

Acupuncture and Moxibustion in the Treatment of Gynecological Perioperative Anxiety: A Systematic Review and Meta-Analysis

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Objective: This systematic review and meta-analysis aims to investigate the effectiveness and safety of acupuncture and moxibustion in managing perioperative anxiety during gynecological surgery.

Methods: Relevant studies published from the establishment of the databases to March 20, 2023, were searched in PubMed, Embase, Cochrane Library, Web of Science, CNKI, Wanfang, VIP, and CBM. Literature screening and data extraction were independently conducted by two investigators. The Cochrane risk-of-bias tool 2.0 was utilized to assess the risk of bias in the included studies. Data analysis was carried out using Stata 15.1 software.

Results: The analysis included a total of 3254 patients from twenty studies. It was found that acupuncture and moxibustion therapy resulted in a reduction of postoperative State-Trait Anxiety Inventory (STAI-S) scores (mean difference [MD] = -3.50, 95% confidence interval [CI] [-6.93 to -0.07], $P = 0.046$), as well as both preoperative and postoperative Visual Analogue Scale-Anxiety (VAS-anxiety) and Self-Rating Anxiety Scale (SAS) scores (pre-operation: SMD = -1.04, 95% CI [-1.73 to -0.35], $P = 0.003$; post-operation: SMD = -0.78, 95% CI [-1.21 to -0.35], $P < 0.001$) in comparison to the control group. Nonetheless, no significant variances were noted between the two groups with regards to preoperative and intraoperative STAI-S scores (pre-operation: MD = -3.38, 95% CI [-9.58 to 2.82], $P = 0.286$; intraoperative: MD = -1.09, 95% CI [-7.32 to 5.13], $P = 0.730$), and intraoperative VAS-anxiety and SAS scores (SMD = -0.44, 95% CI [-1.51 to 0.64], $P = 0.427$).

Conclusion: During the perioperative period of gynecological surgery, acupuncture and moxibustion therapy show potential in alleviating anxiety in patients. It is noteworthy that the current level of evidence is limited by the small sample size. Therefore, further validation of these findings is necessary.

Keywords: perioperative anxiety, gynecological surgery, acupuncture, systematic review, meta-analysis

Introduction

Surgery is a commonly used approach to treat gynecological diseases and often acts as a significant source of stress in clinical settings, eliciting various levels of psychological and physiological stress responses in patients. Studies have shown that a high incidence of anxiety, ranging from 92% to 93%, is frequently observed among patients awaiting surgery, making it a prominent adverse experience related to surgical procedures.¹ Preoperative anxiety not only affects the patient's nervous and endocrine systems, but also hinders the smooth progress of surgery and anesthesia. Furthermore, its persistence can impact postoperative recovery and subsequent quality of life.² Recent research^{3,4} has revealed that in the context of elective surgery across different departments, a higher number of patients experiencing preoperative anxiety are from the gynecology and obstetrics departments. This association is closely related to the unique reproductive system and physiological functions in

females. Therefore, it is especially important to implement effective interventions to alleviate perioperative anxiety in order to facilitate the swift recovery of postoperative patients.⁵

In recent years, the use of sedatives and anxiolytic drugs before surgery has become a common method to reduce anxiety in patients. Although effective, these medications can cause complications like postoperative nausea, vomiting, and pain. These problems not only affect patient satisfaction and comfort but also impact the recovery outcomes of patients.^{6,7} Therefore, there is a pressing requirement for more effective and safer treatments. As a result, there is a growing focus on complementary and alternative interventions. For example, acupuncture and moxibustion therapy have become widely utilized approaches, providing patients with advantages and minimal side effects at relatively low expenses. Research has demonstrated notable benefits of acupuncture in the realm of neurological disorders.^{8–10} For instance, a meta-analysis conducted by Xiong Jingwen confirmed that acupuncture can effectively alleviate myofascial pain,¹¹ likely through the inhibition of P2X7R to relieve neuropathic pain.¹² Furthermore, some experts contend that acupuncture can stimulate the central nervous system of the spinal cord and higher central nervous system to participate in pain processing.¹³ Acupuncture has also been suggested to regulate the functions of the heart and brain, particularly in clinical conditions associated with neuroendocrine imbalance, such as menopause, depression, and insomnia.¹⁴

Acupuncture and moxibustion therapy have been extensively studied for their potential to reduce preoperative anxiety in gynecology. For instance, Wunsch et al¹⁵ demonstrated the effectiveness of auricular acupuncture at specific acupoints in alleviating anxiety in patients undergoing outpatient gynecological surgery. Similarly, Abadi et al¹⁶ successfully improved preoperative anxiety and reduced State-Trait Anxiety Inventory (STAI) scores in patients scheduled for cesarean section by applying pressure at Yintang and Shenmen points. Furthermore, Yuan et al¹⁷ observed that acupuncture not only alleviates preoperative anxiety and pressure, but also diminishes the use of anesthetic drugs and stress responses, leading to stable breathing and homeostasis during the operation. It also imparts a protective effect on vital organs, promotes recovery, effectively reduces postoperative pain, and prevents discomfort such as nausea and vomiting during the recovery period. However, Oviedo et al¹⁸ reported that otopoint pressure and auricular acupuncture treatment did not result in lower anxiety and pain scores compared with a placebo in patients scheduled for induced abortion. Additionally, recent randomized controlled trials (RCTs) have investigated the efficacy of acupuncture and moxibustion in managing anxiety related to gynecological surgery. Notably, there is a lack of a comprehensive meta-analysis addressing the impact of acupuncture and moxibustion therapy on perioperative anxiety in patients with gynecologic diseases undergoing surgical treatment, as well as the effect of different intervention methods on perioperative anxiety for different types of gynecological surgeries. Therefore, a more extensive systematic review is needed.

The purpose of this research is to methodically examine current literature and perform a meta-analysis to evaluate the efficacy and safety of traditional acupuncture and moxibustion treatments in reducing perioperative anxiety and pain associated with gynecological surgery. The objective is to offer evidence-based perspectives for medical practice.

Materials and Methods

The study followed the reporting guidelines specified in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA).¹⁹ The protocol for this meta-analysis can be accessed in the PROSPERO registry (CRD42023432717).

Literature Search

Search Strategy

The researchers conducted a comprehensive search of PubMed, Embase, Cochrane Library, Web of Science, CNKI, Wanfang, VIP, and CBM to identify relevant studies published from the establishment of the databases to March 20, 2023. The search employed a combination of subject terms and free-text terms, integrating keywords such as acupuncture and moxibustion, auricular therapy, electroacupuncture, acupressure, gynecological surgery, laparotomy, laparoscopic surgery, cesarean section, induced abortion, anxiety, and depression. Additionally, they meticulously reviewed the references of relevant studies to ensure the inclusion of all pertinent articles. Subsequently, they performed supplementary searches to capture the latest literature and avoid any potential omissions. The detailed search strategy can be found in the [Appendix 1](#) Using PubMed database search as an example, the search is as shown in [Table 1](#).

Table 1 Example of PubMed Search[illegible]

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Table 1 (Continued).

#5	((Acupuncture[Title/Abstract]) OR (Pharmacopuncture[Title/Abstract]) OR (shonishin[Title/Abstract]) OR (Acupuncture Therapy[Title/Abstract]) OR (Acupuncture Treatment[Title/Abstract]) OR (Acupuncture Treatments[Title/Abstract]) OR (Pharmacopuncture Treatment[Title/Abstract]) OR (Pharmacopuncture Therapy[Title/Abstract]) OR (Acupotomy[Title/Abstract]) OR (Acupotomies[Title/Abstract]) OR (Acupuncture, Ear[Title/Abstract]) OR (Ear Acupunctures[Title/Abstract]) OR (Ear Acupuncture[Title/Abstract]) OR (Auricular Acupunctures[Title/Abstract]) OR (auricular acupuncture[Title/Abstract]) OR (auriculo-acupuncture[Title/Abstract]) OR (Auriculoacupuncture[Title/Abstract]) OR (Auriculotherapy[Title/Abstract]) OR (earlobe acupuncture[Title/Abstract]) OR (Moxibustion [Title/Abstract]) OR (Moxibustion[Title/Abstract]) OR (Acupressure[Title/Abstract]) OR (Shiatsu[Title/Abstract]) OR (Zhi Ya[Title/Abstract]) OR (Chih Ya[Title/Abstract]) OR (Shiatzu[Title/Abstract]) OR (electroacupuncture[Title/Abstract]) OR (electric acupuncture[Title/Abstract]) OR (electrical acupoint stimulation[Title/Abstract]) OR (electrical acupuncture[Title/Abstract]) OR (electro-acupuncture[Title/Abstract]) OR (electrode acupuncture[Title/Abstract]) OR (electronic acupuncture[Title/Abstract]) OR (Warm needling[Title/Abstract]) OR (Fire needling [Title/Abstract]) OR (warm acupuncture[Title/Abstract]) OR (burnt needle therapy[Title/Abstract]) OR (fire acupuncture[Title/Abstract]) OR (fire needle therapy[Title/Abstract]) OR (heat acupuncture[Title/Abstract]) OR (heat-type acupuncture[Title/Abstract]) OR (thermal acupuncture [Title/Abstract]) OR (thermo-acupuncture[Title/Abstract]) OR (Thermoacupuncture[Title/Abstract]) OR (scalp acupuncture[Title/Abstract]) OR (hand acupuncture[Title/Abstract]) OR (Acupoint catgut embedding[Title/Abstract]) OR (catgut embedding[Title/Abstract]) OR (acupoint application[Title/Abstract]) OR (Acupoint injection[Title/Abstract])
#6	#4 OR #5
#7	"Anxiety"[Mesh]
#8	(((anxiety[Title/Abstract]) OR (Angst[Title/Abstract]) OR (Social Anxiety[Title/Abstract]) OR (Social Anxieties[Title/Abstract]) OR (Hypervigilance[Title/Abstract]) OR (Nervousness[Title/Abstract]) OR (Anxiousness[Title/Abstract])
#9	#7 OR #8
#10	#3 OR #6 OR #9

Inclusion and Exclusion Criteria

To establish the inclusion criteria, we followed the Participants, Intervention, Comparison, Outcomes, and Study (PICOS) framework. The criteria were as follows: (1) Participants: The study included adult inpatients or outpatients undergoing elective gynecological surgery with preoperative data, without ethnic restrictions, and experiencing perioperative anxiety. (2) Intervention: The treatment group received otopoint pressure, auricular acupuncture, electroacupuncture, acupuncture, acupressure, or moxibustion. The control group received sham acupuncture, sham acupoints, conventional treatment, or drug treatment. (3) Primary outcome measures involve anxiety assessments, including State-Trait Anxiety Inventory (STAI-S),²⁰ Visual Analogue Scale - Anxiety (VAS-anxiety),²¹ and Self-Rating Anxiety Scale (SAS).²² Additional measures assessed as secondary outcomes encompass pain, depression, and sedation through VAS-anxiety, Hamilton Depression Rating Scale (HAMD), Burns Depression Checklist (BDC), Self-Rating Depression Scale (SDS), Bispectral Index (BIS), and Ramsay Sedation Scale (Ramesay) scores. Moreover, we incorporated the initial postoperative exhaust time, the initial postoperative defecation time, and recovery time for postoperative bowel sounds. (4) Study design: Randomized controlled trials conducted in either Chinese or English.

