Is moxibustion safe and effective in treating female stress urinary incontinence? A systematic review and meta-analysis

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Systematic Review

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Abstract

Background

Stress urinary incontinence (SUI) in women is a female urogenital disease in which urine leaks out involuntarily due to increased abdominal pressure during coughing or sneezing or physical activity. As one of complementary and alternative medicine, moxibustion therapy has been widely used in the clinical treatment of female SUI, but its efficacy and safety have not been systematically evaluated. Therefore, this study aimed to systematically evaluate the efficacy and safety of moxibustion in the treatment of female SUI.

Methods

The following electronic databases were searched from database establishment to December 2021: PubMed, Web of Science, Cochrane Library, Embase, China National Knowledge Infrastructure (CNKI), VIP Database, Wanfang Database, and China Biology Medicine Disc (CBM). All randomized controlled trials (RCTs) with moxibustion as an intervention for the treatment of female SUI were included in this study. The primary outcome of included studies was the change from baseline in urine leakage measured by the 1-hour pad test. Secondary outcomes included clinical efficacy, the International Consultation on Incontinence Questionnaire Short-Form (ICIQ-SF) score, mean 24-hour frequency of incontinence episodes, and adverse events. The meta-analysis was performed by STATA software (version 15.0) in this study.

Results

A total of 13 RCTs were included in this meta-analysis, involving 822 female SUI patients, of which 413 in the experimental group received moxibustion, and 409 in the control group received other conservative treatments (pelvic floor muscle training or acupuncture or Chinese medicine). The results of the meta-analysis showed that compared with receiving pelvic floor muscle training (PFMT) or acupuncture or Chinese medicine treatment, moxibustion intervention for female SUI reduced urine leakage in the one-hour pad test [SMD=-0.86, 95%CI (-1.03,-0.58)], significantly improved clinical efficacy [OR = 3.42, 95%CI (2.32,5.04)], decreased the ICIQ-SF score [SMD=-0.80, 95%CI (-1.03,-0.57)], and reduced average 24-hour incontinence episode frequency [SMD=-0.78, 95%CI (-1.05,-0.54)]. At the same time, no adverse events occurred during the moxibustion intervention.

Conclusions

Based on this meta-analysis, moxibustion, as one of the complementary and alternative medicine therapies, can be effective and safe in the treatment of female SUI. Moxibustion intervention can reduce urine leakage in the one-hour pad test, improve clinical efficacy, reduce the ICIQ-SF score, and reduce the average 24-hour frequency of urinary incontinence episodes. However, due to the low quality of evidence in this study, higher-quality RCTs are needed for further demonstration.

Registration of systematic review:

This systematic review and meta-analysis has been registered in the INPLASY International Registry of Prospective Systematic Reviews under the registration number INPLASY2021120052.

1. Introduction

Female stress urinary incontinence (SUI) is a common genitourinary disease that affects women.(1, 2) It is clinically manifested by involuntary leakage of urine due to elevated abdominal pressure during coughing, sneezing, laughing, or physical activity.(3~5) The pathological causes of SUI are mostly related to female urethra and pelvic floor muscle and fascia relaxation, among which age, pregnancy, obesity, and childbirth are the most common risk factors.(6) According to epidemiological studies, SUI is a common health problem for women worldwide, with 50% of the female population experiencing SUI.(7) The prevalence of female SUI varies across countries and regions. In the United States, SUI is the most common subtype of female incontinence, accounting for 45.9% of adult female incontinence.(8) The prevalence of SUI among Chinese adult females is 18.9%, and among female patients aged 50~59, the prevalence is as high as 28%.(9) Despite the high prevalence of stress incontinence, only a small proportion of women with urinary incontinence seek help, and even fewer receive treatment.(10, 11) Although SUI does not endanger the patient's life, it can seriously affect the patient's physical and mental health, leading to a decline in the patient's quality of life. Women's fear and anxiety about developing stress incontinence symptoms can change their lifestyles, limit their participation in physical and social activities(12), and even lead to more complications. For example, repeated episodes of SUI can lead to urinary tract infections,
hypertension, diabetes, hyperlipidemia, and more. (13–15) Uncontrolled stress incontinence can make women feel unspeakable and ashamed, make them more prone to anxiety and depression, and increase their life and work burdens. (16)

