Clinical and Experimental Obstetrics & Gynecology

Clin. Exp. Obstet. Gynecol. **2024**; 51(1): 23
https://doi.org/10.31083/j.ceog5101023

Original Research

Laparoscopic Correction of Cesarean Scar Defects by Temporary Bilateral Uterine Artery Occlusion

Fei Tang[1,2], Limei Ji[1,2], Lanying Jin[1,2], Mingjun Shao[1,2], Min Hu[2,*]

[1]Department of Obstetrics and Gynecology, Affiliated Jinhua Hospital, Zhejiang University School of Medicine, 321000 Jinhua, Zhejiang, China
[2]Department of Obstetrics and Gynecology, Jinhua Maternity and Child Health Care Hospital, 321000 Jinhua, Zhejiang, China
*Correspondence: humin199709@126.com (Min Hu)
Academic Editor: Christos Iavazzo
Submitted: 24 September 2023 Revised: 16 November 2023 Accepted: 20 November 2023 Published: 22 January 2024

Abstract

Background: The aim of our study was to evaluate the clinical efficacy of temporary bilateral uterine artery blockage for cesarean scar defects when combined with laparoscopy and hysteroscopy. **Methods**: We evaluated 126 patients who had one or more cesarean deliveries with abnormal uterine bleeding (12–20 days). All eligible women were informed of the potential complications, benefits, and alternatives, for each approach before they were assigned into one of two treatment groups. Group A received temporary bilateral uterine artery occlusion and vasopressin injection while Group B received vasopressin injection only. **Results**: Mean blood loss was 54.70 $\pm$ 13.01 mL and 190.82 $\pm$ 15.72 mL in Groups A and B ($p < 0.001$). By the final evaluation, the mean duration of menstruation had reduced to 6.92 $\pm$ 2.16 and 7.16 $\pm$ 2.25 days in Group A and Group B; these values were significantly different than the pre-operative values ($p < 0.001$ respectively). The mean thinnest residual myometrium was 5.39 $\pm$ 0.77 and 5.28 $\pm$ 1.25 mm in Group A and Group B, respectively. These values were thicker than pre-operative values ($p < 0.001$ respectively). The efficacy of anatomic correction was 96.88% (62/64) and 96.77% (60/62) ($p > 0.999$) in Groups A and B, respectively. Overall, 58 of the 64 (90.63%) patients in Group A and 57 of the 62 (91.94%) patients in Group B reported an improved menstrual cycle following surgery ($p = 0.794$). **Conclusions**: The combination of laparoscopy, hysteroscopy, temporary bilateral uterine artery occlusion, and the injection of vasopressin, offers an effective measure to reduce blood loss effectively.

Keywords: abnormal uterine bleeding; blockage; defection; hysteroscopy; laparoscopy; temporary

1. Introduction

The numbers of fertile women undergoing cesarean section delivery have increased considerably worldwide over the years [1,2]. Furthermore, the obstetric complications associated with previous cesarean section, such as placenta previa, placenta accrete, and uterine rupture, are also increasing in subsequent pregnancies [3]. In addition to obstetric complications, some researchers have described a correlation between cesarean section and primary gynecological disturbances, such as continuous discharge, chronic pelvic pain, prolonged menstruation and postmenstrual spotting, thus causing negative effects on the daily life of patients [3,4]. Thurmond *et al.* [4] described an anatomical defect in the anterior lower uterine segment in nine patients at the site of the cesarean scar by ultrasound; all of these patients experienced a postmenstrual discharge involving brown or dark red material lasting from 2 to 12 days. The clinical complications of cesarean scar defection (CSD) have aroused an increasing amount of public concern. Consequently, there is an urgent need to develop new methods to rebuild the muscular layer of the scar site.

Defect correction is an important treatment method for women who wish to preserve their uterus and fertility. The use of vasopressin cannot effectively control hemostasis, the bradycardia and cardiac complications and the loss of peripheral pulses have been reported after repeated injections of vasopressin [5]. In view of these insufficiencies, we demonstrated that temporary bilateral uterine artery blockage during laparoscopy procedure is a feasible and safe technique for anatomical correction and to eliminate the symptoms of abnormal uterine bleeding.

