ISSN 0973-2063 (online) 0973-8894 (print)
Bioinformation 22(10): 6863-6869 (2026)
©Biomedical Informatics (2026)

BIOINFORMATION
Discovery at the interface of physical and biological sciences
BIOMEDICAL INFORMATICS
www.bioinformation.net
Volume 22(10)
Research Article

Received October 1, 2026; Revised October 31, 2026; Accepted October 31, 2026, Published October 31, 2026
DOI: 10.6026/973206300226863

SJIF 2026 (Scientific Journal Impact Factor for 2026) = 8.478
2022 Impact Factor (2023 Clarivate Inc. release) is 1.9

Declaration on Publication Ethics:
The author's state that they adhere with COPE guidelines on publishing ethics as described elsewhere at https://publicationethics.org/. The authors also undertake that they are not associated with any other third party (governmental or non-governmental agencies) linking with any form of unethical issues connecting to this publication. The authors also declare that they are not withholding any information that is misleading to the publisher in regard to this article.

Declaration on official E-mail:
The corresponding author declares that lifetime official e-mail from their institution is not available for all authors

License statement:
This is an Open Access article which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly credited. This is distributed under the terms of the Creative Commons Attribution License

Comments from readers:
Articles published in BIOINFORMATION are open for relevant post publication comments and criticisms, which will be published immediately linking to the original article without open access charges. Comments should be concise, coherent and critical in less than 1000 words.

Disclaimer:
Bioinformation provides a platform for scholarly communication of data and information to create knowledge in the Biological/Biomedical domain after adequate peer/editorial reviews and editing entertaining revisions where required. The views and opinions expressed are those of the author(s) and do not reflect the views or opinions of Bioinformation and (or) its publisher Biomedical Informatics. Biomedical Informatics remains neutral and allows authors to specify their address and affiliation details including territory where required.

Edited by Vini Mehta
E-mail: vmehta@statsense.in
Citation: Tali *et al.* Bioinformation 22(10): 6863-6869 (2026)

Laparoscopic correction of uterine isthmocele: Clinical, sonographic and reproductive outcomes following laparoscopic repair

Irshad Ahmad Tali[1,*], Falak Ara[2], Asif Majid Wani[3], Zarnain Abid[1] & Raana Syed[1]

[1]Department of OBG, Kashmir Medical College, Srinagar, India; [2]Department of Neuro Anesthesia and Critical Care, Sher Kashmir Institute of Medical Sciences, Srinagar, India; [3]Department of Radio Diagnosis and Imaging, Kashmir Medical College, Srinagar, India; *Corresponding author

Affiliation URL:
https://www.kmckashmir.com/
https://www.skims.ac.in/

ISSN 0973-2063 (online) 0973-8894 (print)
Bioinformation 22(10): 6863-6869 (2026)
©Biomedical Informatics (2026)

Author contact:
Irshad Ahmad Tali - E-mail: drirshadtali1141@gmail.com; Phone: +91 7006311401
Falak Ara - E-mail: falakara1220@gmail.com; Phone: +91 7006003199
Asif Majeed Wani - E-mail: dramwani707@gmail.com; Phone: +91 9596942181
Zarnain Abid - E-mail: zarnainabidbanday@gmail.com; Phone: +91 7889389987
Raana Syed - E-mail: raana.wani@gmail.com; Phone: +91 9906950634

Abstract:
Uterine isthmocele is an increasingly recognized complication of cesarean delivery associated with abnormal uterine bleeding, pelvic pain and reproductive dysfunction. This retrospective cohort study evaluated 40 women undergoing laparoscopic repair of symptomatic uterine isthmocele at a tertiary-care center between January 2018 and December 2024. Postmenstrual spotting was the most common symptom (85.0%), while residual myometrial thickness increased from 2.1±0.5 to 8.4±1.8 mm and niche depth decreased from 8.2±2.1 to 1.2±0.7 mm after repair (both $p<0.001$). Laparoscopic correction significantly improved the cesarean scar defect and restored lower uterine segment anatomy. Thus, data support laparoscopic repair as a safe and effective minimally invasive approach for symptomatic uterine isthmocele with favourable clinical and reproductive outcomes.

