

Clinical and Reproductive Outcomes After Hysteroscopic Repair of Isthmocele

Inci OZ^{1,2}, Ali Utku OZ^{3,4}

Istanbul, Türkiye

ABSTRACT

OBJECTIVE: The growing global prevalence of cesarean delivery has increased the incidence of long-term scar complications, among which isthmocele represents a clinically relevant yet often under-recognized entity. This defect, characterized by incomplete myometrial healing at the cesarean incision site, has been associated with abnormal uterine bleeding, pelvic pain, and secondary infertility. Although hysteroscopic correction has emerged as a minimally invasive treatment option, data on its long-term clinical and reproductive outcomes remain limited.

STUDY DESIGN: This multicenter retrospective cohort included 96 women diagnosed with isthmocele who underwent hysteroscopic repair across three hospitals in Turkey. Demographic, hematologic, and surgical data were extracted from institutional records. Primary outcomes were symptom resolution, fertility outcomes, complications, and reoperation rates; secondary measures included operative time, hospital stay, and perioperative morbidity.

RESULTS: The mean patient age was 34.7 years. Preoperative mean hemoglobin was 11.6 g/dL and ferritin 81.4 ng/mL. Complete symptom resolution was achieved in 69.8% of patients, and 25.0% of the total cohort conceived post-surgery. However, this proportion could not be restricted to women who had expressed a desire for pregnancy (see Limitations). The reoperation rate was 36.5%. A mean interval of 3.56 years was recorded among patients with persistent or recurrent symptoms, although these two groups could not be distinguished in this retrospective dataset (see Limitations). No major intraoperative or postoperative complications were observed, and minor complications occurred in 3.1% of cases.

CONCLUSION: Hysteroscopic repair of isthmocele was associated with substantial symptomatic improvement and a low complication profile. Fertility outcomes require cautious interpretation given limitations in linking pregnancy intention to conception at the patient level. Individualized patient selection - informed by residual myometrial thickness where available and by reproductive goals - appears important, although this retrospective, single-arm design cannot directly test that recommendation.

Keywords: Cesarean section; Fertility; Hysteroscopy; Isthmocele; Minimally invasive surgical procedures

Gynecol Obstet Reprod Med 2026;32(2):119-124

¹ Department of Gynecology and Obstetrics, Istinye University Faculty of Medicine, Istanbul. and ²Department of Gynecology and Obstetrics, Medicana Atakoy Hospital, Istanbul, Türkiye

³ Department of Gynecology and Obstetrics, Cam & Sakura City Hospital, Istanbul, Türkiye. and ⁴Department of Gynecology and Obstetrics, Beykoz State Hospital, Istanbul, Türkiye

Address of Correspondence: Inci Oz,
Medicana Atakoy Hospital, Department
of Gynecology and Obstetrics, Istanbul,
Türkiye
opdrincioz@gmail.com.

Submitted for Publication: 13.01.2026 Revised for Publication: 17.04.2026
Accepted for Publication: 06.08.2026 Online Published: 13.08.2026

ORCID IDs of the authors: IO: 0000-0001-9160-2733
AUO: 0009-0000-9908-5187

QR Code	Access this article online
	www.gorm.com.tr • gorm@medicalnetwork.com.tr full magazine: https://mndijital.medicalnetwork.com.tr
	DOI:10.21613/GORM.2025.1687

How to cite this article: Oz I. and Oz AU. Clinical and Reproductive Outcomes After Hysteroscopic Repair of Isthmocele. *Gynecol Obstet Reprod Med*. 2026;32(2):119-124



Copyright© 2026. Oz et al. This article is distributed under a Creative Commons Attribution 4.0 International License.

Introduction

The global adoption of lower-segment cesarean section has risen steadily in recent decades, and with it the mass burden of long-term uterine scar sequelae, one of which is the uterine niche or isthmocele (1). This defect is characterized by a concave deviation at the anterior lower uterine wall at the site of a prior cesarean incision, often communicating with the endometrial cavity and reflecting incomplete or suboptimal myometrial healing. The prevalence of these scar defects is substantial; observational studies using transvaginal ultrasound or gel/saline infusion sonohysterography report rates ranging from approximately one-quarter to more than half of women after a single or multiple cesarean deliveries (2).

