# Meta Analysis of the Effectiveness of Acupuncture and Moxibustion on the Recovery of Gastrointestinal Function in Patients with Gastric Cancer after Surgery

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Introduction. To collect the relevant literature on clinical comparative experiment and clinical randomized comparative experiment of acupuncture and moxibustion to restore gastrointestinal function after gastric cancer surgery in PubMed, Cochrane Library and Embase databases. Combined with systematic review and meta-analysis, this paper explores the effect of acupuncture and moxibustion on the recovery of gastrointestinal function after gastric cancer surgery, and provides a basis for its clinical treatment.
Methods. Through computer retrieval of PubMed, Cochrane Library, and Embase databases, relevant literature is obtained in accordance with inclusive and exclusive criteria and retrieval strategies. The literature search period is set from January 1, 2012 to December 31, 2022. Performing meta-analysis using RevMan 5.3 software and evaluating the bias of the literature using the bias assessment module in Cochrane Handbook 5.1.0.
Results. According to the search strategy, a preliminary search was conducted and 523 articles were retrieved. After screening, 17 articles were ultimately included in the meta-analysis. Among the 17 included literature, 8 articles on the Rome II index were from 2000, and 5 articles were from 2002. There were 2 articles using the Rome III index from 2006, and 2 articles using gastroenterology. There were 12 and 5 articles, 6 articles, 8 articles, 5 articles, 5 articles, and 7 articles each with low risk of bias for random sequence generation, allocation concealment, implementation bias, measurement bias, follow-up bias, reporting bias, and other biases. The analysis of clinical efficacy showed that the total efficacy analysis was $P$=0.0001 and $I^2$ was 73%, indicating heterogeneity among the 8 articles with clinical efficacy as the outcome measure. After excluding sources of heterogeneity, the combined effect energy was 1.74, 95%CI =[1.65,1.89], and Z=5.76. The results of postoperative bowel sound recovery time showed that $I^2$=92%, SMD value =-1.52, and 95%CI values =[-2.03, -1.02]. Postoperative first anal exhaust time: $I^2$=96%, SMD=-11.57, 95%CI=[-14.76, -7.83]. First postoperative bowel movement time: $I^2$=84%, SMD=-11.57, 95%CI=[-14.76, -7.83]. The heterogeneity among the three results mentioned above was significant ($P$<0.0001), and the discrepancies were obvious.
Conclusion. Acupuncture and moxibustion combined with conventional treatment can promote the gastrointestinal functional recovery after gastric cancer surgery. However, due to the fact that most of the literature included in this study is at level B, there is a lack of high-quality literature support, so caution should be taken when approaching this conclusion.

Keywords. Acupuncture and moxibustion; Postoperative gastric cancer; Gastrointestinal dysfunction; System evaluation; Meta analysis

## INTRODUCTION

Gastric cancer (GC) ranks the fourth in the world in terms of incidence rate of cancer and the second in terms of mortality, posing a serious threat to human health. According to research statistics, the incidence rate and mortality of GC in Asia, especially in China, South Korea and Japan, have increased year by year in the past 20 years, and are significantly higher than those in Europe and the United States. The GC treatment ways include surgery, chemotherapy, radiotherapy, and targeted therapy. Among them, chemotherapy has an overall effectiveness rate of only about 50%, and while killing cancer cells, it also has a certain degree of damage to normal cells. Radiation therapy, on the other hand, can cause significant damage to the intestines and may lead to gastritis, even severe bleeding or ulcers. Although targeted therapy can selectively damage cancer cells and reduce normal cell damage, its cost is high and difficult for ordinary people to afford. Therefore, surgery is still the preferred clinical treatment for GC [1-2]. GC surgery (GCS) is divided into curative surgery and palliative surgery. The principle of radical surgery is to remove the entire or partial part of the stomach, including the cancerous lesion and potentially infiltrating gastric wall, and to reconstruct the digestive tract by removing the surrounding lymph nodes according to clinical staging standards. Palliative surgical resection refers to the removal of a tumor through surgery, but there is still residual tumor in the body. Surgery only reduces the tumor burden on the body, not completely eliminates the tumor. Both curative surgery and palliative surgery can have an impact on the patient's gastrointestinal function (GTF), leading to gastrointestinal dysfunction (GTD). Common postoperative GTF problems include reduced bowel sounds, postoperative non defecation, abdominal distension (AD), abdominal pain (AP), and even complications such as poor wound healing or intestinal obstruction, which seriously affect the patients' postoperative life quality [3-5]. The common treatment methods for restoring postoperative GTF in GC include routine postoperative treatment and the use of drugs that promote gastrointestinal motility. But its therapeutic effect is often unsatisfactory and has significant side effects. Therefore, seeking treatment methods with definite efficacy and minimal adverse reactions is of great significance for the postoperative recovery of GTF in patients with GC. Traditional Chinese medicine (TCM), as a medical system that has been passed down for thousands of years, has fewer toxic and side effects in the treatment of diseases, providing a new option for the recovery of GTF after GCS. In TCM, although there is no concept of postoperative GTD, it is categorized such as AD, AP, and qi stagnation according to its clinical manifestations. Acupuncture and moxibustion (ApMb), as a common treatment method of TCM, can promote blood circulation, remove blood stasis, regulate qi, and relieve pain with little side effects. However, the actual evaluation of its efficacy is still unknown. Therefore, to explore the effect of ApMb on the recovery of GTF after GCS, this study collected relevant literature on the GTF recovery after

