



Combined Hysteroscopic and Vaginal Repair of Cesarean Scar Defect (Isthmocele): A Case Series from a Tertiary Infertility Center

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Abstract

Background: Isthmocele, also known as a cesarean scar defect, is an increasingly recognized complication of cesarean delivery that may manifest as abnormal uterine bleeding (AUB), chronic pelvic pain, postmenstrual spotting, and secondary infertility. Although various surgical approaches have been described, the optimal management strategy remains controversial.

Objective: To evaluate the clinical presentation, diagnostic characteristics, surgical outcomes, and fertility outcomes of women undergoing surgical repair of isthmocele at a tertiary infertility center.

Methods: This retrospective cross-sectional case series was conducted at Indira IVF Hospital, Hisar, Haryana, between 2021 and 2024. Women aged >21 years with a previous cesarean section and diagnosed with isthmocele were evaluated. Patients with residual myometrial thickness (RMT) <3 mm and persistent symptoms or infertility were considered for surgical repair. Preoperative assessment included transvaginal sonography (TVS) to evaluate defect dimensions, cervical length, scar position, uterine mobility, and sliding sign. Fourteen patients underwent combined hysteroscopic and vaginal repair, while two underwent laparoscopic repair. Postoperative outcomes included symptom relief, change in RMT, complications, and fertility outcomes.

Results: Among 72 women with previous cesarean delivery, 30 (41.7%) were diagnosed with isthmocele and 16 underwent surgical correction. Fourteen patients underwent vaginal repair and two underwent laparoscopic repair. Successful anatomical correction was achieved in all cases and confirmed hysteroscopically. Symptomatic improvement was observed in 15 of 16 patients (93.8%). One patient continued to experience vaginal discharge with persistent fluid in the uterine cavity on follow-up imaging. Surgical complications included one postoperative scar-site hematoma and one bladder injury during laparoscopic repair, both managed successfully. During follow-up, 7 of 16 women (43.8%) conceived; five achieved live births, one experienced a first-trimester miscarriage, and one pregnancy was ongoing at the time of analysis. A significant increase in postoperative myometrial thickness and overall patient satisfaction were observed.

Conclusion: Isthmocele should be considered in women with secondary infertility, abnormal uterine bleeding, or pelvic pain following cesarean section. Combined hysteroscopic and vaginal repair is a safe and effective treatment option in carefully selected patients, providing excellent symptom relief, restoration of myometrial thickness, and favorable reproductive outcomes. Larger prospective studies with longer follow-up are needed to establish standardized diagnostic criteria and optimal management strategies.

Keywords: Isthmocele; Cesarean scar defect; Secondary infertility; Vaginal repair; Hysteroscopy; Residual myometrial thickness

Introduction

With the global increase in cesarean section deliveries, there has been a corresponding rise in the recognition of cesarean scar defects, commonly referred to as isthmocele. Isthmocele is a defect or pouch-like formation at the site of a previous cesarean section scar, often located in the lower uterine segment. It can contain residual sutures, blood, or fibrotic tissue, and may lead to a range of gynecological and reproductive symptoms. Despite its clinical relevance, there remains no

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universally accepted definition, classification, or diagnostic guideline for this condition.

Several risk factors have been associated with the development of isthmocele, although conclusive scientific evidence is still lacking. Proposed factors include multiple previous cesarean sections, a retroflexed uterus, advanced cervical dilation at the time of cesarean delivery, prolonged labor, and a lower position of the uterine incision. Technical aspects of uterine closure, such as single-layer suturing, omission of the endometrial layer, and non-perpendicular closure angles, may also contribute [1,2]. Additionally, impaired wound healing due to diabetes, smoking, poor nutrition, or early adhesion formation can influence scar integrity.

The classification of isthmocele is also debated. Many studies categorize defects as large or small based on either the absolute size of defect [3] or the thickness of the remaining myometrium. Larger defects are generally associated with more pronounced symptoms and a higher likelihood of fertility impairment [4].

The prevalence of isthmocele varies widely in the literature, with reported rates ranging from 24% to 70% after a single cesarean delivery and up to 100% in women with three or more [5]. While some women may remain asymptomatic, many present with abnormal uterine bleeding, postmenstrual spotting, pelvic pain, and secondary infertility. These symptoms are believed to result from menstrual blood pooling within the defect due to poor uterine contractility and altered cervical mucus [6,7].

Diagnosis typically involves transvaginal ultrasound, saline infusion sonography, or hysteroscopy, with the latter allowing both visualization and treatment. Early recognition and appropriate surgical management can improve symptoms and restore fertility in affected women.