According to the different severity of SUI, the corresponding treatment methods are often used in clinical practice. Female patients with mild to moderate SUI are often treated conservatively, and surgical treatment is mainly used for patients with severe urinary incontinence. At present, conservative treatments (17) that can effectively treat female SUI mainly include PFMT, acupuncture, moxibustion, and drug therapy. Among them, PFMT is recommended by the International Urinary Incontinence Association as a first-line treatment method, (18) but PFMT must be adhered to for a long time to be effective. In addition, it is difficult for female patients to master the correct PFMT method, and there are problems such as difficult PFMT operation and a long treatment period. Although duloxetine is the recommended drug for the treatment of SUI in women, it cannot be used for a long time due to the side effects and adverse reactions of the drug. (19) In severe cases, drug side effects such as arrhythmia and hypertension may occur. (20, 21) Although surgery for severe stress incontinence is effective, (22, 23) it may lead to an increased risk of a range of complications, such as postoperative infection, pain, and difficulty urinating. (24–26) This means that some female patients will not undergo surgery for SUI as a first option. Therefore, we need to find a treatment that can effectively and safely treat SUI in women.

Moxibustion therapy, a branch of acupuncture theory in Traditional Chinese Medicine (TCM), may be a safer and more effective option for treating SUI in women. TCM theory believes that SUI is mainly caused by the lack of essence in the kidneys, which results in the inability of the bladder to control urine on its own. Moxibustion has the functions of warming meridians and dredging collaterals, dispelling cold and relieving pain. Moxibustion on some acupoints of the kidney meridian or bladder meridian can invigorate Qi (also known as vital energy), promote the recovery of bladder function, and finally achieve the purpose of treating SUI. The National Institutes of Health specifically recommends acupuncture theory as a complementary or alternative treatment for many conditions, including the treatment of SUI. (27) A recent study of acupuncture for women with SUI, published in the Journal of the American Medical Association (28), showed that women with SUI who received acupuncture had less urine leakage after 6 weeks of treatment compared with sham acupuncture. This confirms the clinical efficacy of acupuncture therapy in the treatment of female SUI. Moxibustion is a non-penetrating acupuncture therapy, which mainly treats and prevents diseases through the infrared heat stimulation and drug action produced by moxa sticks burning on the diseased part or meridian and acupoints. It has the advantages of non-invasiveness, convenience operation, remarkable curative effect, high safety, and low economic cost. Therefore, more and more female patients in China are willing to accept moxibustion for the clinical treatment of SUI. In recent years, there have been an increasing number of RCTs on moxibustion in the treatment of female SUI in China, but there is still a lack of relevant systematic reviews and meta-analyses. In this study, we aim to perform a meta-analysis on the efficacy and safety of moxibustion in the treatment of female SUI, in order to provide more detailed evidence for the clinical treatment of female SUI.

2. Methods

This meta-analysis is reported according to the Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) statement. (29) The protocol for this systematic review and meta-analysis has been registered in the INPLASY International Registry of Prospective Systematic Reviews under the registration number INPLASY2021120052. Moreover, the protocol (30) has been published in the Journal of Medicine (doi: 10.1097/MD.00000000000028893).