Keywords: Uterine isthmocele, cesarean scar defect (CSD), niche, laparoscopic repair, residual myometrial thickness, Secondary infertility

Background:
Uterine isthmocele, also known as cesarean scar defect (CSD), niche, diverticulum, or cesarean scar pouch, is an iatrogenic defect characterized by a myometrial discontinuity at the site of a previous cesarean section scar in the lower uterine segment **[1].** The defect is generally visualized as a triangular or pouch-like anechoic area within the anterior uterine wall and is increasingly recognized as a significant long-term complication of cesarean delivery **[2].** With the global rise in cesarean section rates over recent decades, the incidence of uterine isthmocele has increased substantially, making it an important concern in contemporary gynecological practice **[3].**The first detailed description of cesarean scar defects was reported in the 1990s when advances in transvaginal ultrasonography facilitated improved visualization of the lower uterine segment **[4].** Since then, growing awareness of the condition has led to a better understanding of its pathophysiology, clinical manifestations and reproductive implications. The reported prevalence of isthmocele varies widely depending on the diagnostic modality used, ranging from 24% to 70% when assessed by transvaginal ultrasonography and reaching up to 84% with saline infusion sonohysterography **[5].** Such variation reflects differences in patient populations, diagnostic criteria and imaging techniques. Although the exact pathogenesis of uterine isthmocele remains incompletely understood, several mechanisms have been proposed. Inadequate healing of the cesarean incision is considered the primary factor. Surgical techniques, including low uterine incision placement, incomplete closure of the myometrium and locking sutures, may contribute to deficient scar formation **[6]**. Patient-related factors such as obesity, diabetes mellitus, smoking, infection and multiple cesarean deliveries have also been implicated in impaired wound healing and subsequent defect formation **[7]**. Furthermore, uterine retroflexion has been associated with increased mechanical tension on the cesarean scar, potentially predisposing patients to the development of larger defects **[8]**.The clinical presentation of uterine isthmocele is highly variable. Many women remain asymptomatic and are diagnosed incidentally during imaging examinations. However, symptomatic patients may experience postmenstrual spotting, abnormal uterine bleeding, chronic pelvic pain, dysmenorrhea, dyspareunia and secondary infertility **[9]**. The accumulation of menstrual blood within the scar niche is believed to contribute to prolonged bleeding and local inflammation. In addition, altered uterine contractility and retention of blood products may adversely affect sperm transport and embryo implantation, thereby contributing to subfertility **[10]**.Beyond gynecological symptoms, isthmocele has significant obstetric implications. The presence of a deficient cesarean scar has been associated with cesarean scar pregnancy, abnormal placentation, uterine rupture and adverse pregnancy outcomes **[11]**. Consequently, accurate diagnosis and appropriate management are essential not only for symptom relief but also for preserving reproductive potential and reducing future obstetric risks. Diagnostic evaluation typically involves transvaginal ultrasonography as the first-line imaging modality, while saline infusion sonohysterography and magnetic resonance imaging may provide additional anatomical details in selected cases **[12]**.Management strategies for uterine isthmocele depend on symptom severity, residual myometrial thickness, fertility desires and defect characteristics. Conservative approaches, including hormonal therapy, may alleviate symptoms but often fail to correct the underlying anatomical defect **[13]**. Surgical treatment aims to restore normal uterine anatomy, improve symptoms and enhance reproductive outcomes. Hysteroscopic resection is generally preferred for small defects with adequate residual myometrial thickness, whereas larger defects or those associated with significantly thinned myometrium may require laparoscopic, vaginal, or combined surgical repair **[14]**. Laparoscopic correction of uterine isthmocele has emerged as a highly effective minimally invasive technique, particularly in women seeking future fertility. The procedure involves complete excision of fibrotic scar tissue followed by multilayer reconstruction of the myometrium under direct visualization **[15]**. This approach allows precise

identification of the defect, restoration of myometrial integrity and preservation of uterine function. Several studies have demonstrated significant improvements in abnormal uterine bleeding, pelvic pain, fertility outcomes and residual myometrial thickness following laparoscopic repair **[16]**. Furthermore, the minimally invasive nature of laparoscopy is associated with reduced postoperative pain, shorter hospital stays, faster recovery and lower morbidity compared with traditional open surgery **[17]**. Therefore, it is of interest to evaluate the current evidence regarding laparoscopic correction of uterine isthmocele, with particular emphasis on surgical techniques, clinical efficacy, fertility outcomes and future directions in management.