Objective

The primary objective of this case series is to describe the clinical presentation, diagnostic findings, and surgical outcomes of patients diagnosed with isthmocele at a tertiary care center.

Methods

We conducted a cross-sectional retrospective study at Indira IVF Hospital, Hisar, Haryana, between 2021 and 2024. All women aged over 21 years who underwent combined hysteroscopic and vaginal isthmocele repair during this period were included.

Inclusion criteria

- Age >21 years.
- History of Cesarean Section (CS) only, with no prior surgeries other than CS, dilation and curettage (D&C), Loop Electrosurgical Excision Procedure (LEEP), Dilation and Evacuation (D&E), or cone biopsy.
- Underwent laparoscopic or hysteroscopic or vaginal repair of the isthmocele.

Exclusion criteria

- Incomplete or unavailable surgical history.
- Pregnant women.
- History of uterine surgery for other pathologies such as polyps, hyperplasia, fibroids (myoma), or malignancy.

The study protocol was approved by the institutional ethics committee. Informed written consent was obtained from all patients regarding the surgical procedure, possible outcomes, and use of clinical data and images for academic purposes. Patients were informed that anonymity would be maintained, though complete concealment of identity cannot be guaranteed.

This case series includes 14 women who underwent combined hysteroscopic and vaginal isthmocele repair between 2021 and 2024. All patients presented with secondary infertility and either failed medical management or had findings of residual myometrial thickness (RMT) <3 mm on imaging. All patients underwent preoperative transvaginal sonography (TVS) at the end of their menstrual cycles.

In three cases, surgery was delayed as patients initially opted for expectant or medical management, including antibiotic therapy and estrogen supplementation.

Ultrasound evaluation

TVS was used to assess the following:

- Cervical length (distance of scar from cervix)
- Scar position
- Length of the defect (distance between caudal and cephalic edges)
- Depth and width of the isthmocele (measured transversely)
- Residual Myometrial Thickness (RMT)
- Adjacent Myometrial Thickness (AMT)
- Uterine mobility and sliding sign

Criteria for vaginal repair

Patients were selected for vaginal repair if they had:

- RMT <3 mm
- Cervical length <4.5 cm
- Mobile uterus with positive sliding sign (suggesting lower likelihood of adhesions)

Patients with a negative sliding sign or cervical length >4.5 cm (indicating poor approachability) were treated via laparoscopic or open approaches.

Data collection

Demographic and clinical data were collected, including age, BMI, parity, number of cesarean deliveries, interval between surgeries, uterine position, menstrual flow characteristics, and symptoms such as Abnormal Uterine Bleeding (AUB), intermittent spotting, Chronic Pelvic Pain (CPP), dysmenorrhea, dyspareunia, and vaginal discharge. Pre- and post-operative imaging measurements and surgical outcomes were recorded.

Surgical technique

Under spinal anesthesia and in lithotomy position, the cervix was held with a vulsellum. A transverse incision was made 0.5 cm below the cervicovaginal junction from 3 to 9 o'clock using a No. 23 scalpel, avoiding major vessels. A bladder flap was created via sharp dissection (no cautery used) to expose the lower uterine segment (LUS) and the isthmocele defect. We did not do hydro dissection with vasopressin or cautery.

A Hegar's dilator was inserted through the cervix and gently hooked into the defect to delineate its borders. The niche was identified manually by palpating for fibrotic tissue, then perforated under direct vision. Scar tissue was excised circumferentially with scissors or scalpel and edges were freshened. The defect was repaired in two interrupted layers using 1-0 Vicryl with a round-bodied curved needle holder. The bladder flap was closed after confirming hemostasis.

A hysteroscopy was performed intraoperatively to confirm successful repair and to assess the uterine cavity for additional pathology.

Postoperative management and follow-up

Patients were discharged on the same day after 6-8 hours. Oral contraceptive pills were prescribed for three months postoperatively. TVS was repeated at 3 and 6 months to assess RMT and healing. Patients were advised to attempt conception after six months.

Outcome measures

Outcomes were evaluated based on:

- Intraoperative confirmation of successful repair
- Pre- and post-operative dimensions of defect and RMT on TVS
- Operative time, intraoperative blood loss (in mL), hospital stay duration, and cost
- Surgical complications such as bladder injury, infection, or organ damage
- Symptom relief (AUB, spotting, dysmenorrhea, discharge, dyspareunia) and patient satisfaction
- Postoperative fertility outcomes (β -hCG, Live Pregnancy Rate [LPR], Live Birth Rate [LBR])
- Cervical length, uterine position, and sliding sign
- Presence of Fluid in the Cavity (FIC) on follow-up TVS

One patient was lost to follow-up.

