Original Article

A systematic review and meta-analysis of the efficacy and safety of hysteroscopic electric resection versus vaginal surgery in the treatment of uterine scar defects after cesarean section

Yongxing Yuan, Jianjian Gao, Jing Wang, Xi Hu, Ping Liu, Hailin Wang

Department of Gynecology, Xi'an International Medical Center Hospital, Xi'an, China

Contributions: (I) Conception and design: Y Yuan; (II) Administrative support: H Wang; (III) Provision of study materials or patients: J Gao; (IV) Collection and assembly of data: J Wang; (V) Data analysis and interpretation: X Hu, P Liu; (VI) Manuscript writing: All authors; (VII) Final approval of manuscript: All authors.

Correspondence to: Hailin Wang. Department of Gynecology, Xi'an International Medical Center Hospital, No.777, Xitai Road, High-Tech Zone, Xi'an 710100, China. Email: 15102966984@163.com.

Background: Cesarean sections are increasingly likely to be applied; however, uterine scar defects (USD) often remain after delivery. The two existing treatment methods, hysteroscopic electric resection and vaginal surgery, are still controversial in terms of efficacy and safety. So, this paper to compares the effectiveness and safety of hysteroscopic electric resection and vaginal surgery in the treatment of USD after cesarean section.

Methods: We performed a related literature search from main databases. According to the PICOS principles inclusion criteria were adult female USD patients to evaluate the efficacy of hysteroscopic resection and vaginal surgery for the treatment of USD, outcome data could be extracted to compare the efficacy and safety of the two procedures. Subsequently, according to the titles, abstracts, and full texts of the retrieved articles, studies that did not meet the inclusion criteria were eliminated. The RevMan 5.20 software was used for meta-analysis and Cochrane Risk of Bias 2 (RoB 2.0) was used to assess the risk of bias. The effectiveness and safety of hysteroscopic resection and vaginal surgery in the treatment of USD patients after cesarean section were compared.

Results: Eight articles were finally included, with a total of 191 patients in the hysteroscopic electric resection group and 212 patients in the vaginal surgery group. Compared with hysteroscopic resection and vaginal surgery, there is less intraoperative blood loss [mean difference (MD) is −25.23, P<0.00001], shorter operation time (MD is −29.45, P<0.00001), and shorter hospital stay (MD is −1.87, P<0.00001), but menstrual improvement risk ratio (RR) is 0.71 (P=0.51) and diverticulum recovery RR is 0.60 (P=0.43) there were no significant differences.

Discussion: Hysteroscopic electric resection provides a more satisfactory outcome than vaginal surgery in terms of intraoperative blood loss, operation time, and hospital stay. However, the sample size of the study was not large enough and some studies had high risk of bias, more large-sample multi-center high quality studies are needed for further comprehensive comparative analysis.

Keywords: Uterine scar defect; hysteroscopic electric resection; vaginal surgery; meta-analysis

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Introduction

Cesarean section has become an important surgical method in the third trimester of pregnancy to deal with obstetric complications or as an optional delivery method. The annual number of cesarean sections worldwide is as high as 1.5 million (1). Research data in recent years has shown that the global cesarean section rate has increased from 6.7% to 19.1%, and is still rising (2,3). Also, the incidence of uterine scar defect (USD) is about 24–84% after cesarean section (2,4,5). Previous reports have shown that the incidence of USD in women with a history of cesarean section is as high as 61%, and almost all USDs in women with a history of cesarean section have occurred more than three times (6). The main pathological changes include the deformation and expansion of the lower uterine incision, accompanied by chronic inflammation (7,8).

Cesarean section scar defect (CSD), also known as previous cesarean section scar defect (PCSD), USD, uterine diverticulum niche, sacculation, or isthmocele, refers to the poor healing of the endometrium (9-11). USD can manifest as abnormal uterine bleeding, dysmenorrhea, discomfort during intercourse, pain in the lower abdomen, and even infertility. Approximately 16.9–88% of USD patients have corresponding clinical symptoms, the most common of which is abnormal uterine bleeding (12), which seriously affects the physical and mental health of patients. Asymptomatic USD can be treated without special treatment. The treatment of symptomatic USD includes drug therapy and surgery. Drug therapy is limited, and surgery can better manage the defect, but there are still different ideas about the choice of surgery (13-18). Surgical treatment usually includes hysteroscopic resection and vaginal surgery. Irregular vaginal bleeding is improved following active treatment of USD patients (5). Some scholars believe that the effect of hysteroscopic electric resection in the treatment of USD is encouraging (11,15), and some scholars have achieved good results with vaginal surgery (9,19). Therefore, exploring more suitable surgical methods is warranted.