2. Materials and Methods

2.1 Patient Selection

This was a retrospective investigation that was carried out in a single-center study. Between January 2014 and January 2017, 126 patients with prior cesarean section deliveries presented with prolonged period of menstruation (12–20 days) and were recruited into our study. The defection of the isthmus of the cervical canal was confirmed by saline infusion sonohysterography (SIS) findings, showing an anechoic defect located between the bladder and the anterior lower uterine segment of the cesarean section scar. The treatment protocol was approved by the Ethics Committee of Jinhua Hospital Zhejiang University School of Medicine (ethics approval No: 2017-53) and informed written consent was provided by all patients. The exclusion criteria [6] were as follows: (1) menstrual irregularities prior to cesarean section; (2) the previous use of an intrauterine contraceptive device; (3) uterine malformations; (4) a history

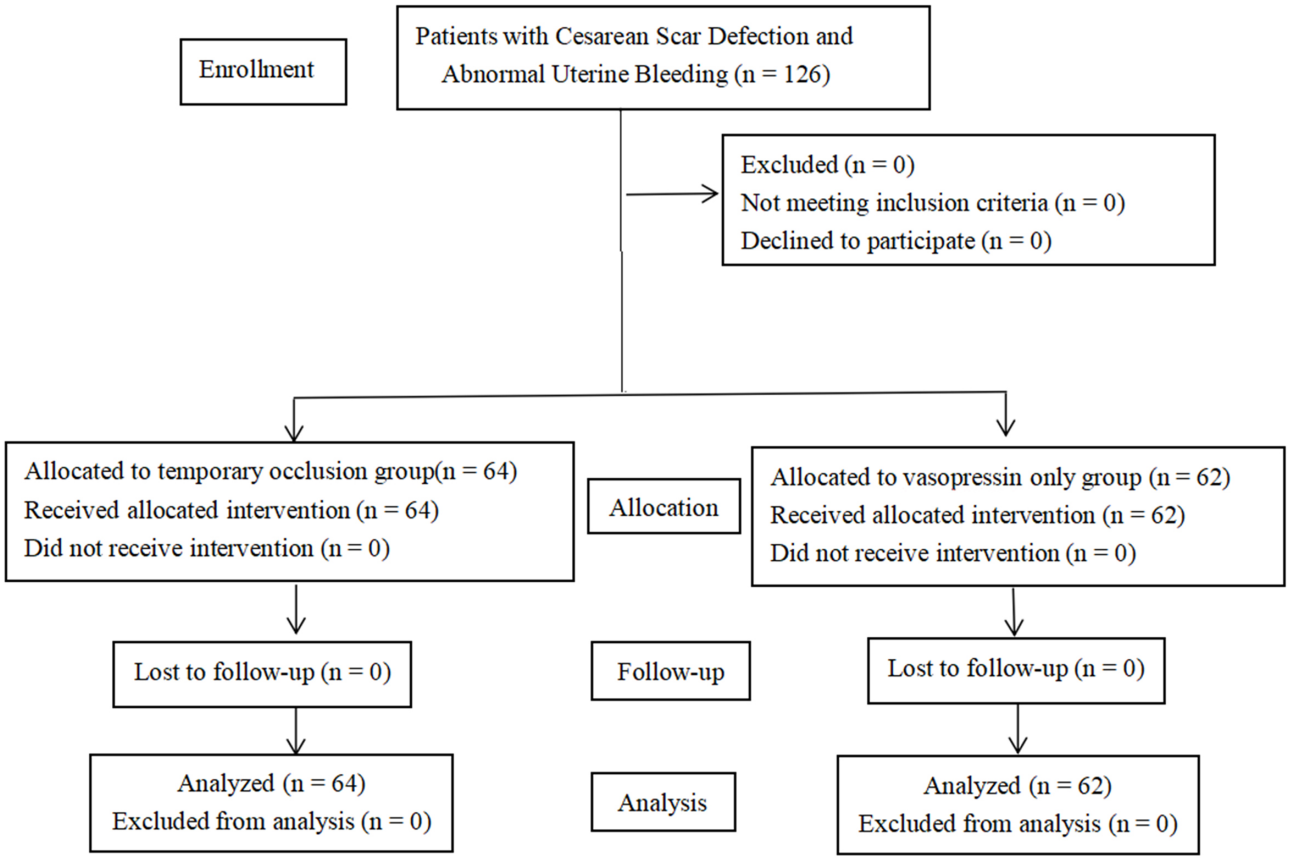

Fig. 1. Consort flow diagram.

of coagulation disorder; and (5) the presence of any other organic uterine disease that could cause menstrual irregularities, including endometrial hyperplasia, polyps, leiomyoma, or endometrial carcinoma. A total of 126 patients were finally included in this study. Patients were assigned to two groups (Fig. 1). Group A consisted of 64 patients and Group B consisted of 62 patients. The patient characteristics and related material are given in Tables 1,2,3.

2.2 Saline Infusion Sonohysterography

Prior to study entry, all defects were measured by SIS. First, a speculum with a catheter was placed inside the uterus. Normal saline was then introduced into the cervix and uterine cavity while retracting the catheter to completely eliminate the small amounts of air within. We continued until we reached a maximum volume of 10 mL, or until uterine cramps occurred or the backflow of water was observed from the cervix [5]. After the speculum had been removed and the vaginal probe reinserted, the thinnest residual myometrium and the shape of the defect were measured and recorded directly, as described previously [7]. The shape of the defect was classified according to a classification scheme published previously [7].