2.1. Search strategy

Two reviewers (Zhongyu Zhou and Dan Wei) independently searched eight databases from inception to publication of relevant studies in December 2021. Four of the Chinese databases were China National Knowledge Infrastructure, Wanfang Database, VIP Database, and China Biology Medicine Database. The other four databases in English were PubMed, Embase, Cochrane Library, and Web of Science. The following terms were mainly searched as keywords, such as “stress urinary incontinence”, “female”, “moxibustion”, “randomized controlled trials”. The languages of the retrieved studies were restricted to Chinese and English. The search strategy for PubMed was mainly as follows: (“urinary incontinence, stress” OR “urinary stress incontinence” OR “incontinence, urinary stress” OR “stress incontinence, urinary”) AND (“woman” OR “female”) AND (“moxibustion” OR “acupuncture therapy”) AND (“randomized controlled trial” OR “randomized controlled trials as topic”). In the PubMed database, the retrieval time was set from its establishment to December 2021. The more complete search strategy for PubMed was presented in Supplementary Table 1.

2.2. Inclusion criteria

All studies were required to meet the following inclusion criteria.

2.2.1 Types of participants

Participants were female patients with a diagnosis of SUI, regardless of age, race, or country.
2.2.2 Type of interventions
The intervention could be the use of moxibustion alone. Studies in which the experimental group used moxibustion combined with the control group therapy were also included. There were no restrictions on the method of moxibustion, the selection of acupoints, the materials of moxibustion, and the course of treatment.

2.2.3 Types of comparisons
The control group used PFMT, acupuncture, sham moxibustion, Chinese medicine, or blank control. The control group also received the same baseline intervention as the experimental group.

2.2.4 Types of outcome measures
The primary outcome was the change from baseline in urine leakage measured by the 1-hour pad test. Secondary outcomes included clinical efficacy, ICIQ-SF score, mean 24-hour frequency of incontinence episodes, and adverse events.

2.2.5 Types of studies design
The included studies were all RCTs.

2.3. Exclusion criteria
The exclusion criteria were as follows:

1. The subjects did not meet the type of SUI in women. Studies with female urgency urinary incontinence or mixed urinary incontinence or males with SUI were excluded.

2. The intervention method of the experimental group was not moxibustion as the main treatment method.

3. The outcome indicators of the study did not meet the inclusion criteria.

4. The study subjects had other serious diseases of the heart, brain, hematopoietic system, and spirit.

5. Female patients with a history of surgical treatment of urinary incontinence or pelvic floor surgery were excluded.

6. Studies with missing or duplicate publications or for which the full text was not available were excluded.

7. The studies included non-RCTs, reviews, case reports, systematic reviews, animal experiments, and conference abstracts.

2.4. Data collection and analysis

2.4.1 Selection of studies
All studies retrieved from the eight electronic databases mentioned above were imported into NoteExpress software (version 3.5.0, Beijing Aiqihai Software Company) for classification management. The steps of literature screening were to first eliminate duplicate published studies. Two reviewers (Qiaochu Zhu and Jie Fu) then independently read the titles and abstracts of the obtained articles and removed some articles that did not meet the requirements according to the inclusion and exclusion criteria. Finally, two reviewers downloaded and read the full texts of the remaining studies to further check whether these articles met the final study criteria. If two reviewers disagreed during the literature search and screening, consensus was reached by consulting a third reviewer (Yangpu Zhang). The detailed process of literature screening was presented according to the PRISMA flow chart (Fig. 1).

2.4.2 Data extraction and management
Two reviewers (Yue Shi and Baoyi Peng) independently extracted the following data and information from included studies:

1. first author, publication year, sample size, patient age, disease duration;

2. interventions in experimental and control groups, and treatment duration;

3. outcome indicators, reported adverse events.

If two reviewers disagreed during data extraction, a third reviewer (Aiqun Song) reviewed the data for consistency.

2.4.3. Risk of bias assessment
The risk of bias of included studies was assessed using the Cochrane Collaboration Risk of Bias Tool. (31) The evaluation criteria included seven items: random sequence generation; allocation concealment; blinding participants and personnel; blinding of outcome assessment; incomplete outcome data; selective reporting; and other biases. At the same time, two reviewers (Yang, Jiao, and Dan, Wei) independently assessed the methodological quality of each included study, and disagreements that arose during the quality assessment were resolved through discussions with the third reviewer (Yueyu, Zhang).