However, there is presently no unified treatment plan for USD, and there have been some divergent views on the efficacy and safety of hysteroscopic resection and vaginal surgery (8,18,20-23). Meta-analysis can comprehensively analyze the results of multiple small-sample studies and resolve the inconsistency of the study results, which has the effect of high-level evidence of evidence-based medicine. This article aims to evaluate the results of randomized controlled trials (RCTs) comparing the clinical efficacy of hysteroscopic electric resection and vaginal surgery for the treatment of USD patients. We present the following article in accordance with the PRISMA reporting checklist (available at https://atm.amegroups.com/article/view/10.21037/atm-22-2916/rc).

Methods

Search strategy

We performed a literature search of both Chinese [China National Knowledge Infrastructure (CNKI), Wanfang, Chongqing Weipu Database for Chinese Technical Periodicals (VIP)] and foreign language (PubMed, Embase, Cochrane, Web of Science) databases. The search terms were as follows: cesarean scar, cesarean section scar, uterine scar, scar defect, diverticulum, hysteroscopic electrotomy, hysteroscopy, and vaginal surgery or transvaginal. The above search terms were freely combined in the form of subject terms and free words to utilize different search styles for the literature search. The retrieval time was from the date of establishment of each database to August 2021. The search languages were limited to English and Chinese.

Inclusion and exclusion criteria

According to the PICOS principles of population, intervention, comparison, outcome, and study design, the inclusion criteria made as follows: (I) population: studies that included patients who were diagnosed with USD by clinicians, and involving female patients who were married after reaching the age of 18 years; (II) intervention and comparison: evaluating the efficacy of two minimally invasive surgical methods (namely, hysteroscopic resection and vaginal surgery) for the treatment of uterine scar diverticulum; (III) outcome: studies from which at least one of the outcome indicators (such as menstrual improvement rate, operation time, intraoperative blood loss, hospital stay, and diverticulum recovery) could be extracted; and (IV) study design: RCT compares the efficacy and safety of the two aforementioned procedures.

The exclusion criteria were as follows: (I) studies that included patients who did not meet the above inclusion criteria; (II) literature with an unknown research object source and unclear grouping status; (III) observational studies, case reports, reviews, and repeated publications; (IV) articles with incomplete data; and (V) animal experiment reports.

Literature screening and data extraction

After reading the titles and abstracts of the articles, two reviewers, who are trained to complete this type of research independently, screened the retrieved articles according to the inclusion and exclusion criteria and excluded documents that were irrelevant to the research. Finally, the researchers carefully read the full texts of the articles and selected studies that met the inclusion and exclusion criteria. Inconsistencies in the opinions of the two researchers were resolved by negotiation and discussion or third-party arbitration.

The two reviewers then independently extracted the data in accordance with the prepared data table. The extracted information included the following aspects: (I) basic information of the literature, including the title, name of the first author, publication year, country, journal, type of research, intervention measures, and sample size of the research; and (II) outcome indicators, such as the menstrual improvement rate, operation time, intraoperative blood loss, hospital stay, and diverticulum recovery.

Quality and risk assessment

In this study, two reviewers independently evaluated the quality and risk of the included RCTs based on the Cochrane collaboration's risk of bias assessment tool Cochrane Risk of Bias 2 (RoB 2.0, an update to the original risk of bias tool). Specifically, the following aspects were assessed: (I) whether random allocation was applied for grouping the included subjects and whether there was selection bias; (II) whether allocation concealment was applied; (III) whether the study participants and researchers were double-blinded, whether the outcome measurer was blinded, and whether there was implementation or measurement bias; (IV) whether the outcome data were complete, whether there was any loss to follow-up bias; (V) whether there was selective reporting in the included literature outcomes, and whether there was publication bias; and (VI) other biases. Studies reasonable performed of the above-mentioned bias assessment items is considered low risk, not performed as required by the items are considered high risk, and not describing how to performed is unclear risk.

