Original Article
Indicator analysis of hysteroscope electrotomy for previous cesarean scar defect

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Abstract: Objective: The aim of this study is to evaluate if transvaginal ultrasonography is an accurate diagnosis method for previous cesarean scar defect (PCSD) and to analyze the indicators of the PCSD patients suitable for undergoing hysteroscope electrotomy treatment. Methods: 25 patients with PCSD related clinical symptoms were selected for this study. The patients were first undergone transvaginal ultrasonography for the diagnosis of PCSD and then confirmed by hysteroscopy. All the patients received hysteroscope electrotomy treatment, and were followed up for 24 months, then the therapeutic efficacy of hysteroscopy electrotomy and the indicators of PCSD patients potentially affecting the outcomes were analyzed. Results: The accuracy of transvaginal ultrasound diagnosis for PCSD was 88%. The overall effective rate of hysteroscopy electrotomy for PCSD was 60%. Compared to the overall effective rate, hysteroscopy electrotomy had a significantly higher effective rate in the patients with single cesarean section (83.3%), or anteverted uterus position (90.9%); in contrast, hysteroscopy electrotomy had a significantly lower effective rate in the patients with multiple cesarean section (38.5%), or retroverted uterus position (35.7%), or with multiple cesarean section plus retroverted uterus position (28.6%). Conclusion: Hysteroscopy electrotomy is an effective treatment for PCSD patients with single cesarean history and anteverted uterus position.

Keywords: Previous cesarean scar defection, transvaginal ultrasonography, hysteroscope electrotomy, repeated cesarean section, retroverted uterus

Introduction

With the advance of obstetric technology, especially due to the introduction of cesarean section operation, the patients with high-risk pregnancy and labour dystocia have now been well managed. However there are some long-term complications observed in the patients with caesarean history. One of the significant complications is previous cesarean scar defect (PCSD). PCSD refers to the diverticulum resulted from the canal between previous lower uterine segment and uterine cavity [1]. Some effort had been focused on its influences on obstetrics, such as low implantation of placenta, uterine rupture. In addition, the effects of PCSD on gynaecology have also attracted attentions from the clinicians, as it can cause the accumulation of blood in the diverticulum, leading to prolonged period, vaginal bleeding between periods and after sexual intercourse, and even

infertility. Therefore, searching for a simple while minimally invasive diagnosis and treatment approach is of great importance to improve the life quality of the patients.

There is no gold standard for the diagnosis of PCSD yet, although most scholars believe that hysteroscopy can make a definite diagnosis of PCSD, because it can directly allow doctors to visualize the location and size of the incisional defect if there is obsolete blood deposition and local endometrial vascular conditions [2-4]. However, the means of hysteroscopy has its innate drawbacks, including high cost, invasive procedure and high risk for infection, and incapability of measuring the residual myometrial thickness. Other diagnostic methods include magnetic resonance imaging, hysterosalpingography (HSG) and saline infusion sonohysterography (SIS). But all the methods above also have their own limitations, such that HSG
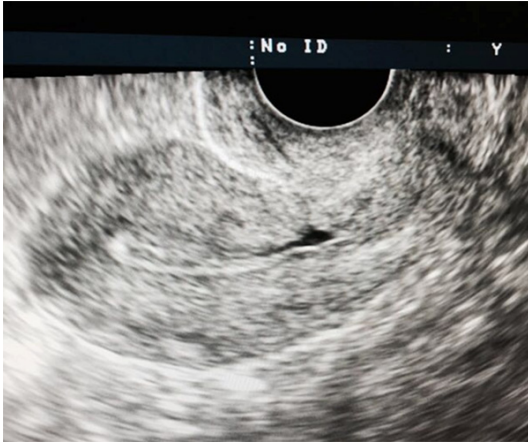
Figure 1. Hypoechoic image from transvaginal ultrasonography. Arrow: the presumed site of previous cesarean defect scar.

and the SIS are not able to measure residual thickness of the muscular layer of the uterus, and MRI is too costly. These methods, therefore, can't be routinely used for the diagnosis of PCSD. In comparison to the methods discussed above, transvaginal ultrasonography is relatively easy, less-costly, less invasive but highly repeatable method for the diagnosis of PCSD, as it can directly approach uterus and cervix, enabling doctor to clearly visualize the incision region of the lower uterine segment [5]. Therefore, transvaginal ultrasonography now has been regarded as a preferred diagnosis method for PCSD.