GCS by ApMb in the past 10 years, and conducted a meta analysis on it. It is expected to provide a basis for the clinical treatment of postoperative GTD in GC.

## 1 MATERIALS AND METHODS

### 1.1 Literature Search

To cross search the PubMed, Cochrane Library and Embase databases from Jan. to Dec. 2012 on the GTF recovery in GC patients after ApMb, the search deadline is Dec. 31, 2022. Retrieval strategies: "Acquisition", "Moxa oxidation", "Actor", "After gas cancer", "Postoperative gas internal dysfunction", "Postoperative intentions and stomach", are used as keywords for full-text retrieval.

### 1.2 Criteria for Inclusion and Exclusion of Literature

Inclusion criteria for literature: (1) The experimental subjects were all patients who had undergone GCS treatment. (2) The experimental types were clinical controlled trials or clinical randomized controlled trials. (3) The patient has symptoms such as AD, vomiting, AP, nausea, and reduced hiccups and bowel sounds after surgery. (4) The intervention measures were ApMb or other methods combined with ApMb in the experimental group (EG), and ApMb and moxibustion techniques were not limited. (5) The main indicators are clinical effective rate and time of first anal discharge. The secondary indicators are the recovery time of bowel sounds (RToBS) and the first bowel movement time (FBMT). (6) The language of the literature is English.

Exclusion criteria for literature: (1) Repeated publications. (2) Literature with unknown data. (3) Clinical case reports, literature reviews, and other experimental literature. (4) Literature related to pregnancy or emergency surgery.

### 1.3 Risk Assessment of Literature Bias

The Cochrane Handbook version 5.1.0 was utilized to evaluate literature. The evaluation items include implementation bias (IB), follow-up bias (FUB), measurement bias (MB), reporting bias (RB), selectivity bias (SB), and other biases. In view of the evaluation criteria, each project is separated into 3 levels: high risk, low risk, and risk uncertainty. The level of the literature is determined through consultation between two researchers. If objection exists, it will be discussed with the 3$^{rd}$ researcher.

### 1.4 Data Processing

2 researchers solely retrieved the literature on the adoption and exclusion criteria, and excluded duplicate literature, unrelated literature, and literature with unknown data. Extracting key information from the included literature (IL), including author name, nationality, publication time, sample size, and intervention measures.

### 1.5 Statistical Method

The data processing of meta-analysis is carried out using RevMan 5.3 software, and heterogeneity tests are conducted on each study. If $P$>0.1 or $I^2$<50%, there is no statistical heterogeneity between the studies. In this case, Mata analysis will use a fixed effects model (FEM), otherwise a random effects model (REM) will be used. The count data is analyzed using relative risk and confidence interval (95%CI). Quantitative data is analyzed through standard mean difference and 95%CI.

## 2 RESULTS

### 2.1 Literature Screening Results

A preliminary search was conducted according to the search strategy, and 427 articles were retrieved. Among them, PubMed retrieved 135 articles, Cochrane Library retrieved 174 articles, and Embase retrieved 118 papers. After screening the abstracts, keywords, and main text, 17 were included, all in English. The total number of cases is 1331, including 641 in the EG and 690 in the control group (CG). The patient data in each study generally showed good balance. The literature screening process is Figure 1.

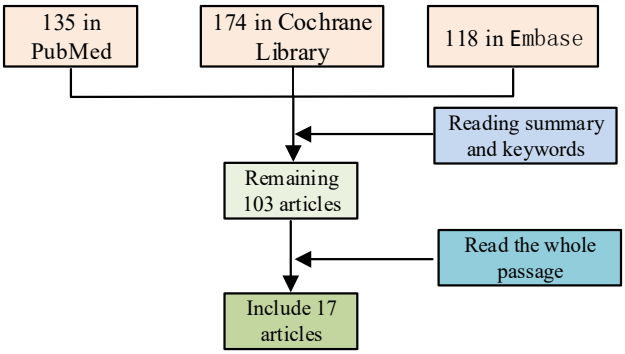


Figure 1 Process of document retrieval and screening

### 2.2 Document Characteristics

The literature features were independently extracted by two researchers. The extracted content includes: title, publication time, total sample size, intervention methods and surgical time for the EG and CG. Table 1 presents the basic features of 17 literature.