2.4.4. Statistical analysis

In this meta-analysis, statistical analysis was performed with STATA (version 15.0) statistical management software (StataCorp, College Station, Texas, USA). An odds ratio (OR) with a 95% confidence interval (CI) is used to represent dichotomous data. For continuous data, use the standardized mean difference (SMD) and its corresponding 95% CI. The heterogeneity of included studies was assessed using the Q-test and $I^2$ statistic. (32) The fixed effect model or random effects model was chosen depending on the $I^2$ statistic. If $I^2 < 50\%$ and the $I^2$-value $> 0.05$, the included studies were considered to be less heterogeneous and we could use a fixed effects model. If $I^2 > 50\%$ or $I^2 < 0.05$, indicating significant heterogeneity among included studies, a random effects model was used for meta-analysis. (33) By the Z-test, $I^2 < 0.05$ was considered to be statistically significant. When there was significant heterogeneity in study results, we employed subgroup analysis or sensitivity analysis to look for sources of heterogeneity. The meta-analysis was graphically represented by forest plots, and the publication bias was represented by funnel plots. At the same time, Egger's test was used to evaluate publication bias. (34)

2.4.5 Evidence grading evaluation

We used the Grading of Recommendations, Assessment, Development and Evaluation (GRADE) tool to assess the level of evidence and pool the results. (35) According to the GRADE guidelines, the quality of evidence was rated at four levels (high, moderate, low, or very low).

3. Results

3.1. Search results

According to the search strategy, a total of 713 studies were initially obtained from the eight electronic databases mentioned above. After removing duplicates, animal experiments, reviews, and conference abstracts, 389 studies were screened. By reading the titles and abstracts, 303 studies were deleted according to the inclusion and exclusion criteria, leaving 86 studies remaining after primary screening. 73 studies were excluded by further reading the full text. Ultimately, 13 RCTs (36–48) were included in this systematic review and meta-analysis. Figure 1 shows the detailed study selection process according to the PRISMA flow chart.

3.2 Characteristics of included studies

The 13 included RCTs were all published in China, of which 9 studies (38–41, 43–45, 47) were journal articles and 4 studies (36, 42, 46, 48) were master's thesis. All the included studies were published between 2007 and 2021. A total of 822 female patients were included in the meta-analysis, including 413 in the experimental group and 409 in the control group. In three studies (39, 40, 46), the experimental group only used moxibustion as a monotherapy, and the control group used PFMT. Another study (37) compared moxibustion monotherapy with acupuncture. The remaining nine studies used moxibustion combined with other therapies. The types of combined therapy used were as follows: moxibustion combined with PFMT versus PFMT (n = 4); moxibustion combined with Chinese medicine versus Chinese medicine (n = 1); moxibustion combined with acupuncture versus acupuncture (n = 1); moxibustion combined with acupuncture and PFMT versus acupuncture and PFMT (n = 1); moxibustion combined with acupuncture and Chinese medicine control acupuncture and Chinese medicine (n = 1); moxibustion combined with PFMT control acupuncture and PFMT (n = 1). More details on the characteristics of the included studies are presented in Table 1.

3.3 Assessment of risk of bias

The Cochrane Collaboration Risk of Bias Assessment Tool was used to assess the risk of bias of the 13 included RCTs from seven aspects. In terms of random sequence generation, one study did not correctly use the randomized control method and was rated as high risk of bias, while the remaining 12 studies used randomized control methods and were rated as low risk. In terms of allocation concealment, only one study used allocation concealment and was assessed as low risk of bias, and the remaining 12 studies did not mention allocation concealment and were assessed as unclear risk of bias. In terms of participant and personnel blinding, 13 studies were assessed as being at high risk of bias due to the nature and subjectivity of moxibustion treatment, which made it difficult to implement blinding. In terms of blinding of outcome assessments, one study described the use of blinding by outcome assessors and was rated as low risk of bias, and the remaining 12 studies were rated as unclear risk due to insufficient blinding information from the studies. With regard to incomplete outcome data, 13 studies had no missing data and were assessed as having a low risk of bias. In the selective reporting section, 13 studies reported all outcomes and were rated as low risk of bias. In terms of other biases, all included studies had no other factors causing bias and were assessed as having a low risk of bias. Full details of risk of the bias are presented in Figs. 2 and 3.
3.4 Results of meta-analysis