Statistical analysis

The Chi^2 (χ^2) test was used to estimate whether each effect size was heterogeneous. According to the Cochrane Handbook, $I^2 \leq 50\%$ signified that the heterogeneity among the included studies was small, and a fixed-effects model is used. However, $I^2 > 50\%$ indicated that the heterogeneity of the included studies was large, and the random-effects model was used. The 95% confidence interval (CI) was used to express the 95% CI of each effect size. RevMan 5.20 software (Cochrane Collaboration) was used for statistical analysis. We set $\alpha=0.05$ as the test standard, and $P<0.05$ indicated that the difference between the groups was statistically significant. Meanwhile, $P>0.05$ indicated that the difference between the groups was not statistically significant. The funnel plot and Egger's test was used to analyze publication bias, and $P<0.05$ was considered statistically significant.

Results

Search results and study characteristics

According to the initial search strategy, we performed a literature search of each database and a total of 908 records related to USD were retrieved. After a simple screening, 765 records were obtained. After excluding the case reports and reviews, 461 records were used for the literature retrieval and the final retrieval obtained 140 articles. After reading the full texts of the remaining articles, 132 articles that did not meet the requirements were eliminated. Finally, eight RCTs meeting the inclusion and ranking criteria were included in the study. The specific literature screening results are shown in *Figure 1*. The eight articles included a total of 403 patients, which were divided into two groups: a hysteroscopic resection group (191 cases) and a vaginal surgery group (212 cases). The basic information of the included articles is shown in *Table 1*.

Literature quality assessment

The quality of the eight included articles was evaluated according to the evaluation criteria of the Cochrane Risk Assessment Tool. All studies described the random sequence generation and allocation concealment. Three articles blinding of participants and personnel are high-risk, and five articles had an unclear risk. The risk of outcome assessment is unclear in all articles. Seven articles reported on the completeness of the result data, selective reporting of the results, and other aspects, and only one article could not be evaluated. The specific results are shown in *Figure 2*.

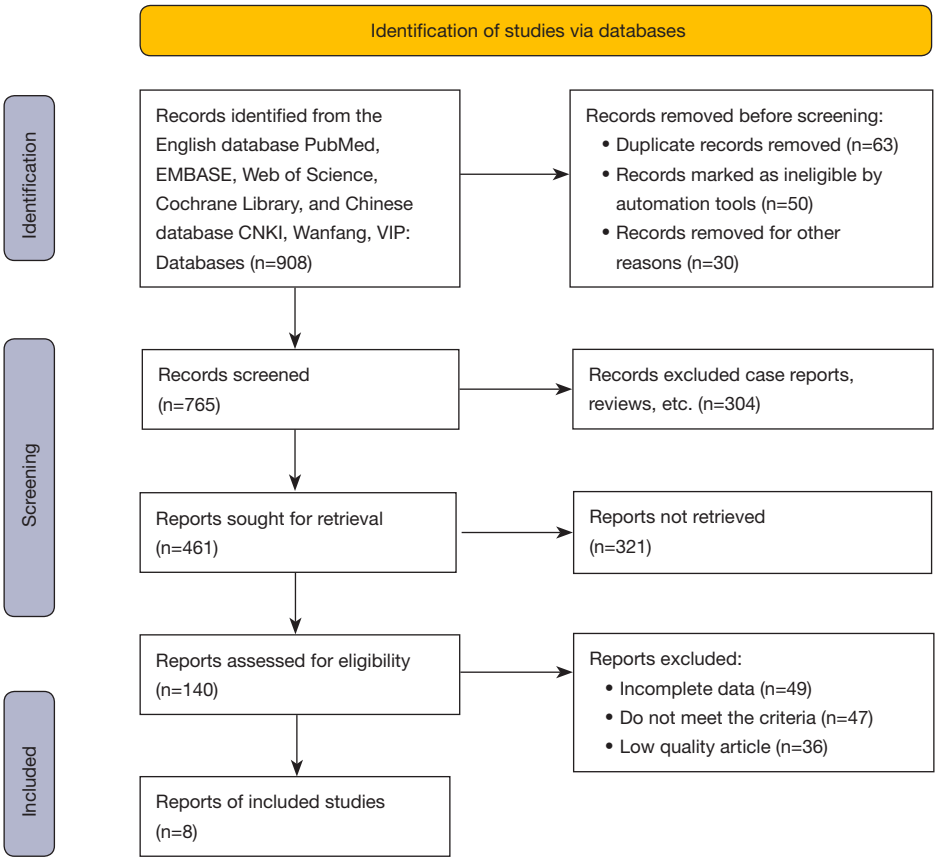

Figure 1 Flow chart of research included in the meta-analysis. CNKI, China National Knowledge Infrastructure.

