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Discussion on Treatment Modalities for Cesarean Scar Defect

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Abstract: The incidence of post-cesarean scar defect(PCSD) after cesarean section is increasing annually,which is significantly impacting patients' quality of life. This study analyzed clinical data from 156 patients with PCSD, divided into three groups based on treatment modality: Group A (hysteroscopic surgery, n=47), Group B (laparoscopic surgery, n=57), and Group C (LNG-IUS, n=52). The primary outcomes compared were post-treatment duration of postmenstrual spotting, treatment costs, and intraoperative blood loss. The results showed total effective rates of 68.08%, 78.95%, and 94.23% for Groups A, B, and C, respectively. Group A demonstrated advantages over Group B, including reduced blood loss, lower hospitalization costs, and shorter operative time. In conclusion, the choice of treatment modality should be individualized based on factors such as fertility requirements, residual myometrial thickness at the scar site, and diverticulum dimensions.

1. Introduction

A Previous Cesarean Scar defect, also known as Post-Cesarean Scar Defect (PCSD), refers to iatrogenic thinning of the myometrium at the site of hysterotomy. This leads to the formation of a depression or pouch-like structure connected to the uterine cavity, which can manifest in various clinical symptoms[1]. Over recent decades, the cesarean section rate has gradually increased worldwide, far exceeding the 10-15% recommended by the World Health Organization. In China, the cesarean section rate rose from 3% in 1988 to 34.9% in 2014, with some provinces peaking at 62.5%. The number of patients with PCSD increases by 3 million annually, at least one-third of which are attributed to non-indicated cesarean sections[2-4]. Furthermore,China's fertility policies has led to a simultaneous rise in both primary cesarean sections and multiple repeat cesarean sections. The etiology of PCSD remains multifactorial and not fully elucidated; it may be related to factors such as the location of the incision, the uterine suturing technique, the number of cesarean sections, and comorbidities, including postoperative infection, anemia, obesity and gestational diabetes[5].

The incidence of PCSD varies widely in the literature, ranging from 19.4% to 88%[1]. 70% of PCSD cases are asymptomatic.The common clinical symptoms include abnormal uterine bleeding, dysmenorrhea, chronic pelvic pain, and infertility. Abnormal uterine bleeding (AUB) is the most

prevalent symptom, ranging from 28.9% to 82%[6],which is impacting patients' quality of life. Studies by Tulandi demonstrated that 75% of PCSD patients experience abnormal uterine bleeding, which can manifest as postmenstrual spotting or intermenstrual bleeding[7].

The diagnosis of PCSD relies on the medical history, clinical symptoms and examinations, including transvaginal ultrasound (TVUS), hysterosalpingography (HSG), magnetic resonance imaging (MRI), and hysteroscopy. Among these, TVUS is the most economical, convenient, and non-invasive method, demonstrating a sensitivity of 56% and a specificity of 73.4%[8]. TVUS enables the precise measurement of the length and depth of the diverticulum, the thickness of remaining muscular layer (TRM),and the thickness of the adjacent myometrium. TRM is considered the most critical measurement parameter for evaluating PCSD, which can predicate the clinical decision.

Treatments for PCSD comprise medical and surgical therapy. Medical therapy primarily utilizes combined oral contraceptives and the levonorgestrel-releasing intrauterine system (LNG-IUS). Surgical therapy principally include laparoscopic, transvaginal, and hysteroscopic surgery. Additionally, the treatments such as traditional Chinese medicine, stem cell transplantation, laparotomy and robot-assisted laparoscopic surgery have been described. However, a unified standard for the optimal treatment method remains elusive. This article primarily evaluates the efficacy of three treatments—hysteroscopic , laparoscopic surgery, and LNG-IUS—in reducing the duration of postmenstrual spotting. Furthermore, it compares the clinical outcomes and economics, providing a choice for selecting suitable treatment plans for PCSD patients.