2.3 Operative Procedures

Patients were placed in the Trendelenburg position and then placed under general anesthesia. In Group A, the bladder peritoneum was opened and the anterior leaf of the broad ligament was separated by blunt and sharp dissection in laparoscopic procedure. The bladder peritoneum was then incised and the bladder was separated away from the lower segment of the uterus completely. After we separated the uterine artery, we used titanium clips to block the bilateral uterine arteries in place under direct vision (Fig. 2). The clips were easy to apply and remove. The structure of these clips is similar to non-invasive forceps and causes less damage to vessels when compared with other clips. Next, we located the uterine artery via the posterior leaf of the broad ligament. Vasopressin 6U was injected into the cervical stroma. In Group B, we opened the bladder peritoneum, and then injected vasopressin. A Fr15 hysteroscope was inserted into uterine cavity to observe the cesarean scar defect. Hysteroscopic examination (Fig. 3) allowed us to visualize the cesarean scar defect in great detail. With illumination from a cold light source under hysteroscopic guidance (Fig. 4), a transverse incision was made to open the CSD laparoscopically. Then, the defect was completely resected to the normal margins of the incision with scissors (Fig. 5). The normal healthy muscular wound margins were then stitched with 1-0 absorbable sutures (Ethicon, Inc., LLC.,

Table 1. Characteristics of the patients.

Characteristics	Group A	Group B	*p* value
Age (years)	31 (26–43)	32 (25–44)	0.709
No. of previous cesarean sections	1–3	1–3	
No. of patients (n)	64	62	
Body mass index (kg/m^2)	21.78 $\pm$ 2.39	21.20 $\pm$ 2.08	0.166
Blood loss in operation (mL)	54.70 $\pm$ 13.01	190.82 $\pm$ 15.72	$<$0.001
Operation time (min)	84.45 $\pm$ 16.65	86.31 $\pm$ 16.75	0.535

The distribution of the enrolled patients' age, body mass index, number of previous cesarean sections and patients, blood loss and operation time were described in detail. There were no differences in age, body mass index and operation time between two groups ($p > 0.05$). The mean blood loss in Group A was significant less than Group A ($p < 0.001$).

Table 2. Average duration of menstruation.

Characteristics	Group A	Group B	*p* value
Average duration of menstruation (days)			
Preoperation	14.38 $\pm$ 2.09	14.68 $\pm$ 2.37	0.460
Postoperation	6.92 $\pm$ 2.16	7.16 $\pm$ 2.25	0.543
p value	$<$0.001	$<$0.001	
Mean thinnest residual myometrium (mm)			
Preoperation	2.08 $\pm$ 1.03	2.25 $\pm$ 0.90	0.301
Postoperation	5.39 $\pm$ 0.77	5.28 $\pm$ 1.25	0.550
p value	$<$0.001	$<$0.001	

During the following period, the average duration of menstruation in both groups significantly decreased compared with those before operation ($p < 0.001$), and there were no significantly differences between two groups ($p > 0.05$); the mean thinnest residual myometrium in both groups were statistically significant compared with preoperation ($p < 0.001$ respectively) and the difference between two groups was no statistically significant ($p > 0.05$).

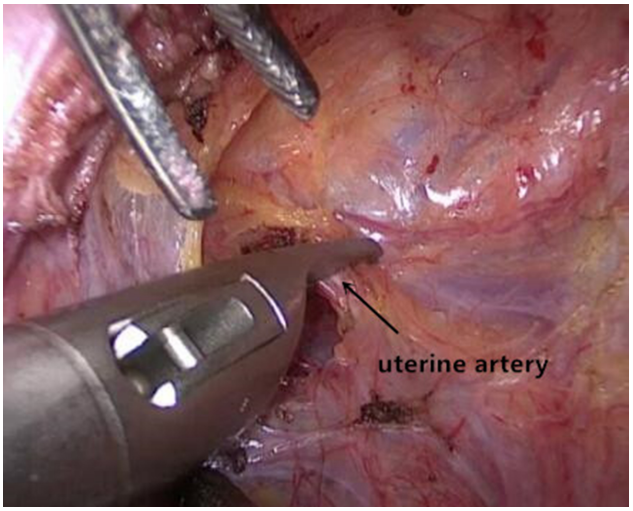

Fig. 2. Transient occlusion of uterine artery with a titanium clip (left side).

Raritan, NJ, USA) in a continuous fashion (Fig. 6). Each sutured was not tightened completely so as to ensure that each stitch could be inserted into the whole layer of the myometrium. After the incision had been sutured completely, the stitches were tightened one by one until the final knot was created. The titanium clips in Group A were removed after sutures, and flow was returned to both uterine arteries after removing the titanium clip. The application and removal of the titanium clips was performed according to the approach described in our previous paper [8]. Once sutures were complete, hysteroscopy was repeated to ensure that the defect had been corrected. Finally, the peritoneum was closed. All excised tissues were sent for pathological examination to exclude other forms of malignancy in the scar tissue.