Materials and Methods:

Study design and setting:

This retrospective cohort study was conducted at the Department of Obstetrics and Gynecology of a tertiary-care referral center specializing in minimally invasive gynaecologic surgery. The study evaluated the clinical, sonographic and reproductive outcomes of women who underwent laparoscopic correction of symptomatic uterine isthmocele between January 2021 and December 2025.The study protocol was approved by the Institutional Ethics Committee and all procedures were performed in accordance with the ethical standards of the Declaration of Helsinki and its subsequent amendments. Owing to the retrospective nature of the study, patient confidentiality was maintained through anonymization of all collected data.

Study population:

Medical records of women diagnosed with uterine isthmocele and treated surgically during the study period were reviewed. Diagnosis was established based on clinical presentation and imaging findings obtained through transvaginal ultrasonography (TVUS), with saline infusion sonohysterography (SIS) or magnetic resonance imaging (MRI) performed when additional anatomical characterization was required. A total of 40 consecutive women meeting the eligibility criteria and undergoing laparoscopic isthmocele repair during the study period were included in the final analysis.

Sample size:

The study included a total sample size of 40 patients. All eligible women who underwent laparoscopic correction of uterine isthmocele between January 2018 and December 2024 were consecutively enrolled. The sample size was determined by the number of patients fulfilling the study criteria during the study period and represented the complete institutional experience with this surgical procedure.

Eligibility criteria and inclusion criteria:

[1] Women were eligible for inclusion if they met all of the following criteria:
[2] Age between 18 and 45 years.
[3] History of at least one previous lower-segment cesarean section.
[4] Symptomatic uterine isthmocele confirmed by imaging.
[5] Presence of one or more symptoms attributable to the niche, including abnormal uterine bleeding, postmenstrual spotting, chronic pelvic pain, dysmenorrhea, dyspareunia, or secondary infertility.
[6] Residual myometrial thickness less than 3 mm and/or a large niche considered unsuitable for hysteroscopic correction.
[7] Underwent laparoscopic repair as the primary surgical treatment.
[8] Availability of complete preoperative and postoperative follow-up data.

Exclusion criteria:

[1] Patients were excluded if they had:
[2] Current pregnancy.
[3] Active pelvic inflammatory disease.
[4] Gynecological malignancy or premalignant lesions.
[5] Congenital uterine anomalies.
[6] Significant intrauterine pathology independently responsible for abnormal bleeding, including submucosal fibroids or endometrial carcinoma.
[7] Previous surgical repair of isthmocele.
[8] Incomplete clinical records or inadequate follow-up.

Pre-operative evaluation:

All patients underwent comprehensive clinical assessment before surgery. Demographic characteristics including age, body mass index (BMI), parity, gravidity, number of previous cesarean sections and reproductive history were recorded. Clinical symptoms were systematically documented, including duration and severity of postmenstrual spotting, abnormal uterine bleeding, dysmenorrhea, chronic pelvic pain and infertility. Baseline laboratory investigations included complete blood count, coagulation profile, renal and hepatic function tests and serum β-human chorionic gonadotropin where indicated. Transvaginal ultrasonography was performed during the early follicular phase by experienced sonographers using high-resolution ultrasound equipment. Measurements included niche depth, width, length and residual myometrial thickness (RMT). Saline infusion sonohysterography was utilized in selected cases to improve delineation of the defect. Magnetic resonance imaging was reserved for complex cases requiring detailed evaluation of myometrial architecture and adjacent pelvic structures.

Surgical procedure:

All laparoscopic procedures were performed by surgeons experienced in advanced minimally invasive gynaecologic surgery under general anesthesia. Following induction of anesthesia, patients were placed in the dorsal lithotomy position with Trendelenburg tilt. Pneumoperitoneum was established using either a Veress needle or open Hasson technique. A 10-mm umbilical trocar and three accessory 5-mm trocars were inserted under direct visualization. After inspection of the pelvis, adhesiolysis was performed when necessary. The vesicouterine

peritoneal fold was dissected and the bladder was mobilized caudally to expose the lower uterine segment and cesarean scar defect. Intraoperative transillumination using a uterine manipulator was employed to facilitate accurate localization of the niche. Fibrotic and poorly vascularized scar tissue was completely excised until healthy myometrial margins were identified. The defect was reconstructed using delayed absorbable sutures in a two-layer closure technique. The first layer approximated the deep myometrium, while the second layer reinforced the repair and restored the normal contour of the uterine wall. Additional serosal imbrication was performed when deemed necessary by the operating surgeon. Hemostasis was verified, the operative field was irrigated and all trocar sites were closed according to standard surgical practice.