2. Methods

2.1 Patients

Patients(n=156) with PCSD treated at the Affiliated Hospital of Hebei University from 2019 to 2022 were retrospectively recruited to our study. Based on the treatments, patients were divided into three groups:

Group A: Hysteroscopic surgery group(n=47)

Group B: Laparoscopic surgery group(n=57)

Group C: LNG-IUS group(n=52)

2.2 Inclusion Criteria

The overall inclusion criteria as follows: (1) At least one cesarean section and no history of other myometrial surgery; (2) A history of regular menses before the cesarean section, followed by the development of postmenstrual spotting; (3) A definitive diagnosis of PCSD based on TVUS or hysteroscopy; (4) Absence of other etiologies for postmenstrual spotting, including endometrial hyperplasia, endometrial polyps, submucous myomas, pregnancy or coagulation disorders; (5) Age between 20 and 40 years old.

Group Criteria:

Group A: Patients who failed medical treatment, or with TRM ≥3 mm who requested hysteroscopic surgery.

Group B: Patients with a strong desire for fertility and TRM <3mm.

Group C: Patients without contraindications to medical treatment, fertility desire and refused surgery.

2.3 Treatment Methods

Group A: Patients in Group A underwent hysteroscopic electroresection under ultrasound guidance. The procedure involved resection of the edge of the diverticulum using a loop electrode and ablation to cauterize the endometrial tissue and congested blood vessels within the diverticulum niche using a rollerball electrode.

Group B: Patients in group B underwent laparoscopic repair of the uterine scar diverticulum.The procedure involved pushing away the peritoneal fold of bladder from the lower edge of the diverticulum, resction of the diverticulum tissue under hysteroscopic guidance,and closing the uterine incision with continuous full-thickness single-layer sutures using 2-0 absorbable material.

Group C: Patients in group treated by LNG-IUS (Bayer Inc,J20090144). LNG-IUS was placed on days 2 to 7 of the menstrual cycle.TVUS were performed at 1, 3, and 6 months post-placement to confirm the device's correct positioning.

2.4 Observation Indicators

The primary observation indicator of this study was the time of menstruation at the one-year post-treatment. Secondary observation indicators included total treatment costs and intraoperative blood loss. Menstruation lasting <7 days was defined as a cure; menstruation >7 days but shortened by >3 days compared to pre-treatment was defined as effective; cases not meeting these two criteria were defined as ineffective.

2.5 Statistical Analysis

Statistical analysis was performed with the software SPSS 24.0. Measurement data are expressed as the mean ± standard deviation ($x \pm s$). Comparisons between two groups were performed using the Student's t-test, while comparisons among multiple groups were performed using Bonferroni and Student-Newman-Keuls test. Comparisons of categorical data between groups were performed using the χ^2 test. $P < 0.05$ was considered statistically significant.

3. Results

3.1 General Characteristics

There were no significant differences in the age, the numbers of cesarean section, time of menstruation, TRM among the three groups. The parameters before the surgery are shown in Table 1.

Table 1: General Characteristics.

Variable	Group A	Group B	Group C	F	P
Number of patients	47	57	52	—	—
Age(years)	31.36±3.35	34.19±3.35	34.10±3.22	11.63	0.01
Number of cesarean sections	1.62±0.49	1.77±0.57	1.62±0.53	1.54	0.21
Time of menstruation(days)	12.64±2.41	13.16±2.23	12.31±2.29	1.88	0.15
TRM(cm)	0.43±0.12	0.17±0.08	0.38±0.19	53.07	0.01

3.2 Comparison of Treatment Efficacy

The time of shortened menstrual duration at 12 months post-treatment was compared, and the difference was statistically significant ($P < 0.05$). The total effective rates for the three groups were 68.08%, 78.95%, and 94.23%, respectively, as shown in Table 2.

Table 2: Comparison of Treatment Efficacy.

Variable	Group A	Group B	Group C	F	P
The time of shortened menstrual duration[1](day)	4.55±3.45	6.32±2.65	9.69±3.81	31.04	0.01
The total effective rates[2](%)	68.08%	78.95%	94.23%	—	—
The time of shortened menstrual duration =The time of menstrual duration before treatment - The time of menstrual duration after treatment.(1) The total effective rates =(Number of cured cases + Number of effective cases) / Number of patients of each group.(2)					

3.3 Comparison of Surgical Conditions between Group A and B

The intraoperative blood loss, operative time, and hospitalization costs were compared between Group A and B, and the differences were statistically significant ($P < 0.05$), as shown in Table 3.