3.4.1 Changes in urine leakage in the one-hour pad test

Thirteen studies measured changes in urine leakage from baseline using the 1-hour pad test. The differences in the pooled data were statistically significant (Fig. 4A), and the heterogeneity test indicated that there was a large heterogeneity \(I^2 = 74.4\%\), \(P < 0.05\), SMD = 0.86, 95% CI [-1.33, -0.58]). Therefore, a random-effects model was used for the meta-analysis. We then performed a subgroup analysis (Fig. 5A) and divided the 13 studies into two groups according to duration of treatment (group 1 > 30 days, group 2 ≤ 30 days). However, the heterogeneity remained substantial (group 1 \(I^2 = 80.9\%\), group 2 \(I^2 = 61.1\%\)). Next, we performed a sensitivity analysis to exclude sources of heterogeneity one by one (Fig. 7). The result showed a significant reduction in heterogeneity \(I^2 = 31.8\%\), \(P = 0.137 > 0.05\), SMD = 0.73, 95% CI (-0.90, -0.55)), when one study(37)(Zhao JJ et al 2016) was removed, indicating that this study was probably the source of the heterogeneity (Fig. 4B). For the remaining 12 studies, we used funnel plots to analyze whether there was publication bias. Twelve studies appeared essentially in the funnel plot, and the merged OR value was taken as the center for spreading distribution and basic symmetry (Fig. 6A). At the same time, we used Egger’s test to assess publication bias \(P = 0.167 > 0.05\), and the results indicated that there was no publication bias.

3.4.2 Clinical efficacy

Since the clinical efficacy was quantitative data, we used the dichotomous variable method for meta-analysis. Clinical cure, marked effect, and effectiveness were included in the total effective rate. A total of 12 RCTs reported the clinical efficacy of moxibustion in the treatment of female SUI. As shown in Fig. 4C, no heterogeneity among the 12 studies was found after pooling the data \(I^2 = 0\%\), \(P = 0.959 > 0.05\). Therefore, we used a fixed-effects model to analyze the pooled OR value [OR = 3.42, 95% CI (2.32, 5.04)]. The results showed that moxibustion intervention had a significant difference in female SUI compared with other treatments. The forest chart was used to compare the clinical efficacy of the moxibustion intervention group and the control group in treating female SUI. A funnel plot was used to analyze the publication bias of the 12 studies (Fig. 6B). The included studies were basically within the 95% CI, but the Egger’s test showed that there was still publication bias \(P = 0.024 < 0.05\). We therefore performed a trim-and-fill analysis of the funnel plot asymmetry (Fig. 6C). It showed that in the future we would include four studies with similar characteristics to Wang WT 2020(42), Wang Q et al 2020(45), Qiao XQ et al 2018(40), Hu D et al 2017(38) to eliminate publication bias.