Table 1 Basic characteristics of the study articles

Author	Country	Year	Journal	Hysteroscopic (n)	Vaginal (n)
Guo *et al.* (18)	China	2019	*Hebei Medicine*	41	46
Liang *et al.* (19)	China	2014	*Chinese Journal of Family Planning & Gynecotokology*	16	20
Zhang *et al.* (20)	China	2017	*Journal of Laparoscopic Surgery*	12	13
Zhang *et al.* (21)	China	2019	*Journal of Clinical and Experimental Medicine*	26	32
Yu *et al.* (22)	China	2015	*Chinese Journal of Family Planning & Gynecotokology*	14	16
Xia *et al.* (7)	China	2020	*Chinese Journal of Family Planning & Gynecotokology*	18	23
Zhou *et al.* (23)	China	2021	*Chinese Journal of Family Planning*	45	48
Zhang *et al.* (8)	China	2016	*International Journal of Gynecology and Obstetrics*	19	14

Meta-analysis results

Intraoperative blood loss

All eight included articles reported on the intraoperative blood loss of the two groups of patients, including 191 cases in the hysteroscopic resection group and 212 cases in the vaginal surgery group. The heterogeneity test showed that chi^2=306.11, degrees freedom (df) =7, and P<0.00001, indicating that the difference was statistically significant. Also, I^2=98%>50%, so the random-effects model was used for merging.

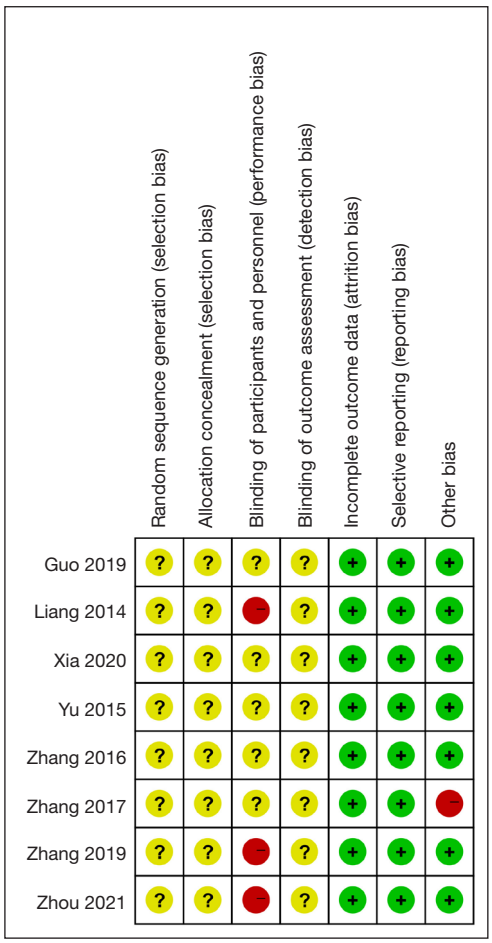

Figure 2 Literature quality evaluation details.

The meta-analysis results are shown in *Figure 3*; the mean difference (MD) =−25.23 and its 95% CI was (−34.18, −16.28). The combined test showed that Z=5.53 and P<0.00001<0.05, indicating that the difference was statistically significant. Therefore, there is a difference in the amount of intraoperative blood loss between hysteroscopic resection and vaginal surgery in the treatment of USD.

Operation time

All eight included articles reported on the operation time of the two groups, including 191 cases in the hysteroscopic resection group and 212 cases in the vaginal operation group. The heterogeneity test showed that chi^2=547.25, df=7 (P<0.00001), and I^2=99%>50%, so the random-effects model was used for merging.

The meta-analysis results are shown in *Figure 4*; the MD =−29.45 and its 95% CI was (−44.97, −13.93). The combined test showed that Z=3.72 and P=0.0002<0.05, indicating that the difference was statistically significant. Therefore, there is a difference in the operation time between hysteroscopic resection and vaginal surgery in the treatment of USD.