Table 1. Basic elements of the literature

| Included in the literature | Number of cases in the experimental group | Case numbers of control group | Mean operative time | Index |
|---|---|---|---|---|
| Xu H 2014[6] | 60 | 60 | 1.5/1.5 | 1、3 |
| Yong Z 2019[7] | 47 | 52 | 1.3/1.4 | 1、2 |
| A S G 2019[8] | 60 | 60 | 1.2/1.1 | 2、4 |
| He-Qing L 2018[9] | 44 | 44 | 1.4/1.4 | 1、3、4 |
| Yang W 2014[10] | 13 | 13 | 1.7/1.6 | 1、2、4 |
| Lei D 2017[11] | 45 | 45 | 1.5/1.4 | 2、3 |
| Caihong C | 40 | 40 | 1.2/1.2 | 1、4 |

| | | | | |
|---|---|---|---|---|
| 2019[12] | | | | |
| Qun K 2016[13] | 42 | 40 | 1.6/1.6 | 2、3 |
| Jing W 2015[14] | 30 | 30 | 1.3/1.3 | 1、3、4 |
| Yang C 2017[15] | 47 | 42 | 1.5/1.7 | 2、4 |
| Guo-Wang Y 2017[16] | 53 | 53 | 1.4/1.4 | 2、4 |
| Gejuan Y 2018[17] | 31 | 30 | 1.1/1.3 | 3、4 |
| Kim 2016[18] | 5 | 5 | 1.5/1.5 | 1、3 |
| Chang-Lin Q 2017[19] | 30 | 30 | 1.2/1.2 | 2、3 |
| Zhen T 2018[20] | 32 | 24/29 | 1.6/1.5 | 2、4 |
| Lei-Yu L 2015[21] | 30 | 30/30 | 1.4/1.3 | 1、3 |
| Wei Z 2015[22] | 32 | 33 | 1.7/1.5 | 2、3 |

Note: 1 represents clinical effective rate; 2 represents the RToBS; 3 represents the time of first anal discharge; 4 represents the FBMT.

In Table 1, among the 17 IL, 8 used the 2000 Rome II index, 5 used the 2002 Rome II index, 2 used the 2006 Rome III index, and 2 used gastroenterology. The judgment criteria for each literature are locally consistent. The intervention measures for each literature are as follows. Xu H 2014: The EG received routine treatment+daily ApMb treatment, while the CG received routine treatment+erythromycin. Yong Z 2019: Except for conventional treatment, EG was treated with ApMb, while CG was treated with conventional treatment. A S G 2019: EG was stimulated with percutaneous acupoint acupuncture, while CG was given a placebo. He Qing L 2018: EG received comprehensive treatment, while CG received comprehensive treatment and intervention. Yang W 2014: EG used ApMb on the basis of conventional treatment, while CG only used conventional treatment. Lei D 2017: EG underwent conventional Western medicine treatment with spleen opening and acupuncture, while CG underwent conventional Western medicine treatment. Caihong C 2019: EG was treated with a combination of TCM and Western medicine, Jiuchengqi oral liquid, and warm needle therapy. CG was cured with conventional Western medicine and Jiuchengqi oral liquid. Qun K 2016: EG received routine moxibustion treatment and care, while CG received routine treatment and care. Jing W 2015: EG received ApMb treatment on the basis of routine care, while CG received routine care. Yang C 2017: EG underwent postoperative acupuncture combined with functional exercise, with no intervention from CG. Guo Wang Y 2017: EG used ApMb and TCM acupoints on the basis of traditional treatment, while CG injected metoclopramide on the conventional treatment. Gejuan Y 2018: EG was treated with acupuncture, while CG was treated with Xiangsha Liujunzi Tang. Kim 2016: EG was

treated with ApMb without CG intervention. Chang Lin Q 2017: EG was treated with conventional therapy and ApMb therapy, while CG was treated with conventional therapy. Zhen T 2018: EG received regular ApMb treatment according to acupoint application group, CG1 received nutritional support and symptomatic treatment, and CG2 received external application program. Lei Yu L 2015: EG was treated with electroacupuncture to stimulate Shunguan and Zusanli. CG1 received oral treatment and was swallowed with warm water. CG2 received routine nutritional support with Dongjing, external gastric branches, and intramuscular injection to protect the gastric mucosa. Wei Z 2015: EG adopted comprehensive TCM nursing techniques, including Zusanli ApMb, fennel hot compress treatment, transdermal administration, foot bath, etc. CG used routine nursing.