2.4 Follow-Up

Patients were followed-up for 12 months. We evaluated the perioperative blood loss by calculating the blood volume in the suction bottles during the surgery; we also recorded the duration of surgery. Uterine bleeding was estimated via the use of a special menstrual application before and after surgery. SIS was performed and the alleviation of abnormal uterine bleeding was assessed at 12 months post-surgery. The result of spotting was graded on a 3-point scale according to the duration of menstruation, as follows: 3-points, postoperative menstrual duration $<$8 days; 2-points, compared with preoperative menstrual duration, the postoperative spotting was reduced by more than 3 days; 1-point, postoperative spotting was reduced by less than 3 days compared with the preoperative menstrual duration. Three and two points were considered as an improvement.

2.5 Statistical Analysis

All statistical analysis was carried out with Statistical Package for Social Science version 13.0 software (SPSS, Inc., an IBM Company, Chicago, IL, USA). Data are presented as mean $\pm$ standard deviation (SD), absolute number (%), or median (range). The difference in means between Group A and Group B was tested by analysis of variance (ANOVA). The paired-sample *t* test was used to compare

Table 3. Perioperative data and follow-up data.

Characteristics	Group A	Group B	*p* value
The efficacy of anatomic correction n (%)	62/64 (96.88%)	60/62 (96.77%)	>0.999
The relief rate of abnormal spotting n (%)			0.794
Improved	58/64 (90.63%)	57/62 (91.94%)	
Not improved	6/64 (9.38%)	5/62 (8.06%)	

During the following period, the efficacy of anatomic correction and the relief rate of abnormal spotting no significantly differences between two groups ($p > 0.05$).

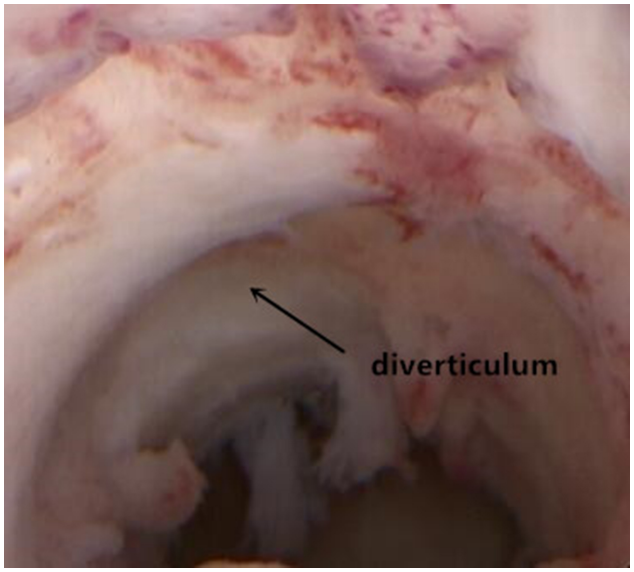

Fig. 3. Hysteroscopy showed a small diverticulum at the site of the cesarean scar.

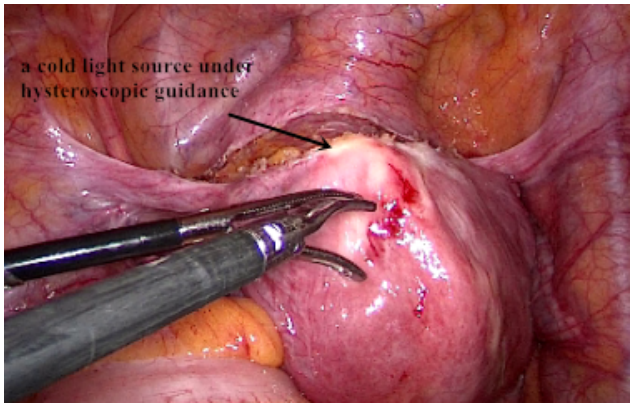

Fig. 4. The illumination from cold light source of hysteroscopic guidance.

the mean duration of menstruation before and after surgery. If variables were not normally distributed, then the rank sum test was used. Categorical variables are presented as percentages and were compared using χ^2 tests or Fisher's exact tests. $p < 0.05$ was considered to be statistically significant.