Table 3: Comparison of Surgical Conditions.

Variable	Group A	Group B	F	P
Intraoperative blood loss (ml)	12.77±6.58	37.89±20.68	13.90	＜0.01
Operative time (min)	34.57±7.50	160.28±32.54	34.78	＜0.01
Hospitalization costs (CNY)	9377.81±795.37	15120.43±1721.06	8.01	＜0.01

4. Discussion

PCSD is a common long-term complication after cesarean section, and its incidence parallels the global rise in the cesarean delivery rate. Primary clinical symptoms include postmenstrual spotting or intermenstrual bleeding, which seriously impair the patient's quality of life. While the reasons of PCSD-related postmenstrual spotting remains multifactorial, current theories include: (1) The diverticulum acts as a pouch-like structure that delays menstrual blood. Due to the scar tissue's weak contractility in this area, the accumulated blood slowly drains, leading to prolonged postmenstrual spotting[9]. (2) New capillaries form in the diverticulum. Due to the lymphocytic infiltration and capillaries dilation, it lead to oozing of blood within the diverticulum. This accounts for 65% of PCSD cases[10.11]. (3) An imbalance in the expression of estrogen and progesterone receptors at the diverticulum site renders the endometrium less responsive to cyclical hormone changes, resulting in prolonging bleeding[12]. (4) Altered contraction patterns of the anterior uterine wall impede adequate menstrual blood outflow[13]. (5) Other factors include polyps, chronic inflammation, exposed suture material and localized endometriosis.

Treatments for PCSD include surgical and medical interventions. Hysteroscopic surgery improves symptoms by resecting the obstructive tissue flap of the diverticulum and electrocoagulating of the dilated capillaries and endometrial tissue within the diverticulum. Some studies suggest symptom improvement rates of 78.83% for PCSD by hysteroscopic surgery, with an

abnormal uterine bleeding improvement rate of 85.5% and a pregnancy rate of 69.77%[14,15]. In this study, the improvement rate for abnormal uterine bleeding after hysteroscopic surgery was approximately 68.08%, which is slightly lower than values reported in the literature. However, hysteroscopic surgery does not increase the myometrial thickness at the scar site. Therefore, it is contraindicated for patients with fertility desires and a TRM <3mm. The Chinese expert consensus recommends hysteroscopic surgery specifically for PCSD patients with a TRM ≥3mm[5]. Studies by Bujold et al demonstrate that TRM <2.3mm is an independent risk factor for uterine rupture during labor[16]. However, this measurement was taken at 35-38 weeks of gestation. Currently, there is a lack of research on the critical non-pregnant TRM thickness associated with uterine rupture in patients with PCSD during labor. Some studies have performed hysteroscopic surgery on patients with an TRM <3mm, reporting similar efficacy and complication rates compared to patients with a TRM ≥3mm[10,17,18]. However, These data lack large-sample studies.