2.3 Bias Risk Assessment Results

This study conducted a risk assessment of bias in six items: IB, FUB, MB, RB, SB, and other biases, as shown in Figure 2.

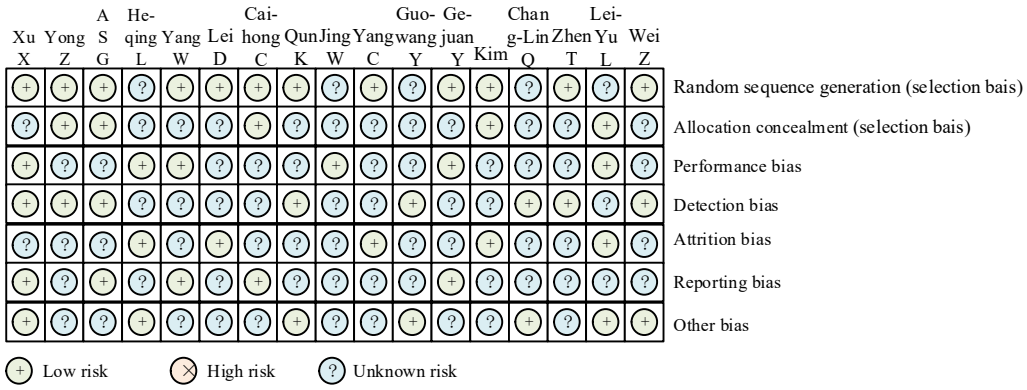


Figure 2. Risk of bias for each literature

In Figure 2, the bias risk of all literature is low or unknown, and there are no literature with high bias risk. Among them, 12 and 5 articles in the random sequence generation and allocation hidden items in the selective bias project are low-risk, respectively. There were 6, 8, 5, 5, and 7 cases of IB, MB, FUB, RB, and other biases, respectively, indicating a low risk of bias (RoB), as exhibited in Figure 3.

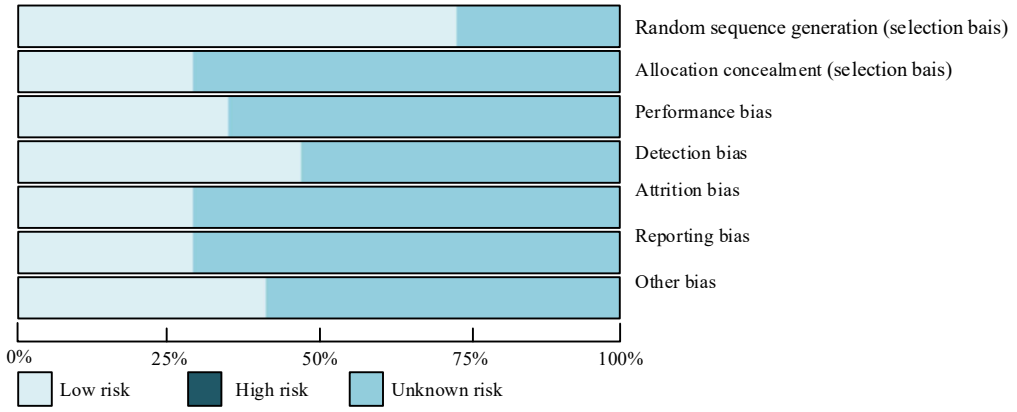


Figure 3. The overall RoB in the included literature

In Figure 3, the overall low bias risk for generating and allocating hidden entries in random sequences in selective bias projects is around 73% and 29%, respectively. The overall low risk of IB, MB, FUB, RB, and other biases is 35%, 47%, 29%, 29%, and 41%, respectively. This indicates that the overall quality of the literature selected is acceptable and can provide some support for the research.

2.4 Meta Analysis of Clinical Efficacy

There are a total of 8 articles included in the literature with clinical efficacy as the outcome indicator, and the remaining articles do not have clinical efficacy indicators. Therefore, the remaining articles were excluded and only these 8 articles were subjected to meta-analysis. The total effective rate (TER) analysis results are shown in Figure 4.