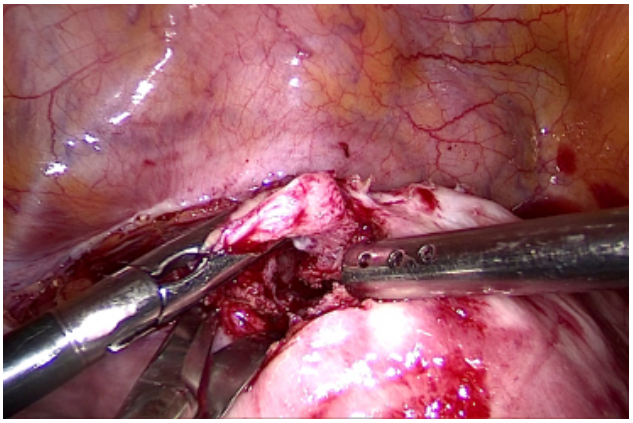

Fig. 5. Resected the defection of the scar to the normal margins with scissors.

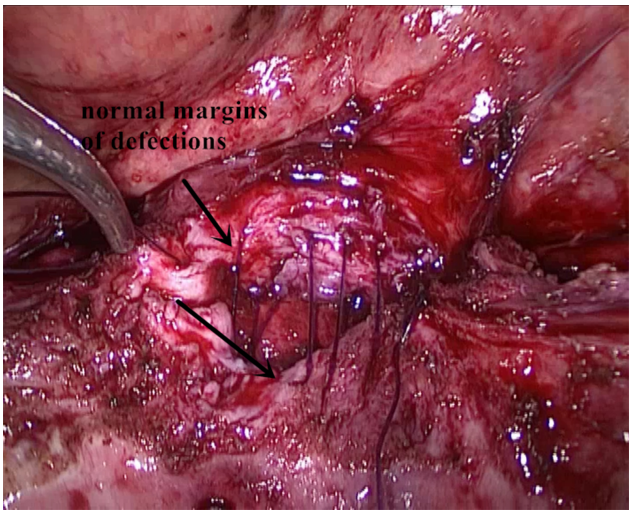

Fig. 6. Stitched the normal margins of the defection in a continuous fashion.

3. Results

Patient characteristics are given in Table 1. Perioperative and follow-up data at 12 months after surgery are given in Tables 2, 3. The mean perioperative blood loss was 54.70 $\pm$ 13.01 mL and 190.82 $\pm$ 15.72 mL in Group A and Group B, respectively ($p < 0.001$). The mean operation time was 84.45 $\pm$ 16.65 min and 86.31 $\pm$ 16.75 min in Group A and Group B, respectively ($p = 0.535$). At the 12-month follow-up timepoint, the mean duration of menstruation was 6.92

$\pm$ 2.16 and 7.16 $\pm$ 2.25 days, in Group A and Group B, respectively. These values were markedly shorter than pre-surgical values ($p < 0.001$); there was no statistical difference between the two groups in this respect ($p = 0.543$). The mean thinnest residual myometrium was 5.39 $\pm$ 0.77 min and 5.28 $\pm$ 1.25 min in Group A and Group B, respectively. These values were statistically significant when compared with pre-surgical values ($p < 0.001$); there was no statistical difference between the two groups in this respect ($p > 0.05$). According to clinical assessment, 58 of the 64 (90.63%) patients in Group A, and 57 of the 62 (91.94%) patients in Group B, improved the prolonged menstrual bleeding syndrome ($p = 0.794$). However, 11 patients still experienced postmenstrual spotting (6 patients in Group A and 5 patients in Group B, respectively); however, the duration still lasted for 13–19 days. SIS performed 12 months after surgery revealed that the defect still remained in 4 cases, although these were smaller than pre-surgery.

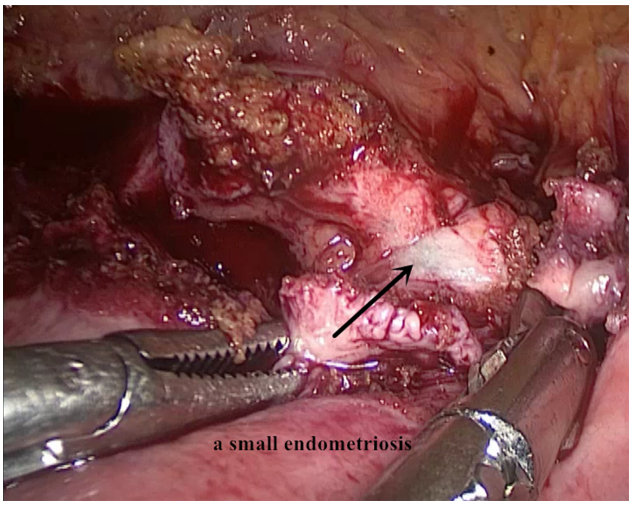

Fig. 7. Laparoscopy showed a small endometriosis at the left site of the cesarean section defection.