Hospital stay

All eight included articles reported on the hospital stay of two groups of patients, including 191 cases in the hysteroscopic resection group and 212 cases in the

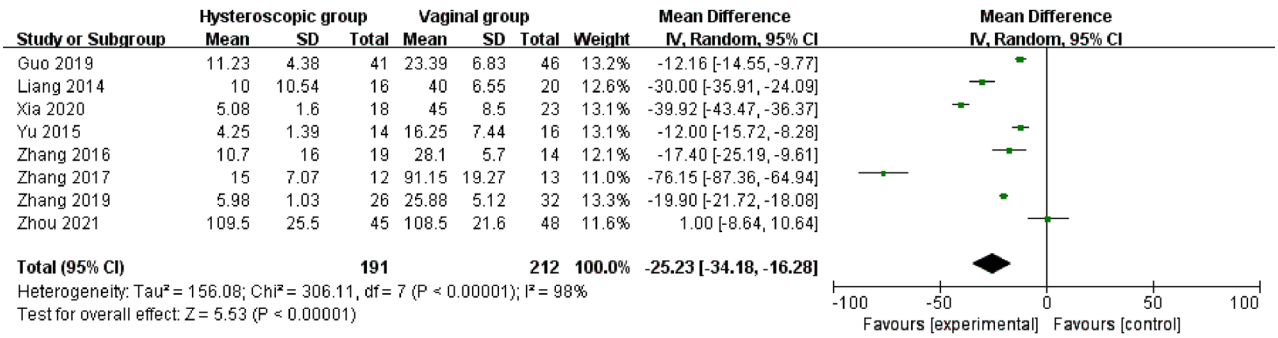

Figure 3 Forest plot of intraoperative blood loss. Comparison of intraoperative blood loss between the hysteroscopic electric resection group and the vaginal surgery group. Statistical method: inverse variance of random effects model (MD and 95% CI). MD, mean difference; CI, confidence interval.

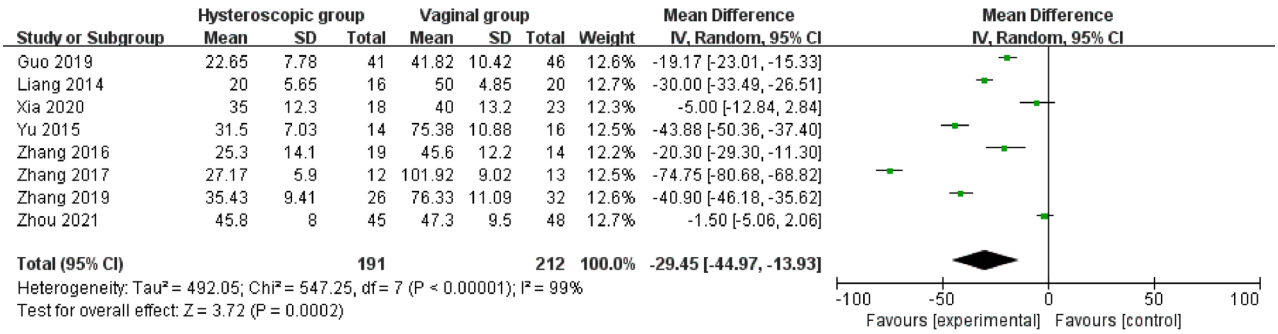

Figure 4 Forest plot of operation time. Comparison of operation time between the hysteroscopic electric resection group and the vaginal surgery group. Statistical method: inverse variance of the random effects model (MD and 95% CI). MD, mean difference; CI, confidence interval.

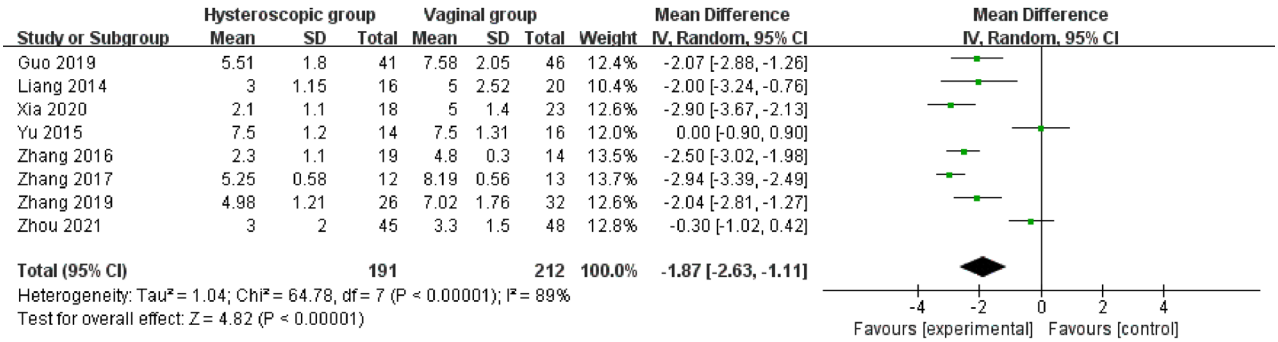

Figure 5 Forest plot of hospital stay. Comparison of hospital stay between the hysteroscopic electric resection group and the vaginal surgery group. Statistical method: inverse variance of the random effects model (MD and 95% CI). MD, mean difference; CI, confidence interval.