The exclusion criteria are as follows: (1) Articles that are not related to gynecological surgery or do not include acupuncture and moxibustion intervention in the treatment group. (2) Articles categorized as meta-analyses, reviews, animal experiments, case reports, conference abstracts, guidelines, letters, or graduation theses. (3) Articles lacking outcome measures of interest or extractable data, or containing incorrect data. (4) Articles that used other treatment combination methods. (5) In cases where literature exists in both Chinese and English versions, the English version will be retained.

Study Selection and Data Extraction

The obtained results were imported into the EndNote X9 software, and two authors (Xiu Wang and Qianqian Yu) independently performed literature screening according to the predefined inclusion and exclusion criteria. After removing duplicate studies, the titles and abstracts of the literature underwent primary screening. Subsequently, studies that did not satisfy the inclusion criteria were excluded, and the complete texts of the remaining literature were carefully examined to

identify eligible studies. In the event of any disagreements, a third investigator (Xia Xu) was consulted for discussion and decision-making.

Two investigators (Junlan Liu and Xuyuan Gao) independently conducted data extraction using a pre-defined spreadsheet. The extracted and recorded data information included: author, year, country, sample size, age, surgery type, intervention measure, specific intervention process, and outcome measure. Any discrepancies were resolved through discussion between the two investigators, and if needed, a third investigator (Jun Zhu) was consulted.

Risk-of-Bias Assessment

The risk of bias for each study was evaluated by two independent reviewers (Xiudie Wang and Lanlan Wang) using Version 2 of the Cochrane Risk-of-Bias Tool for randomized trials (RoB 2.0).²³ Each study was placed into categories of “low risk of bias”, “some concerns”, or “high risk of bias” according to the following domains: bias arising from the randomization process, bias due to deviations from the intended intervention, bias from missing outcome data, bias in the measurement of outcomes, and bias in the selection of the reported results, including deviations from the registered protocol. Trials were considered to have an overall high risk of bias if one or more domains were rated as “high risk of bias”, and were deemed to have an overall low risk of bias if all domains were rated as “low risk of bias”.

Statistical Analysis

Data analysis was conducted using Stata 15.1. Heterogeneity was quantified through Cochran’s Q test and Higgins I². Significant heterogeneity among the studies was indicated by a significance level of $P < 0.10$ or $I^2 > 50\%$, leading to the adoption of a random-effects model for analysis. Conversely, a fixed-effects model would be selected if heterogeneity was not significant. In cases of excessive heterogeneity, sensitivity analysis and subgroup analysis were performed to explore the sources of heterogeneity. Funnel plots were used to visually represent potential publication bias, and statistical assessment of publication bias was carried out using Begg and Egger tests. If publication bias was identified, the trim-and-fill method was applied to analyze its impact on the results of the meta-analysis. A significance level of $P < 0.05$ indicated the statistical significance of the combined statistics of the included studies.

Results

Literature Search and Study Selection

After conducting database searches and manual retrieval, a total of 856 articles were obtained. Following the screening of titles and abstracts, 248 duplicate articles and 547 irrelevant articles were excluded. Subsequently, attempts were made to download the full texts of the remaining 61 articles, but the full texts of 8 articles were unavailable. Finally, 20 studies^{18,24–42} were included, after excluding 5 studies without data, 2 studies lacking exact treatment time, 3 studies without specific surgery type, 1 study lacking a control group, 6 studies where the Chinese version was excluded and the English version retained, and 16 studies involving other combined treatment methods. The literature screening process is outlined in Figure 1.

Characteristics of Included Studies

Twenty studies^{18,24–42} were eligible and included, involving a total of 3254 patients, with 1578 patients in the treatment group and 1676 in the control group. These studies were conducted in four countries. The surgeries under consideration included cesarean section,^{24,29,31,33,35,42} induced abortion,^{18,27,34} laparoscopic surgery,^{26,28,30,32,36–41} and laparotomy.^{25,28} The various interventions employed in these studies are detailed below. For the treatment group, otopoint pressure was used in ten studies,^{18,25,26,28,30,33,35,38–40} auricular acupuncture in four studies,^{18,34,37,42} acupressure in three studies,^{24,27,32} acupuncture in one study,³² electroacupuncture in one study,⁴¹ moxibustion in one study,²⁹ and acupoint application in two other studies.^{31,36} In the control group, one study⁴¹ utilized Midazolam Injection, eight studies^{18,25,26,28,30,34,37,42} employed sham acupuncture, and fifteen studies^{24,25,27,29,31–36,38–42} described conventional treatment. Intervention times varied, including pre-operation,^{18,42} the night before the operation, or 12–24 hours before the operation,^{24–26,30,32,39–41} the day after enrollment,³⁷ after baseline measurement,²⁸ 1 hour before the operation,^{33,35} 3–5 minutes before the operation,³⁴ and post-operation or 6 hours after the operation.^{27,29,31,36,38} Furthermore, the treatment durations also varied. For example,

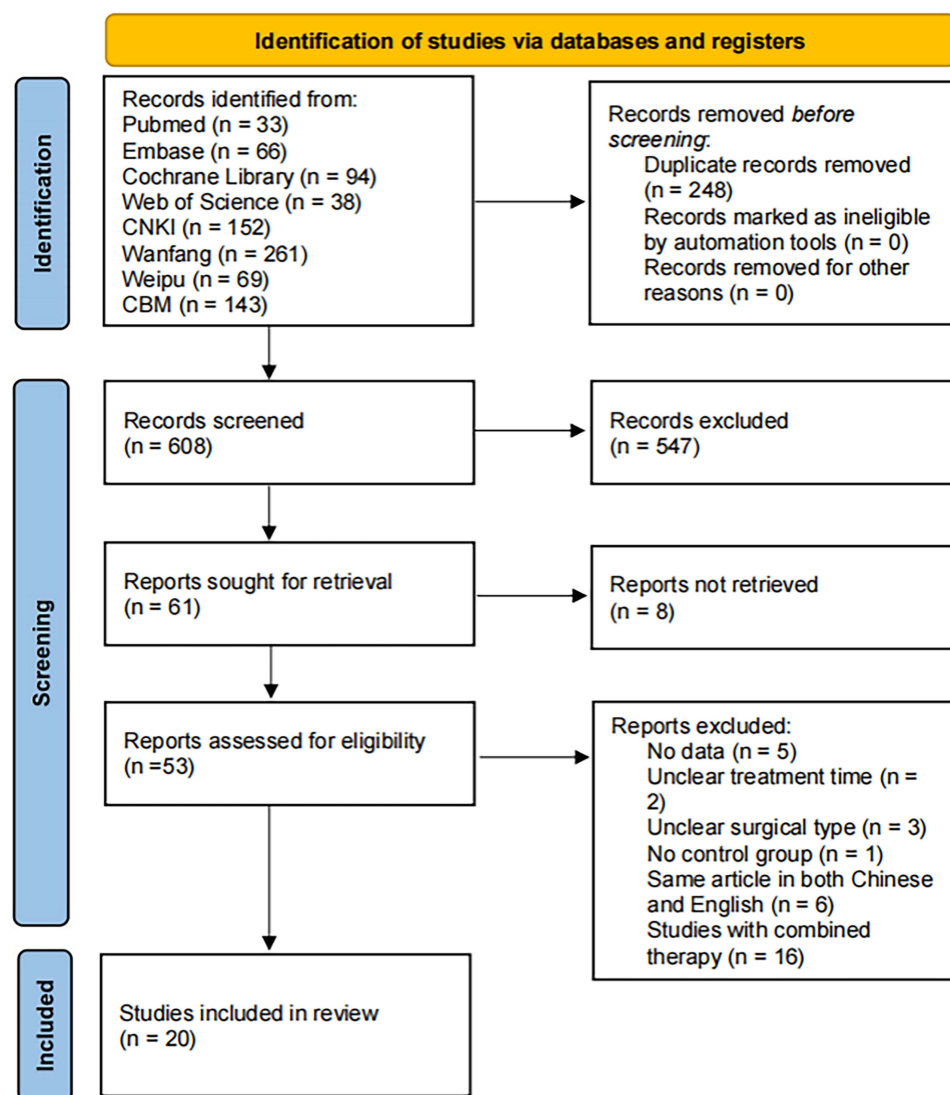


Figure 1 Studies selection flowchart.

otopoint pressure often continued until 72–96 hours after the operation. Auricular acupuncture had different durations, such as preoperatively lasting 3–5 minutes, throughout the entire cesarean section, each time lasting 30 minutes, extending to 72–96 hours after the operation, and lasting for a course of treatment, typically 11 days. Acupressure preoperatively lasted 3–5 minutes, 2–4 hours at one night before the operation, or after the operation, and 8–10 hours after, with a 5-minute intervention each time. Electroacupuncture was administered 24 hours and 2 hours before anesthesia induction. In terms of postoperative intervention, there were seven sessions of acupressure, acupoint application replaced every 4 hours until anal exhaust, as well as moxibustion and otopoint pressure with no specific time description. The specific acupoints and procedures involved in the intervention are detailed in [Table S1](#).

Primary outcomes, including STAI-S, VAS-anxiety, and SAS, were derived from the results of three anxiety scales. Additionally, VAS-anxiety scores for pain were reported in six studies,^{18,24,32–35} while BIS and Ramsay scores were reported in four studies.^{25,28,32,41} Furthermore, depression scores, including BDC, SDS, and HAMD, were reported in four studies.^{27,29,36,38} The first postoperative exhaust time was noted in five studies,^{25,26,29,31,38} and the first postoperative defecation time was mentioned in two studies^{26,31} reported the first postoperative defecation time, and three studies^{29,31,38} The characteristics of the included literature are detailed in [Table 2](#).