Although many women harbor such defects asymptotically, a growing body of literature links them to post-menstrual spotting, inter-menstrual bleeding, dysmenorrhea, chronic pelvic pain, secondary infertility, and possibly ad-

verse obstetric outcomes (3). From a pathophysiological standpoint, several mechanisms have been proposed to explain symptom development in women with isthmoceles. Retained menstrual fluid in the niche pouch may act as a reservoir for coagulation- and iron-degradation byproducts, leading to local inflammation, impaired endometrial receptivity, and altered myometrial contractility (4).

In addition, thinning of residual myometrium over the niche may produce a biomechanically weaker scar, predisposing to obstetric complications in subsequent pregnancies such as uterine rupture or placenta accreta spectrum (3). Diagnostic evaluation of isthmoceles remains heterogeneous: while two-dimensional transvaginal ultrasound offers wide availability, saline infusion sonohysterography and three-dimensional imaging tend to enhance detection sensitivity and defect characterization (2). Yet no universally accepted threshold (e.g., residual myometrial thickness, niche depth) or standardized classification system has been adopted across practice (3).

Therapeutic options have proliferated over recent years. Minimally invasive approaches such as hysteroscopic resection, laparoscopic excision and vaginal repair have been utilized in symptomatic cases, especially where residual myometrial thickness is deemed low, or fertility preservation is desired (5). Such interventions have demonstrated promising symptomatic relief and fertility-enhancing effects in case series; however, the evidence base remains limited in terms of prospective randomized data and long-term obstetric outcomes (3). Moreover, a recent meta-analysis reported that women with cesarean scar defects had a 3.22-fold increased risk of abnormal uterine bleeding compared to those without defects (4).

Given the increasing prevalence of cesarean delivery and the under-recognized burden of scar-related uterine dysfunction, a rigorous evaluation of clinical, haematologic, symptomatic and reproductive outcomes following hysteroscopic repair of isthmocele is warranted. In this context, the present retrospective multicenter cohort study was designed to assess the outcomes of hysteroscopic intervention in women with isthmocele, including symptom resolution, fertility outcomes, complications, and reoperation rates.

Material and Method

included in this retrospective cohort study. All participants were treated and followed at the Departments of Gynecology and Obstetrics. This study was conducted across hospitals in Turkey. Clinical data were retrieved from institutional medical records. They included demographic characteristics, cesarean section history, preoperative symptoms, hematologic parameters, recurrence of symptoms, duration until recurrence, fertility outcomes, reoperation rates, and postoperative findings.

Inclusion criteria included: women aged 18-45 years; history of at least one cesarean section; diagnosis of isthmocele confirmed by transvaginal ultrasound (TVUS) or saline infusion sonohysterography (SIS); presence of symptoms (abnormal uterine bleeding, postmenstrual spotting, pelvic pain) and/or secondary infertility; undergoing hysteroscopic repair. Exclusion criteria included: active pelvic infection; uterine malignancy or premalignant lesions; severe intrauterine adhesions; residual myometrial thickness (RMT) <2 mm (preferred for laparoscopic approach); incomplete clinical records. Although the inclusion criteria allowed women with a history of at least one cesarean section, no patient with a single prior cesarean delivery was identified in the final cohort; all 96 participants had undergone two or more cesarean deliveries (Table I).

Isthmocele was defined as an anechoic triangular or semi-circular defect at the anterior lower uterine segment communicating with the uterine cavity, as described by Jordans et al.(2). The following parameters were recorded when available: niche depth ≥ 2 mm; residual myometrial thickness (RMT) measured from serosa to niche apex; defect width and length. Due to the retrospective design, quantitative measurements (especially RMT) were not consistently available for all patients, which is acknowledged as a limitation and may have influenced surgical outcomes (Domínguez et al. (3).

All procedures were performed using a standardized hysteroscopic technique: a 26-Fr resectoscope with bipolar energy was used; fibrotic tissue at the niche was resected; the

Table I: Case characteristics and clinical outcomes of hysteroscopic surgery patients (n=96)

Parameter / Clinical Variable	Hysteroscopic Surgery Cohort
N (Total sample)	96 (100%)
Age (years)	34.72
Hemoglobin (g/dL)	11.59
Ferritin (ng/mL)	81.42
Symptom recurrence time (years) (among n=29)	3.56
Minor complications	3 (3.1%)
Pregnancy desire (No/Yes / Total)	71 (74.0%) / 25 (26.0%) / 96 (100%)
Cesarean section number (2/3 / ≥ 4 /Total)	86 (89.6%) / 6 (6.3%) / 4 (4.2%) / 96 (100%)
Pregnant after surgery (No/Yes/Total)	72 (75.0%) / 24 (25.0%) / 96 (100%)
Reoperation required (No/Yes/Total)	61 (63.5%) / 35 (36.5%) / 96 (100%)
Symptom resolution achieved (No/Yes/Total)	29 (30.2%) / 67 (69.8%) / 96 (100%)

distal edge of the defect was leveled to facilitate drainage; and coagulation was applied to reduce abnormal vascularization. No full-thickness resection was performed to avoid uterine perforation. While these core resection steps were standardized, specific technical adaptations (e.g., extent of tissue resection and use of adjunctive coagulation) varied according to surgeon experience and anatomical considerations. They were not systematically recorded (see Limitations).