vaginal surgery group. The heterogeneity test showed that chi^2=64.78, df=7, and P<0.00001, indicating that the difference was statistically significant, and I^2=89%>50%, so the random-effects model was used for merging.

The meta-analysis results are shown in *Figure 5*; the MD =−1.87 and its 95% CI was (−2.63, −1.11). The combined test showed that Z=4.82 and P<0.00001<0.05, indicating that the difference was statistically significant. Therefore, there is a difference in the hospital stay of patients after hysteroscopic resection and vaginal surgery in the treatment of USD.

Menstrual improvement

Only four included articles reported on menstrual improvement in the two groups of patients, including 70 cases in the hysteroscopic resection group and 84 cases in the vaginal surgery group. The heterogeneity test showed that chi^2=2.29, df=3, and P=0.51, indicating that the difference was not statistically significant, and I^2=0%<50%, so the fixed-effects model was used for merging.

The meta-analysis results are shown in *Figure 6*; the risk ratio (RR) =0.71 and its 95% CI was (0.59, 0.85). The combined test showed that Z=3.79 and P=0.0002<0.05, indicating that the difference was statistically significant. Therefore, there is a difference in the improvement of menstruation after hysteroscopic resection and vaginal surgery in the treatment of USD.

Diverticulum recovery

Four of the included articles reported on diverticulum recovery in the two groups of patients, including 87 cases in the hysteroscopic resection group and 102 cases in the vaginal surgery group. The heterogeneity test showed that chi^2=2.77, df=3, and P=0.43, indicating that the difference was not statistically significant, and I^2=0%<50%, so the fixed effects model was used for merging.

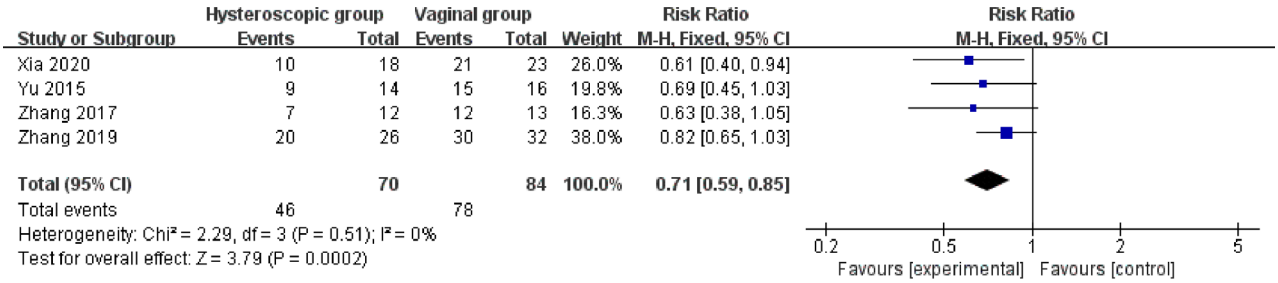

Figure 6 Forest plot of menstrual improvement. Comparison of menstrual improvement between the hysteroscopic electric resection group and the vaginal surgery group. Statistical method: Mantel-Haenszel of the fixed effects model (RR and 95% CI). RR, relative risk; CI, confidence interval.