The efficacy rate of transvaginal surgery for treating AUB can reach 80.65-90%[19,20], especially for women with concurrent pelvic organ prolapse. Transvaginal surgery is challenging due to limited exposure, requiring high surgical skill, and pelvic adhesions can further increase its difficulty. Given the limited number of transvaginal surgery cases at our hospital, these were excluded from the present comparative study. The efficacy rate of laparoscopic surgery can reach 90%[21]. Although some literature reports no significant difference in therapeutic outcomes between laparoscopy and transvaginal surgery[20], it is generally higher than hysteroscopic surgery. In this study, the efficacy rate of laparoscopic surgery was 78.95%, which is lower than values reported in other literature. Both laparoscopic and transvaginal surgeries can locate the scar site under guidance, such as fluorescence probes or standard probes. Intraoperative combination with hysteroscopy can improve surgical accuracy. Both traditional laparoscopic and transvaginal surgeries involve incising the uterus at the original scar site, removing the pathological tissue, and performing anatomical re-approximation. However, these procedures carry a risk of secondary impaired wound healing, potentially forming a new scar defect. Physiological maturation of the post-cesarean incision takes approximately 3 months, with complete recovery occurring around six months. The optimal tissue integrity for scar repair is observed at 2-4 years[22]. Therefore, it is recommended that patients wait at least 24 months after surgery before pregnancy, consistent with current guidelines following a primary cesarean delivery. The 2019 expert consensus proposed a plication suture technique for defect management. Under hysteroscopic transillumination guidance, the diverticulum site can be accurately located. The hysteroscope enables electrocoagulation of the endometrium and dilated vessels. Instead of excising the defective muscle layer, continuous plication sutures are applied directly. Since uterine integrity is not disrupted using this technique, pregnancy can be attempted as early as 6 months postoperatively[5]. In a comparative analysis of suture techniques for cesarean section in scarred uteri, the study group using continuous longitudinal plication sutures demonstrated a significantly thicker lower uterine segment myometrium at 6 months postpartum compared to the traditional suture group (3.83±0.26mm vs. 3.14±0.17mm). Furthermore, this approach resulted in a significantly lower rate of scar diverticulum formation at 1 year postpartum (1% vs. 8%)[23]. In another study of transvaginal plication surgery and traditional transvaginal surgery for PCSD, the plication suture group demonstrated significantly greater myometrial thickness in the lower uterine segment and a reduction in menstrual duration at 6 months postoperatively, compared to the traditional surgery group[24]. However, the difference was not statistically significant due to the small sample size. In this study, hysteroscopic surgery was significantly superior to laparoscopic surgery in terms of operative time, intraoperative blood loss, and hospitalization costs.

Medical treatment includes combined oral contraceptives (COCs) and LNG-IUS. Medical treatment offers advantages such as lower cost, avoidance of hospitalization and anesthesia, reduced

surgical morbidity, and greater safety. However, it does not improve myometrial thickness at the scar site. COCs work by raising endogenous estrogen and progesterone levels, promoting cyclical endometrial shedding, and improving symptoms of prolonged menstruation. Long-term and regular administration is required, which poses adherence challenges for patients, and the recurrence rate following discontinuation is notably high. Our hospital also treats patients with COCs; however, no standardized medication regimen has been established. In this study, over one-fourth of the patients experienced recurrence after discontinuing COCs. The LNG-IUS is a long-acting intrauterine system, primarily used to treat endometrial hyperplasia, adenomyosis, and menorrhagia. It works by continuously releasing levonorgestrel directly onto the endometrial tissue, thereby reducing the number of bleeding days and the volume of menstrual bleeding. Patient compliance is high. Research indicates that the therapeutic efficacy of the LNG-IUS is comparable to that of surgical intervention at 6 months of treatment. Furthermore, it surpasses surgical methods in reducing the duration of vaginal bleeding at twelve months, irrespective of TRM[25].In another study, LNG-IUS efficacy was comparable to COCs at 3 months but significantly superior at 6 months, with a total effective rate of 96%[26]. This is similar to the 94.23% found in this study. Most of patients experienced amenorrhea, while a small number of patients had significantly reduced menstrual flow in this study. Among the ineffective cases, two patients experienced amenorrhea after 6 months of LNG-IUS treatment but developed prolonged spotting again after 18 months.

5. Conclusion

The choice of treatment for PCSD should be individualized based on the patient's fertility desires and treatment goals. For patients without fertility desires, conservative treatment with LNG-IUS can be the first choice regardless of myometrial thickness at the scar site. For patients who fail medical treatment or have fertility desires, surgical treatment should be considered. Hysteroscopic surgery offers benefits in reducing blood loss, hospitalization costs, and operative time; however, it does not increase myometrial thickness. Some study suggest that hysteroscopic surgery is safe for TRM >2.2mm, but this remains unsupported by large-scale clinical data[27]. The 2019 Chinese expert consensus recommends hysteroscopic surgery for TRM ≥3mm, which is the preferred option for patients without fertility desires. Both transvaginal and laparoscopic surgery can increase myometrial thickness, improve clinical symptoms and infertility. Still, they do not significantly affect complications during pregnancy such as placenta accreta, adhesions, or uterine rupture[28]. Transvaginal surgery demonstrates superiority over laparoscopic surgery concerning blood loss, hospitalization costs, and operative time[29]. The selection of surgical approach should be contingent upon the surgeon's expertise and the extent of pelvic adhesions. For patients with urgent fertility considerations or those of advanced maternal age, transvaginal or laparoscopic plication surgery may be viable options.