The treatments for PCSD include conservative treatments and surgical procedures. The conservative treatment involves giving oral contraceptives to temporarily improve relevant symptoms, but the side effects of the conservative treatment were revealed by several studies [6] and it is now replaced by surgical intervention, especially by hysteroscopy electrotomy, which had been reported as an excellent management method for PCSD patients [7-9]. However, seldom studies have looked into how the effectiveness of hysteroscopy electrotomy is related to the characteristics of the patients such as cesarean history and uterine position. The aim of this study was to evaluate if tranvaginal ultrasonography is accurate enough for the diagnosis of PCSD, and also gain more insight into if the treatment outcome of hysteroscopy electrotomy was related to the characteristics (cesarean history and position of uterine) of patients, so as to provide evidence and guid-

ance for the surgeons to select the suitable PCSD patients undergoing hysteroscopy electrotomy.

Materials and methods

Patient information

Twenty-five PCSD patients undergone hysteroscope electrotomy from 2011 to 2014 were reviewed retrospectively. All the procedures were performed by three experienced specialists in Xiamen First Hospital, Fujian province, China. The study was approved by the Human Ethics Committee at Xiamen First Hospital, and the written informed consents were obtained from the patients. The patients' age was between 27 and 39 years old with an average age of 35.8 years; they had an average of 3.2 times (1-5) of pregnancy. All of the cases had uterine lower segment transverse incision cesarean, and thirteen of them had more than two times of cesarean history (47.6%). The symptoms include extended period, increased menstrual flow, lumbar-sacral pain before menstruation, and bleeding after intercourse. All the selected patients didn't have pregnancy intention in the next few years, and have no morbidities of gynaecological malignancy, endometrial hyperplasia anomalies and intrauterine contraceptive devices, and polyps. The myometrial thickness in all the patients was larger than 2.5 mm at the defection site.

Patient diagnosis

Cervical liquid-based cytology was used to exclude the cases with any cervical morbidity, and then transvaginal ultrasound was employed to examine the patients at day 8 after menstruation. In brief, transvaginal ultrasound transducer (4.0-9.0 HMz, GE LOGIC E9) was applied to the vagina and had longitudinal, transverse and multi-angle section scan, to clearly show the uterus and double attachment area. Special attention was directed to the abnormalities in the lower part of the uterus. If there were abnormalities, the echo patterns were recorded and the echo area and the distance from the top to the serosal layer were measured. The patients were diagnosed with PCSD if the lower incision segment of anterior uterine had a continuous surface membrane layer, but a discontinuous muscular layer with "breakage phenomena"; no
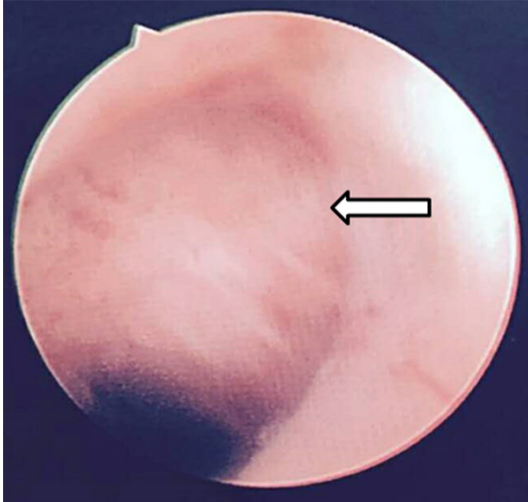
Figure 2. Hysterosopic image of a previous cesarean defect scar. Arrow: Diverticulum was showed with an arched vault defect size.

echo found within the uterine muscle wall; and one end embedded in the muscle and one end interlinked intrauterine, like "Y" shape; and wedge or cystic echo-free zone formed near the cervix (Figure 1).

After the ultrasound examination, patients were further undergone hysteroscopy examination (Japan OlympusC4000) for confirmed diagnosis. Diverticulum under hysteroscopy was showed with an arched vault defect size. The membranes at defect sites were often accompanied by local angiogenesis and polyp formation, even visibility of blood clot (Figure 2).