3.4.3 Change in ICIQ-SF score

ICIQ-SF scores were reported in 10 of the 13 included studies. After the heterogeneity test, it was suggested that there was heterogeneity among the studies \(I^2 = 53.5\%\), \(P = 0.023 < 0.05\), and a random-effects model was selected for meta-analysis (Fig. 4D). The comprehensive analysis showed that the difference was statistically significant [SMD = -0.80, 95% CI (-1.03, -0.57)]. Due to the heterogeneity of the pooled data, we chose to perform a subgroup analysis (Fig. 5B), dividing the 10 studies into two groups according to the Ingelman-Sundberg grading method (the first group was mild to severe, and the second group was mild and moderate). Because one study (Chen NL 2007) used the Stamey scale, it could not be included for subgroup analysis. The results of subgroup analysis showed that the effect size of the ICIQ-SF score of the first group after moxibustion intervention was SMD = -0.62 [95% CI (-0.86, -0.39), \(I^2 = 0\%\), \(P = 0.971\)]. The change in ICIQ-SF score in the second group was SMD = -1.12 [95% CI (-1.40, -0.84), \(I^2 = 31.5\%\), \(P = 0.224\)]. Heterogeneity was significantly reduced, suggesting that inclusion of women with severe SUI may be a source of heterogeneity.

3.4.4 Change in mean 24-hour frequency of incontinence episodes

Four studies included the analysis of the reduction in the mean 24-hour incontinence episodes. The forest plot (Fig. 4E) showed little heterogeneity between studies \(I^2 = 15.2\%\), \(P = 0.316 > 0.05\), so we used a fixed-effects model to analyze the pooled data. The four studies compared moxibustion with PFMT or acupuncture, and the results suggested a statistically significant difference [SMD = -0.78, 95% CI (-1.05, -0.54)].

3.4.5 Adverse events

Only one study reported the occurrence of adverse reactions, which showed that 3 patients in the control group developed minor subcutaneous bruising after treatment, which had no effect on the study results. There were no adverse events in the other 12 studies.

3.5 Grade evaluation

We assessed the quality of evidence for included studies using the GRADE tool. The quality of the evidence was low to moderate. Only a minority of studies were rated as low risk of bias, and most studies were at high or unclear risk of bias in at least one domain. The presence of a high risk of bias was mainly influenced by blinding, resulting in a downgrade of the evidence by at least one level. The results of two comparisons suggested heterogeneity among studies \(I^2 > 50\%\). Although the heterogeneity that existed could be explained by interventions and treatment experience, this finding would lead to a lower level of evidence. Egger’s test found potential publication bias in the comparison of
4. Discussion

Although many clinical RCTs in China have shown that moxibustion has substantial therapeutic effects on female SUI (49–51), its efficacy and safety have not been scientifically proven. Therefore, the purpose of this systematic review and meta-analysis was to evaluate the efficacy and safety of moxibustion in the treatment of female SUI. This meta-analysis included 13 eligible studies that compared moxibustion with other conservative treatments (PFMT or acupuncture or Chinese medicine). The data were pooled and analyzed from four aspects: urine leakage in the 1-hour pad test, clinical efficacy, ICIQ-SF score, and average 24-hour frequency of urinary incontinence episodes. In terms of reducing the urine leakage in the one-hour pad test, after moxibustion treatment, the urine leakage in the experimental group was significantly reduced compared with the control group [SMD = -0.86, 95% CI (-0.1.13, -0.56)]. Evidence suggests that women who received moxibustion had more significant reductions in urine leakage compared to women who used PFMT or acupuncture or Chinese medicine. In terms of the total clinical effective rate, the treatment effect of moxibustion in the experimental group in the treatment of female SUI was significantly improved compared with the control group [OR = 3.42, 95% CI (2.32, 5.04)]. This showed that moxibustion could effectively treat female SUI. Through the analysis of ICIQ-SF score, the data showed that compared with the control group after receiving moxibustion treatment, the experimental group could effectively reduce the ICIQ-SF score [SMD = -0.80, 95% CI (-1.03, -0.57)], which was helpful to improve the quality of life of female SUI patients. Based on the pooled data on the mean 24-hour frequency of incontinence episodes, compared with the control group using PFMT or acupuncture, moxibustion intervention in the experimental group reduced the mean 24-hour frequency of incontinence episodes [SMD = -0.78, 95% CI (-1.05, -0.54)]. The results showed that moxibustion could effectively reduce the frequency of urinary incontinence in female patients in the short term. Only one study reported mild subcutaneous bruising in 3 patients in the control group after treatment, and the remaining 12 studies had no adverse events. The data was insufficient for quantitative analysis, so we performed a descriptive analysis of adverse events.