The primary prerequisite for reducing the incidence of PCSD is lowering the cesarean section rate. Cesarean section is an essential treatment for resolving dystocia and saving mothers and newborns. Therefore, it is crucial to strictly adhere to the indications for cesarean section, optimize suturing techniques, select appropriate incision sites, and choose proper antibiotics to prevent perinatal infections[30-32]. For patients with PCSD who exhibit clinical symptoms and have no contraindications, medical treatment may be considered. For patients with fertility desires and medical treatment had failed, surgical intervention may be pursued.

References

[1] Tower A.M., Frishman G.N. Cesarean scar defects: an underrecognized cause of abnormal uterine bleeding and other gynecologic complications. J Minim Invasive Gynecol. 2013. 20(5): 562-572.

[2] Pan H., Zeng M., Xu T. The prevalence and risk predictors of cesarean scar defect at 6 weeks postpartum in Shanghai, China: A prospective cohort study. Acta Obstet Gynecol Scand. 2019. 98(4): 413-422.
[3] Li H.T., Luo S.L.,Leo T. Geographic variations and temporal trends in cesarean delivery rates in China,2008-2014. JAMA.2017. 317(1): 69-76.
[4] Feng X.L., Xu L., Guo Y. Socioeconomic inequalities in hospital births in China between 1988 and 2008. Bull World Health Organ. 2011. 89(6): 432-441.
[5] Family Planning Branch of Chinese Medical Association. Expert guideline for diagnosis and treatment of PCSD. Chinese Journal of Obstetrics and Gynecology. 2019. 54(3): 145-148.
[6] Glenn T.L., Han E. Cesarean scar defect: far from understood. Fertil Steril. 2021. 116(2): 369-370.
[7] Tulandi T., Cohen A. Emerging Manifestations of Cesarean Scar Defect in Reproductive-aged Women. J Minim Invasive Gynecol. 2016. 23(6): 893-902.
[8] Vaate A., Brlmann H., Voet L. Ultrasound evaluation of the Cesarean scar: relation between a niche and postmenstrual spotting. Ultrasound Obstetrics and Gynecology. 2011. 37(1).
[9] Naimi A., Wolnicki B., Mouzakiti N. Anatomy of the sonographic post-cesarean uterus. Arch Gynecol Obstet. 2021. 304(6): 1485-1491.
[10] Zou J.M., Luo S.Y., Ye L.J. Clinical observation f trimming lower uterine segment scar combined with Gongkangning for preventing PCSD in second cesarean section in scarred uterus. Medicine Theory and Practice. 2022. 35(23): 4053-4055.
[11] Morris, Hugh. Surgical Pathology of the Lower Uterine Segment Caesarean Section Scar. INTERNATIONAL JOURNAL OF GYNECOLOGICAL PATHOLOGY. 1995. 14(1): 16-20.
[12] Xin L., Lin X., Pan Y. A collagen scaffold loaded with human umbilical cord-derived mesenchymal stem cells facilitates endometrial regeneration and restores fertility. Acta Biomater. 2019. 92: 160-171.
[13] Jordans I., Vissers J., Huang Y. Increased amplitude of subendometrial contractions identified by ultrasound speckle tracking in women with a caesarean scar defect. Reprod Biomed Online. 2023. 46(3): 577-587.
[14] Mutairi B., Alrumaih I. Hysteroscopy in the Treatment of Myometrial Scar Defect (Diverticulum) Following Cesarean Section Delivery: A Systematic Review and Meta-Analysis. Cureus. 2020. 12(11).
[15] Iannone P. Isthmocele:from risk factors to management. Rev Bras Ginecol Obstet. 2019. 41(1): 44-52.