Post-operative management and follow-up:
Patients were discharged after achieving satisfactory post-operative recovery. Standard post-operative analgesia and antibiotic prophylaxis were administered according to institutional protocols. Follow-up evaluations were conducted at 1 month, 3 months, 6 months and 12 months post-operatively. Clinical assessment focused on symptom resolution, menstrual pattern, pain relief, fertility outcomes and procedure-related complications. Repeat transvaginal ultrasonography was performed during follow-up to evaluate niche resolution, uterine scar healing and changes in residual myometrial thickness.

Outcome measures:
Primary outcomes:
The primary outcome measures included:
[1] Resolution of postmenstrual spotting.
[2] Improvement in abnormal uterine bleeding.
[3] Reduction in pelvic pain and dysmenorrhea.
[4] Increase in residual myometrial thickness following surgical repair.

Secondary outcomes:
Secondary outcome measures included:
[1] Operative duration.
[2] Estimated intraoperative blood loss.
[3] Length of hospital stay.
[4] Intraoperative and postoperative complications.
[5] Pregnancy rate following surgery.
[6] Live birth rate among women attempting conception.
[7] Recurrence of symptoms or niche formation during follow-up.

Statistical analysis:
Data were analyzed using IBM SPSS Statistics version 26.0 (IBM Corp., Armonk, NY, USA).Continuous variables were assessed for normality using the Shapiro–Wilk test. Normally distributed variables were expressed as mean ± standard deviation (SD), whereas non-normally distributed variables were presented as median and interquartile range (IQR). Categorical variables were summarized as frequencies and percentages. Pré-operative and post-operative continuous variables were compared using the paired Student's t-test or Wilcoxon signed-rank test, as appropriate. Associations between categorical variables were assessed using Pearson's chi-square test or Fisher's exact test. A two-sided p-value <0.05 was considered statistically significant. Missing data were handled through complete-case analysis. Results were reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.

Results:
A total of 40 women with symptomatic uterine isthmocele underwent laparoscopic repair between January 2018 and December 2024. The mean age was 33.8 ± 4.6 years (range: 24–43 years). The mean body mass index (BMI) was 27.1 ± 3.4 kg/m². Most patients (62.5%) had undergone two previous cesarean sections. Secondary infertility was present in 17 (42.5%) women, while postmenstrual spotting represented the most common presenting symptom. **Table 1** summarizes the demographic and clinical profile of the study population. The mean age of the patients was 33.8 ± 4.6 years, reflecting the predominance of women in their reproductive years. Most patients had undergone two previous cesarean sections (62.5%), supporting the established association between repeated cesarean deliveries and the development of uterine isthmocele. Postmenstrual spotting was the most frequent presenting symptom, affecting 85.0% of patients, followed by abnormal uterine bleeding (65.0%), dysmenorrhea (52.5%) and chronic pelvic pain (35.0%). Secondary infertility was identified in 42.5% of women, highlighting the potential reproductive consequences of cesarean scar defects. **Table 2** presents the sonographic characteristics of uterine isthmocele before surgical intervention. The mean niche depth was 8.2 ± 2.1 mm, indicating the presence of clinically significant defects. The average niche width and length were 10.7 ± 3.2 mm and 13.5 ± 3.9 mm, respectively. Importantly, the mean residual myometrial thickness was only 2.1 ± 0.5 mm, suggesting substantial thinning of the anterior uterine wall and supporting the indication for laparoscopic repair rather than hysteroscopic management in the majority of patients. **Table 3** shows favourable perioperative outcomes following laparoscopic correction of uterine isthmocele. All procedures were completed laparoscopically without conversion to laparotomy, indicating a high technical success rate. The mean operative time was 82.4 ± 18.6 minutes, while estimated blood loss remained low at 71.3 ± 28.5 mL. The average hospital stay was 1.6 ± 0.5 days, reflecting the minimally invasive nature of the procedure. No major intraoperative complications occurred and postoperative complications were limited to two minor events (5.0%), both of which resolved with conservative management. **Table 4** compares symptom prevalence before and after surgical intervention. Significant improvement was observed across all evaluated clinical parameters. Postmenstrual spotting decreased from 85.0% preoperatively to 12.5% postoperatively ($p<0.001$). Similarly, abnormal uterine bleeding declined from 65.0% to 10.0% ($p<0.001$), dysmenorrhea from 52.5% to 7.5% ($p<0.001$) and chronic pelvic pain from 35.0% to 5.0% ($p=0.002$). These findings demonstrate the effectiveness of