Treatments

All the patients were received hormone therapy before the surgery was considered, but no patients showed significantly improved symptoms after receiving the hormone therapy. Thus all 25 patients were selected for surgical intervention. Briefly, misoprostol (600 mg) was placed at the posterior fornix of the vagina to soften the cervix at the night before the surgery. The patients were intravenously anesthetized by giving propofol, and antibiotics were used 30 mins before the operation. After routine sterile drape, the cervix was dilated with the expanded fluid of 5% Dextrose. The expanding pressure was 140 mmHg, and flow rate was 260 ml/min, and Cutting power was 40-45 W. The low part of diverticulum and scar tissue on two side margins, as well as diverticulum polyps were resected under the direction of

abdominal ultrasound. Spherical electrode was used to flocculate diverticulum and the expansion of the blood vessels. The specimens were undergone pathological examination. All 25 patients had no complications after surgery and would be discharged after 1-2 days of operation.

Follow-up

Follow-up was performed by the means of telephone and visiting out-patient department at the time of 1 month, 3 months, 6 months, 12 months and 24 months after discharge. The follow-up contents were the patients' previous complains (the time of first menstrual period after operation, menstrual duration, vaginal bleeding between period, bleeding after intercourse, backache and dysmenorrhea, 100% follow-up rate). At the time of 24 months, all the patients were undergone hysteroscopy examination to examine if there were any morphological changes or other complication occurred.

Treatment efficacy evaluation

The treatment efficacy was classified as followings: (1) Cure: shortened menstrual period (less than 7 days), no bleeding after intercourse, reduced menstruation volume, and improved lumbar-sacral pain before menstruation; (2) Improving: shortened menstrual period (still more than 7 days but at least two days less than that of pre-treatment), no bleeding after intercourse, reduced menstruation volume and; (3) Stationary: No significant change in menstrual period or less than two days of shortened period, existing vaginal bleeding after intercourse, no significant change in menstruation volume; (4) Recurring: the symptoms occurred after 6 months of the operation even they were cured or improved in 3 months following the operation. The evaluations of Cure and Improving were defined as "effective" while Stationary and Recurring were defined as "not effective". It was notable that it was also regarded as "effective" if the hormone therapy became effective after the surgery even the surgery itself did not significantly improve the symptoms of patients.

Statistical methods

All data were processed by SPSS 21. The effective rates of hysteroscope electrotomy for PCSD in the groups divided by the factors of cesarean

Table 1. The comparisons of effective rate of hysteroscope electrotomy for PCSD patients with different cesarean history and uterus position

Variable (N)	Hysteroscope electrotomy effectiveness		Effective rate (%)	P value
	Effective	Ineffective		
Overall (25)	15	10	60	n/a
Cesarean history = 1 (12)	10	2	83.3	< 0.05
Cesarean history ≥ 1 (13)	5	8	38.5	< 0.05
Anteverted uterus (11)	10	1	90.9	< 0.05
Retroverted uterus (14)	5	9	35.7	< 0.05
Cesarean history > 1 + Retroverted uterus (7)	2	5	28.6	< 0.05

history and/or uterus position were compared to overall rate of all subjects by Chi-square and *P* value less than 0.05 was considered as significant.

Results

Diagnosis of PCSD by transvaginal ultrasound

Among the 25 cases selected, 22 patients were diagnosed as PCSD by transvaginal ultrasound with a correct detection rate of 88%. Under hysteroscopy, there was diverticulum formed by incisional scar cavity at the uterine isthmus, and the capillaries were visible on the surface of the endometrium, and the small hyperplastic polyp was seen in some diverticula. Histological examination revealed that the sectioned fibrous scar tissue contained the endometrial glands, and was made of the proliferated collagen fibers and smooth muscle tissue. The combination of pathological examination, clinical symptoms and signs were consistant with the PCSD diagnosis.

Surgical procedures and effectiveness analysis

The surgical procedures were successfully completed for all 25 patients without any complication such as bleeding, uterine perforation, bladder damage. Operation time was between 35 to 95 minutes (Mean = 38 mins). After two-year follow-up, hysteroscope electrotomy was effective in 15 out of 25 patients with improved symptoms, such as shortened menstrual period (8.1 days in average for postoperative menstrual period, compared to 15.0 days in average for preoperative menstrual period, P < 0.01). The effective rate was 60% (15/25).