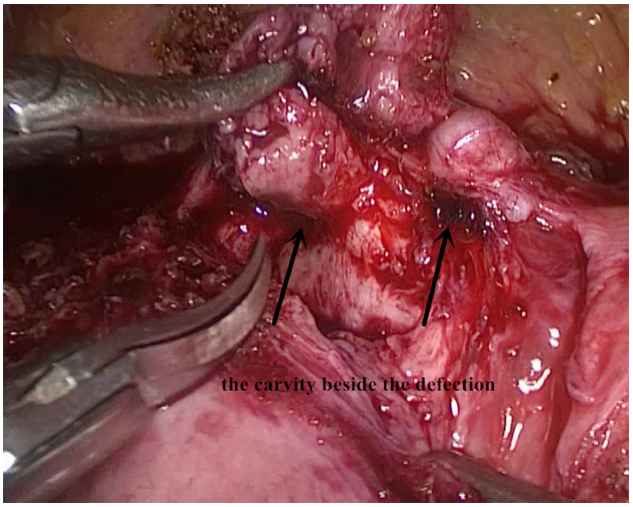

Fig. 8. The cavity beside the cesarean section defection.

4. Discussion

Cesarean section is one of the most common surgical procedures in fertile women [1]. Furthermore, cesarean scar defects are estimated to occur in 60% of all cesarean section cases [9,10]. The exact etiology of the such defects has yet to be fully elucidated. Uterine defection in cesarean section scars may arise from the cesarean section, infection, or events during labor. Antila-Långsjö *et al*. [9] and Zhou *et al*. [10] considered that the lack of coordinated muscular contractions around the scar tissue obstructed menstrual blood drainage and resulted in intermittent postmenstrual discharge. In another study, İsci *et al*. [11] and Paul *et al*. [12] reported the presence of endometriosis in previous cesarean incision scars; it is possible that the iatrogenic endometrial implantation theory could be responsible for such findings [13]. In one of our cases, laparoscopy showed a small endometriotic mass (approximately 0.5 cm) on the left side of the cesarean scar in the cesarean section defect (Fig. 7). Our own clinical experience, and the iatrogenic endometrial implantation theory, supports the fact that endometriosis may be related to the formation of CSDs. It is possible that the development of CSD symptoms may also be related to the number of cesarean deliveries and the size of the defect [14].

Oral contraceptives may temporarily improve the symptoms of CSD [15]. However, many patients cannot accept these medications, due to the increased risk of deep vein thrombosis and the long-term nature of the treatment. The surgical methods to treat CSD include hysteroscopic surgery, laparotomy, transvaginal defection repair, and hysterectomy [16]. Mashiach R *et al*. [17] showed the success rates for treating postmenstrual uterine bleeding are comparable, with a slight edge in favor of laparoscopic over hysteroscopic surgery (78%–94% *versus* 60%–100%). Complete hysterectomy is a complete cure for patients who do not wish to have children. However, most of the individuals with uterine scar defects are still in child-bearing age; this limits the use of complete hysterectomy. The hysteroscopic approach has also been used to treat cesarean section scar abnormalities [18]. Under hysteroscopy, the defect site can be identified directly; this procedure involves removal of the fibrotic tissue in the inferior and superior edges of the pouch using a cutting loop and restoration to the continuity of the endometrium. The objective of resection is to facilitate menstrual discharge and reduce the accumulation of blood in the cervix [19,20]; Wang *et al*. [21] showed about 59.6% to 100% of patients become asymptomatic after surgery, therefore, we considered hysteroscopic surgery is effective in reduce postmenstrual uterine bleeding. However, the weakness associated with the defect cannot be corrected by hysteroscopy, and the myometrial thickness in the defect site can be reduced further. Furthermore, the resection technique would increase the potential risk of uterine rupture during a subsequent pregnancy [9].

In the light of these findings, we used the laparoscopic surgical approach for the simultaneous removal and repair of defects. The common shape of these defects has been described as semicircular, triangular, droplet-shaped, and can sometimes include cysts [22]. CSD does not only exist in the anterior wall, but can also be exist in the lateral wall, and even extend to the posterior wall; in these cases, it is difficult to remove the defect in a delicate manner. Under hysteroscopic and SIS vision, it is possible to better assess the location and specific shape of the defect and thus minimize the possibility of the neglect correction of the scar defections (Fig. 8).

Suturing technique is very important when correcting CSD. The traditional suture method involves interrupted suturing to close the edges of the incision. However, the increased time required for suturing and confusion between stitches during surgery might lead to a longer operation time. In the current study, we pioneered the use of a continuous suture to close the incision. This method has two major advantages. Firstly, the technique is simpler to perform and avoids the need to tie multiple knots, thus saving time. Secondly, this technique allows us to completely close the whole myometrium layer at the incision site.