Table 2 Characteristics of Included Literature

No.	Title	First author	Year of publication	Country	Study type (single-center/multicenter)	Sample size		Age (mean $\pm$ SD)		Type of surgery	Interventions		Intervention regimens (time, frequency, acupoint)	Acupoints	Outcomes
						Treatment group	Control group	Treatment group	Control group		Treatment group	Control group			
1	Effect of Acupressure on Nausea, Vomiting, Anxiety and Pain among Post-Cesarean Section Women in Taiwan	Huei-Mein Chen	2005	Taiwan, China	Multicenter	52	52	32.69 $\pm$ 4.09	32.27 $\pm$ 4.74	Cesarean section	Acupressure	Routine treatment	This group received three acupressure treatments before CS and within the first 24 hours after CS. The first treatment was performed the night before CS, the second treatment between 2- and 4-hours following CS, and the third was performed between 8 and 10 hours after CS. The applied acupressure force was validated by applying thumb pressure on a 6-kg scale, calibrated to national standards. For each pressure cycle on each side, Neiguan (P6) pressure was applied by the operator's thumb for a period of 6 seconds, which was then followed by a pressure release of 2 seconds, and then reinstated. The total therapy time of 5 minutes was administered for each of the patient's arms.	Neiguan (P6)	Anxiety: STAI-S, VAS; Pain: VAS
2	Effects of magnetic auricular point-sticking on adjuvant anesthesia and postoperative recovery of body function	Wanshan Li	2011	China	Single-center	31	Control group 1: 31, Control group 2: 30		Control group 1: 44.06 $\pm$ 7.57, Control group 2: 42.07 $\pm$ 8.63	Laparotomy	Auricular point pressing	Control group 1: sham control, Control group 2: routine treatment	On the day before the surgery, the sensitive acupoints from Shenmen, subcortex, endocrine, lung, spleen, uterus and pelvic cavity meridians were detected by CLRH-A auricular point detector on both sides, and the "HWATO Magnetic Treatment Plaster" was applied to these acupoints after the skin had been disinfected with 75% ethanol. The patients were instructed to press the auricular points with their thumbs and index fingers 3 to 5 times a day to produce tolerable soreness, numbness, distension, pain and heat. During the operation, the auricular points were pressed once every 30 minutes at a frequency of 60 to 90 times per minute for 30 seconds by the anesthetist. At the end of the surgery, an auricular point detector was used to detect the acupoints from the intestine, stomach and brain meridians in the auricular points area of the patients in the auricular points group, and the magnetic plasters were applied to these acupoints. After the surgery, patients or their family members were instructed to press the auricular points following the preoperative requirements.	Bilateral auricular points from Shenmen, subcortex, endocrine, lung, spleen, uterus, and pelvic cavity meridians; Acupoints from the intestine, stomach, and brain meridians	Anxiety: SAS; Sedation: Ramesay score; Postoperative flatus time

(Continued)

Table 2 (Continued).

No.	Title	First author	Year of publication	Country	Study type (single-center/multicenter)	Sample size		Age (mean $\pm$ SD)		Type of surgery	Interventions		Intervention regimens (time, frequency, acupoint)	Acupoints	Outcomes
						Treatment group	Control group	Treatment group	Control group		Treatment group	Control group			
3	Effect of assisted anesthesia of auricular point magnetic sticking on postoperative recovery of gynecological surgery	Wanshan Li	2013	China	Single-center	36	38	34 $\pm$ 9	33 $\pm$ 9	Laparoscopic surgery	Auricular point pressing	Sham control	The night before the surgery, the sensitive acupoints from Shenmen, uterus, stomach, large intestine, and other meridians of both ears were detected with a detector. After the sensitive points were detected, the magnetic beads were pressed on the auricular points for 30 seconds for each acupoint at a frequency of 60 to 90 times per minute with even force. The patients or their family members were instructed to press the auricular points five times a day after the operation.	Bilateral auricular points from Shenmen, uterus, stomach, and large intestine	Anxiety: STAI-S; Postoperative flatus time; Postoperative defecation time
4	Observation on the effect of TCM aromatherapy combined with acupoint pressure on depression after artificial abortion operation	Yanzhen Zhu	2014	China	Single-center	32	31	27.78 $\pm$ 5.39	28.26 $\pm$ 5.52	Artificial abortion operation	Acupressure	Routine treatment	The method of acupoint-pressing with a middle finger was used. In this method, the middle finger of the right hand was slightly flexed, and also the metacarpophalangeal joint and the interphalangeal joint, the index finger was pressed on the back of the middle finger, the thumb pulp was pressed on the palmar side of the middle finger joint, and the ring finger and little finger were clenched tightly. Through the movement of the shoulder, elbow and wrist joints, the Qi and strength of the whole body were concentrated on the end of the middle finger to press a specific acupoint for 3min. The first treatment was given one hour after recovery on the day of operation, followed by one treatment in the afternoon every day, for a total of seven times.	Xingjian, Taichong, Sanyinjiao, Taiyang acupoint, etc.	Depression: BDC
5	Effect of Auricular Point Sticking on Preoperative Anxiety in Women Receiving gynecological surgery	Liang Luo	2016	China	Single-center	21	22	35 $\pm$ 7	36 $\pm$ 7	Laparotomy and laparoscopic surgery	Auricular point pressing	Sham control	After baseline measurement, bilateral "relaxation points" were marked with 1mm diameter magnetic balls and opaque earmuffs were used for fixation. The intervention lasted 30 minutes each time.	The "relaxation points" are located in the upper lateral walls of the triangular fossae.	Sedation: BIS
6	Acupoint Moxibustion Combined with Glycerine Enema for Promoting Recovery of Intestinal Function After Caesarean Section	Fengxian Guo	2017	China	Single-center	40	40	27.6 $\pm$ 2.2	27.4 $\pm$ 2.1	Cesarean section	Moxibustion	Routine treatment	After the operation, mild moxibustion was performed at a height of 2 to 3 cm above the acupoints until the skin was hot and flushed, 10 to 15 minutes/time.	Shenque, Zusanli, and Neiguan	Anxiety: SAS; Depression: SDS; Postoperative bowel sound recovery time; Postoperative flatus time

7	Effect of Auricular Compression on the Stress State in Patients with Uterine Fibroids Laparoscopic Surgery	Qiangang Wei	2017	China	Single-center	139	137	48.31 ±6.23	47.65 ±7.17	Laparo scopic surgery	Auricular point pressing	Sham control	At 8 o'clock on the day before the operation, auricular point pressure was performed on patients who were undergo the operation on the next day. The seeds of cowherb were placed in the center of 0.7 cm × 0.7 cm adhesive tapes and pasted on bilateral auricular acupoints from Shenmen, subcortex and heart meridians. The placebo group was given a soft sponge ball of adhesive plaster with the same size and appearance as the cowherb seeds plaster, but without cowherb seeds. Both groups were treated with "pressure between two fingers". In this method, a researcher placed the pulps of index finger and thumb on the back and front of the patient's auricle to apply gentle to stronger pressure gradually. Each point was pressed for 2 minutes in the morning, noon and evening, respectively, three times in total, until reaching local slight pain and fever.	Auricular points from Shenmen, subcortical, and heart meridians	Anxiety: STAI, SAS
8	Effect of Acupoint Application on Recovery of Intestinal Function in Patients After Cesarean Section	Yanping Zhou	2017	China	Single-center	50	50			Cesarean section	Acupoint application	Routine treatment	Six hours after the operation, the patients were given acupoint application and massage for 3 minutes, and the acupoint application plaster was changed once every four hours until flatus. The application medicament was prepared by mixing 100g of magnolia officinalis pow and 20g of honey with warm water.	Sanyinjiao, Tianshu, and Zusanli	Postoperative flatus time; Postoperative defecation time; Postoperative bowel sound recovery time
9	Acupuncture Reduces the time from Extubation to 'Ready for Discharge' from the Post Anaesthesia Care Unit: Results from the Randomised Controlled AcuARP Trial	J. Fleckenstein	2018	Germany	Single-center	Treatment group 1: 23, Treatment group 2: 24	24			Laparo scopic surgery	Treatment group 1: acupuncture, Treatment group 2: acupressure	Routine treatment	Twelve to 24 hours before the operation, 12 pressing needles or 12 pressing plasters were applied to the patients for 72 to 96 hours to cover the whole perioperative period, and at least three times of stimulations were guaranteed every day. During emergence, i.e., starting with the end of anaesthetic drugs, the treatment group was required to stimulate at the acupuncture point GV26.	CV17 (on the middle body line), and bilateral LI4, HT7, LR3, ST36 and PC6/GV26	Anxiety: STAI-S; Pain: VAS; Sedation: BIS
10	Effect of Auricular-point Pressure Combined with Personalized Music Therapy on Perioperative Stress Response in Primipara	Wei Liu	2019	China	Single-center	488	485	26±4	27±3	Cesarean section	Auricular point pressing	Routine treatment	One hour before operation and 3H, 6H, 12H and 24H after operation, 75% medical ethanol was used for degreasing and then the seeds of cowherb were pasted for pressing. Each acupoint was pressed for one minute each time, and the pressing was repeated once every 15 minutes. Both ears were pressed at the same time. The force was from gentle to stronger each time until reaching a sensation of swelling, sourness and radiation sensation at the auricles.	Auricular points from Shenmen, subcortex, heart, uterus, ovary, and internal genitalia meridians	Anxiety: SAS; Pain: VAS

(Continued)

Table 2 (Continued).