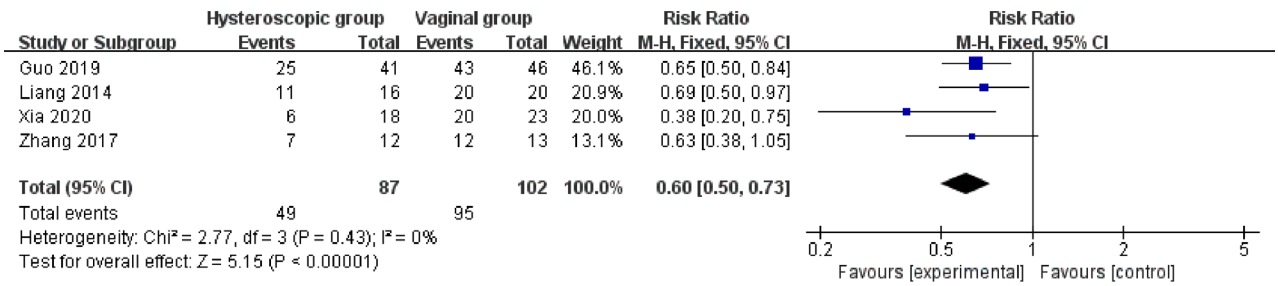

Figure 7 Forest plot of diverticulum recovery. Comparison of diverticulum recovery between the hysteroscopic electric resection group and the vaginal surgery group. Statistical method: Mantel-Haenszel of the fixed effects model (RR and 95% CI). RR, relative risk; CI, confidence interval.

The meta-analysis results are shown in *Figure* 7; the RR =0.60 and its 95% CI was (0.50, 0.73). The combined test showed that Z=5.15 and P<0.00001<0.05, indicating that the difference was statistically significant. Therefore, there is a difference in diverticulum recovery between hysteroscopic resection and vaginal surgery in the treatment of USD.

Publication bias

A funnel plot was used to examine the publication bias of intraoperative blood loss and the operating time. As shown in *Figure 8*, both funnel charts exhibited asymmetry, indicating that there may be publication bias. And the Egger test showed that the operation time was t=−0.88, P=0.412, and the intraoperative blood loss was t=−0.81, P=0.448, and the difference was not statistically significant.

Risk of bias

All of the included articles reported that the random sequence generation and allocation concealment bias was unclear. Also, in terms of blinding of participants and researchers, three RCTs (19,21,23) had a higher risk of bias, while five RCTs (7,8,18,20,22) had an unclear risk of bias. All of the included RCTs reported that the risk of bias in terms of the blinding of results assessment was unclear. Moreover, all of the included RCTs had a low risk of bias with regard to the incomplete outcome data and selective reporting domains. In terms of other biases, one of the included studies was judged to have a high risk (20) and seven studies were judged to have a low risk (7,8,18,19,21-23), as shown in *Figure 9*.

Discussion

In recent years, with the increased rates of cesarean section, the description and reporting of complications after cesarean section have become more frequent. These complications include abnormal vaginal bleeding, secondary infertility, pelvic pain, and USD (11,24,25). Studies have demonstrated that the formation of USD is related to factors such as the

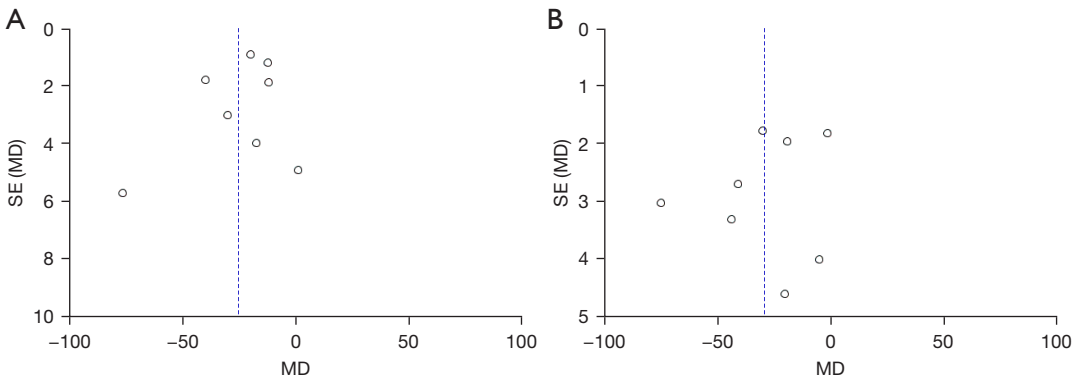

Figure 8 Funnel plot analysis of possible publication bias in subgroups. The intraoperative blood loss (A) and the operating time (B) funnel plot. MD, mean difference; SE, standard error of the mean.