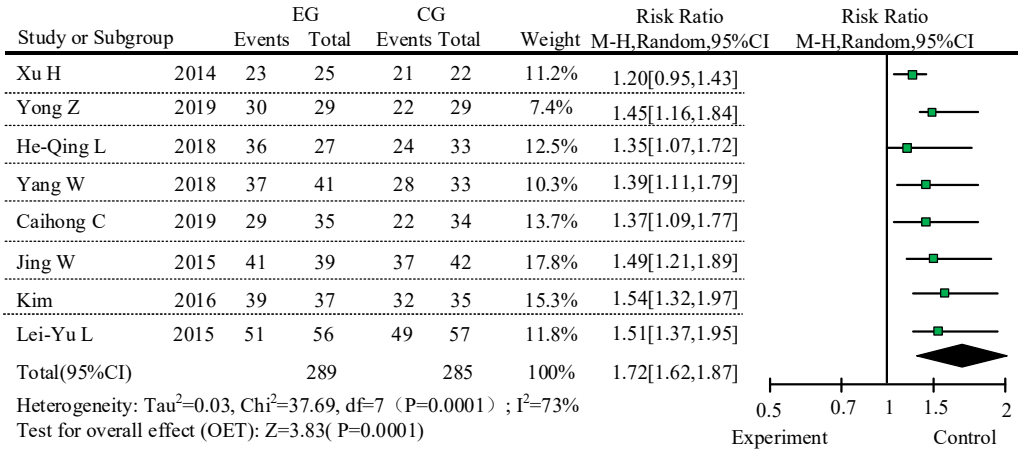


Figure 4. Total response efficiency analysis results

In Figure 4, the TER analysis results are *P*=0.0001 and $I^2$ is 73%, indicating heterogeneity among the 8 articles with clinical effective rate as the outcome indicator. Therefore, a REM was utilized for meta-analysis. The result shows that the combined

effect energy is 1.72, with 95%CI=[1.62,1.87]. Due to the significant heterogeneity of the literature, the literature with the highest TER was excluded and sensitivity analysis was performed. The analysis results are displayed in Figure 5.

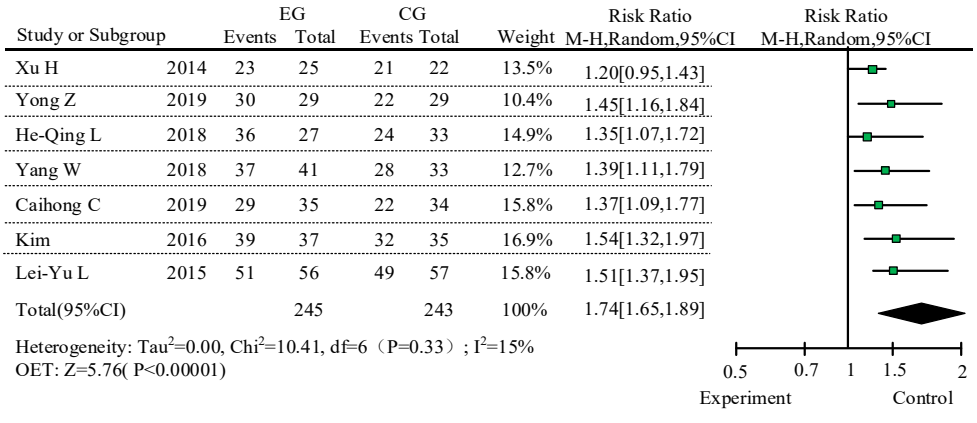


Figure 5 A. Results of the sensitivity analysis

In Figure 5, the sensitivity analysis results show that $P$=0.33 and $I^2$=15%, indicating homogeneity in the literature mentioned above. Therefore, a FEM is used. The merging effect energy is 1.74, 95%CI=[1.65,1.89], $Z$=5.76. The above data indicates that ApMb is effective in restoring GTF after GCS, and the difference between EG and CG is statistically significant.

## 2.5 Meta Analysis of Postoperative Bowel Sound Recovery Time

10 studies related to postoperative bowel sound recovery time were included, and the analysis was conducted on the 10 studies. The analysis results are listed in Figure 6.

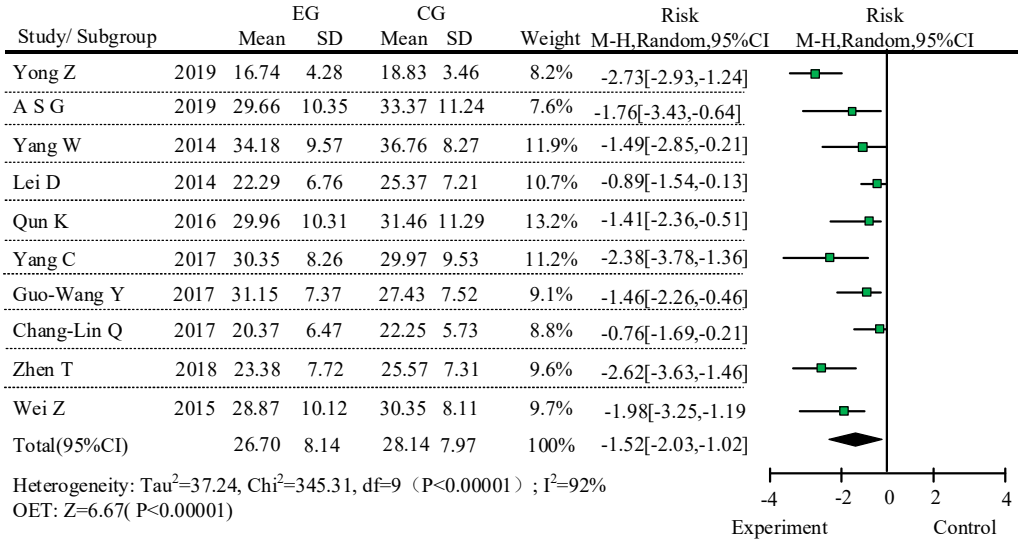


Figure 6 Results of a meta-analysis of the postoperative bowel song recovery time