No.	Title	First author	Year of publication	Country	Study type (single-center/multicenter)	Sample size		Age (mean $\pm$ SD)		Type of surgery	Interventions		Intervention regimens (time, frequency, acupoint)	Acupoints	Outcomes
						Treatment group	Control group	Treatment group	Control group		Treatment group	Control group			
11	Auricular Acupuncture as an Adjunct for Pain Management During First Trimester Abortion: a Randomized, Double-blinded, Three arm trial	Chioma Ndubisi	2019	USA	Single-center	52	Control group 1: 49, Control group 2: 49	31.0 $\pm$ 6.8	Control group 1: 28.7 $\pm$ 6.9, Control group 2: 30.9 $\pm$ 7.6	Artificial abortion operation	Auricular acupuncture therapy	Control group 1: sham control, Control group 2: routine treatment	Pyonex TM press tack needles were placed on a 12 mm adhesive base and put on the bilateral ears beyond the participant's sight, and the intervention took approximately 3-5 minutes.	Auricular points from the cingulate gyrus, thalamus, point zero, Shenmen, cervix (left ear only), uterus C (right ear only) meridians	Anxiety: VAS; Pain: VAS
12	Effect of Auricular Point Sticking on Stress Reactions in Primiparae During Perioperative Period	Rizhu Lu	2019	China	Single-center	96	93			Cesarean section	Auricular point pressing	Routine treatment	One hour before the operation and 3H, 6H, 12H, 24H after the operation, 75% medical ethanol was used for degreasing and then the cowherb seeds were pasted for pressing. Each acupoint was pressed for 1 min each time, and the pressing was repeated once every 15 min. Both ears were pressed at the same time. The force was from being gentle to stronger until reaching a sensation of swelling, sourness and radiation sensation at the auricles.	Auricular points from Shenmen, subcortex, heart, uterus, ovary, and internal genitalia meridians	Anxiety: SAS; Pain: VAS
13	Effect of Acupoint Application on Unhealthy Emotion and Quality of Life in Patients with Pneumoperitoneum After Gynecologic Laparoscopic Surgery	Xuan Zhang	2019	China	Single-center	123	123	48.9 $\pm$ 2.5	49.2 $\pm$ 2.6	Laparoscopic surgery	Acupoint application	Routine treatment	Postoperative acupoint application		Depression: HAMD
14	Effect of Intradermal Needling at Auricular Points on Postoperative Cognitive Dysfunction Following Laparoscopic Hysterectomy	Nini Jiao	2020	China	Single-center	40	40	50 $\pm$ 13	49 $\pm$ 11	Laparoscopic surgery	Auricular acupuncture therapy	Sham control	On the same day after entering the group, the patients were applied with thumbtack needles of a size of 0.2mm $\times$ 0.6mm. Each acupoint was massaged once after each meal, three times a day, and 10 minutes each time. The pressure should be tolerable. If individual acupoint particularly hurts, the massage time and intensity can be reduced appropriately. Each treatment lasted for three days first, followed by one day of rest, and this cycle was repeated for three times, and the course of one complete treatment lasted for 11 days.	Bilateral auricular points from heart, kidney, Shenmen, sympathetic, subcortex meridians	Anxiety: SAS

15	Application of Seed-burying in Auricular Point in Patients Undergoing Gynecologic Laparoscopic Surgery	Cuiqin He	2020	China	Single-center	30	30	43.51 ±5.36	42.86 ±5.33	Laparo scopic surgery	Auricular point pressing	Routine treatment	Six hours after the operation, the auricular points were buried with seeds, and each auricular point was pressed with the index finger and thumb for 30 to 60 seconds and once an hour, so that the patients could feel the feeling of soreness, numbness and distending pain. The family members were taught how to press the auricular points.	Auricular points from sympathetic, large intestine, small intestine, stomach, triple energizer meridians, etc.	Anxiety: HAMA; Depression: HAMD; Postoperative flatus time; Postoperative bowel sound recovery time
16	Effect of Auricular Acupressure Combined with Rapid recovery Surgical Nursing on Sleep Quality and Negative Emotions in Patients Receiving Laparoscopic Myomectomy	Xiaojie Liu	2021	China	Single-center	30	30	30±3	27±4	Laparo scopic surgery	Auricular point pressing	Routine treatment	A probe was used to find the tender points of the acupoints on the auricles, and a 0.4 cm × 0.4 cm adhesive tape with cowherb seeds was applied to each selected acupoint. The thumb and index finger pulps were pressed on the front and back of the patient's auricles to make the patient feel acid, numbness, distension and heaviness. The pressure should be tolerable to the patients and was applied three times a day in the morning, noon and evening, respectively. Each acupoint was pressed for one minute each time. The auricular acupoint was pressed one day before the operation until 72 hours after the operation.	Auricular points from Shenmen, heart of posterior surface, neurasthenia point, subcortex, liver, and kidney meridians	Anxiety: SAS
17	Effect of Auricular Point Therapy Combined with "He" Character Sound on Perioperative Stress Response for Patients Undergoing Total Hysterectomy	Junrui Wang	2021	China	Single-center	30	30	48.3±4.2	48.4±4.9	Laparo scopic surgery	Auricular point pressing	Routine treatment	The cowherb seed auricular point plasters were applied to the selected acupoints one day before operation. The patient was instructed to press each acupoint clockwise to produce a sensation of soreness, numbness, swelling and pain, and the intensity of pressing should be tolerated to the patient. Each acupoint was pressed for one minute, once in the morning, at noon, in the evening and before going to bed, respectively, and the auricular point paste was removed on the third day after operation.	Auricular points from uterus, sympathetic, subcortex, endocrine, Shenmen, and heart meridians	Anxiety: STAI-S
18	Auricular Acupressure and Auricular Acupuncture as an Adjunct for Pain Management During First Trimester Aspiration Abortion: A randomized, Double-blinded, Three-arm Trial	Johana D. Oviedo	2021	USA	Single-center	Treatment group 1: 70; Treatment group 2: 51	52	Treatment group 1: 31.4 ± 6.6; Treatment group 2: 31.5 ± 6.2	30.3±6.2	Artificial abortion operation	Treatment group 1: auricular point pressing; Treatment group 2: auricular acupuncture therapy	Sham control	Disposable gold-plated needle beads of 1.2 mm diameter were placed on a 7.6 mm adhesive base before surgery; disposable 0.2 mm Pyonex acupuncture compression needles of 1.2 mm length were placed on a 12 mm adhesive base. When applying each acupressure bead, the study auriculotherapist stimulated the corresponding acupoint by pressing the bead for 10 seconds.		Anxiety: VAS; Pain: VAS

(Continued)

Table 2 (Continued).

No.	Title	First author	Year of publication	Country	Study type (single-center/multicenter)	Sample size		Age (mean $\pm$ SD)		Type of surgery	Interventions		Intervention regimens (time, frequency, acupoint)	Acupoints	Outcomes
						Treatment group	Control group	Treatment group	Control group		Treatment group	Control group			
19	Effect of Electroacupuncture at Baihui (GV 20) and Sishencong (EX-HN 1) on Presurgical Anxiety in Patients with Gynecological Laparoscopic Surgery	Aote Zheng	2022	China	Single-center	90	Control group 1: 90, Control group 2: 90	41 $\pm$ 10	Control group 1: 41 $\pm$ 10, Control group 2: 39 $\pm$ 10	Laparoscopic surgery	Electroacupuncture	Control group 1: Midazolam injection, Control group 2: routine treatment	Twenty-four hours and two hours before anesthesia induction, the acupoints Baihui (DU20) and Sishencong (DU20) were needled backwards for 10-15 mm at an angle of 15° to 30° with a 0.25mm $\times$ 40mm disposable acupuncture needle using the method of reinforcing and reducing by twirling or slight rotating until there was a feeling of soreness and swelling. The front, back, left and right Sishencong acupoints were connected to CMNS6-1 electroacupuncture therapeutic apparatus for continuous wave stimulation at a frequency of 100 Hz. The intensity should be tolerated to the patient, and the needle was retained for 30 min.	Baihui and Sishencong	Anxiety: STAI-S, VAS; Sedation: BIS
20	Auricular Acupuncture for Preoperative Anxiety in Parturient Women with Scheduled Cesarean Section: A Randomized Placebo-Controlled Blind Study	Jeremy Favre-Felix	2022	France	Single-center	30	Control group 1: 30, Control group 2: 30	33.5 $\pm$ 4.9	Control group 1: 33.6 $\pm$ 3, Control group 2: 34.0 $\pm$ 4.7	Cesarean section	Auricular acupuncture therapy	Control group 1: sham control, Control group 2: routine treatment	Three New Pyonex auricular needles were inserted into the right ear at MA-TF-1 (apex of the triangular fossa), MALO1 (central side of the ear lobe), and MA-TG2-TG4 (along the whole length of the vertically ascending tragus, lower tragus-internal nose), maintained during the cesarean section, and removed upon admission to the post-anesthesia care unit (PACU).	MA-TF1(apex of the triangular fossa), MALO1 (central side of the ear lobe), and MA-TG2-TG4 (along the entire length of the vertically ascending tragus)	Anxiety: VAS

Risk of Bias Assessment

Figure 2 presents the summary of the risk-of-bias assessment based on Cochrane criteria. Two studies^{6,43} exhibited a high risk of bias in one domain. Due to inadequate information, ten studies^{1,4,6,7,18,19,25,27,28} were assessed with some concerns