Symptom recurrence was defined as the reappearance of abnormal uterine bleeding-typically prolonged premenstrual spotting-during follow-up. Patients were followed at regular intervals postoperatively. The mean follow-up duration was 3.6 ± 1.2 years. Outcomes assessed during follow-up included symptom resolution, recurrence, pregnancy outcomes, and reoperation. Because persistent and recurrent symptoms were not distinguished in the retrospective records, the “time to symptom recurrence” reported below reflects the interval to last documented follow-up among patients with persistent or recurrent complaints combined, rather than a validated recurrence event (see Limitations).

All statistical analyses were performed using Wistats v3.0 (WisdomEra Corp., Istanbul, Turkey). Descriptive statistics - means for continuous variables and frequencies with percentages for categorical variables - were used to summarize demographic and clinical data. Planned comparisons of clinical variables against outcomes (pregnancy, symptom recurrence, reoperation), originally intended to be evaluated using chi-square or t-tests, could not be completed for this analysis and are not reported (see Limitations). This study was approved by the clinical research ethics committee of Beykoz Government Hospital Retrospective Research Ethics Committee (Date: 09.08.2022, number: BEYKOZ DH 57)

Results

A total of 96 patients who underwent hysteroscopic surgery were analyzed. The mean age of the study population was 34.7 years, indicating that the majority of patients were in their reproductive age. The mean hemoglobin level before surgery was 11.6 g/dL, and the mean serum ferritin concentration was 81.4 ng/mL; the proportion of patients meeting thresholds for anemia or iron deficiency cannot be inferred from mean values alone and is not reported (see Limitations). Postoperative hemoglobin and ferritin values were not consistently available and are not reported. A mean interval of 3.56 years was recorded among the 29 patients (30.2%) with persistent or recurrent symptoms; as this group combines persistent and recurrent cases, it should not be interpreted as a validated time-to-recurrence estimate (see Limitations).

Regarding reproductive intentions, 26.0% of patients reported a desire for future pregnancy, whereas 74.0% had no such desire. The majority of the cohort (89.6%) had a history of two cesarean deliveries, with smaller proportions having

three (6.3%) or four or more (4.2%) cesarean sections.

Additional perioperative outcomes were as follows: mean operative time was 16 minutes (range: 11-27 minutes; mean hospital stay was 4.5 hours (range: 3.4-12 hours). No major intraoperative complications occurred; minor complications were observed in 3.1% (n=3) of cases, as detailed in Table 1.

Following surgery, 25.0% of the total cohort (24/96) achieved pregnancy, while 75.0% did not conceive during the follow-up period. Twenty-five women (26.0%) had recorded a desire for future pregnancy at the time of surgery; the retrospective dataset available for this analysis did not permit patient-level linkage between pregnancy desire and postoperative conception, so a conception rate restricted to women desiring pregnancy could not be calculated. The obstetric outcomes of the 24 postoperative pregnancies (live birth, miscarriage, ectopic or cesarean scar pregnancy, mode of delivery) were not systematically captured (see Limitations). Reoperation was required in 36.5% of cases (n=35), whereas 63.5% of patients remained free of repeat procedures; notably, six of these reoperations occurred in patients otherwise classified as having achieved complete symptom resolution, and the indication, surgical approach and timing of reoperations were not consistently recorded (see Limitations). Overall, 69.8% of patients experienced complete resolution of symptoms, while 30.2% reported persistent or recurrent complaints (Table 1 and Figure I).