Limitations

This meta-analysis also has certain limitations that need to be addressed: (1) The 13 included studies lacked follow-up evaluation of long-term treatment effects, and most studies only reported short-term effects of about 2 months of treatment. Therefore, we need to include more RCTs with long-term effects.

(2) The sample size of the included studies was small, none of the studies published a protocol, and no double-blind method was used, resulting in a lack of high-quality evidence. Therefore, more large-sample, multi-center, high-quality randomized controlled trials are needed in the future before definite conclusions can be drawn.

(3) Only one of the 13 included RCTs reported adverse events in the control group. The included studies lacked data comparing the safety of the interventions, making it difficult to assess whether moxibustion was safer than other treatments.

(4) In the assessment of clinical efficacy, the results of Egger's test indicated potential publication bias in the included studies, which may be related to unpublished negative results and studies for which data were unavailable.

(5) All the included RCTs were researched and published in China, which may lead to certain publication bias in the results. This may be related to the popularity of moxibustion therapy only in Asian countries such as China.

Implications for future research

First, RCTs with larger sample sizes, high-quality clinical trial designs, and long-term efficacy follow-up are required in the future. Second, more RCTs in other languages related to female SUI need to be included in the future. Finally, the cost-effectiveness of moxibustion in the treatment of female SUI should also be considered.

5. Conclusion

Overall, this systematic review and meta-analysis conclude that moxibustion is effective and safe in the treatment of female SUI. Compared with the control group, moxibustion intervention can effectively reduce the amount of urine leakage and improve the symptoms of urinary incontinence in female patients. However, due to the rarity of adverse event reports and the small sample size included, we cannot draw a conclusion that moxibustion in treating female SUI is safer than the control group. In addition, the conclusions should be interpreted with caution, considering the existence of heterogeneity, publication bias, and limitations on the language of the included literature. Due to the lack of high-quality evidence levels in the included studies, we need more well-designed, large-sample, high-quality RCTs in the future to further demonstrate the above conclusions.

Abbreviations

clinical efficacy (P < 0.05). This could also lead to a weakening of the quality of the evidence. The detailed quality of evidence assessment is shown in Supplementary Table 2.
Declarations

**Ethics approval and consent to participate:** Not applicable. This manuscript does not report on or involve the use of any animal or human data or tissue.

**Consent for publication:** Not applicable. This manuscript does not contain data from any individual person.

**Availability of data and materials:** The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

**Competing interests:** The authors declare that they have no competing interests.

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**Authors’ contributions:** The article was conceived and designed by Yueyu Zhang and Aiqun Song. The software was written by Dan Wei and Yangpu Zhang. Jie Fu and Qiaochu Zhu completed the data collection. Yang Jiao and Zhongyu Zhou provided administrative support. Baoyi Peng and Yue Shi analyzed and illustrated the data. The writing of the original manuscript was done by Yueyu Zhang. All authors read and approved the final manuscript.