Case Presentation

A total of 72 women with a history of Lower Segment Cesarean Section (LSCS) presented to the clinic between 2021 and 2024. Among them, seven women had undergone two prior cesarean deliveries.

Of the 72 women evaluated, 30 (43%) were diagnosed with isthmocele based on clinical presentation and Transvaginal Sonography (TVS) findings. Out of these, 19 women (63%) were recommended for surgical repair. Sixteen of these 30 women (53%)

underwent surgical correction of isthmocele, as they had Residual Myometrial Thickness (RMT) less than 3 mm.

Among the 16 women who underwent repair, 2 patients had laparoscopic repair, while the remaining 14 underwent vaginal repair. The choice of surgical approach was based on preoperative TVS findings, as outlined in the Materials and Methods section.

The clinical and demographic characteristics of the 16 women who underwent vaginal isthmocele repair are summarized in the table.

The surgical procedure was successful in all patients, with clear anatomical correction confirmed intraoperatively by hysteroscopy. Symptom improvement was reported by all women postoperatively. Patient satisfaction was assessed based on symptom relief and their willingness to recommend the procedure to others; all patients expressed satisfaction with the outcome.

Although all patients underwent vaginal repair, two cases required laparoscopic assistance first due to negative sliding sign on preoperative assessment indicating possible adhesions while all other criteria for vaginal feasibility were met and second due to lap cystectomy to be performed for endometrioma and long cervix.

Of the 16 patients who underwent vaginal repair, 7 (44%) successfully conceived during the follow-up period. The remaining patients are currently under follow-up, with the exception of one who was lost to follow-up. out of the seven conceptions 5 have delivered while 1 aborted at seven weeks and 1 was awaited for delivery.

Patient demographics and clinical characteristics

The demographic and obstetric characteristics of the study population are summarized in Table 1. The patients were women of reproductive age presenting with secondary infertility following one or more previous Lower Segment Cesarean Sections (LSCS). Information regarding age, parity, obstetric history, and the number of prior cesarean deliveries was collected for all patients. Most women had undergone one previous cesarean section, while a smaller proportion had a history of two cesarean deliveries.

Clinical presentation

The clinical presentations of the patients are shown in Table 2. All women included in the series presented with secondary infertility. In addition, many experienced gynecological symptoms commonly associated with isthmocele, including Abnormal Uterine Bleeding (AUB), postmenstrual spotting, chronic pelvic pain, dysmenorrhea, and vaginal discharge. The severity and duration of symptoms varied among patients, although postmenstrual spotting and infertility were the most frequently reported complaints.



Figure 1: Isthmocele defect in sagittal view and transverse view.

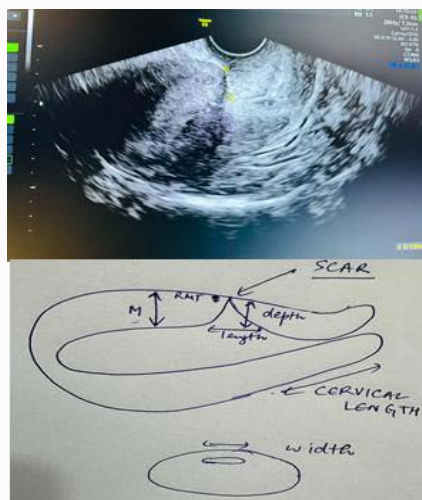


Figure 2: Increased RMT after surgery (10mm).

Diagnostic evaluation

All patients underwent preoperative imaging assessment, primarily with Transvaginal Sonography (TVS), which served as the initial diagnostic modality. In selected cases, additional investigations such as Saline Infusion Sonography (SIS) and Magnetic Resonance Imaging (MRI) were performed when further anatomical clarification was required. Representative imaging findings are illustrated in Figure 1 and 2.

The diagnosis of isthmocoele was established by identifying a triangular or pouch-like defect at the site of the previous cesarean scar. Measurements obtained included defect depth, width, length, and Residual Myometrial Thickness (RMT). Other relevant parameters such as cervical length, scar location, uterine mobility, and the presence of fluid within the uterine cavity were also assessed. Associated findings included retroflexed uterus in several patients and occasional coexisting gynecological pathologies identified during imaging and hysteroscopic evaluation.