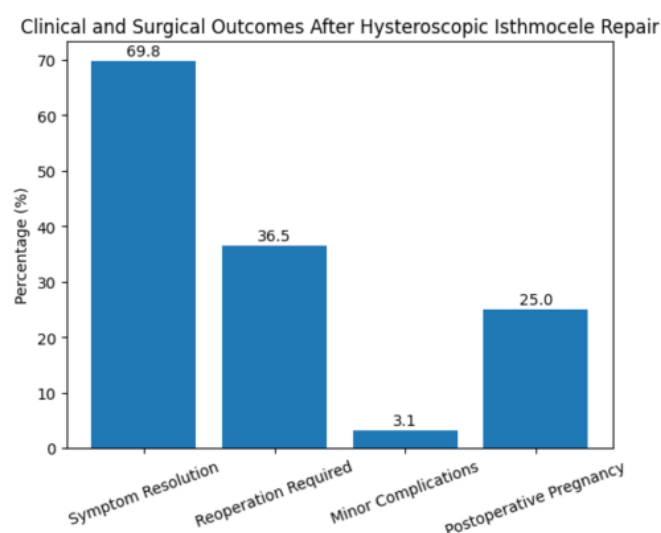


Figure 1: Hysteroscopic evaluation and postoperative surgical follow-up tracking for the cohort study.

Discussion

The present retrospective analysis provides new insight into the clinical and reproductive outcomes following hysteroscopic repair of isthmoele. Among 96 women treated surgically, complete symptom resolution was achieved in nearly 70% of cases, while one quarter conceived during follow-up, and the overall reoperation rate approached 36%. Recurrence

was not analyzed as a distinct endpoint, and persistent and recurrent symptoms were evaluated together due to limitations of retrospective data. These findings highlight both the strengths and the limitations of hysteroscopic management for cesarean-related uterine scar defects. As a retrospective, single-arm cohort without a comparator group - such as expectant management or an alternative surgical technique - this study cannot support conclusions about the comparative efficacy of hysteroscopic repair; the literature comparisons discussed below are therefore presented as informal contextual comparisons, subject to differences in case mix, outcome definitions and denominators across studies.

The relatively high reoperation rate (36.5%) observed in our study exceeds that reported in most previous series. The lack of standardized preoperative RMT assessment and broad inclusion criteria may explain this discrepancy. Similar variability has been reported in the literature, emphasizing the importance of careful patient selection and standardized surgical protocols (10,11). We were not able to identify predictors of reoperation (e.g., age, parity, preoperative hemoglobin) within our own cohort, as the stratified statistical comparisons planned for this analysis were not completed (see Limitations); this would be a valuable direction for future analysis of this dataset.

Symptom relief after hysteroscopic niche correction in our series is consistent with previous evidence. Hysteroscopic excision of fibrotic tissue and re-approximation of the endometrial cavity typically restore effective menstrual outflow and eliminate post-menstrual spotting, as demonstrated in multiple cohort studies. Vervoort et al. (6). reported marked reductions in post-menstrual bleeding and significant symptom resolution following hysteroscopic niche resection. In contrast, He et al. (7). further observed that such correction may also improve fertility outcomes in women with symptomatic cesarean scar defects.

In our cohort, 25.0% of all treated women (24/96) conceived after surgery. Published pregnancy rates following isthmocele repair, such as those synthesized by Harjee et al. (9). and Busnelli et al. (10), are conventionally calculated among women actively attempting conception rather than the whole treated population, and are therefore not directly comparable to the cohort-wide rate reported here. Only 26.0% of women in our series (n=25) had recorded a desire for future pregnancy at the time of surgery; we were unable to link pregnancy desire to postoperative conception at the patient level using the retrospective data available for this analysis, so a conception rate restricted to women desiring pregnancy - the denominator conventionally used in the literature - could not be calculated. We therefore do not draw a direct quantitative comparison with these published rates (see Limitations).

Residual myometrial thickness (RMT) is now recognized as a key determinant of both surgical safety and postoperative

outcomes. According to Domínguez et al., hysteroscopic approaches are most appropriate when the RMT exceeds 2-3 mm, whereas thinner myometrium may warrant laparoscopic or combined repair (3). Mashlach et al. likewise emphasized that adequate RMT plays a pivotal role in determining surgical success, noting that patients with RMT greater than 2-3 mm are best suited for hysteroscopic remodeling. 11 It should be emphasized that RMT was not consistently measured across our own cohort (see Materials and Methods and Limitations); the recommendation above is therefore drawn from the cited literature rather than derived from an internal analysis of RMT and outcome in our patients.

Complication rates in our cohort were minimal, aligning with Enderle et al.8, who also reported a low rate of minor postoperative complications following surgical management of isthmocele. The absence of severe adverse events further underscores the procedural safety of hysteroscopic intervention when performed by experienced surgeons. Nevertheless, the relatively high rate of repeat surgery observed warrants continued refinement of technique and long-term follow-up.