After surgery, the mean thinnest residual myometrium in Group A and B had increased significantly when compared with pre-surgical values ($p < 0.001$ respectively). In total, 58 (90.63%) patients in Group A, and 57 (91.94%) patients in Group B, showed improvements in prolonged spotting after surgery. This result is similar to previous studies in which 89.80% and 94% showed an improvement of their symptoms improvement following laparoscopic repair with hysteroscopy [23,24]. We intended to use titanium clips to reduce blood loss during the laparoscopic management of CSD. In our trial group, the operation lasted only 84.45 min on average, and the amount of blood loss during surgery did not exceed 60 mL; these values showed a significant reduction compared to those in the control group ($p < 0.001$). In the trial group, transient bilateral uterine artery occlusion was sufficient to ensure clear visualization and safe surgery and was carried out in a similar operation time (84.45 $\pm$ 16.65 min in Group A and 86.31 $\pm$ 16.75 min in Group B, $p = 0.535$). From these results, we can conclude that temporary occlusion combined with vasopressin injection appears to be a more appropriate surgical treatment for all patients. Thus far, Shao *et al*. [25] and Ji *et al*. [8] have not reported any injuries to the uterine artery when using these clips. The average duration of menstruation was 6.92 $\pm$ 2.16 and 7.16 $\pm$ 2.25 days for Groups A and B, respectively; these durations were significantly shorter at final follow-up than pre-surgery ($p < 0.001$, respectively).

It is important to note that 11 of the 126 patients with partial symptoms did not show any improvement after surgery (6 patients in Group A and 5 patients in Group B). After SIS, 4 of these patients still had a defect, although the size of the defect was smaller than before surgery. A second round of surgery was proposed to these patients due to the poor prospects of surgical repair; one patient requested hysterectomy as a definitive treatment. Another 10 patients wished to alleviate their symptoms by hormonal therapy. These 10 patients are still being followed up. The reasons for failure to achieve improvement in clinical symptoms may be that the surgeon was unable to completely repair the defect, especially on the uterine lateral side, a problem with suturing, because of the patient's wound healing ability, or some unknown factors. Further research is now needed to investigate the specific pathological changes associated with CSD.

5. Conclusions

CSD may be associated with reproductive and gynecological consequences. The technique we developed in our study for the repair of CSD combined laparoscopic repair with hysteroscopic diagnosis using a minimally invasive approach. Transient bilateral uterine artery occlusion with titanium clips, combined with vasopressin injection, is a highly effective method for controlling massive hemorrhage. The accurate and complete removal of cesarean section scars, and delicate suturing, are the keys to success.

Availability of Data and Materials

The datasets generated and/or analyzed during the current study are not publicly available due to further research is needed in the future, but datasets are available from the corresponding author on reasonable request.

Author Contributions

MH and FT designed the research study. MH, FT and MS performed the research. LJi and LJin analyzed the data. All authors contributed to editorial changes in the manuscript. All authors read and approved the final manuscript. All authors have participated sufficiently in the work and agreed to be accountable for all aspects of the work.

Ethics Approval and Consent to Participate

The study was approved by the Ethics Committee of Jinhua Hospital Zhejiang University School of Medicine (ethics approval No.2017-53) and informed written consent was provided by all patients.

Acknowledgment

Thanks are due to Dongge Wang for valuable discussion.

Funding

This research received no external funding.

Conflict of Interest

The authors declare no conflict of interest.

References

[1] Peng FS, Lin HM, Lin HH, Tu FC, Hsiao CF, Hsiao SM. Impact of clinical audits on cesarean section rate. Taiwanese Journal of Obstetrics and Gynecology. 2016; 55: 530–533.

[2] Betrán AP, Ye J, Moller AB, Zhang J, Gülmezoglu AM, Torloni MR. The increasing trend in caesarean section rates: global, regional and national estimates: 1990–2014. PLoS ONE. 2016; 11: e0148343.

[3] Pomorski M, Fuchs T, Rosner-Tenerowicz A, Zimmer M. Standardized ultrasonographic approach for the assessment of risk factors of incomplete healing of the cesarean section scar in the uterus. European Journal of Obstetrics and Gynecology and Reproductive Biology. 2016; 205: 141–145.

[4] Thurmond AS, Harvey WJ, Smith SA. Cesarean section scar as a cause of abnormal vaginal bleeding: diagnosis by sonohysterography. Journal of Ultrasound in Medicine. 1999; 18: 13–16.

[5] Riess ML, Ulrichs JG, Pagel PS, Woehlck HJ. Severe Vasospasm Mimics Hypotension after High-Dose Intrauterine Vasopressin. Anesthesia and Analgesia. 2011; 113: 1103–1105.

[6] Shapira M, Mashiach R, Meller N, Watad H, Baron A, Bouaziz J, *et al*. Clinical Success Rate of Extensive Hysteroscopic Cesarean Scar Defect Excision and Correlation to Histologic Findings. Journal of Minimally Invasive Gynecology. 2020; 27: 129–134.

[7] Bij de Vaate AJM, Brölmann HAM, Van Der Voet LF, Van Der Slikke JW, Veersema S, Huirne JAF. Ultrasound evaluation of the Cesarean scar: relation between a niche and postmenstrual spotting. Ultrasound in Obstetrics & Gynecology. 2011; 37: 93–99.