[16] Bujold E., Jastrow N., Simoneau J. Prediction of complete uterine rupture by sonographic evaluation of the lower uterine segment. Am J Obstet Gynecol. 2009. 201(3): 320.e1-6.
[17] Fan R., Deng S. Analysis of the Efficacy of Hysteroscopic Treatment for Cesarean Section Scar Defect. Journal of Reproductive Medicine.2019. 28(8): 866-871.
[18] Tsuji S., Takahashi A., Higuchi A. Pregnancy outcomes after hysteroscopic surgery in women with cesarean scar syndrome. PLoS One. 2020. 15(12): e0243421.
[19] Niu G., Luo L., He K. Transvaginal resection of uterine scar divericulum after cesarean section: a clinical analysis of 34 cases . Chinese Journal of Practical Obstetrics and Gynecology. 2012. 28(03): 209-211.
[20] You J.J., Huang Y.J., Zhao W.X.l. Analysis of the Efficacy of Hysteroscopic Surgery versus Combined Hysteroscopic and Laparoscopic Surgery in the Treatment of Cesarean Scar Diverticulum. Journal of Zunyi Medical University.2022. (02):352-358.
[21] Zhang N.N., Wang G.W., Yang Q. Analysis of Clinical Treatment for 52 Cases of Cesarean Scar Diverticulum. Journal of Reproductive Medicine. 2017. 26(04): 331-335.
[22] Yu H., Huang Y.J., Wang Y.J. Analysis of the Preventive Effect of Previous Uterine Scar Trimming on Cesarean Scar Diverticulum in Second Cesarean Section. Chinese Journal of Maternal and Child Health Care. 2020. 35(11): 2115-2117.
[23] Liu L.M., Li Z.M. Analysis of the Efficacy of Continuous Folded Suturing of the Lower Uterine Segment in Reinforcing the Absence of Myometrium at the Uterine Scar. Journal of Modern Medicine and Health. 2023. 7(10): 66-68.
[24] Wu X.X., Zhu R., Wei Z.L. Analysis of the Efficacy of Hysteroscopy Combined with Transvaginal Folded Suturing in the Treatment of Cesarean Scar Diverticulum. Current Progress in Obstetric and Gynecology. 2023. 32(02): 113-117.
[25] Xiao J.L, Zhang W.Y., Zhang M. Treatment Modalities and Outcomes of Cesarean Scar Diverticulum.Journal of Wuhan Medical University.2023.44(3):324-334.
[26] Hu Z.H., Guo H.J. Efficacy of Mirena in the Treatment of Abnormal Uterine Bleeding Induced by Cesarean Scar Diverticulum. Journal of Practical Obstetrics and Gynecology. 2022. 9(31): 30-33.
[27] Zhu Q., He X., Jiang L. Effectiveness of hysteroscopic resection of a uterine caesarean niche can be predicted: a prospective cohort study. Sci Rep. 2020. 10(1): 17424.
[28] Cheng X.Y., Cheng L., Li W.J. The effect of surgery on subsequent pregnancy outcomes among patients with cesarean scar diverticulum. Int J Gynaecol Obstet. 2018. 141(2): 212-216.
[29] Zhang Y. A Comparative Study of Transvaginal Repair and Laparoscopic Repair in the Management of Patients With Previous Cesarean Scar Defect. Journal of Minimally Invasive Gynecology. 2016: 535-541.

[30] Osser O.V., Valentin L. Risk factors for incomplete healing of the uterine incision after caesarean section: General obstetrics. BJOG An International Journal of Obstetrics & Gynaecology. 2010. 117(9): 1119-1126.
[31] Vikhareva O., Rickle G.S., Lavesson T,et al. Hysterotomy level at Cesarean section and occurrence of large scar defects: a randomized single-blind trial. Ultrasound Obstet Gynecol. 2019. 53(4): 438-442.
[32] Huang D., Chen S., Cai Y. Adjunctive azithromycin prophylaxis protects women from uterine cesarean scar defect: A randomized controlled trial. Acta Obstet Gynecol Scand. 2022. 101(8): 889-900.