Limitations

This study has several important limitations arising from its retrospective, single-arm, non-comparative design and from the completeness of the source data. Residual myometrial thickness -repeatedly identified in the literature as central to patient selection and prognosis -was not consistently measured or recorded, precluding an internal analysis of outcome by RMT and limiting the RMT-based recommendations discussed above to inferences drawn from external literature rather than findings of this study.

Several outcome measures could also not be fully characterized. "Complete symptom resolution," the primary outcome, was not assessed using a standardized instrument (e.g., a pictorial blood loss assessment chart or a validated pain score); bleeding, pelvic pain, and infertility were collapsed into a single binary endpoint, and resolution by individual symptom type is not reported. Patient satisfaction, listed among the original study aims, was not systematically captured and is not reported. Persistent and recurrent symptoms were not distinguished, so the reported "time to symptom recurrence" reflects an interval to last documented follow-up among a combined group rather than a validated recurrence estimate; this interval closely approximates the overall mean follow-up duration, which may reflect right-censoring rather than a true recurrence date, and should be interpreted with this in mind. The indication, technique, and timing of reoperation were not consistently recorded, including for the six patients who underwent reoperation despite being classified as having achieved complete symptom resolution. Preoperative hemoglobin and ferritin were the only hematologic values available; postoperative values, and the proportion of patients meeting thresholds for anemia or iron deficiency, are not reported.

Most importantly for interpretation of this study's central reproductive-outcome finding, the retrospective dataset did not permit patient-level linkage between recorded pregnancy desire and postoperative conception. We therefore cannot state what proportion of the 25 women desiring pregnancy actually conceived, nor report the obstetric outcomes of the 24 postoperative pregnancies (live birth, miscarriage, ectopic or cesarean scar pregnancy, mode of delivery); any comparison of our cohort-wide conception rate with literature-reported rates calculated among women actively attempting conception would be invalid and has accordingly been avoided in the Discussion above. In addition, the stratified statistical comparisons of clinical variables against pregnancy, symptom recurrence and reoperation originally planned for this analysis were not completed; no measures of dispersion (standard deviation, range) or confidence intervals are reported for continuous variables or outcome proportions, and no predictors of outcome are identified. Finally, a STROBE flow diagram and a completed STROBE checklist are not available for the dataset underlying this analysis. These limitations should be borne in mind when interpreting the reported outcomes, and several of them - particularly the pregnancy-desire linkage and the stratified outcome analyses - represent priorities for reanalysis of the existing dataset in a future revision.

Conclusion

Hysteroscopic repair of isthmocele was associated with significant symptom improvement and a low complication profile in this cohort. Reproductive outcomes and the true reoperation risk require cautious interpretation given the denominator and data-completeness limitations discussed above; within these constraints, individualized patient selection - informed by residual myometrial thickness where available - appears important. Prospective, controlled studies with standardized outcome definitions, complete RMT measurement, and predefined statistical comparisons are required to define better the role of hysteroscopic repair in the management of isthmocele.

Congress: The article has not been presented previously at a scientific meeting.

Ethics Committee Approval: This study was approved by the clinical research ethics committee of the Beykoz State Hospital. Date: 09 August 2022, number: BEYKOZ DH 57.

Informed Consent: N/A

Conflict of Interest: None declared by the authors.

Financial Disclosure: None declared by the authors

Acknowledgments: We would like to thank the Artificial Intelligence Research and Application Center of Istinye University (<https://yzaum.istinye.edu.tr/>) for their support in the technical assessment of the manuscript, including verification of data integrity and plagiarism screening before submission. We also extend our appreciation to the Ditako Data Analytics Team (<https://ditako.com>) for providing professional

statistical analysis services that contributed to the robustness of the results.

Author Contributions:Idea/Concept: IO, AUO; Design: IO, AUÖ; Data Collection/Processing: IO, AUO; Analysis/ Interpretation: IO; Literature Review: IO; Drafting/Writing: İÖ; Critical Review: İÖ, AUÖ.