In Figure 6, heterogeneity is significant ($P$<0.0001, $I^2$=92%). Therefore, a REM was taken to merge statistics for analysis. The SMD value is -1.52, and the 95%CI value is [-2.03, -1.02] ($P$<0.0001), indicating that the difference between EG and CG is statistically significant. However, due to significant heterogeneity among the literature, this study conducted subgroup analysis based on factors such as surgical approach, intervention measures, intervention time, and intervention frequency during sensitivity analysis. After removing the IL one by one, the results did not show significant changes and no sources of heterogeneity were found. Therefore, ApMb has certain advantages in the RToBS after GCS.

2.6 Meta Analysis of the First Postoperative Anal Exhaust Time

There are also 10 studies included in the literature related to the first postoperative anal exhaust time, as exhibited in Figure 7.

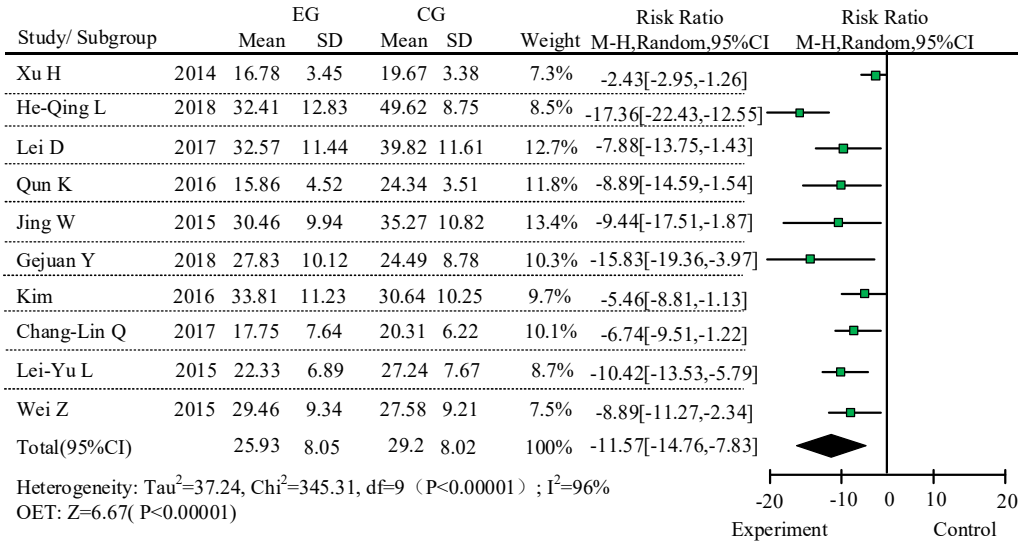


Figure 7 Results of the Meta-analysis of the time of the first anal exhaust after surgery

The heterogeneity in Figure 7 is significant ($P$<0.0001, I2=96%). Therefore, a REM was utilized to merge statistics for meta-analysis. SMD=-11.57, 95% CI=[-14.76, -7.83] ($P$<0.0001), indicating that the difference between EG and CG is statistically significant. However, due to significant heterogeneity among the literature, this study conducted subgroup analysis based on factors such as surgical approach, intervention measures, intervention time, and intervention frequency during sensitivity analysis. After removing the IL one by one, the results did not show significant changes and no sources of heterogeneity were found. Therefore, ApMb has certain advantages in the FBMT after GCS.

2.7 Meta Analysis of the First Postoperative Bowel Movement Time

There are 9 studies included related to the time of FBMT. A meta-analysis was conducted on these 9 literature to obtain Figure 8.