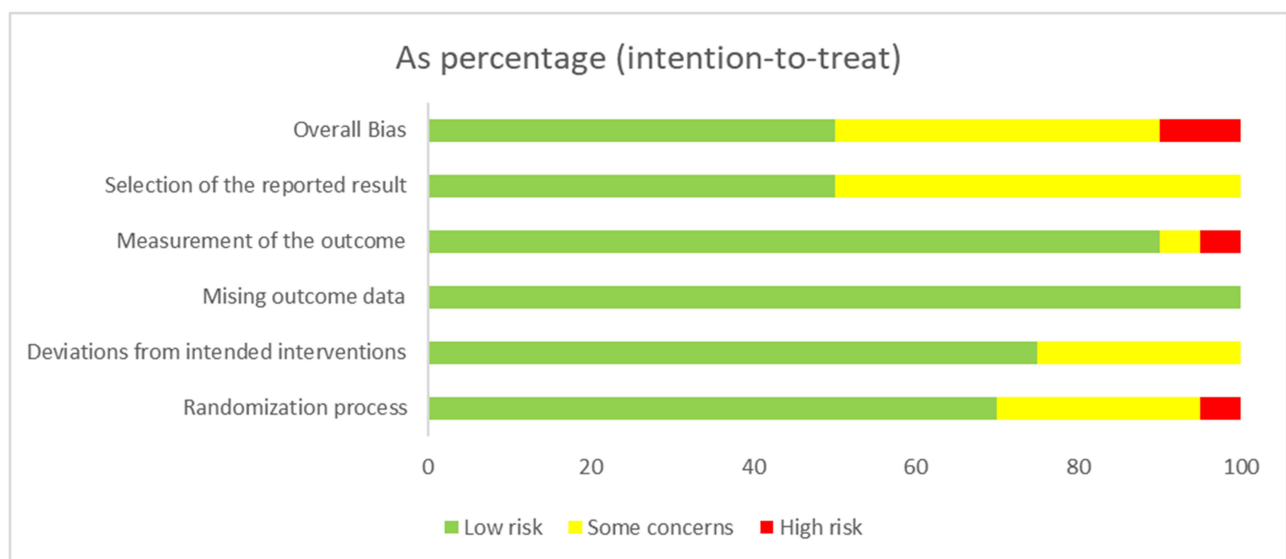
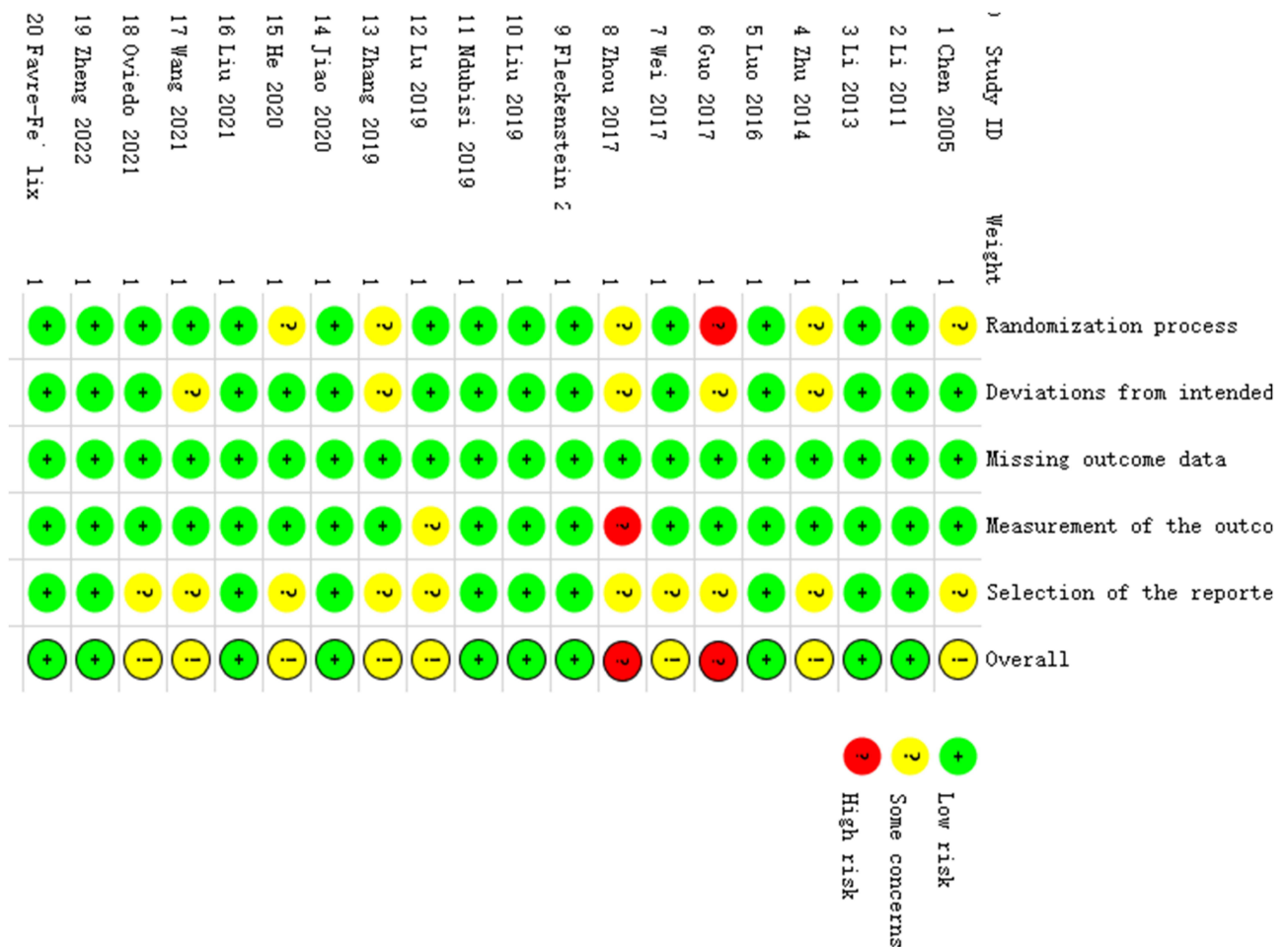


Figure 2 Risk of bias domain and summary for each included study.

in at least one domain. One study⁶ demonstrated bias in randomization, while five studies^{1,4,19,25,43} described inadequate randomization. Additionally, five studies^{4,6,19,27,43} were assessed with some concerns for deviations from established interventions. All the studies were evaluated as having a low risk of bias for missing outcome data. Furthermore, one study⁴³ was judged to have a high risk of bias in the outcome measurements. For the selection of reported results, ten studies^{1,4,6,7,18,19,25,27,28,43} were assessed with some concerns, while the remaining studies were considered to have a low risk of bias. Overall, two studies^{6,43} were evaluated as having a high risk of bias, ten studies^{2,3,5,15–17,24,26,29,30} were assessed with a low risk of bias, and eight studies^{1,4,7,18,19,25,27,28} were assessed with some concerns. The risk-of-bias summary is depicted in Figure 2.

Results

Primary Outcome Measures

STAI-S Score for Anxiety

Four research studies (involving a total of 505 participants and 6 groups of data)^{24,32,40,41} reported preoperative STAI-S scores. Before the surgery, the post-treatment STAI-S scores were compared with the baseline data to evaluate the impact of acupuncture and moxibustion on preoperative anxiety. A pooled analysis identified significant heterogeneity ($I^2 = 97.8\%$), leading to the utilization of a random-effects model for analysis. The pooled results (Figure 3A) indicated that acupuncture and moxibustion appeared to have a tendency to improve preoperative anxiety (MD = -3.38 , 95% CI [-9.58 to 2.82]) compared with the control group, but the difference was not statistically significant ($P = 0.286$).

The impact of acupuncture and moxibustion on postoperative anxiety was assessed by comparing postoperative STAI-S scores with baseline data in three studies involving 4 groups of data^{24,40,41} comprising 434 participants. Significant heterogeneity ($I^2 = 94.4\%$) was revealed in the pooled analysis, leading to the use of a random-effects model for the analysis. The pooled results (Figure 3B) indicated a statistically significant beneficial effect of acupuncture and moxibustion on postoperative anxiety (MD = -3.50 , 95% CI [-6.93 to -0.07]) compared with the control group ($P = 0.046$).

Four studies, involving 5 sets of data,^{24,26,40,41} were conducted with a total of 508 participants to report the STAI-S scores during surgery. The STAI-S scores at the completion of the surgery were compared with post-treatment data to evaluate the impact of acupuncture and moxibustion on intraoperative anxiety. The pooled analysis indicated significant heterogeneity ($I^2 = 98.0\%$), leading to the implementation of a random-effects model for the analysis. The overall findings (Figure 3C) demonstrated that acupuncture and moxibustion appeared to have a tendency to alleviate anxiety during surgery (MD = -1.09 , 95% CI [-7.32 to 5.13]) when compared with the control group, although the difference was not found to be statistically significant ($P = 0.730$).

VAS-Anxiety and SAS Scores

The review included six studies with a total of 1902 participants among 8 groups of data^{24,30,33,35,41,42} reporting preoperative VAS-anxiety and SAS scores. Before the surgery, the post-acupuncture scores were compared with the baseline data to evaluate the effect of acupuncture and moxibustion on preoperative anxiety. The analysis of the pooled data showed significant heterogeneity ($I^2 = 97.5\%$), thus a random-effects model was used for the analysis. The pooled results (Figure 3D) illustrated that acupuncture and moxibustion can effectively alleviate preoperative anxiety (SMD = -1.04 , 95% CI [-1.73 to -0.35]) compared with the control group, and this difference was statistically significant ($P = 0.003$).

Six research studies (involving 9 sets of data)^{18,24,34,37,39,41} with a total of 837 participants, reported postoperative VAS-anxiety and SAS scores. Following surgery, postoperative scores were compared to baseline data to evaluate the impact of acupuncture and moxibustion on postoperative anxiety. The pooled analysis revealed significant heterogeneity ($I^2 = 90.8\%$), necessitating the use of a random-effects model for analysis. The combined results (Figure 3E) indicated that acupuncture and moxibustion had a positive impact on postoperative anxiety (SMD = -0.78 , 95% CI [-1.21 to -0.35]) compared to the control group, and this difference was statistically significant ($P < 0.001$).

Three separate research studies, each involving data from 5 groups,^{24,25,41} totaling 466 participants in all, presented results on VAS-anxiety and SAS scores during surgery. The scores recorded at the end of surgery were compared with post-treatment data to evaluate the impact of acupuncture and moxibustion on anxiety levels during the operation. Analysis of the combined data revealed a marked heterogeneity ($I^2 = 97.2\%$), prompting the adoption of a random-effects