References

1. Antila-Långsjö RM, Mäenpää JU, Huhtala HS, Tomás EI, Staff SM. Cesarean scar defect: a prospective study on risk factors. *Am J Obstet Gynecol.* 2018;219(5):458.e1-458.e8. Doi: 10.1016/j.ajog.2018.09.004. PMID: 30240650.
2. Jordans IPM, de Leeuw RA, Stegwee SI, Amso NN, Barri-Soldevila PN, van den Bosch T, et al. Sonographic examination of uterine niche in non-pregnant women: a modified Delphi procedure. *Ultrasound Obstet Gynecol.* 2019;53(1):107-15. Doi: 10.1002/uog.19049. PMID: 29536581, PMCID: PMC6590297.
3. Dominguez JA, Pacheco LA, Moratalla E, Carugno JA, Carrera M, Perez-Milan F, et al. Diagnosis and management of isthmocele (Cesarean scar defect): a SWOT analysis. *Ultrasound Obstet Gynecol.* 2023;62(3):336-44. Doi: 10.1002/uog.26171. PMID: 36730180.
4. Xu XJ, Jia JX, Sang ZQ, Li L. Association of caesarean scar defect with risk of abnormal uterine bleeding: results from meta-analysis. *BMC Womens Health.* 2024; 24(1): 432. Doi: 10.1186/s12905-024-03198-6. PMID: 39075427, PMCID: PMC11285571.
5. Urman B, Arslan T, Aksu S, Taskiran C. Laparoscopic repair of cesarean scar defect "Isthmocele". *J Minim Invasive Gynecol.* 2016;23(6):857-8. Doi: 10.1016/j.jmig.2016.03.012. PMID: 27006058.
6. Vervoort A, van der Voet LF, Hehenkamp W, Thurkow AL, van Kesteren P, Quartero H, et al. Hysteroscopic resection of a uterine caesarean scar defect (niche) in women with postmenstrual spotting: a randomised controlled trial. *BJOG.* 2018;125(3):326-34. Doi: 10.1111/1471-0528.14733. PMID: 28504857, PMCID: PMC5811899.
7. He C, Xia W, Yan L, Wang Y, Tian Y, Mol BW, et al. Fertility outcomes after hysteroscopic niche resection compared with expectant management in women with a niche in the uterine caesarean scar. *Eur J Obstet Gynecol Reprod Biol.* 2023;284:136-42. Doi: 10.1016/j.ejogrb.2023.03.009. PMID: 36989689.
8. Enderle I, Dion L, Bauville E, Moquet PY, Leveque J, Lavoue V, et al. Surgical management of isthmocele symptom relief and fertility. *Eur J Obstet Gynecol Reprod Biol.* 2020;247:232-7. Doi: 10.1016/j.ejogrb.2020.01.028. PMID: 32081440.
9. Harjee R, Khinda J, Bedaiwy MA. Reproductive outcomes following surgical management for isthmoceles: a systematic review. *J Minim Invasive Gynecol.* 2021;28(7):1291-1302.e2. Doi: 10.1016/j.jmig.2021.03.012.

PMID: 33839308.

10. Busnelli A, Levi-Setti PE, Inversetti A, Bignardi T, Vitagliano A, Dell'Acqua C, et al. Investigating the impact of isthmocele and its surgical repair on fertility: results from a systematic review and meta-analysis. *Reprod Biomed Online*. 2025;50(6):104746. Doi: 10.1016/j.rbmo.2024.104746. PMID: 40340186.
11. Mashlach R, Burke YZ. Optimal isthmocele management: hysteroscopic, laparoscopic, or combination. *J Minim Invasive Gynecol*. 2021;28(3):565-74. Doi: 10.1016/j.jmig.2020.10.026. PMID: 33152531.
12. Nezhat C, Zaghi B, Baek K, Nezhat A, Nezhat F, Lindheim S, et al. Outcomes of laparoscopic cesarean scar defect repair: retrospective and observational study. *J Clin Med*. 2023;12(11):3720. Doi: 10.3390/jcm12113720. PMID: 37297915, PMCID: PMC10254061.
13. Baldini GM, Lot D, Malvasi A, Di Nanni D, Laganà AS, Angelucci C, et al. Isthmocele and Infertility. *J Clin Med*. 2024;13(8):2192. Doi: 10.3390/jcm13082192. PMID: 38673465, PMCID: PMC11050579.
14. Morlando M, Conte A, Schiattarella A. Reproductive outcome after cesarean scar pregnancy. *Best Pract Res Clin Obstet Gynaecol*. 2023;91:102362. Doi: 10.1016/j.bpobgyn.2023.102362. PMID: 37355427.
15. Tower AM, Frishman GN. Cesarean scar defects: an underrecognized cause of abnormal uterine bleeding and other gynecologic complications. *J Minim Invasive Gynecol*. 2013;20(5):562-72. Doi: 10.1016/j.jmig.2013.03.008. PMID: 23680518.