Treatment modality

Management was individualized according to symptom severity, fertility desires, and imaging findings. Some patients initially underwent expectant or medical management, including hormonal therapy and antibiotic treatment when indicated. Surgical intervention was recommended for women with persistent symptoms, infertility, or an RMT of less than 3mm.

The choice of surgical approach depended on preoperative assessment. Fourteen patients underwent a combined vaginal and hysteroscopic repair, while two patients required laparoscopic repair because of unfavorable anatomical features identified on imaging. Intraoperative hysteroscopy was performed to confirm localization of the defect, assess the uterine cavity, exclude concomitant pathology, and verify successful repair. Detailed operative findings, operative time, blood loss, and perioperative outcomes are presented in Table 3.

Outcomes

Postoperative outcomes are summarized in Table 3 and 4. Symptom resolution was achieved in nearly all patients following repair. Improvement in abnormal uterine bleeding, postmenstrual spotting, pelvic pain, and dysmenorrhea was observed in all but one

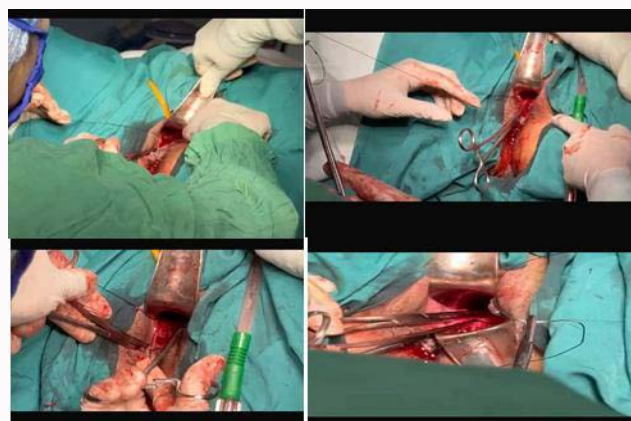


Figure 3: Intraoperative images of the vaginal isthmocoele repair.

patient. This patient continued to complain of vaginal discharge and demonstrated persistent Fluid in the Uterine Cavity (FIC) on follow-up transvaginal sonography despite anatomical correction of the defect.

Complications were infrequent. One patient presented with postoperative bleeding per vaginam and was found on TVS to have a hematoma at the scar repair site, which was managed conservatively. Another patient who underwent laparoscopic repair sustained a bladder injury intraoperatively. The injury was recognized and repaired during the same procedure, and bladder drainage was maintained with a urinary catheter for 21 days (Figure 3).

Reproductive outcomes were encouraging. During the follow-up period, seven patients achieved conception. Among these, five resulted in live births, one ended in a spontaneous miscarriage at seven weeks of gestation, and one pregnancy was ongoing at the time of manuscript preparation. Follow-up imaging demonstrated satisfactory healing of the cesarean scar defect, with increased residual myometrial thickness and restoration of lower uterine segment anatomy in most patients. Hysteroscopic evaluation, where performed, confirmed successful repair and normalization of the uterine cavity.

Discussion

We undertook this case series analysis to contribute to the limited literature on transvaginal repair of isthmocoele and to highlight its efficacy, procedural steps, risks, complications, and outcomes. Additionally, we aimed to clarify the criteria for selecting cases suitable for the vaginal approach.

Isthmocoele often leads to symptoms such as Abnormal Uterine Bleeding (AUB), intermittent spotting, dysmenorrhea, and Chronic Pelvic Pain (CPP). These symptoms primarily result from the accumulation of menstrual blood in the niche, due to reduced contractility of the Lower Uterine Segment (LUS) and fibrotic scar tissue formation. Secondary infertility is another significant consequence, linked to abnormal cervical mucus production which impairs sperm transport and quality. Furthermore, the presence of Fluid in the Uterine Cavity (FIC) decreases endometrial receptivity and embryo implantation, contributing to infertility.

The correlation between Residual Myometrial Thickness (RMT) and the choice of surgical technique is a critical consideration in isthmocoele repair. Thin residual myometrium (<3mm) is associated with a higher risk of uterine rupture during subsequent pregnancies,

which often guides the preference toward more invasive approaches such as laparoscopic repair. In contrast, patients with adequate RMT and favorable anatomical criteria may benefit from less invasive transvaginal or hysteroscopic repairs, balancing surgical risks and recovery time.