laparoscopic repair in alleviating both menstrual and pain-related symptoms associated with uterine isthmocele. **Table 5** illustrates the anatomical restoration achieved following laparoscopic reconstruction. Residual myometrial thickness increased significantly from 2.1 ± 0.5 mm before surgery to 8.4 ± 1.8 mm after repair (p<0.001). Concurrently, niche depth decreased from 8.2 ± 2.1 mm to 1.2 ± 0.7 mm (p<0.001). These results indicate successful excision of the scar defect and effective reconstruction of the lower uterine segment, thereby restoring myometrial integrity and potentially reducing future obstetric risks. **Table 6** summarizes reproductive outcomes among women attempting conception after surgery. Of the 17 women seeking pregnancy, 11 (64.7%) achieved spontaneous conception during the follow-up period. Nine women subsequently delivered healthy live infants, yielding a live birth rate of 52.9%, while two pregnancies remained ongoing at the time of analysis. No miscarriages or uterine ruptures were reported. These findings suggest that laparoscopic correction of isthmocele may substantially improve reproductive potential in appropriately selected patients. **Figure 1** illustrates the patient selection process for the present study. A total of 52 women diagnosed with symptomatic uterine isthmocele were initially identified during the study period from January 2018 to December 2024. Twelve patients were excluded because of incomplete medical records, previous surgical correction of isthmocele, current pregnancy, congenital uterine anomalies, or inadequate follow-up. Forty women fulfilled the eligibility criteria, underwent laparoscopic repair, completed post-operative follow-up and were included in the final analysis.

Table 1: Baseline demographic and clinical characteristics (n=40)

Variable	Value
Age (years), mean ± SD	33.8 ± 4.6
BMI (kg/m²), mean ± SD	27.1 ± 3.4
Gravidity, mean ± SD	2.9 ± 1.1
Parity, mean ± SD	2.1 ± 0.8
Previous Cesarean Sections (n)	
One	10 (25.0%)
Two	25 (62.5%)
Three or more	5 (12.5%)
Secondary infertility	17 (42.5%)
Postmenstrual spotting	34 (85.0%)
Abnormal uterine bleeding	26 (65.0%)
Dysmenorrhea	21 (52.5%)
Chronic pelvic pain	14 (35.0%)

Table 2: Pre-operative isthmocele characteristics

Variable	Mean ± SD
Niche depth (mm)	8.2 ± 2.1
Niche width (mm)	10.7 ± 3.2
Niche length (mm)	13.5 ± 3.9
Residual myometrial thickness (mm)	2.1 ± 0.5

Table 3: Surgical outcomes

Variable	Value
Operative time (minutes)	82.4 ± 18.6
Estimated blood loss (mL)	71.3 ± 28.5
Hospital stay (days)	1.6 ± 0.5
Conversion to laparotomy	0 (0%)
Intraoperative complications	0 (0%)
Postoperative complications	2 (5.0%)

Table 4: Clinical outcomes before and after laparoscopic repair

Symptom	Preoperative n (%)	Postoperative n (%)	p-value
Postmenstrual spotting	34 (85.0)	5 (12.5)	<0.001
Abnormal uterine bleeding	26 (65.0)	4 (10.0)	<0.001
Dysmenorrhea	21 (52.5)	3 (7.5)	<0.001
Chronic pelvic pain	14 (35.0)	2 (5.0)	0.002

Table 5: Sonographic outcomes

Variable	Preoperative	Postoperative	p-value
Residual myometrial thickness (mm)	2.1 ± 0.5	8.4 ± 1.8	<0.001
Niche depth (mm)	8.2 ± 2.1	1.2 ± 0.7	<0.001