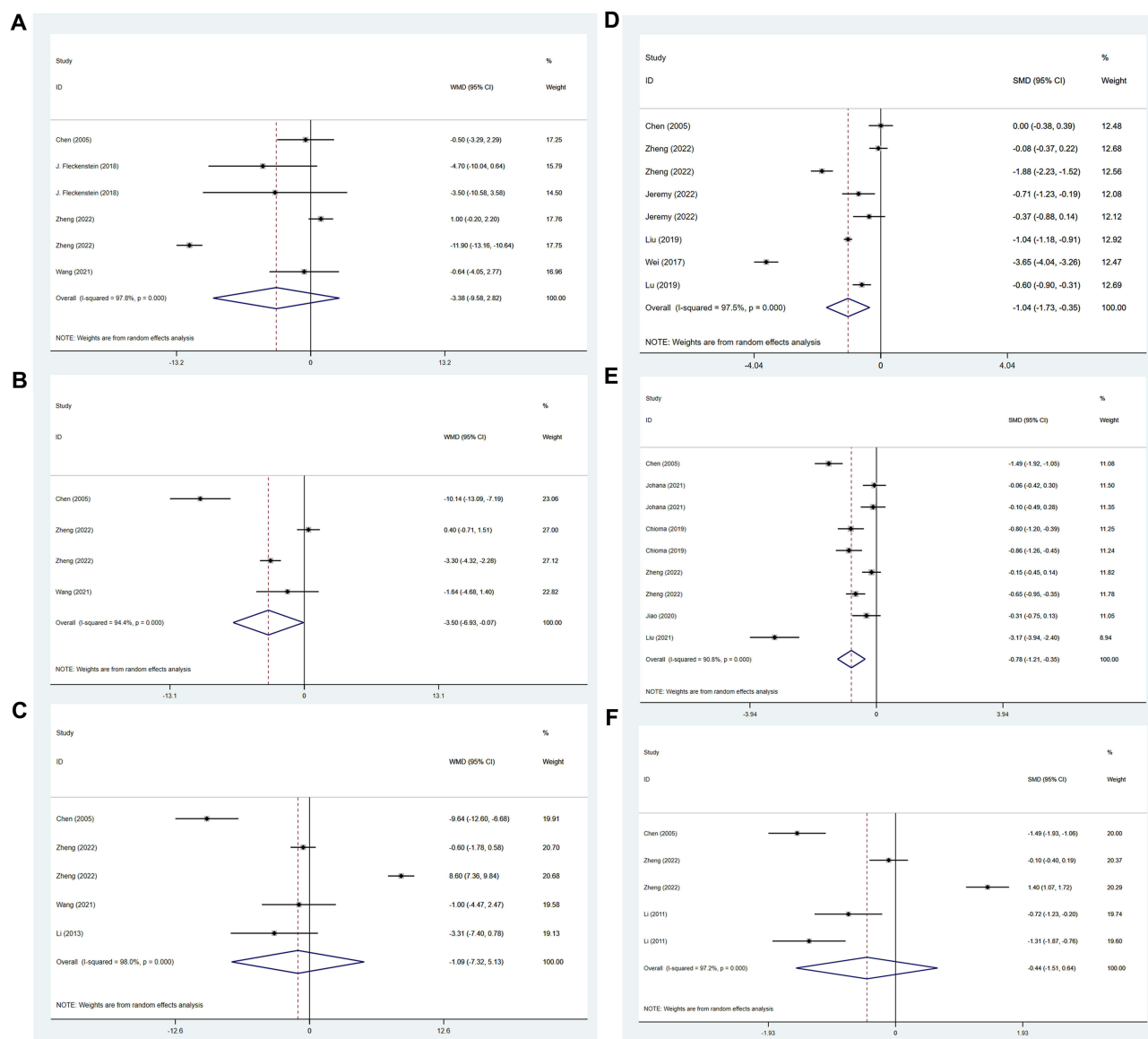


Figure 3 STAI-S score for anxiety. (A) Pre-operation; (B) Post-operation; (C) Post-treatment to completion of operation. (D) Pre-operation; (E) Post-operation; (F) Post-treatment to completion of operation.

model for analysis. The overall findings (Figure 3F) indicated a trend towards the reduction of intraoperative anxiety with acupuncture and moxibustion intervention (SMD = -0.44 , 95% CI $[-1.51$ to $0.64]$) compared to the control group, although this difference did not achieve statistical significance ($P = 0.427$).

Secondary Outcome Measures

Pain Score

After surgery, the postoperative VAS-pain scores from three studies, which involved a total of 427 participants and 5 groups of data,^{18,24,34} were compared with baseline to evaluate the impact of acupuncture and moxibustion on postoperative pain. The analysis used a random-effects model due to significant heterogeneity ($I^2 = 86.1\%$) identified through pooled analysis. The results from the pooled analysis (Figure S1A) indicated that acupuncture and moxibustion exhibited a preventive effect on postoperative pain (MD = -0.67 , 95% CI $[-2.23$ to $0.90]$) compared to the control group, although the difference was not statistically significant ($P = 0.403$).

Three research studies, including 4 sets of data,^{32,33,35} were conducted to evaluate the impact of acupuncture and moxibustion on pain levels 6 hours after an operation. A total of 1233 participants were involved in these studies, which compared the VAS-pain scores at 6 hours post-operation with those at the time of completion. The pooled analysis unveiled substantial heterogeneity ($I^2 = 83.8\%$), leading to the application of a random-effects model. The combined results ([Figure S1B](#)) demonstrated that acupuncture and moxibustion effectively alleviated pain among patients at the 6-hour mark post-operation (MD = -1.35, 95% CI [-2.08 to -0.63]) when compared to the control group, and this difference was deemed statistically significant ($P < 0.001$).

Sedation score

Two studies, which involved 3 groups of data,^{28,41} were conducted with a total of 313 participants to report preoperative BIS. Prior to surgery, the preoperative BIS scores were compared with baseline data in order to evaluate the impact of acupuncture and moxibustion on preoperative sedation. A pooled analysis revealed a significant level of heterogeneity ($I^2 = 97.3\%$), leading to the use of a random-effects model. The pooled results ([Figure S2A](#)) demonstrated that acupuncture and moxibustion are capable of improving preoperative sedation (MD = -5.46, 95% CI [-10.31 to -0.60]) when compared with the control group, and this difference was found to be statistically significant ($P = 0.028$).

Three research trials (involving 6 sets of data)^{25,32,41} with a total of 433 participants documented BIS and Ramsay indicators. Following surgery, the postoperative scores were compared to the baseline data in order to evaluate the effects of acupuncture and moxibustion on postoperative sedation. A combined analysis indicated substantial heterogeneity ($I^2 = 70.0\%$), leading to the utilization of a random-effects model. The collective findings ([Figure S2B](#)) demonstrated that acupuncture and moxibustion were able to enhance postoperative sedation (SMD = -0.38, 95% CI [-0.70 to -0.05]) in comparison to the control group, with a statistically significant difference ($P = 0.023$).

Depression Score

Four studies, encompassing 4 sets of data,^{27,29,36,38} were conducted involving a total of 449 participants. These studies reported measures of BDC, SDS, and HAMD. The evaluation following the operation aimed to assess the impact of acupuncture and moxibustion on postoperative depression by comparing post-treatment and pre-treatment data. The analysis of combined results revealed substantial heterogeneity ($I^2 = 87.7\%$), leading to the adoption of a random-effects model for the analysis. It was indicated by the pooled results ([Figure S3](#)) that acupuncture and moxibustion exhibited a positive impact on postoperative depression (SMD = -1.20, 95% CI [-1.84 to -0.56]) in comparison with the control group, with this difference proving to be statistically significant ($P < 0.001$).

The First Postoperative Exhaust Time

The first exhaust time post-operation was reported in a total of 406 participants across five studies, involving 6 groups of data.^{25,26,29,31,38} Significantly high heterogeneity ($I^2 = 83.8\%$) was observed in the pooled analysis, leading to the utilization of a random-effects model. The combined results ([Figure S4](#)) illustrated that acupuncture and moxibustion could effectively enhance the first postoperative exhaust time (MD = -8.08, 95% CI [-10.94 to -5.21]) in comparison to the control group, with a statistically significant difference ($P < 0.001$).

The First Postoperative Defecation Time

In two studies involving 2 groups of data,^{26,31} a total of 174 participants reported the first postoperative defecation time. A pooled analysis revealed that the heterogeneity was not significant ($I^2 = 0.0\%$), leading to the usage of a fixed-effects model for analysis. The pooled results ([Figure S5](#)) indicated that acupuncture and moxibustion had a beneficial effect on the first postoperative defecation time (MD = -11.80, 95% CI [-13.00 to -10.59]) compared with the control group, and the difference was statistically significant ($P < 0.001$).

Postoperative Bowel Sound Recovery Time

Three studies (involving 3 groups of data)^{29,31,38} involving 240 participants, showcased the postoperative recovery time for bowel sounds. A combined analysis found considerable heterogeneity ($I^2 = 95.0\%$), leading to the utilization of a

random-effects model for the assessment. The consolidated findings (Figure S6) indicated that acupuncture and moxibustion resulted in a reduction of the postoperative recovery time for bowel sounds (MD = -6.13, 95% CI [-9.86 to -2.40]) compared to the control group, with a statistically significant difference (P = 0.001).

Subgroup Analysis

Due to substantial heterogeneity, we performed a subgroup analysis for each outcome. The outcomes are presented in Table 3, and the forest plot is displayed in Figure S7. Subgroup analyses for preoperative, postoperative, and intraoperative anxiety (STAI-S) were conducted based on the type of acupuncture and moxibustion, the type of surgery, and the control interventions. The analysis revealed that electroacupuncture, the conventional treatment used in the control group intervention, and laparoscopic surgery could potentially contribute to the heterogeneity. For preoperative, postoperative, and intraoperative anxiety (VAS-anxiety and SAS), subgroup analyses were conducted based on the type of acupuncture, the type of surgery, and the control interventions. The findings suggested that otopoint pressure, electroacupuncture, and

Table 3 Subgroup Analysis

Time Period	Subgroup Factors		Number of Studies	MD/ SMD*	95% CI	I ²	P		
STAI-S for Anxiety	Pre-operation	Acupuncture and moxibustion	Acupuncture	1	−4.70	−10.04~0.64	—	>0.05	
			Otopoint pressure	1	−0.64	−4.05~2.77	—	>0.05	
			Acupressure	2	−0.90	−3.50~1.69	0.0%	>0.05	
			Electroacupuncture	2	−5.45	−18.09~7.19	99.5%	>0.05	
		Control	Conventional treatment	5	−4.34	−10.72~2.05	95.2%	>0.05	
	Post-operation	Surgery type	Drug treatment	1	1.00	−0.20~2.20	—	>0.05	
			Cesarean section	1	−0.50	−3.29~2.29	—	>0.05	
			Laparoscopic surgery	5	−3.97	−11.26~3.31	98.1%	>0.05	
		Post-treatment to completion of operation	Acupuncture and moxibustion	Otopoint pressure	1	−1.64	−4.68~1.40	—	>0.05
				Acupressure	1	−10.14	−13.09~−7.19	—	<0.05
Electroacupuncture	2			−1.46	−5.08~2.17	95.7%	>0.05		
Control	Conventional treatment			3	−4.95	−9.22~−0.68	90.3%	<0.05	
Post-treatment to completion of operation	Surgery type		Drug treatment	1	0.40	−0.71~1.51	—	>0.05	
		Cesarean section	1	−10.14	−13.09~−7.19	—	<0.05		
		Laparoscopic surgery	3	−1.51	−4.32~1.31	91.3%	>0.05		
	VAS, SAS for Anxiety	Pre-operation	Acupuncture and moxibustion	Otopoint pressure	2	−1.97	−4.61~0.68	0.0%	>0.05
				Acupressure	1	−9.64	−12.60~−6.68	—	<0.05
Electroacupuncture				2	4.00	−5.02~13.01	99.1%	>0.05	
Control				Conventional treatment	3	−0.63	−12.53~11.28	98.6%	>0.05
Post-operation		Surgery type	Drug treatment	1	−0.60	−1.78~0.58	—	>0.05	
			Sham control	1	−3.31	−7.40~0.78	—	>0.05	
			Cesarean section	1	−9.64	−12.60~−6.68	—	<0.05	
		Laparoscopic surgery	4	1.06	−5.05~7.17	97.7%	>0.05		

(Continued)

Table 3 (Continued).