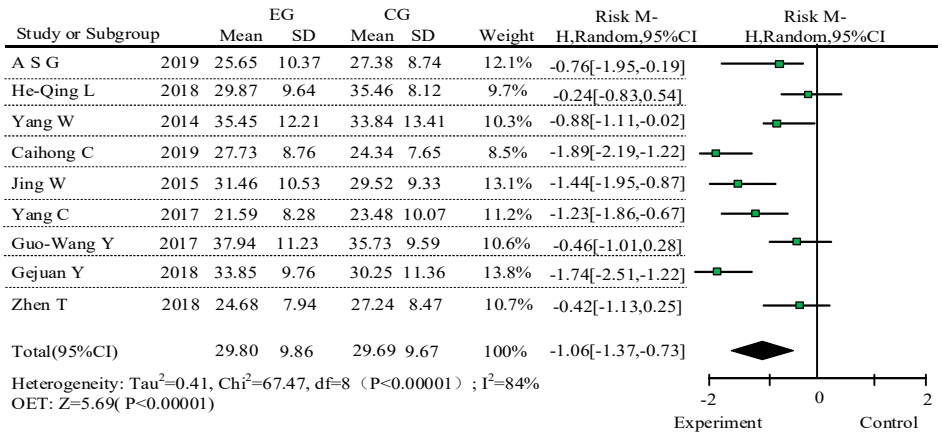


Figure 8 Time of first defecation after the operation

In Figure 8, heterogeneity is significant ($P$<0.0001, $I^2$=84%). Therefore, using a REM combined with statistical measures for meta-analysis, SMD=-1.06, 95%CI=[-1.37, -0.73] ($P$<0.0001) was obtained, indicating that the difference between EG and CG is statistically significant. However, due to significant heterogeneity among the literature, sensitivity analysis in this study was conducted based on factors such as surgical approach, intervention measures, intervention time, and intervention frequency for subgroup analysis. After removing the IL one by one, the results did not show significant changes and no sources of heterogeneity were found. The above indicates that ApMb treatment has certain advantages in the FBMT after GCS.

## 2.8 Publication Bias Analysis

This study used a funnel plot to analyze the overall and major indicator publication bias of the IL, as shown in Figure 9.

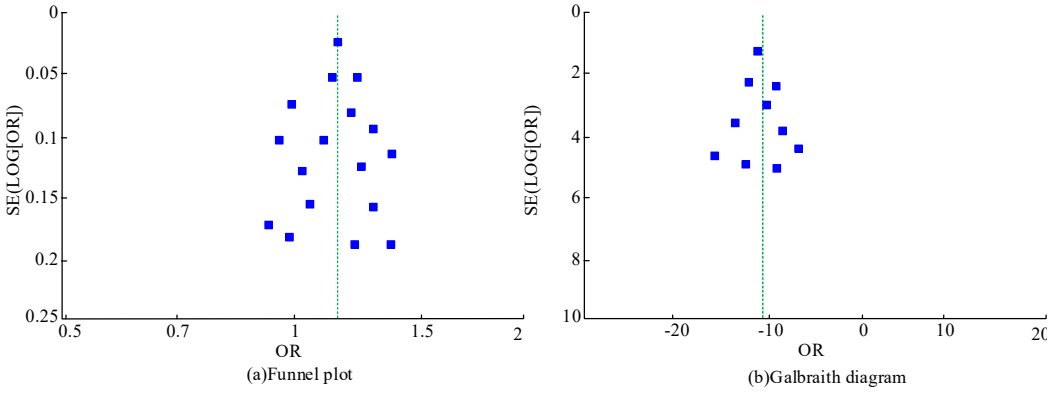


Figure 9 Results of the publication bias analysis of the literature

In Figure 9 (a), the funnel plot of total effective efficiency shows a relatively

symmetrical distribution on the left and right. The axis is OR=1.21, indicating that most of the IL is located at the tip of the funnel and presents a symmetrical form on both sides. This indicates that there exists the TER of the literature without bias. In Figure 9 (b), there is an asymmetric funnel plot of the first postoperative anal exhaust time. This indicates that there may be some bias in the indicator. The above phenomenon may be due to the difficulty in publishing articles with negative results, and the insufficient sample size of some literature.

## 3 CONCLUSION

GC is an average malignant tumor. According to the data statistical report released by the World Health Organization, its annual incidence in the world is 13.86%/100,000 people, second only to lung cancer, and the second highest incidence of malignant tumors. Surgery is a common clinical treatment for GC. After GCS, patients may experience discomfort symptoms such as AP, indigestion, malnutrition, GTD, and bloating. The traditional treatment methods for these adverse reactions include encouraging patients to move down to the ground as early as possible, using drugs that promote gastrointestinal motility, and restoring enteral nutrition or oral feeding as early as possible. But the above methods often have poor results. TCM is increasingly valued in restoring GTF after GCS due to its advantages of thorough disease treatment and minimal side effects on the body. In TCM, GCS is considered to be caused by a golden wound, so the adverse symptoms of patients after surgery are generally caused by deficiency of qi and blood, weakness of spleen, and loss of qi regulation [23-24]. As a common treatment method in TCM, ApMb has therapeutic effects such as promoting meridians and activating collaterals, regulating yin and yang, regulating qi circulation, and relieving pain by unblocking the internal organs. However, the systematic and objective evaluation of the therapeutic effect of ApMb on postoperative GTF issues in GC is lack. Therefore, to evaluate the efficacy of ApMb in the recovery of GTF after GCS, this paper analyzed relevant literature from over 10 years. This meta-analysis shows that ApMb can effectively promote the GTF recovery in patients after GCS, shorten the RToBS, the FBMT, and the first defecation time.