Table 6: Fertility outcomes

Outcome	Value
Women attempting conception	17
Spontaneous pregnancies	11 (64.7%)
Live births	9 (52.9%)
Ongoing pregnancies	2 (11.8%)
Miscarriages	0
Uterine rupture	0

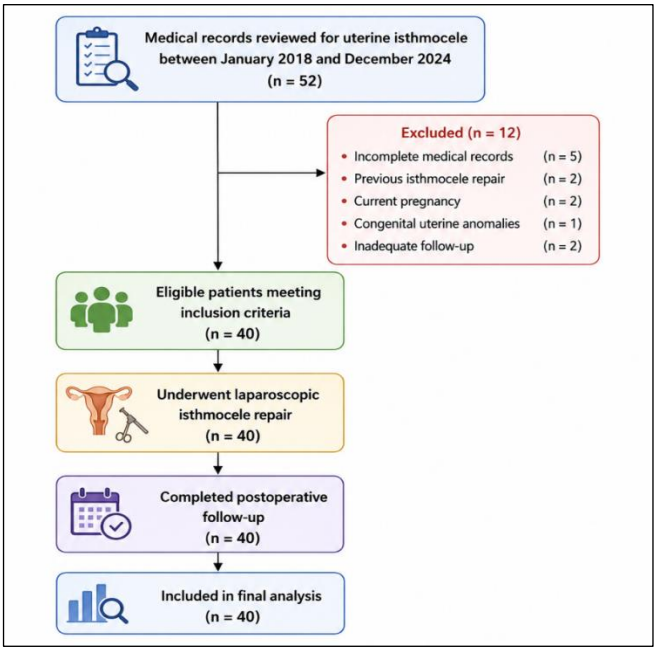


Figure 1: STROBE flow diagram of patient selection

Discussion:

The present study evaluated the clinical, sonographic and reproductive outcomes of laparoscopic correction of symptomatic uterine isthmocele in 40 women treated between January 2018 and December 2024. The findings demonstrated significant improvement in gynecological symptoms, restoration of myometrial integrity, favourable perioperative outcomes and encouraging reproductive results following surgical intervention. These findings support the growing evidence that laparoscopic repair is an effective treatment modality for women with symptomatic cesarean scar defects, particularly those with large niches, thin residual myometrium and a desire for future