Time Period	Subgroup Factors		Number of Studies	MD/ SMD*	95% CI	I ²	P
Post-operation	Acupuncture and moxibustion	Otopoint pressure	2	-1.60*	-4.64~-1.45	98.1%	>0.05
		Acupressure	1	-1.49*	-1.92~-1.05	–	<0.05
		Electroacupuncture	2	-0.40*	-0.89~0.09	81.5%	>0.05
		Auricular acupuncture	4	-0.52*	-0.89~-0.15	69.0%	<0.05
	Control	Conventional treatment	4	-1.47*	-2.28~-0.67	92.7%	<0.05
		Drug treatment	1	-0.15*	-0.45~0.14	–	>0.05
		Sham control	4	-0.31*	-0.64~0.02	64.4%	>0.05
		Surgery type					
		Cesarean section	1	-1.49*	-1.92~-1.05	–	<0.05
		Induced abortion	4	-0.45*	-0.87~-0.03	78.7%	<0.05
		Laparoscopic surgery	4	-0.99*	-1.82~-0.16	94.4%	<0.05
Post-treatment to completion of operation	Acupuncture and moxibustion	Otopoint pressure	2	-1.01*	-1.59~-0.42	58.2%	<0.05
		Acupressure	1	-1.49*	-1.93~-1.06	–	<0.05
		Electroacupuncture	2	0.64*	-0.83~2.12	97.8%	>0.05
		Control					
		Conventional treatment	3	-0.63*	-12.53~11.28	98.6%	>0.05
		Drug treatment	1	-0.60*	-1.78~0.58	–	>0.05
		Sham control	1	-3.31*	-7.40~0.78	–	>0.05
	Surgery type	Cesarean section	1	-1.49*	-1.93~-1.06	–	<0.05
		Laparoscopic surgery	2	0.64*	-0.83~2.12	97.8%	>0.05
		Laparotomy	2	-1.01*	-1.59~-0.42	58.2%	<0.05
VAS for Pain Post-operation	Acupuncture and moxibustion	Auricular acupuncture	3	-1.67	-3.96~0.62	87.3%	>0.05
		Otopoint pressure	1	0.20	-0.88~1.28	–	>0.05
		Acupressure	1	1.32	0.02~2.62	–	>0.05
		Control					
		Conventional treatment	2	-0.62	-4.46~3.22	93.2%	>0.05
		Sham control	3	-0.71	-2.63~1.21	85.7%	>0.05
	Surgery	Cesarean section	1	1.32	0.02~2.62	–	>0.05
		Induced abortion	4	-1.17	-2.89~0.55	85.5%	>0.05
Completion of operation to 6 h after operation	Acupuncture and moxibustion	Otopoint pressure	2	-2.04	-2.23~-1.86	0.0%	<0.05
		Acupressure	1	0.10	-1.17~1.37	–	>0.05
		Acupuncture	1	-0.50	-1.55~0.55	–	>0.05
		Surgery type					
		Cesarean section	2	-2.04	-2.23~-1.86	0.0%	<0.05
		Laparoscopic surgery	2	-0.26	-1.07~0.56	0.0%	>0.05
BDC, SDS, HAMD for Depression Post-treatment	Acupuncture and moxibustion	Otopoint pressure	1	-1.38*	-1.94~-0.81	–	<0.05
		Acupressure	1	-0.17*	-0.67~0.32	–	>0.05
		Acupoint application	1	-1.48*	-1.76~-1.20	–	<0.05
		Moxibustion	1	-1.74*	-2.26~-1.23	–	<0.05
	Surgery type	Induced abortion	1	-0.17*	-0.67~0.32	–	>0.05
		Cesarean section	1	-1.74*	-2.26~-1.23	–	<0.05
		Laparoscopic surgery	2	-1.46*	-1.71~-1.21	0.0%	<0.05
BIS, Ramesay for Sedation Pre-operation	Acupuncture and moxibustion	Electroacupuncture	2	-2.91	-7.03~1.20	95.8%	>0.05
		Otopoint pressure	1	-10.70	-12.56~-8.84	–	<0.05
	Surgery type	Laparotomy and laparoscopic surgery	1	-10.70	-12.56~-8.84	–	<0.05
		Laparoscopic surgery	2	-2.91	-7.03~1.20	95.8%	>0.05

(Continued)

Table 3 (Continued).

Time Period	Subgroup Factors		Number of Studies	MD/ SMD*	95% CI	I ²	P	
Post-operation	Acupuncture and moxibustion	Electroacupuncture	2	−0.07*	−0.36~0.22	48.3%	>0.05	
		Otopoint pressure	2	−0.67*	−1.36~0.02	—	>0.05	
		Acupressure	1	−0.21*	−0.78~0.36	—	>0.05	
		Acupuncture	1	−0.82*	−1.42~−0.23	—	<0.05	
	Control	Conventional treatment	4	−0.47*	−1.03~0.10	81.8%	>0.05	
		Sham control	1	−0.33*	−0.83~0.17	—	>0.05	
		Drug treatment	1	−0.22*	−0.51~0.07	—	>0.05	
	Surgery type	Laparotomy	2	−0.67*	−1.36~0.02	71.8%	>0.05	
		Laparoscopic surgery	4	−0.23*	−0.54~0.09	59.6%	>0.05	
	The first postoperative exhaust time							
Post-treatment	Acupuncture and moxibustion	Otopoint pressure	4	−8.49	−11.44~−5.55	41.2%	<0.05	
		Acupoint application	1	−4.88	−5.74~−4.02	—	<0.05	
		Moxibustion	1	−10.20	−12.39~−8.01	—	<0.05	
	Control	Sham control	2	−8.16	−15.25~−1.07	76.0%	>0.05	
		Conventional treatment	4	−8.15	−11.69~−4.60	88.5%	<0.05	
	Surgery type	Cesarean section	2	−7.44	−12.65~−2.23	94.9%	<0.05	
		Laparoscopic surgery	2	−7.30	−11.69~−2.90	68.5%	<0.05	
		Laparotomy	2	−10.81	−15.19~−6.43	0.0%	<0.05	
	The first postoperative defecation time							
	Post-treatment	Acupuncture and moxibustion	Otopoint pressure	1	−9.28	−16.07~−2.49	—	<0.05
Acupoint application			1	−11.88	−13.11~−10.65	—	<0.05	
Control		Sham control	1	−9.28	−16.07~−2.49	—	<0.05	
		Conventional treatment	1	−11.88	−13.11~−10.65	—	<0.05	
Surgery type		Laparoscopic surgery	1	−9.28	−16.07~−2.49	—	<0.05	
		Cesarean section	1	−11.88	−13.11~−10.65	—	<0.05	
Postoperative bowel sound recovery time								
Post-treatment		Acupuncture and moxibustion	Otopoint pressure	1	−7.40	−9.28~−5.52	—	<0.05
	Acupoint application		1	−2.99	−3.78~−2.20	—	<0.05	
	Moxibustion		1	−8.20	−9.93~−6.47	—	<0.05	
	Surgery type	Cesarean section	2	−5.54	−10.64~−0.43	96.5%	<0.05	
		Laparoscopic surgery	1	−7.40	−9.28~−5.52	—	<0.05	

Notes: SMD* (standardized mean difference) can be used to convert raw data into standard units so that results from different studies, derived by different measurement tools or with different measurement scales can be pooled and compared.

auricular acupuncture, the conventional treatment and sham used in the control group, cesarean section, laparoscopic surgery, and induced abortion could be potential sources of heterogeneity.

Preoperatively, auricular acupuncture, otopoint pressure, and cesarean section exhibited significant effects on VAS-anxiety and SAS ($P < 0.05$). Postoperatively, auricular acupuncture, induced abortion, and laparoscopic surgery showed significant impact on VAS-anxiety and SAS ($P < 0.05$). Additionally, during the intraoperative period, otopoint pressure and laparotomy demonstrated significant effects on VAS-anxiety and SAS ($P < 0.05$).

Sensitivity Analysis

The study conducted sensitivity analyses for STAI-S (pre-operation, post-operation, and during the operation), VAS-anxiety, and SAS (pre-operation, post-operation, and during the operation), as well as VAS-pain (post-operation, completion of surgery to 6 hours after the operation), sedation (post-operation), depression, and the first postoperative exhaust time. The findings demonstrated the robustness of the meta-analysis results ([Figure S8](#)).

Publication Bias

Funnel plots were utilized to visually identify publication bias for STAI-S (pre-operation, post-operation, and during the operation), VAS-anxiety and SAS (pre-operation, post-operation, and during the operation), pain (post-operation), sedation (post-operation), and the first postoperative exhaust time ([Figure S9](#)). Quantitative analysis was performed using Begg and Egger tests. The findings revealed no publication bias, except for postoperative VAS-anxiety and SAS ([Table S2](#)). Consequently, the trim and fill method was implemented to address the bias in VAS-anxiety and SAS. Two additional articles were incorporated, and the results indicated (SMD = -1.004, 95% CI [-1.480 to -0.529]), suggesting the potential presence of publication bias but with minimal impact.

Discussion

This study conducted a meta-analysis of 20 articles to examine the efficacy of acupuncture and moxibustion techniques in alleviating anxiety, pain, sedation, depression, and associated clinical symptoms in the perioperative period of gynecological surgeries. The findings demonstrated significant improvements in postoperative STAI-S anxiety, preoperative and postoperative VAS-anxiety and SAS, VAS-pain (from completion of surgery to 6 hours after the operation), preoperative and postoperative BIS and Ramesay sedation, as well as BDC, SDS, and HAMD for depression due to acupuncture and moxibustion interventions. Moreover, there was a notable impact on enhancing the time to first postoperative exhaustion, first postoperative defecation, and the recovery time of postoperative bowel sounds. While there was a tendency towards improvement in outcome measures such as postoperative and intraoperative STAI-S anxiety, intraoperative VAS-anxiety, SAS, and postoperative VAS-pain, the differences were not statistically significant.

