8 days	NR	NR	A, B
Limin Lv	30/30	66.13 $\pm$ 5.81/ 65.20 $\pm$ 5.17	Large intestine, Lower rectum, Lung, Constipation point, Subcortex, Stomach, Sanjiao, Spleen, Kidney	Magnetic seeds	Alternate ear	3 minutes for each eachacupoint , 4 times a day for 14 days	3d	Trained personnel	A, B, C
QingWang	30/30	56.5 $\pm$ 0.8/ 56.7 $\pm$ 0.8	Large Intestine, Small Intestine, sympathy, Kidney, Spleen, Sanjiao	Vaccaria seeds	Alternate ear	1 to 2 minutes each time, 2 to 3 times daily	2-3d	NR	A
Chunying Zhang	40/40	71.46 $\pm$ 4.32/ 70.21 $\pm$ 5.12	Constipation point, Large Intestine, Spleen, Sanjiao	Vaccaria seeds	Alternate ear	3 minutes each time, 3 times daily	3d	NR	A, C
Changxi Yu	50/50	41 $\pm$ 7.28/ 43 $\pm$ 6.89	Lung, Stomach, Large intestine, Small intestine, Sigmoid colon, Sanjiao, Spleen, Kidney, Endocrine, Shenmen	Vaccaria seeds	Alternate ear	3 minutes for each-acupoint, 3 times a day for 15 days	4-5d	Patients	A

Bichou Cai	28/28	57±20/ 56±20	Lung, Stomach, Large intestine, Small intestine, Sanjiao	Vaccaria seeds	Alternate ear	1 to 2 minutes for each acupoint, 2 to 3 times a day for 28 days	3d	NR	A
Hongmei Xu	40/39	58.48±9.01/ 60.46±7.34	Large intestine, Sanjiao, Constipation point, Spleen	Vaccaria seeds	Alternate ear	20 seconds for Eachacupoint, 3 to 4 times a day	3-5d	NR	A

**Table 2:** Characteristics of the included studies.

A= clinical effectiveness rate; B= Constipation clinical symptom score; C= adverse events

**Abbreviations:** NR= not reported

## Discussion

### Effectiveness and safety of auricular acupressure for post-stroke constipation

The result of this meta-analysis suggested that auricular acupressure was safe and could be an effective treatment method for post-stroke constipation. Other studies also reported remarkable clinical efficacy of auricular acupressure in preventing the development of constipation after stroke [26,27]. One of the included studies [18] showed that there was no statistically significant difference between the scores of defecation traits of the two groups. It may be related to the mechanism of action of phenolphthalein in conventional treatment to prevent the intestinal wall from absorbing water resulting in softened stool. In the experimental group, there was no recurrence of constipation two weeks post cessation of the intervention. This may be attributed to the continuous effect of auricular acupressure, which targeted both the symptoms and the root cause. The etiology of post-stroke constipation was not well understood. The cause of the disorder was believed to be multi-factorial. Constipation after stroke may be related to neurocentral damage, changes in diet and bowel habits, prolonged bed rest, and depression or anxiety [28]. It was of interest to note that the use of evidence-based dietary and auricular pressure interventions for stroke patients could also effectively improve sleep quality and neurological deficits and alleviate anxiety or depression [29].

Although the application of acupuncture points was generally consistent, the selection and localization of auricular points were not clearly referenced to sources and without detailed descriptions in the included studies. Most of the studies were guided by either conventional wisdom or prior experience of success in the choice of auricular points. Unfortunately, only two studies reported on the dialectical application of acupressure points. Such an approach followed the belief of TCM where constipation was classified as deficiency and excess [30]. The treatment for the condition of excess was based on heat circulation and dissipation. The management of deficiency was primarily based on the principle of nourishing and preserving Yin and the blood while warming up Yang and replenishing Qi. The treatment of constipation should first identify whether it originated from deficiency or excess in order to re-establish equilibrium by targeting both the symptoms and the underlying condition of the problem. Also, it was worth mentioning that the treatment protocols were not consistent in the choice of stimulator, frequency and intensity of compression, or duration of the therapy among the included studies. Most studies did not describe who the clinician applying the intervention was. A few studies listed nurses, trainees, or patients, but none monitored compliance with auricular acupressure. These factors could have resulted in patients receiving different dosage of the acupressure, hence leading

to varied degrees of treatment effectiveness. In addition to differences in intervention protocols, treatment effects were complicated by confounding variables such as diet, exercise, and medications. This issue was not addressed thoroughly by the researchers either.