fertility **[18, 19]**. In the present cohort, postmenstrual spotting was the most common presenting symptom, affecting 85.0% of patients, followed by abnormal uterine bleeding, dysmenorrhea and chronic pelvic pain. These findings are consistent with previous reports indicating that abnormal uterine bleeding and prolonged postmenstrual spotting are the most frequent clinical manifestations of isthmocele **[20]**. The pathophysiological basis for these symptoms is believed to involve retention of menstrual blood within the niche, impaired uterine drainage and chronic local inflammation. Similar symptom profiles have been reported in several observational studies evaluating women undergoing surgical correction of cesarean scar defects **[14]**. One of the most important findings of this study was the significant reduction in symptom burden following laparoscopic repair. Postmenstrual spotting decreased from 85.0% preoperatively to 12.5% postoperatively, while marked reductions were also observed in abnormal uterine bleeding, dysmenorrhea and chronic pelvic pain. These results are comparable to those reported by Vervoort *et al.*, who demonstrated substantial improvements in menstrual complaints, ultrasound findings and quality-of-life measures following laparoscopic niche resection **[16]**. Similarly, Karampelas *et al.* reported symptom improvement rates exceeding 70% among women undergoing laparoscopic repair of symptomatic isthmocele **[21].** A multicenter retrospective study by Oz and Oz also reported complete symptom resolution in 69.8% of women following hysteroscopic repair, although 36.5% underwent reoperation for persistent or recurrent symptoms. These findings highlight the importance of continued follow-up when evaluating the durability of surgical treatment **[22].** The observed clinical benefits are likely attributable to complete excision of fibrotic scar tissue, elimination of menstrual blood retention and restoration of normal uterine anatomy. Anatomical restoration of the lower uterine segment is a principal objective of laparoscopic isthmocele repair. In our study, residual myometrial thickness increased significantly from 2.1 ± 0.5 mm before surgery to 8.4 ± 1.8 mm after surgery, while niche depth decreased markedly. These findings indicate successful reconstruction of the cesarean scar and restoration of myometrial continuity. In a retrospective comparison of 41 women, Halilzade and Seçen found that abdominal repair was associated with greater post-operative myometrial thickness and a lower rate of persistent isthmocele than hysteroscopic repair, whereas hysteroscopy was associated with shorter operative time and hospital stay **[23]**. Similar outcomes were reported by Marotta *et al.*, who showed significant increases in residual myometrial thickness following laparoscopic repair of post-cesarean scar defects **[24]**. Restoration of myometrial thickness is clinically important because severe thinning of the lower uterine segment has been associated with increased risks of cesarean scar pregnancy, uterine dehiscence and uterine rupture in subsequent pregnancies. The perioperative outcomes observed in the present study further support the safety and feasibility of laparoscopic repair. The feasibility of minimally invasive scar reconstruction is further illustrated by Rashid *et al.,* who described uncomplicated robotic-assisted laparoscopic excision and two-layer repair of a symptomatic isthmocele, with minimal blood loss and early postoperative symptom improvement **[25]**. All procedures were completed laparoscopically without conversion to laparotomy, estimated blood loss was low and hospital stay was short. Moreover, no major intraoperative complications occurred. These findings are consistent with previous systematic reviews that have identified laparoscopic repair as a minimally invasive procedure associated with high success rates, low morbidity and rapid low operative recovery **[26, 27]**. The favourable perioperative outcomes observed in this study likely reflect advances in laparoscopic surgical techniques, improved visualization and increasing surgeon experience in complex uterine reconstructive procedures. The reproductive outcomes of this study are particularly encouraging. Among women attempting conception, 64.7% achieved spontaneous pregnancy and 52.9% achieved live birth during follow-up. Although the mechanisms linking isthmocele to infertility remain incompletely understood, several factors have been proposed, including chronic inflammation, retention of menstrual blood, altered sperm transport and impaired embryo implantation **[28]**. Surgical correction may improve fertility by restoring the normal architecture of the uterine cavity and eliminating adverse local factors that interfere with conception. Our reproductive outcomes are comparable to those reported in the literature. Donnez *et al.* reported favourable pregnancy outcomes following laparoscopic repair of cesarean scar defects, particularly among women presenting with secondary infertility **[14]**. Ali *et al.* reported a successful full-term pregnancy following hysteroscopic assessment and laparoscopic excision and repair of a cesarean scar defect associated with scar endometriosis, providing a clinical example of successful conception after reconstructive surgery **[29]**. Furthermore, recent evidence suggests that surgical correction of symptomatic niches may significantly improve spontaneous conception rates and live birth outcomes in appropriately selected patients **[30, 31]**. The findings of the present study therefore provide additional support for the role of laparoscopic reconstruction in women with symptomatic isthmocele and reproductive dysfunction. Several strengths of this study should be acknowledged. First, all patients underwent a standardized laparoscopic surgical procedure performed at a specialized tertiary referral center. Second, comprehensive assessment of both clinical and sonographic outcomes was performed during structured postoperative follow-up. Third, fertility outcomes were evaluated in women actively attempting conception, providing clinically meaningful reproductive data. Nevertheless, certain limitations should be considered. The retrospective design may introduce selection and information bias. The relatively small sample size limits the generalizability of the findings and reduces statistical power for subgroup analyses. Furthermore, the absence of a control group prevents direct comparison with hysteroscopic, vaginal, or conservative management approaches. Finally, longer follow-up is required to evaluate long-term reproductive and obstetric outcomes, particularly regarding future pregnancy safety. From a clinical perspective, the present findings support laparoscopic repair as an effective treatment

strategy for symptomatic uterine isthmocele, especially in women with large defects and residual myometrial thickness below 3 mm. Significant symptom improvement, restoration of lower uterine segment anatomy, low complication rates and favourable reproductive outcomes collectively suggest that laparoscopic reconstruction should be considered the preferred surgical option in carefully selected patients. Future multicenter prospective studies and randomized controlled trials are warranted to establish standardized treatment algorithms and further define the long-term benefits of laparoscopic repair.