Indicator analysis of hysteroscope electrotomy for PCSD

We further analyzed how the characteristics of the patients, including cesarean delivery and uterine position, affected the effectiveness of operation. It was found that, in comparison to overall effective rate (60%), hysteroscopy electrotomy had a significantly higher effective rate in the patients with single cesarean section (83.3%), or anteverted uterus position (90.9%); in contrast, hysteroscopy electrotomy had a significantly lower effective rate in the patients with multiple cesarean section (38.5%), or retroverted uterus position (35.7%), or with multiple cesarean section plus retroverted uterus position (28.6%). The summary of indicator analysis was shown in **Table 1**.

Discussion

In this report, we showed that transvaginal ultrasonography might be a preferred diagnosis method for PCSD, and hysteroscopy electrotomy can serve as an effective treatment for PCSD patients, but multiple cesarean history and retroverted uterus position might significantly compromise the effectiveness of hysteroscope electrotomy.

By using transvaginal ultrasonography for the diagnosis of PCSD, in this study we had missed the diagnosis for 3 out of 25 PCSD cases with 88% of detection rate. It was speculated that the reason of missed diagnosis might partly attribute to the line-shaped diverticulum; in addition, PCSD is also difficult to be detected by transvaginal ultrasonography when PCSD is accompanied with cervical cyst, uterine fibroids, uterine adenomyosis and adenomyoma. In order to further improve the diagnosis

rate of transvaginal ultrasonography for PCSD, we suggested that it is crucial to choose the right time to undergo transvaginal ultrasonic examination. The proposed time would be a few days after menstruation with a bit of bleeding remaining, as in this period the blood is accumulated in uterine cavity and the liquid flowed from cavity can be easily visualized during the examination. In addition, hysteroscope surgical procedure is accurate for diagnosis for PCSD while might lead to the risks of the injuries of uterine and bladder. For our point of view, it would be critical to properly select the patients for hysteroscopy surgical procedure to prevent such injuries of uterine and bladder. One of key selection criteria is the myometrial thickness at the defection site. It was recommended by some authors [10, 11] that hysteroscopy surgical procedure should be avoided if the myometrial thickness at the defection site is less than 2 mm, instead laparoscopic or transvaginal surgery would be needed. Due to the thermal conductivity of hysteroscopy electrosurgical cutting, the patients having less than 2 mm myometrial thickness at the defection site are prone to confront uterine perforation and the injuries of bladder, intestines and other around organs. However, Sen [12] and Rozenberg [13] suggested that the actual myometrial thickness might be larger than the detected thickness by ultrasonography. Therefore, all our selected patients have a myometrial thickness larger than 2.5 mm and none of them have any complications including the injuries of uterine and bladder. Thus our recommended minimum myometrial thickness for the PCSD undergoing hysteroscopy surgical procedure is 2.5 mm.

For the treatment of PCSD, we firstly employed hormone therapy for the treatment of PCSD, and it turned out to be ineffective for most cases. Then hysteroscope electrotomy was employed to treat all these PCSD Patients. Our results demonstrated that hysteroscope electrotomy was effective for 15 out of 25 cases (60%) in general, which is consistent with the effective rate reported by Chang [14]. The other two reports showed that they have higher effective rates by using hysteroscope electrotomy for the treatment of PCSD [8, 9]. However, these reports have not analysed how patients' characteristics including cesarean delivery times and uterine position would possibly affect the outcome of hysteroscope electroto-

my for the treatment of PCSD, which leads to our main aim of this study. Our results showed that the effective rate of hysteroscope electrotomy for the patients with repeated cesarean history was significantly lower than the patients with single cesarean section (38.5% *vs.* 83.3%). However, there was one study by Wang showing that there is no correlation between the effectiveness of hysteroscope electrotomy and cesarean delivery times [15]. We can not exactly pinpoint what reasons underlie the difference between his and our study, but we assumed that the poor blood supply resulted from the scar tissue by multiple cesarean deliveries would potentially compromise the healing capability of uterus and lead to poor outcome of operation. In addition, we showed that the effective rate of hysteroscopy electrotomy for the patients with retroverted uterus was much lower than those with anteverted uterus (35.7% *vs.* 90.9%), which is consistent with Wang's study. The poor effective rate for the patients with retroverted uterus might attribute to the increased tension around the flexion of the cervical diverticulum, leading to poor local blood perfusion, while hysteroscopic surgery itself is unable to correct position of the uterus and improves local blood flow perfusion. Very importantly, we showed for the first time in this study that the effective rate further dropped to 28.6% (2/7) for the patients who had both multiple caesarean deliveries and retroflexed uterine position, indicating that there is a combinational effect of multiple cesarean deliveries and retroflexed uterine position negatively reducing the effective rate of hysteroscopy electrotomy for the treatment of PCSD.