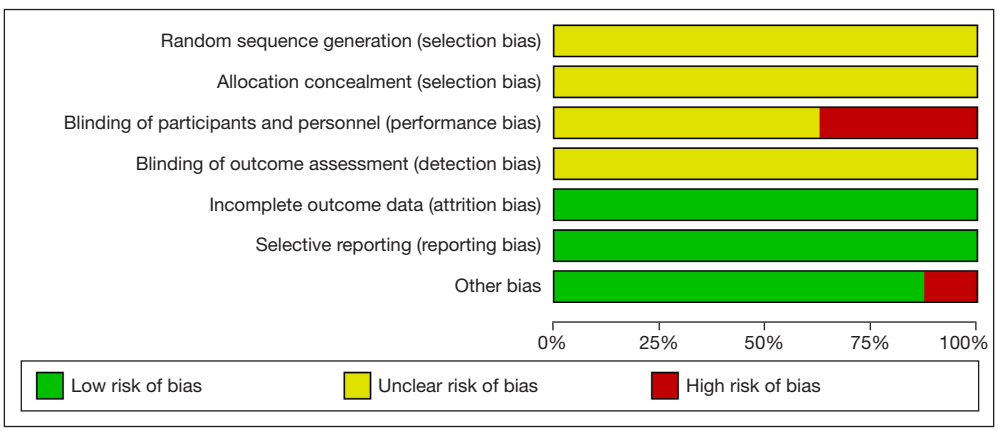

Figure 9 The intensity and distribution of the quality risk of the articles included in the study.

timing of cesarean section, surgical incision site selection, suture technique, the posterior position of the uterus, infection factors, incision endometriosis, multiple cesarean section history, and other factors (2,4,26). The layered suture of the myometrium is easier to form a diverticulum than the full-thickness suture of the myometrium (12,27,28). A previous meta-analysis showed a similar incidence of uterine scar diverticulum in the uterus with single- and double-layer sutures (29). In addition, the incidence of double-suture uterine scar diverticulum is lower than that with a single suture (30).

Numerous studies have reported on the treatment of USD; however, there is still no unified treatment plan. To reduce the incidence of USD, the indications for cesarean section should be strictly controlled. Lowering the rate of cesarean section is an effective means to reduce USD (31). Common surgeries used to treat USD include combined hysteroscopy or laparoscopic surgery, vaginal surgery, and hysteroscopic resection. However, the advantages of the various surgical techniques remain controversial. Some scholars believe that laparoscopic surgery or hysteroscopy combined with laparoscopic surgery is better than vaginal surgery for USD (16,17,32,33).

In recent years, hysteroscopic resection has become more widely used in the diagnosis and treatment of USD. The present article discusses the efficacy of hysteroscopic resection and vaginal surgery for the treatment of USD through the female natural cavity and compares the advantages and disadvantages of these two minimally invasive procedures. The results of this meta-analysis showed that there were statistically significant differences between the hysteroscopic resection group and the vaginal surgery group in the amount of intraoperative bleeding, operation time, hospitalization time, menstrual

improvement, and diverticulum recovery in the treatment of uterine scar diverticulum (P<0.05). The results demonstrated that hysteroscopic resection is superior to vaginal surgery in terms of the above outcome indicators. In future research, other related outcome indicators should be analyzed to more comprehensively evaluate the difference in the curative effect of these two procedures.

This study has certain limitations that should be noted. Firstly, this study was restricted by social ethics and other issues; given the risks of surgery, patients and their families have the right to informed consent, making it difficult to strictly implement blinding and allocation concealment, which limited the quality of included studies. Secondly, most of the studies that met the inclusion criteria were Chinese articles. This may be related to the large population base in China, the high rate of cesarean section, and the large number of USD patients. Thirdly, some outcome indicators in this study had a small sample size and insufficient follow-up time, which may have had an impact on the reliability of the results. Lastly, there may be heterogeneity among the included literature.

Conclusions

Both hysteroscope electric resection and vaginal surgery for USD can improve the clinical symptoms of patients. The results of this meta-analysis showed that hysteroscopic electric resection was superior to vaginal surgery in terms of intraoperative blood loss, operation time, hospital stay, menstrual improvement, and diverticulum recovery. However, the small sample size in this study has a certain impact on the reliability of the results. Therefore, more large-sample, multicenter RCTs are needed for further comparative analysis to confirm the differences in the efficacy of these two surgical treatments for USD patients.

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Footnote

Reporting Checklist: The authors have completed the PRISMA reporting checklist. Available at https://atm.amegroups.com/article/view/10.21037/atm-22-2916/rc

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://atm.amegroups.com/article/view/10.21037/atm-22-2916/coif). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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