In the IL, the acupoints selected by ApMb include Tianshu acupoint, Zusanli acupoint, Neiguan acupoint, Gongsun acupoint, Shangjuxu acupoint, Xiajuxu acupoint, Zhongwan acupoint, and Yanglingquan acupoint, all of which have avoided the surgical wound location. This is consistent with the characteristics of ApMb treatment after GCS. From the selected acupoints, the Tianshu acupoint is located in the abdomen, horizontally flat in the navel, 2 inches apart from the anterior midline, and is mainly used to treat symptoms such as AP, bloating, constipation, and diarrhea. Zusanli acupoint is on the outer side of the calf, 3 inches below the calf nose, on the line connecting the calf nose and Jiexi. It is mainly used to treat gastrointestinal diseases, lower limb paralysis, mental disorders, surgical diseases, and various syndromes of deficiency and fatigue [25-26]. Neiguan acupoint is sited on the palmar side of the forearm, on the line connecting Quze and Daling, 2 inches above the wrist

crease, between the palmaris longus tendon and the radial wrist flexor tendon. It is mainly used to treat angina, myocarditis, arrhythmia, gastritis, hysteria, and other conditions. Gongsun acupoint exists in the spleen meridian of Foot Taiyin, located on the inner edge of the foot, below the anterior base of the first metatarsal bone, at the red and white flesh border. It is mainly used to treat symptoms such as stomach pain, vomiting, intestinal ringing, AP, diarrhea, dysentery, bloating, and inability to digest food. The Shangjuxu acupoint is located 6 inches below the Du Bi acupoint and 3 inches below the Zu San Li acupoint, and is mainly used to treat gastrointestinal diseases such as intestinal ringing, AP, diarrhea, constipation, and intestinal carbuncle. The Xiajuxu acupoint is located 9 inches below the calf's nose on the anterior lateral side of the calf, and is used to treat gastrointestinal diseases such as diarrhea, dysentery, and AP [27-28]. Zhongwan acupoint is located on the upper abdomen, midline anterior, and 4 inches above the navel. It is mainly used to treat symptoms such as stomach pain, vomiting, hiccup, nausea, AP, and bloating. Yanglingquan acupoint is located in the depression below the anterior part of the fibular head. It is mainly used to treat symptoms such as bitter mouth, vomiting, and jaundice. It can be seen that the above acupoints are all related to gastrointestinal polyps.

In terms of the RoB in literature, all literature has a low or unknown risk of bias (URB), and there are no literature with a high RoB. The overall quality of the literature selected for this study is acceptable and can provide some support for the research theory. In addition, in terms of clinical efficacy, the combined effect energy was 1.74, 95% CI=[1.65,1.89], Z=5.76 ($P$<0.0001), and the difference between EG and CG was statistically significant. This indicates that ApMb is effective in restoring GTF after GCS. There is heterogeneity in the RToBS among the literature, and no sources of heterogeneity were found after excluding each article. SMD value=-1.52, 95% CI=[-2.03, -1.02] ($P$<0.0001), showing that the difference between EG and CG is statistically significant. ApMb has certain advantages in the RToBS after GCS. There is also heterogeneity among the literature in terms of the first postoperative anal exhaust time, but after excluding the literature one by one, no sources of heterogeneity were found. SMD=-11.57, 95% CI=[-14.76, -7.83] ($P$<0.0001). The difference between EG and CG is statistically significant, indicating that ApMb can shorten the FBMT after GCS. In terms of the FBMT, there was $P$<0.0001, and $I^2$=84%, and no sources of heterogeneity were found. SMD=-1.06, 95% CI=[-1.37, -0.73] ($P$<0.0001), the distinction between EG and CG is significant. ApMb treatment has certain advantages in the FBMT after GCS. In terms of publication bias, the funnel plot of the TER has a relatively symmetrical distribution on the left and right, with an axis of OR=1.21, indicating that there is no bias in the TER of the literature.

To sum up, ApMb can promote the skin care of GTF after GCS, and can effectively shorten the RToBS, the FBMT and defecation time. However, due to the URB in a considerable portion of the IL, the overall literature quality is only B-level, lacking high-quality literature support, and it is currently impossible to draw a definite conclusion. This requires large-scale, multi-center randomized controlled trials to provide more reliable support for clinical trials.

PROJECT FUND

BE2020788 Electroacupuncture promotes early gastrointestinal function rehabilitation and application after laparoscopic gastric cancer surgery

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