In summary, in this study we demonstrated transvaginal ultrasonography is a preferred diagnosis method for PCSD, but its missed diagnosis should be noted. Hysteroscopy electrotomy can serve as an effective treatment for PCSD patients with single cesarean history and/or anteverted uterus position. When the patients have the history of multiple cesarean deliveries or retroverted uterus position, especially the combination of both, hysteroscopy electrotomy should be carefully chosen or avoided for the treatment of PCSD. Thus this study might provide very important guidance for the clinicians to choose the proper PCSD patients for undergoing hysteroscopy electrotomy.

Disclosure of conflict of interest

None.

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References

[1] Surapaneni K, Silberzweig JE. Cesarean section scar diverticulum: appearance on hysterosalpingography. Am J Roentgenol 2008; 190: 870-874.

[2] Marotta ML, Donnez J, Squifflet J, Jadoul P, Darii N, Donnez O. Laparoscopic repair of postcesarean section uterine scar defects diagnosed in nonpregnant women. J Minim Invasive Gynecol 2013; 20: 386-391.

[3] Ceci O, Cantatore C, Scioscia M, Nardelli C, Ravi M, Vimercati A, Bettocchi S. Ultrasonographic and hysteroscopic outcomes of uterine scar healing after cesarean section: comparison of two types of single-layer suture. J Obstet Gynaecol Res 2012; 38: 1302-1307.

[4] Klemm P, Koehler C, Mangler M, Schneider U, Schneider A. Laparoscopic and vaginal repair of uterine scar dehiscence following cesarean section as detected by ultrasound. J Perinat Med 2005; 33: 324-331.

[5] Donnez O, Jadoul P, Squifflet J, Donnez J. Laparoscopic repair of wide and deep uterine scar dehiscence after cesarean section. Fertil Steril 2008; 89: 974-980.

[6] Tahara M, Shimizu T, Shimoura H. Preliminary report of treatment with oral contraceptive pills for intermenstrual vaginal bleeding secondary to a cesarean section scar. Fertil Steril 2006; 86: 477-479.

[7] Chang Y, Tsai EM, Long CY, Lee CL, Kay N. Resectoscopic treatment combined with sono-hysterographic evaluation of women with post-menstrual bleeding as a result of previous cesarean delivery scar defects. Am J Obstet Gynecol 2009; 200: 370, e371-374.

[8] Gubbini G, Casadio P, Marra E. Resectoscopic correction of the "isthmocele" in women with postmenstrual abnormal uterine bleeding and secondary infertility. J Minim Invasive Gynecol 2008; 15: 172-175.

[9] Fabres C, Arriagada P, Fernandez C, Mackenna A, Zegers F, Fernandez E. Surgical treatment and follow-up of women with intermenstrual bleeding due to cesarean section scar defect. J Minim Invasive Gynecol 2005; 12: 25-28.

[10] Feng YL, Li MX, Liang XQ, Li XM. Hysteroscopic treatment of postcesarean scar defect. J Minim Invasive Gynecol 2012; 19: 498-502.

[11] Tower AM, Frishman GN. Cesarean scar defects: an underrecognized cause of abnormal uterine bleeding and other gynecologic complications. J Minim Invasive Gynecol 2013; 20: 562-572.

[12] Sen S, Malik S, Salhan S. Ultrasonographic evaluation of lower uterine segment thickness in patients of previous cesarean section. Int J Gynaecol Obstet 2004; 87: 215-219.

[13] Rozenberg P, Goffinet F, Phillippe HJ, Nisand I. Ultrasonographic measurement of lower uterine segment to assess risk of defects of scarred uterus. Lancet 1996; 347: 281-284.

[14] Chang Y, Tsai EM, Long CY, Lee CL, Kay N. Resectoscopic treatment combined with sono-hysterographic evaluation of women with post-menstrual bleeding as a result of previous cesarean delivery scar defects. Am J Obstet Gynecol 2009; 200: 370, e371-374.

[15] Wang CJ, Huang HJ, Chao A, Lin YP, Pan YJ, Horng SG. Challenges in the transvaginal management of abnormal uterine bleeding secondary to cesarean section scar defect. Eur J Obstet Gynecol Reprod Biol 2011; 154: 218-222.