Conclusion:

Laparoscopic repair of symptomatic uterine isthmocele demonstrated favourable clinical outcomes, particularly in women with large defects and reduced residual myometrial thickness. Surgery substantially improved postmenstrual spotting, abnormal uterine bleeding, dysmenorrhea, and chronic pelvic pain while restoring lower uterine segment anatomy. The significant increase in residual myometrial thickness and reduction in niche dimensions support laparoscopic reconstruction as a promising treatment option, although larger prospective studies are needed to establish long-term reproductive and obstetric outcomes.

References:

[1] Morris H. *Int J Gynecol Pathol.* 1995 **14**:16. [PMID: 7883420]
[2] Bij de Vaate AJ *et al. Ultrasound Obstet Gynecol.* 2014 **43**:372. [PMID: 23996650]
[3] Betran AP *et al. BMJ Glob Health.* 2021 **6**:e005671. [PMID: 34130991]
[4] Thurmond AS *et al. J Ultrasound Med.* 1999 **18**:13. [PMID: 9952074]
[5] van der Voet LF *et al. BJOG.* 2014 **121**:145. [PMID: 24373589]
[6] Roberge S *et al. Int J Gynaecol Obstet.* 2011 **115**:5. [PMID: 21794864]
[7] Vervoort AJ *et al. Hum Reprod.* 2015 **30**:2695. [PMID: 26409016]
[8] Wang CB *et al. Ultrasound Obstet Gynecol.* 2009 **34**:85. [PMID: 19565535]
[9] Tower AM & Frishman GN. *J Minim Invasive Gynecol.* 2013 **20**:562. [PMID: 23680518]
[10] Florio P *et al. Gynecol Endocrinol.* 2011 **27**:434. [PMID: 21204608]
[11] Jordans IPM *et al. Ultrasound Obstet Gynecol.* 2019 **53**:107. [PMID: 29536581]
[12] Osser OV *et al. Ultrasound Obstet Gynecol.* 2009 **34**:90. [PMID: 19499514]
[13] Vervoort A *et al. BJOG.* 2018 **125**:326. [PMID: 28504857]
[14] Donnez O *et al. Fertil Steril.* 2017 **107**:289. [PMID: 27816234]
[15] Donnez O *et al. Fertil Steril.* 2008 **89**:974. [PMID: 17624346]
[16] Vervoort A *et al. BJOG.* 2018 **125**:317. [PMID: 28703935]
[17] Api M *et al. J Minim Invasive Gynecol.* 2015 **22**:1145. [PMID: 26122897]
[18] Setubal A *et al. J Minim Invasive Gynecol.* 2018 **25**:38. [PMID: 29024799]
[19] Mashiach R & Burke YZ. *J Minim Invasive Gynecol.* 2021 **28**:565. [PMID: 33152531]
[20] Fabres C *et al. J Ultrasound Med.* 2003 **22**:695. [PMID: 12862268]
[21] Karampelas S *et al. J Clin Med.* 2021 **10**:5785. [PMID: 34945080]
[22] https://gorm.com.tr/index.php/GORM/article/view/1687/1167
[23] Halilzade İ & Seçen Eİ. *Rev Assoc Med Bras (1992).* 2025 **71**:e20250566. [PMID: 41172468]
[24] Marotta ML *et al. J Minim Invasive Gynecol.* 2013 **20**:386. [PMID: 23357466]
[25] Rashid M *et al. J Surg Case Rep.* 2026 **2026**:rjag288. [DOI: 10.1093/jscr/rjag288]
[26] Vitale SG *et al. Arch Gynecol Obstet.* 2020 **301**:33. [PMID: 31989288]
[27] Li C *et al. J Perinat Med.* 2014 **42**:363. [PMID: 24310769]
[28] Verberkt C *et al. Fertil Steril Rep.* 2022 **3**:1. [DOI: 10.1016/j.xfnr.2022.05.003]
[29] Ali J *et al. Cureus.* 2024 **16**:e54576. [PMID: 38524095]
[30] Vidal A *et al. Front Endocrinol (Lausanne).* 2025 **16**:1507482. [PMID: 40303644]
[31] Harjee R *et al. J Minim Invasive Gynecol.* 2021 **28**:1291. [PMID: 33839308]

Caveat Emptor is applicable among the literate community where required and possible. The publisher, its journal, editors and the internal/external reviewers take adequate steps to check, evaluate, correct, edit, revise and improve content where possible and required.