[8] Ji L, Jin L, Hu M. Laparoscopic myomectomy with temporary bilateral uterine artery occlusion compared with traditional surgery for uterine myomas: Blood loss and recurrence. Journal of Minimally Invasive Gynecology. 2018; 25: 434–439.

[9] Antila-Långsjö RM, Mäenpää JU, Huhtala HS, Tomás EI, Staff SM. Cesarean scar defect: a prospective study on risk factors. American Journal of Obstetrics and Gynecology. 2018; 219: 458.e1–458.e8.

[10] Zhou X, Yang X, Chen H, Fang X, Wang X. Obstetrical outcomes after vaginal repair of caesarean scar diverticula in reproductive-aged women. BMC Pregnancy and Childbirth. 2018; 18: 407.

[11] İsci H, Gonenc G, Yigiter AB, Guducu N, Dünder D. Intrauterine endometriotic cyst at the site of previous cesarean scar; scar endometriosis. Clinical and Experimental Obstetrics and Gynecology. 2015; 42: 106–107.

[12] Paul PG, Bulusu S, Radhika KT, Shintre H, Paul G. A Rare Case of Cesarean Scar Endometriosis. Journal of Minimally Invasive Gynecology. 2017; 24: 889–890.

[13] Seki A, Maeshima A, Nakagawa H, Shiraishi J, Murata Y, Arai H, *et al*. A subserosal uterus-like mass presenting after a sliding hernia of the ovary and endometriosis: a rare entity with a discussion of the histogenesis. Fertility and Sterility. 2011; 95: 1788.e15–1788.e19.

[14] Xu R, Xia X, Liu Y, Du X, Hao Z, Wang L, *et al*. A case report of an endometriosis cyst at cesarean scar defect and review of literature. BMC Pregnancy and Childbirth. 2022; 22: 954.

[15] Setubal A, Alves J, Osório F, Guerra A, Fernandes R, Albornoz J, *et al*. Treatment for Uterine Isthmocele, a Pouchlike Defect at the Site of a Cesarean Section Scar. Journal of Minimally Invasive Gynecology. 2018; 25: 38–46.

[16] Glenn TL, Han E. Cesarean scar defect: far from understood. Fertility and Sterility. 2021; 116: 369–370.

[17] Mashiach R, Burke YZ. Optimal Isthmocele Management: Hysteroscopic, Laparoscopic, or Combination. Journal of Minimally Invasive Gynecology. 2021; 28: 565–574.

[18] Zeller A, Villette C, Fernandez H, Capmas P. Is Hysteroscopy a Good Option to Manage Severe Cesarean Scar Defect? Journal of Minimally Invasive Gynecology. 2021; 28: 1397–1402.

[19] Tsuji S, Kimura F, Yamanaka A, Hanada T, Hirata K, Takebayashi A, *et al*. Impact of hysteroscopic surgery for isthmocele associated with cesarean scar syndrome. Journal of Obstetrics and Gynaecology Research. 2018; 44: 43–48.

[20] Vervoort A, van der Voet L, Hehenkamp W, Thurkow A, van Kesteren P, Quartero H, *et al*. Hysteroscopic resection of a uterine caesarean scar defect (niche) in women with postmenstrual spotting: a randomised controlled trial. BJOG: an International Journal of Obstetrics and Gynaecology. 2018; 125: 326–334.

[21] Wang C, Huang H, Chao A, Lin Y, Pan Y, Horng S. Challenges in the transvaginal management of abnormal uterine bleeding secondary to cesarean section scar defect. European Journal of Obstetrics and Gynecology and Reproductive Biology. 2011; 154: 218–222.

[22] Bij de Vaate AJM, Brölmann HAM, van der Slikke JW, Emanuel MH, Huirne JAF. Gel instillation sonohysterography (GIS) and saline contrast sonohysterography (SCSH): comparison of two diagnostic techniques. Ultrasound in Obstetrics and Gynecology. 2010; 35: 486–489.

[23] Liu S, Lv W, Li W. Laparoscopic repair with hysteroscopy of cesarean scar diverticulum. Journal of Obstetrics and Gynaecology Research. 2016; 42: 1719–1723.

[24] Li C, Guo Y, Liu Y, Cheng J, Zhang W. Hysteroscopic and laparoscopic management of uterine defects on previous cesarean delivery scars. Journal of Perinatal Medicine. 2014; 42: 363–370.

[25] Shao M, Hu M, Hu M. Temporary Bilateral Uterine Artery Occlusion Combined with Vasopressin in Control of Hemorrhage during Laparoscopic Management of Cesarean Scar Pregnancies. Journal of Minimally Invasive Gynecology. 2013; 20: 205–208.