Both hysteroscopic and laparoscopic repairs have shown effectiveness in treating isthmocele. Hysteroscopic repair offers a minimally invasive approach with shorter operative times and reduced morbidity, especially in patients with sufficient RMT ($>3\text{mm}$). However, laparoscopic repair may provide better access for extensive defects or cases with significant adhesions. Our combined vaginal and hysteroscopic approach capitalized on the benefits of both techniques, allowing enhanced visualization, precise resection, and confirmation of successful repair intraoperatively.

Diagnosis of isthmocele remains challenging due to the lack of standardized criteria for defect measurement and classification. Various imaging modalities Transvaginal Sonography (TVS), Saline Infusion Sonohysterography (SIS), gel sonography, hysteroscopy, and MRI have been employed, but consensus on the optimal diagnostic approach is still evolving. In our study, TVS performed during the early proliferative phase facilitated effective visualization of the defect by utilizing natural menstrual blood as contrast, reducing the need for invasive contrast techniques. However, the variability in diagnostic criteria underscores the urgent need for standardized definitions and measurement protocols to improve comparability of studies and clinical decision-making.

Early detection of isthmocele in women with secondary infertility and a history of cesarean section is crucial. Identifying and appropriately managing isthmocele can significantly improve symptoms, fertility outcomes, and reduce obstetrical risks in subsequent pregnancies. Therefore, a high index of suspicion should be maintained in patients presenting with AUB, pelvic pain, or infertility following cesarean delivery.

Repair of the isthmocele is especially necessary in infertile patients with large defects or a Residual Myometrial Thickness (RMT) less than 3 mm, as a thin RMT has a well-documented association with an increased risk of uterine rupture in subsequent pregnancies. Various surgical approaches for repair have been described, including hysteroscopic, laparoscopic, laparoscopic-assisted vaginal, vaginal, or combined techniques [1,7,8].

In our series, we adopted a combined vaginal and hysteroscopic approach, which provided several advantages: enhanced visualization and precise measurement of the defect, confirmation of complete excision of scar tissue, verification of repair success intraoperatively, ability to rule out any concomitant intrauterine pathology.

Similar combined approaches have been reported by Kaya et al. [9] and Candiani et al. [10], who noted shorter operative times, reduced hospital stays, minimal blood loss, and high cure rates, with a significant increase in scar thickness postoperatively. Luo et al. [11] reported a 92.99% success rate in resolving AUB and emphasized that hysteroscopy before vaginal repair offered a safer identification of the defect.

A comparative overview of operative times, hospital stay, and success rates in similar studies is summarized below in Table 5.

Transvaginal Sonography (TVS) remains the initial non-invasive investigation of choice for diagnosing isthmocele. When performed

during the early proliferative phase, retained menstrual blood within the defect provides a natural contrast, reducing the need for Saline Infusion Sonohysterography (SIS) or gel sonography. In our study, we measured the defect in both sagittal and transverse planes, facilitating direct pre- and post-operative comparisons. This comprehensive approach to measurement is not common in many studies but proved effective.

Our findings showed a significant increase in RMT after repair (from $<3\text{mm}$ preoperatively to $10.2\text{ mm} \pm 2\text{ mm}$ postoperatively), which aligns with results reported in other studies ($5.6 \pm 2.0\text{ mm}$ [12], $6-10 \pm 4.43\text{ mm}$ [13], and $9.5 \pm 2.51\text{ mm}$ [14]).

Currently, there is no consensus regarding the optimal surgical approach for isthmocele repair. However, most studies advocate laparoscopic repair when RMT is less than 3 mm. Studies by Zhang, et al. [14], Xie, et al. [15] and Van der Voet, et al. [16] have demonstrated comparable outcomes regardless of the surgical technique used. Symptom relief and pregnancy rates remain consistent across the literature.

The complication rate associated with vaginal repair is low, making it an effective and less invasive alternative to laparoscopic repair. However, few studies have compared obstetrical outcomes directly between vaginal and laparoscopic repairs, highlighting the need for further research.

The 6-month follow-up period for measuring RMT was chosen based on published data indicating that uterine scar healing should be complete by this time [17].

Conclusion

Isthmocele should be considered in women with secondary infertility, AUB, or pelvic pain after cesarean section. TVS is a useful diagnostic tool. Surgical repair is recommended for RMT $< 3\text{mm}$, with the choice of vaginal or laparoscopic approach based on defect accessibility. Vaginal repair is effective in symptom relief and increasing myometrial thickness, offering shorter surgery and hospital stays. Combined hysteroscopy improves outcomes. Larger studies with longer follow-up are needed to confirm these findings.

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