A previous meta-analysis has suggested that acupuncture and moxibustion treatments can effectively reduce preoperative anxiety in patients undergoing various surgeries, as indicated by reductions in STAI-S and VAS-anxiety scores.⁴⁴ However, the analysis covered a broad spectrum of surgeries, including neurosurgery, lithotripsy, gynecology, coronary angiography, orthopedics, breast cancer, laparoscopy, and cesarean section. The interventions were consistently administered prior to surgery. In contrast, our meta-analysis focuses specifically on patients undergoing gynecological surgery. Within the selected studies, participants underwent laparoscopic surgery in 10 studies (including one study involving both laparotomy and laparoscopic surgery), cesarean section in 6 studies, abortion in 3 studies, and laparotomy in 2 studies (including one study involving both laparotomy and laparoscopic surgery). Notably, among the studies demonstrating the most pronounced positive effects of acupuncture and moxibustion on perioperative anxiety, patients undergoing laparoscopic surgery and cesarean section were most representative. For example, Shu-Yu Kuo et al⁴⁵ revealed that, compared to conventional nursing care, applying pressure to the Shenmen auricular point could reduce cortisol levels, heart rate, anxiety, and fatigue in the early postpartum period following cesarean section. Similarly, Gul et al⁴⁶ conducted a double-blind RCT and found that applying finger pressure to the Shenmen point for 10 minutes could alleviate preoperative acute anxiety in pregnant women undergoing cesarean section with spinal anesthesia. However, further investigation is necessary to confirm whether patients undergoing cesarean section or laparoscopic surgery derive more significant benefits from acupuncture and moxibustion treatment. Additionally, significant heterogeneity was observed in all outcome indicators, except for the first postoperative defecation time.

Due to the clinical heterogeneity, we proceeded with additional subgroup analyses focusing on acupuncture methods, types of surgery, and other relevant factors. The assessment of anxiety outcomes primarily included otopoint pressure, auricular acupuncture, acupuncture, electroacupuncture, and acupressure. While the statistical analysis revealed no significant impact of acupuncture and electroacupuncture on alleviating perioperative anxiety in patients, it was noted that patients receiving acupuncture or acupressure demonstrated a less pronounced increase in anxiety from admission to anesthesia induction compared to the control group.³² As the surgery date approaches, patients typically experience

heightened anxiety, indicating a potential correlation with the timing of measurements. In contrast to the standard treatment group, patients undergoing laparoscopic surgery in the electroacupuncture and drug groups exhibited a noteworthy decrease in preoperative and postoperative anxiety levels. In our investigation, the control group comprised the drug group and conventional treatment. Electroacupuncture showed similar effectiveness to drugs, particularly Midazolam, a traditional anti-anxiety medication, without a statistically significant variance. Nonetheless, a statistical disparity was observed between electroacupuncture and conventional treatment.⁴¹

Although anxiety may not have been the primary focus in some of the studies included, particularly those examining postoperative functional recovery and pain, it's important to recognize that all measures, including pain, sedation, and functional recovery, could impact patients' emotional well-being. As a result, we investigated pain, sedation, and other relevant measures. Pain was predominantly addressed in a randomized, double-blind, three-arm trial, which illustrated that auricular acupuncture intervention did not reduce the pain score in females undergoing vacuum aspiration compared to the placebo group.¹⁸ Similarly, electroacupuncture did not exhibit a statistically significant effect on sedation. Additionally, electroacupuncture demonstrated efficacy on par with Midazolam in alleviating anxiety, consistent with previous findings.⁴¹ In terms of depression measures, while acupressure did not display statistical significance, it was observed that applying finger pressure at acupoints could alleviate postoperative depressive symptoms in patients undergoing induced abortion.²⁷ This effect may be attributed to the data collected before the operation and 7 days after the operation in our analysis. Furthermore, our analysis uncovered that acupuncture and moxibustion treatments, including otopoint pressure, acupoint application, and moxibustion, markedly improved the first postoperative exhaust time, first postoperative defecation time, and postoperative bowel sound recovery time, thus facilitating overall body function recovery.

Furthermore, this research has identified a range of acupoints involved in auricular acupressure, notably including Shenmen, subcortex, sympathia, endocrine, brain points, internal genitals, pelvis, uterus, ovary, heart, lung, spleen, liver, kidney, stomach, intestine, San Jiao (commonly known as "Triple Burner"), nerve fading point, and the "relaxation point" (located on the upper side wall of the triangular fossa). Essential points for auricular acupuncture encompass Cingulate gyrus, Thalamus, Point Zero, Shenmen, Cervix (left ear), Uterus (right ear), MA-TF-1 (apex of the triangular fossa), MALO1 (central side of the ear lobe), MA-TG2-TG4 (along the entire length of the vertically ascending tragus) (right ear), Heart, Kidney, Sympathetic, and Subcortex. Acupressure mainly entails Neiguan, Shenmen, Yintang, Taiyang, Sanyinjiao, Xingjian, and Taichong points. Acupuncture centers on CV17 (on the middle body line), bilateral LI4, HT7, LR3, ST36, PC6, and GV26. Electroacupuncture focuses on Baihui and Sishencong points. Moxibustion targets Shenque, Zusanli, and Neiguan. Applications of acupoints include Tian Shu, Zusanli, and Sanyinjiao. It is important to note that the selection of acupoints varies and cannot be entirely standardized, which may contribute to potential heterogeneity in the outcomes.

It is important to note that the timing of acupuncture and moxibustion interventions varied, with initiation ranging from 1 day before the operation, the night before the operation, 1 hour before the operation, to 3–5 minutes before the operation. Similarly, the varied durations of acupuncture and moxibustion interventions were primarily due to the different types of gynecological diseases or intervention methods employed. Our findings emphasized that when comparing post-treatment data before the operation with baseline data, key outcome measures included anxiety indicators such as STAI-S, VAS-anxiety, and SAS. Among patients receiving acupressure, acupuncture, electroacupuncture, or otopoint pressure from the night before the operation to 12–24 hours before the operation, especially those undergoing laparoscopic surgery and cesarean section, while there was no statistically significant difference in the STAI-S scores compared with the control group, the results indicated a significant effect of auricular point therapy combined with the "He" character on perioperative stress response in patients undergoing hysterectomy. Research has focused more on the impact of auricular point therapy combined with the "He" character on perioperative anxiety in gynecological surgery.⁴⁰ In addition, the study observed that VAS-anxiety and SAS scores predominantly originated from patients undergoing cesarean section and laparoscopic surgery. These patients received at least one of the following treatments: acupressure, otopoint pressure, or electroacupuncture, either from the night before or 24 hours prior to the operation, or otopoint pressure starting 1 hour before the operation in the case of cesarean section. These findings highlighted the variability in the initiation time of acupuncture and moxibustion interventions with respect to different types of gynecological diseases. Specifically, for cesarean section, a distinct gynecological surgery type, the initiation time for acupuncture and moxibustion intervention can be reduced to 3–5 minutes before the operation, which also alleviates anxiety. Our findings revealed that acupressure in cesarean section, otopoint pressure, and auricular acupuncture in induced abortion,

along with electropuncture, auricular acupuncture, and otopoint pressure in laparoscopic surgery, improved postoperative STAI-S, VAS-anxiety, and SAS scores for anxiety compared to the baseline data, in the context of sufficiently early initiation time of interventions, long enough intervention durations, and adequate treatment durations. This suggests an effective impact of acupuncture and moxibustion on improving perioperative anxiety in gynecological surgery compared with the control group. Furthermore, acupuncture and moxibustion treatment methods tended to improve intraoperative STAI-S, VAS-anxiety, and SAS compared with the control group. However, the differences were not statistically significant, which also reflected the effectiveness of acupuncture and moxibustion treatment. Nevertheless, extensive in-depth research is required to explore the preferred start time, the optimal frequency, the effective dose, and the effective combination of acupuncture techniques with the types of gynecological surgeries, due to the limitations of this study.

To the best of our understanding, there is currently no comprehensive review or meta-analysis of randomized controlled trials examining the effectiveness of acupuncture and moxibustion in reducing perioperative anxiety in gynecological surgery. This study marks the initial effort to synthesize relevant literature and perform a meta-analysis to assess the potential therapeutic advantages of acupuncture and moxibustion for perioperative anxiety in gynecological surgery. We employed well-established assessment tools, specifically STAI-S and VAS-anxiety, to evaluate anxiety and enhance the dependability of our findings. Nevertheless, it is important to acknowledge several limitations. Firstly, there was evident clinical heterogeneity, potentially resulting from diverse intervention methods and types of surgeries. Due to limited original data, the heterogeneity stemming from clinical discrepancies was not comprehensively analyzed. Secondly, the inherent limitation of acupuncture and moxibustion therapy, which makes complete blinding unfeasible, may introduce bias into the research quality. While our assessment and analysis may have been biased, it is important to consider the potential for publication bias. Selecting studies published only in Chinese and English could introduce a degree of selection bias. We look forward to future research that can facilitate a more comprehensive discussion and analysis. Significant variations in treatment methods and selected acupuncture points exist across the studies included. Currently, there is no consensus on the superior acupuncture technique or point. Future research necessitates larger sample sizes and strict designs to substantiate the effectiveness and safety of acupuncture and moxibustion during the perioperative period of gynecological surgery. Furthermore, there is a need for additional research on acupuncture points and methods. The long-term efficacy and safety of acupuncture were not further analyzed in our current study due to the limited number of literature and lack of relevant reports. This emphasizes the necessity for future research to focus on these aspects, with the hope that more studies will explore long-term efficacy and safety, enhancing our understanding of acupuncture during the perioperative period in gynecological surgeries.

Conclusion

This meta-analysis included 20 studies for the first time to evaluate perioperative anxiety and pain in gynecological surgery. Acupuncture and moxibustion were found to reduce postoperative STAI-S, preoperative and postoperative VAS-anxiety and SAS, postoperative VAS-pain at 6 hours after operation, preoperative and postoperative BIS and Ramesay sedation, and BDC, SDS, and HAMD for depression, compared with conventional or sham treatment. Additionally, they significantly improved the first postoperative exhaust time, the first postoperative defecation time, and postoperative bowel sound recovery time. However, although there was a trend of improvement in preoperative and intraoperative STAI-S, intraoperative VAS-anxiety, SAS, and postoperative VAS-pain, the differences were not statistically significant. Due to significant heterogeneity in the included studies, further multicenter, large-sample, high-quality RCTs are required to consolidate the safety and efficacy of acupuncture and moxibustion therapy.

Patient and Public Involvement

No patient involved.

Data Sharing Statement

All data is available in the manuscript.

Ethical Approval

This study does not involve human participants and ethical approval was not required.

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Disclosure

The authors declare no conflicts of interest in this work.

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