**Acknowledgements:** Not applicable.

**References**


Tables

Table 1 Characteristics of the studies included in the meta-analysis.
<table>
<thead>
<tr>
<th>Study</th>
<th>Number of patients (EG/CG)</th>
<th>Mean age (EG/CG)</th>
<th>Course of disease (EG/CG)</th>
<th>Experiment group</th>
<th>Control group</th>
<th>Treatment duration</th>
<th>Outcomes</th>
<th>Adverse events</th>
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<td>Chen NL 2007</td>
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<td>47.93±12.15/45.07±12.51(y)</td>
<td>3.53±2.47/4.03±2.95(y)</td>
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<tr>
<td>Wang WT 2020</td>
<td>34/30</td>
<td>53.69±6.07/53.17±6.16(y)</td>
<td>4.9±4.72/4.97±4.66(y)</td>
<td>M</td>
<td>A</td>
<td>6w, qw</td>
<td></td>
<td>none</td>
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<tr>
<td>Yang XB et al 2020</td>
<td>46/46</td>
<td>47.15±11.23/46.26±10.26(y)</td>
<td>25.35±11.56/23.67±12.37(m)</td>
<td>M+PFMT</td>
<td>PFMT</td>
<td>8w, tiw</td>
<td></td>
<td>none</td>
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<tr>
<td>Zang XM et al 2020</td>
<td>32/32</td>
<td>54.47±6.29/53.44±7.02(y)</td>
<td>4.25±1.17/4.20±1.04(y)</td>
<td>M+PFMT</td>
<td>PFMT</td>
<td>8w, qw</td>
<td></td>
<td>none</td>
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<tr>
<td>Wang Q et al 2020</td>
<td>35/35</td>
<td>49.3±5.5/50.1±5.2(y)</td>
<td>27.8±14.7/25.5±15.5(m)</td>
<td>M+A+C</td>
<td>A+C</td>
<td>4w, tiw</td>
<td></td>
<td>CG: three patients none</td>
</tr>
<tr>
<td>Li QF 2020</td>
<td>36/36</td>
<td>52.86±9.23/51.92±10.57(y)</td>
<td>32.72±20.68/32.50±21.22(m)</td>
<td>M</td>
<td>PFMT</td>
<td>8w, bw</td>
<td></td>
<td>none</td>
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<tr>
<td>Zhang C et al 2021</td>
<td>60/60</td>
<td>54.98±5.27/53.48±4.94(y)</td>
<td>7.86±2.15/7.75±1.09(y)</td>
<td>M+PFMT</td>
<td>PFMT</td>
<td>12w, qd</td>
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<tr>
<td>Gao ZY 2021</td>
<td>36/36</td>
<td>53.5±4.831/54.42±5.598(y)</td>
<td>7.69±3.267/7.33±3.680(y)</td>
<td>M+PFMT</td>
<td>A+PFMT</td>
<td>8w, qw</td>
<td></td>
<td>none</td>
</tr>
</tbody>
</table>

EG: experiment group; CG: control group; y: years; m: months; w: weeks; d: days; M: moxibustion; C: Chinese medicine; A: acupuncture; PFMT: pelvic floor muscle training; ICIQ-SF: International Consultation on Incontinence Questionnaire Short-Form; qd: once a day; qw: once a week; biw: twice a week; tiw: three times a week; qid: four times a week; 1-hour pad test; total effective rate; ICIQ-SF score; mean 24-hour frequency of incontinence episodes;
Figure 1

Flow diagram of the study selection process. Abbreviations: SUI = stress urinary incontinence; RCT = randomized controlled trial
Figure 2
Risk of bias summary

- Random sequence generation (selection bias)
- Allocation concealment (selection bias)
- Blinding of participants and personnel (performance bias)
- Blinding of outcome assessment (detection bias)
- Incomplete outcome data (attrition bias)
- Selective reporting (reporting bias)
- Other bias

Figure 3
Risk of bias graph
Figure 4

Forest plot: (A) one-hour pad test for urine leakage; (B) one-hour pad test for urine leakage (when Zhao JJ et al 2016 was removed); (C) clinical efficacy; (D) ICIQ-SF score; (E) mean 24-hour frequency of incontinence episodes

Abbreviations: OR= odds ratio; SMD= standardized mean difference; CI= confidence interval; ICIQ-SF= International Consultation on Incontinence Questionnaire Short-Form
Figure 5

Subgroup analysis: (A) one-hour pad test for urine leakage; (B) ICIQ-SF score
Figure 6

Funnel plot: (A) one-hour pad test for urine leakage; (B) clinical efficacy; (C) clinical efficacy trim-and-fill analysis
Figure 7

Sensitivity analysis: one-hour pad test for urine leakage

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- SupplementaryTable1.docx
- SupplementaryTable2.docx