The current diagnostic methods of constipation included clinical presentation and evaluation, endoscopy, anorectal manometry, balloon expulsion testing, barium enema, defecography and magnetic resonance defecography and Colonic Transit Time (CTT) [31]. However, studies in this review used subjective, non-standardized outcome evaluation metrics. We would like to see objective indicators such as CTT adding to the research. Finally, most studies had focused on the short-term efficacy of auricular acupressure for relief of constipation and lacked follow-up evaluation of long-term result. Only one study had a two-week post-intervention follow-up with a small sample size over a short period of time. Better designed trials may produce more creditable results related to the long-term effects of the therapy.

### Underlying mechanism

The Yellow Emperor’s Classic of Internal Medicine stipulates that “the ear is the place where the meridians are gathered” [32]. All twelve meridians of the human body are directly or indirectly connected to the ear. Stimulating the ear points can trigger the corresponding meridian sensory transmission and regulate the function of the internal organs to bring them into balance for the purpose of treating diseases. According to the Law of Biological Holography [33], the ear is the epitome of the human body, and the auricular acupuncture points are the areas where the epidermis of the ear communicates with the internal organs and meridians of the body. There are reflection points corresponding to the stomach, small intestine, large intestine, rectum, anus, and other internal organs. The auricular nerve is rich in innervations sources, which have been hypothesized by many scholars as having a mechanism of action closely related to the nerve conduction in the auricle [34]. By stimulating the ear acupuncture points, the sympathetic and parasympathetic activities of the body would be continuously regulated. This in turn would improve the activity of the gastrointestinal tract [35].

### Implications for practice

Acupuncture has been proven to be effective for treating constipation. Nevertheless, the general public might be unwilling to accept the treatment modality [36]. There may be several reasons for this: Firstly, if asepsis is not strictly enforced, infections or even blood-borne diseases could occur. Secondly, acupuncture treatments are difficult to perform in patients who are afraid of needles or pain. Auricular acupressure is an inherent part of acupuncture medicine. Because of its simplicity in operation and without the aforementioned drawbacks, researchers believe that this technique is appropriate to be used in

both the hospital and community settings [37]. Moreover, constipation is a physical suffering as well as financial burden for patients and caregivers with hundreds of millions of dollars spent on the use of medications each year [38]. The application of acupressure therapy can potentially reduce the costs for the individuals and healthcare system.

Although the application of auricular acupuncture for treating constipation has been recognized in China, auricular acupressure is not recommended in international medical guidelines [39,40]. More studies are needed to validate its effectiveness and safety before it can be promoted as an ancillary therapy in clinical practice.

## Limitations

The included literature presents some major limitations. First, their methodological quality is not high due to lack of clarity in blinding or allocation concealment. This may be due to the difficulty in making patients or caregivers oblivious to the auricular acupressure application. In addition, the diagnostic criteria for post-stroke constipation, the implementation of interventions, and the methods and timing of outcome assessment indicators varied among the included studies resulting in clinical heterogeneity. In the future, a standardized treatment protocol should be summarized in an evidence-based approach. Finally, all of the studies were conducted in China. Because of the cultural and geographical differences, the applicability of auricular acupressure for post-stroke constipation in other ethnic populations still needs to be further explored.

## Conclusion

In summary, this review suggested that auricular acupressure was effective and safe in the treatment of post-stroke constipation. However, these results should still be interpreted with caution and can only provide some references for clinical practice at this time. We expect to see more rigorous randomized controlled trials to validate this TCM technique as an alternative or supplementary treatment method in the acute care and community settings.

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